DRAFT BASIC ASSESSMENT REPORT

13 July 2021

THE PROPOSED SIYANDA SOLAR POWER PLANT NEAR VILJOENSKROON, FREE STATE PROVINCE.

ENVIRONAMICS

PROJECT DETAIL

DFFE Reference No.	**:**	To be confirmed
Project Title	**:**	The proposed Siyanda Solar Power Plant near Viljoenskroon, Free State Province.
Authors	**:**	Ms. Christia van Dyk Ms. Lisa Opperman
Reviewer	:	Mrs. Carli van Niekerk
Client	**:**	Siyanda Solar Power Plant (RF) (Pty) Ltd
Report Status	**:**	Draft Basic Assessment Report
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GLOSSARY OF TERMS AND ACRONYMS

BA	Basic Assessment
BAR	Basic Assessment Report
CEA	Cumulative Effects Assessment
DFFE	Department of Forestry, Fisheries and the Environment
DM	District Municipality
DMRE	Department of Mineral Resources and 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
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
REDZ	Renewable Energy Development Zone
REIPPP	Renewable Energy IPP Procurement Process
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SPP	Solar Power Plant
VU	Vegetation Unit

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, 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. 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 Mineral Resources and Energy's (DMRE) 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 DMRE (2019 Integrated Resource Plan Update 2010-2030). The IRP also identifies the preferred generation technologies required to meet the expected demand growth up to 2030 and incorporates government objectives including affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources and localisation and regional development. In terms of the Integrated Resource Plan Update (2019 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 1000MW 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) programme was announced in August 2012, with the intention of DMRE 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 programme 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, Siyanda 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 on the Remaining Extent of Portion 1 of the Farm Grootdraai 468, Registration Division Viljoenskroon, Free State Province (refer to Figure 1 for the locality map). The project entails the generation of up to 150MW electrical power through photovoltaic (PV) technology. The total development footprint of the project will approximately be 283 hectares (including supporting infrastructure on site). From a regional site selection perspective, this region is preferred for solar energy development due to its global horizontal irradiation value of around 2068 kwh/m^2. The region is also preferred for its inclusion within the Klerksdorp Renewable Energy Development Zone (REDZ) 10.

EXECUTIVE SUMMARY

Like many other small and developing municipalities in the country, the Moqhaka Local Municipality, within which the Siyanda Solar Power Plant is proposed, faces a number of challenges in addressing the needs and improving the lives of the community. The Integrated Development Plan (2020-2021) of the Fezile Dabi District Municipality[1] states that it is the vision of the municipality to improve the lives of their citizens and to meet their economic, basic and social needs through sustainable development. The municipality aims to achieve their key strategic goals, such as delivering quality basic services (i.e. electricity, water and sanitation) to their communities, stimulating local economic growth and to ensure sound financial management and viability within the municipality. The Moqhaka Local Municipality's Integrated Development Plan (2020-2021) vision is to create an environment for sustainable development and socio-economic growth. Providing quality, affordable, efficient and effective services to enhance the quality of life for the people of the community, is the mission of the Moqhaka Local Municipality. The development of the Siyanda Solar Power Plant will contribute to the realisation of the vision and mission of the respective local and district municipalities that will be affected by the proposed development.

Siyanda Solar Power Plant (RF) (Pty) Ltd intends to develop a photovoltaic solar facility and associated infrastructure on the Remaining Extent of Portion 1 of the Farm Grootdraai 468, Registration Division Viljoenskroon. The solar facility will have a generating capacity of up to 150MW. The town of Viljoenskroon is located approximately 30km east-southeast and the town of Orkney is located approximately 3km north -northwest of the proposed development (refer to Figure 1 and Figure 2 for the respective locality and regional maps). The total footprint of the project will be approximately 283 hectares (including supporting infrastructure on site). The site[2] 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 into the national grid), as well as site access via a main road (i.e. to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase). Grid connection infrastructure is also being proposed and assessed within this report. The grid connection infrastructure includes a 132kV power line to connect the facility from a 130 MVA (High Voltage - 132kV and Medium Voltage – 33kV) substation to the national grid at the existing Vaal Reefs Nine Substation 132/6.6kV or using a loop in – loop out connection to either the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line. A larger grid connection corridor of 100m wide and 3 km long is assessed within this report for the placement of the proposed power line.

In terms of the National Environmental Management Act (Act 107 of 1998), with specific reference to Sections 24 and 24D, as read with GNR 324-327, as amended (2017), Environmental Authorisation is required for the Siyanda Solar Power Plant. The following listed activities have been identified with special reference to the proposed development and is listed in the EIA Regulations (as amended):

[1] The Moqhaka Local Municipality falls within the Fezile Dabi District Municipality.

[2] The site is defined as the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468. The full extent of the site has been assessed as part of this BA process for the development by the EAP and the independent specialists.

- Activity 11(i) (GN.R 327): *"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 14 (GN.R 327): "*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters."*

- Activity 24 (ii) (GN.R 327): *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters"*

- Activity 28 (ii) (GN.R 327): *"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 56 (ii) (GN.R 327): *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"*

- Activity 1 (GN.R 325): *"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 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation."*

- Activity 12 (b)(i) (GN.R 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation…(b) in the Free State (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004."*

Activities required for the development of the solar facility which are listed under Listing Notice 1, 2 and 3 (GNR 327, 325 & 324) implies that the development could potentially have an impact on the environment that will require mitigation. The proposed Siyanda Solar Power Plant (SPP) is located within a Renewable Energy Development Zone (REDZ) and subsequently a Basic Assessment process is required to be followed as described in Regulations 19 and 20 of the EIA Regulations (as amended). Environamics has been appointed as the independent Environmental Assessment Practitioner to undertake the Basic Assessment (BA) on behalf of Siyanda Solar Power Plant (RF) (Pty) Ltd.

Regulation 19 of the EIA Regulations (2017) requires that a Basic Assessment Report (BAR) must contain the information set out in Appendix 1 of the Regulations or comply with a protocol or minimum information requirements relevant to the application as identified and gazetted by the Minister in a government notice. Appendix 1 of GNR326 requires that the environmental outcomes, impacts and residual risks of the proposed activity be set out in the BAR. It has been determined through the BA process that the proposed development will have a net positive impact for the area and will subsequently ensure the optimal utilisation of resources and land. All negative environmental impacts can be effectively mitigated through the recommended mitigation measures and no residual

negative impacts are foreseen. The potentially most significant environmental impacts associated with the development are briefly summarized below.

Impacts during the construction phase:

Construction of the solar power plant will potentially result in the following impacts: habitat destruction and fragmentation, soil, air and water pollution, increased soil erosion and sedimentation, spread and establishment of alien invasive species, impact on priority and resident avifauna, loss of avian habitats, impact on fossil heritage, potential loss of productive farmland, visual impact on observers in-migration or influx of job seekers, presence of construction workers on the local communities, increased risk of veld fires, Impacts on daily living and movement patterns and generation of waste. Socio-economic impacts such as the creation of local employment and business opportunities, skills development and training and technical support to local farmers and municipalities will be positive impacts emanating from the construction.

Impacts during the operational phase:

During the operational phase, the site 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 and water pollution, spread and establishment of alien invasive species, displacement of priority and resident avifauna, collisions of avifauna with PV array and power lines, avifauna electrocution when perched on power line infrastructure visual impacts and dangerous goods hazards as part of battery storage facility (catching fire, exploding or leaking dangerous pollutants). The provision of sustainable service delivery from the local municipality 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. Additional electricity will also be generated from a clean renewable resource.

Impacts during the decommissioning phase:

The physical environment will benefit from the closure of the solar facility since the site will be rehabilitated to an acceptable state. The decommissioning phase will however potentially result in impact on the fauna and flora, pressure on existing service infrastructure, fossil and 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:

According to the DFFE database approximately ten (10) applications have been submitted for renewable energy projects within the geographical area of investigation, with six (6) of these being considered valid in terms of an Environmental authorisation, as two (2) applications have lapsed or was withdrawn, one (1) application is only for transmission infrastructure and there is uncertainty regarding the completion of the EIA process for one (1) project which seems to be incorrectly listed on the DFFE database based on the lack of information available for the project. The majority of these projects are located in close proximity to Orkney, and to the north of the site considered for the Siyanda Solar Power Plant.

The potentially most significant cumulative impact during the construction phase relate to the displacement of priority avifauna, loss of important avian habitats and the impact with large scale in-migration of people. The potential cumulative effects during the operational phase relate to collision of avifauna with power line infrastructure, electrocution of avifauna when perched on power line

infrastructure and visual impacts. During the decommissioning phase, the generation of waste may result in cumulative impacts.

In accordance with the EIA Regulations, this BAR evaluates and rates each identified potential impact, and identifies and recommends mitigation measures which will be required in order to ensure the reduction of the impact significance of negative impacts to acceptable levels and the avoidance of negative residual risks. This BAR also contains information that is required by the competent authority to consider the Application for Environmental authorisation and to reach a decision contemplated in Regulation 20 of GNR 326. No fatal flaws were identified and the impacts from the proposed development are expected to be at an acceptable level with the implementation of mitigation measures and therefore the project can be authorised subject to the implementation of the recommended mitigation measures.

1 INTRODUCTION

This section aims to introduce the Basic Assessment Report (BAR) and specifically to address the following requirements of the regulations:

Appendix 1. (3) A basic 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:

(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

The National Environmental Management Act identifies listed activities (in terms of Section 24) which are likely to have an impact on the environment. These activities cannot commence without obtaining an EA from the relevant competent authority. Sufficient information is required by the competent authority to make an informed decision and the project is therefore subject to an environmental assessment process which can be either a Basic Assessment Process or a full Scoping and Environmental Impact Assessment process.

The EIA Regulations No. 324, 325, and 327 outline the activities that may be triggered and therefore require EA. The following listed activities with special reference to the proposed development is triggered:

Table 1.1: Listed activities

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(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."* • Activity 11(i) is triggered as the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area. The infrastructure for the distribution of electricity will includes a powerline (132 kV), an on-site HV/MV substation (130 MVA, High Voltage: 88/132kV, Medium Voltage: 33kV) and switching station. It is expected that the facility will tie in with Vaal Reefs Nine 132/6.6 kV Substation or using a loop in – loop out connection to either the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line.

GNR. 327 (as amended in 2017)	Activity 14	• "*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters."* • Activity 14 is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel) in containers with a capacity of 80 cubic metres.
GNR. 327 (as amended in 2017)	Activity 28(ii)	• *"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 28(ii) is triggered as portions of the affected farm has been previously used for grazing and the property will be re-zoned to "special" use. The development footprint of the solar power plant will be 283 hectares.
GNR. 327 (as amended in 2017)	Activity 24(ii)	• *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters;* • Activity 24(ii) is triggered as the internal roads will vary between 7 and 12 meters in width.
GNR. 327 (as amended in 2017)	Activity 56 (ii):	• *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* • Activity 56 (ii) is triggered as the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres.
GNR. 325 (as amended in 2017)	Activity 1	• *"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 1 is triggered since the proposed photovoltaic solar facility will generate up to 150 megawatts electricity through the use of a renewable resource.

GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • In terms of vegetation type the preferred site falls within the Dry Highveld Grassland Bioregion, more precisely the Vaal-Vet Sandy Grassland (Gh10) and Vaal Reefs Dolomite sinkhole (Gh12) which is described by Mucina and Rutherford (2006) respectively as 'endangered' and 'vulnerable'. Activity 15 is triggered since 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. The development footprint of the solar power plant will be 283 hectares.
GNR. 324 (as amended in 2017)	Activity 12 (b)(i)	• *"The clearance of an area of 300 square metres or more of indigenous vegetation…(b) in the Free State (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004."* • Activity 12(b)(i) is triggered since the proposed development is located in the Free State province and the vegetation on site is classified as being 'endangered' or 'vulnerable'. Portions of the site has not been lawfully disturbed during the preceding ten years. The development footprint of the project will be 283 hectares and therefore, more than 300 square meters of indigenous vegetation will be removed.

The activities triggered under Listing Notice 1, 2 and 3 (Regulation 327, 325 & 324) for the project implies that the development is considered as potentially having an impact on the environment and therefore require the implementation of appropriate mitigation measures. Based on the location of the entire extent of the project within the Klerksdorp REDZ (see Figure 8), the process to be followed will be as per GNR 114, as gazetted on 16 February 2018. Therefore, the Siyanda Solar Power Plant is subject to a Basic Assessment process and not a full EIA process, as well as a shortened timeframe for the processing of the Application for Environmental Authorisation by the Department of Forestry, Fisheries and the Environment (DFFE). The Basic Assessment must be undertaken in line with the requirements stipulated under Regulations 19 – 20 of the EIA Regulations. According to Appendix 1 of Regulation 326, the objective of the basic assessment process 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;

- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Describe the need and desirability of the proposed alternatives;
- Through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine —
    - The nature, significance, consequence, extent, duration and probability of the impacts occurring; and
    - degree to which these impacts-
        - can be reversed;
        - may cause irreplaceable loss of resources, and
        - can be avoided, managed or mitigated; and
- Through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to
    - Identify and motivate a preferred site, activity and technology alternative;
    - 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 Basic Assessment Report (BAR) that has been submitted to the Department of Forestry, Fisheries and the Environment (DFFE) for review and comment. According to GNR 326 all registered interested and affected parties (I&APs) and relevant State Departments (including Organs of State) must be allowed the opportunity to review and provide comment on the report. The BAR has been made available to registered I&APs and all relevant State Departments for a 30-day review and comment period from 12 July 2021 to 12 August 2021. They will be requested to provide written comments on the BAR within 30 days of receiving it. All issues identified during this review period are documented and compiled into a Comments and Response Report to be submitted as part of the Final BAR to DFFE for decision-making on the Application for EA.

1.2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

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

Contact person:	Christia van Dyk
Postal Address:	14 Kingfisher Street, Tuscany Ridge Estate, Potchefstroom, 2531
Telephone:	078 470 5252 (Cell)
Electronic Mail:	christia@environamics.co.za

And/or

Contact person:	Lisa Opperman
Postal Address:	14 Kingfisher Street, Tuscany Ridge Estate, Potchefstroom, 2531
Telephone:	084 920 3111 (Cell)
Electronic Mail:	lisa@environamics.co.za

Regulation 13(1)(a) and (b) determines that an independent and suitably qualified and experienced EAP should conduct the BA. 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 BA is also summarized in the curriculum vitae included as part of Appendix A.

1.3 DETAILS OF SPECIALISTS

Table 1.2 provides information of the independent specialists that have been appointed as part of the Basic Assessment process. Regulation 13(1)(a) and (b) determines that an independent and suitably qualified and experienced 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), which must comply with sub regulation (1). In terms of the independent status of the specialists, their declarations are attached as Appendix D to this report. The expertise of the specialists is also summarized in their respective curriculum vitae's.

Table 1.2: Details of specialists

Study	Prepared by	Contact Person	Postal Address	Tel	e-mail
Geotechnical Study	SMEC South Africa	Richard Roberts	267 Kent Avenue, Ferndale, Randburg, 2194	Tel: 011 369 0600	johannesburg@smec.com
Avifaunal Assessment	Agreenco	ASH Haagner	PO Box 19896 Noordbrug Potchefstroom, 2522	Cell: 082 214 3738	adrian.haagner@agreencogroup.com
Terrestrial Biodiversity, Plant and Animal Impact Assessment	AGES	Mari Van Der Westhuizen	P.O. Box 19460 Noordbrug Potchefstroom, 2522	Cell: 082 257 1715	mvdwesthuizen@ages-group.com
Wetland Assessment	AGES	Mari Van Der Westhuizen	P.O. Box 19460 Noordbrug Potchefstroom, 2522	Cell: 082 257 1715	mvdwesthuizen@ages-group.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 Almond	PO Box 12410 Mill Street Cape Town, 8010	Cell: 021 462 3622	naturaviva@universe.co.za

Agriculture Agro-ecosystem Specialist Assessment	Johann Lanz Soil Scientist	Johann Lanz	P. O. Box 6209 Uniedal Stellenbosch, 7612	Tel: 021 866 1518 Cell: 082 927 9018	johann@johannlanz.co.za
Visual Impact Assessment	Phala Environmental Consultants	Johan Botha	30 Fouche Street Steynsrus, 9515	Tel: 082 316 7749	johan@phala-environmental.co.za
Social Impact Assessment	Phala Environmental Consultants	Marelie Botha	30 Fouche Street Steynsrus 9515	Cell: 082 493 5166	mareliebotha90@gmail.com
Traffic Assessment Study	BVi Consulting Engineers	Liza van Zyl	Edison Square, Century City, 7441	Cell: 060 557 7467	dirkvdm@bviwc.co.za

1.4 STATUS OF THE BA PROCESS

The BA process is conducted strictly in accordance with the stipulations set out in Regulations 19 – 20 and Annexure 1 of Regulation No. 326. Table 1.3 provides a summary of the BA process and future steps to be taken. It can be confirmed that to date:

- A pre-application meeting request and public participation plan was submitted on 05 March 2021.
- A site visit was conducted on 08 March 2021.
- The pre-application meeting was held on 11 March 2021.
- The DFFE accepted the public participation plan in an email dated 18 March 2021.
- Site notices were erected on site on 21 March 2021 and a newspaper advertisement was placed in the Klerksdorp Record on 26 March 2021 for the commencement of the public participation process.
- An Application for Environmental Authorisation and the draft BAR was submitted on 09 July 2021.
- The Basic Assessment Report has been made available for a 30-day review and comment period from 12 July to 12 August 2021.

It is envisaged that the BA process should be completed within approximately five months of submitting the Application for EA and the BAR, i.e. by Sept 2021 – see Table 1.3.

Table 1.3: Project schedule

Activity	Prescribed timeframe	Timeframe
Appoint specialists	-	19 Feb. 2021
Submit pre-application meeting request and public participation plans	-	05 March 2021
Site visit	-	08 March 2021
Pre-application meeting	-	11 March 2021
Approval of PPP	-	18 March 2021
Newspaper Advertisement	-	26 March 2021
Public participation (BID)	30 Days	26 March – 26 April 2021
Conduct specialist studies	2 Months	All reports were due by mid- April 2021
Review of Specialist reports		May 2021

Submit application form and release the BAR for a 30-day review and comment period	-	12 July 2021
Public participation (DBAR) & Public meetings (if required)	30 Days	12 July -12 Aug 2021
Submit Final BAR	90 Days	Aug 2021
Decision	57 Days	October 2021
Public participation (decision) & submission of appeals	20 Days	October 2021

1.5 STRUCTURE OF THE REPORT

This report is structured in accordance with the prescribed contents stipulated in Appendix 1 of Regulation No.326. 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 BAR as specified in the Regulations		**Section in report**
Appendix 1. (3) - A basic 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
	(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
	(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; and	
	(ii) a description of the activities to be undertaken including associated structures and infrastructure.	
(e)	a description of the policy and legislative context within which the development is proposed including:	3
	(i) An identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	
	(ii) How the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks and instruments;	
(f)	a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	4
(g)	A motivation for the preferred site, activity and technology alternative.	5
(h)	a full description of the process followed to reach the preferred alternative 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;	
	(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;	6 & 7
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	
	(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;	
	(viii) the possible mitigation measures that could be applied and level of residual risk;	

	(ix) the outcomes of the site selection matrix;	
	(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 alternatives, including preferred location of the activity;	
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including -	
	(i) a description of all environmental issues and risks that were identified during the 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
(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	8
	(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, impact management measures from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;	
(n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Not applicable
(o)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	8
(p)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	
(q)	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
(r)	an undertaking under oath or affirmation by the EAP in relation to-	Appendix A to the report
	(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	
	(iv) any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs; and	
(s)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Not applicable
(t)	any specific information that may be required by the CA; and	Not applicable
(u)	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 1. (3) An BAR (...) 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 the Remaining Extent of Portion 1 of the farm Grootdraai 468, Registration Division Viljoenskroon, Free State Province situated within the Moqhaka Local Municipality. The proposed development is located in the Free State Province in the central interior of South-Africa (refer to Figure 2 for the regional map). The town of Viljoenskroon is located approximately 30km east-southeast and Orkney is located approximately 3km north-northeast of the proposed development (refer to Figure 1 for the locality map).

The project entails the generation of up to 150MW electrical power through the operation of photovoltaic (PV) panels. The total development footprint of the project will approximately be 283 hectares (including supporting infrastructure on site – which includes specific grid connection infrastructure) – refer to Table 2.1 for general site information. The property on which the facility is to be constructed will be leased by Siyanda Solar Power Plant (RF) (Pty) Ltd from the property owner, Big Four Cowboys (Pty) Ltd, for the lifespan of the project (minimum of 20 years).

Table 2.1: General site information

Description of affected farm portion	The Remaining Extent of Portion 1 of the Farm Grootdraai No. 468, Registration Division Viljoenskroon, Free State Province
Description of the affected farm portion for the powerline	Remaining Extent of Portion 1 of the Farm Grootdraai No. 468, Portion 23 of the Farm Pretorius Kraal No. 53 and Portion 24 of the Farm Pretorius Kraal No. 53 Registration Division Viljoenskroon, Free State Province.
21 Digit Surveyor General codes	<u>Solar Power Plant:</u> F03600000000046800001 <u>Power Line:</u> F03600000000046800001 F03600000000005300023 F03600000000005300024
Type of technology	Photovoltaic solar facility
Structure Height	• Panels ~6 m • Buildings ~ 6 m • Power line pylon structures ~32 m • Battery storage facility ~8 m
Battery storage	Within a 4ha area within the development footprint
Surface area to be covered (Development footprint)	Approximately 283 ha
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 (EIA footprint)	Assessed 283 hectares for the development of the solar power plant and a 3km long and 100 m wide grid connection corridor for the placement of the proposed power line
Generation capacity	Up to 150 MW

Expected production	320-360 GWh per annum (Expected production by 150MWdc modules Considering Bifacial and one-axis tracker)

The site is located in a rural area and is bordered by farms where mainly agricultural activities are undertaken and mining. The site survey revealed that the affected property currently consists of grazing cattle, as well as pockets of cultivated land located within the northern and southern sections of the sites – refer to plates 1-8 for photographs of the site.

2.2 ACTIVITY DESRIPTION

The proposed development will trigger the following activity:

Table 2.2: Listed activities

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(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."* • Activity 11(i) is triggered as the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area. The infrastructure for the distribution of electricity will includes a powerline (132 kV), an on-site HV/MV substation (130 MVA, High Voltage: 88/132kV, Medium Voltage: 33kV) and switching station. It is expected that the facility will tie in with Vaal Reefs Nine 132/6.6 kV Substation or using a loop in – loop out connection to either the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line.
GNR. 327 (as amended in 2017)	Activity 14	• "*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters."* • Activity 14 is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel) in containers with a capacity of 80 cubic metres.
GNR. 327 (as amended in 2017)	Activity 28(ii)	• *"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 28(ii) is triggered as portions of the affected farm has been previously used for grazing and the property

		will be re-zoned to "special" use. The development footprint of the solar power plant will be 283 hectares.
GNR. 327 (as amended in 2017)	Activity 24(ii)	• *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters;* • Activity 24(ii) is triggered as the internal roads will vary between 7 and 12 meters in width.
GNR. 327 (as amended in 2017)	Activity 56 (ii):	• *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* • Activity 56 (ii) is triggered as the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres.
GNR. 325 (as amended in 2017)	Activity 1	• *"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 1 is triggered since the proposed photovoltaic solar facility will generate up to 150 megawatts electricity through the use of a renewable resource.
GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • In terms of vegetation type the preferred site falls within the Dry Highveld Grassland Bioregion, more precisely the Vaal-Vet Sandy Grassland (Gh10) and Vaal Reefs Dolomite sinkhole (Gh12) which is described by Mucina and Rutherford (2006) respectively as 'endangered' and 'vulnerable'. Activity 15 is triggered since 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. The development footprint of the solar power plant will be 283 hectares.
GNR. 324 (as amended in 2017)	Activity 12 (b)(i)	• *"The clearance of an area of 300 square metres or more of indigenous vegetation…(b) in the Free State (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the*

		publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004." • Activity 12(b)(i) is triggered since the proposed development is located in the Free State province and the vegetation on site is classified as being 'endangered' or 'vulnerable'. Portions of the site has not been lawfully disturbed during the preceding ten years. The development footprint of the project will be 283 hectares and therefore, more than 300 square meters 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 access to the site will need to be confirmed.
- 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 roads/paths – existing paths will be used were reasonably possible. A short access road will be constructed to link the site with the Stokkiesdraai road which connects to the R30 Provincial Road. 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 layering 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 150 MW, 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, or using one-axis tracker structures to follow the sun in order to increase the yield of the plant.

- 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 88kV or 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 88kV or 132kV. An onsite substation and switching station will be required on the site to step the voltage up to 88kV or 132kV, after which the power will be evacuated into the national grid via a single circuit 132kV power line (assessed within a 100 m wide grid connection corridor). Whilst Siyanda Solar Power Plant (RF) (Pty) Ltd has not yet received a cost estimate letter from Eskom, it is expected that the electricity generated from the facility will be evacuated to the national grid via a connection to the existing Vaal Reefs Nine 132/6.6 KV Substation or alternatively to one of the two 88kV power lines (Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line) via a loop-in loop-out connection. The project will inject up to 100 MW into the National Grid. The installed capacity will be approximately 150 MW.

  Two alternative power line routes are being considered for development within the assessed grid connection corridor (100 m wide) (refer to chapter 4 for more information). The technically preferred power line route is located east of the project footprint. The power line corridor from the on-site substation to the Vaal Reefs Nine substation (located on the Vaal South Reefs Gold mine) is approximately 3 kilometres long.

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4 m 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 (~200 m²);
  - Switch gear and relay room (~400 m²);
  - Staff lockers and changing room (~200 m²); and
  - Security control (~60 m²)

- Battery Energy Storage System – Up to 500 MW Battery Storage Facility with a maximum height of 8m and a maximum volume of 1740 m^3 of batteries and associated operational, safety and control infrastructure.
- Roads – Access to the facility will be obtained via a gravel road from the Stokkiesdraai road connected to the R30 Provincial Road. An internal site road network will also be required, with a width of between 6 m and 12 m, to provide access to the solar field and associated infrastructure. The access and internal roads will be constructed within a 25-meter corridor.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding properties. Fencing with a height of 2.5 meters will be used.

2.4 LAYOUT DESCRIPTION

The layout plan will consider and adhere to the limitations of the site and aspects such as environmentally sensitive areas, roads, fencing and servitudes on site. The total surface area covered by the layout include the PV panel arrays (spaced to avoid shadowing), access and maintenance roads and associated infrastructure (buildings, power inverters, power lines, onsite substation and switching station and perimeter fences). Limited environmental features of significance exist on site. A final layout plan is included in Appendix H under Layout Plans in the report. Table 2.3 below provides detailed information regarding the layout for the proposed facility as per DFFE requirements.

Table 2.3: Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	6 meters
Area of PV Array	283 Hectares (Development footprint)
Number of inverters required	Minimum 50
Area occupied by inverter / transformer stations / substations / BESS	Central inverters+ LV/MV trafo: 20 m^2 HV/MV substation with switching station: 15 000 m^2 BESS: 4 000 m^2
Capacity of on-site sub- and switching station	Minimum 130MVA in HV/MV substation High Voltage: 132kV Medium Voltage: 33kV
Area occupied by both permanent and construction laydown areas	Permanent Laydown Area: 283 Hectares Construction Laydown Area: ~2000 m^2

Area occupied by buildings	Security Room: ~60 m^2 Office: ~200 m^2 Staff Locker and Changing Room: ~200 m^2 Switch gear and relay room: ~400 m^2
Battery storage facility	Maximum height: 8 m Maximum volume: 1740 m^3 Capacity: 500MW
Length of internal roads	Approximately 20 km
Width of internal roads	Between 6 & 12 meters
Proximity to grid connection point	Approximately 3.5 kilometers
Height of fencing	Approximately 2.5 meters

Table 2.4 provides the coordinate points for the proposed site, grid connection corridor and other associated infrastructure.

Table 2.4: Coordinates

Coordinates			
Project Site	A	27° 0'48.56"S	26°44'28.48"E
	B	27° 0'41.44"S	26°44'37.49"E
	C	26°58'43.70"S	26°43'0.55"E
	D	26°58'54.11"S	26°42'48.75"E
	E	26°59'8.49"S	26°42'39.33"E
Power Line Corridor	1	27° 0'8.92"S	26°43'56.15"E
	2	27° 0'8.86"S	26°43'59.26"E
	3	27° 0'2.67"S	26°43'59.55"E
	4	27° 0'2.65"S	26°44'4.10"E
	5	26°59'42.46"S	26°44'38.98"E
	6	26°59'25.33"S	26°44'42.06"E
	7	26°59'3.15"S	26°44'58.58"E
	8	26°58'55.12"S	26°44'45.67"E
	9	26°58'59.13"S	26°44'42.31"E

	10	26°59'5.43"S	26°44'52.69"E
	11	26°59'24.09"S	26°44'38.58"E
	12	26°59'40.49"S	26°44'35.69"E
	13	26°59'59.40"S	26°44'3.03"E
	14	26°59'59.36"S	26°43'56.30"E
Substation	A	27° 0'8.91"S	26°43'56.44"E
	B	27° 0'5.79"S	26°43'56.45"E
	C	27° 0'5.71"S	26°43'50.97"E
	D	27° 0'8.88"S	26°43'50.99"E
Battery Energy Storage System (BESS)	A	27° 0'19.16"S	26°43'57.01"E
	B	27° 0'9.56"S	26°43'57.56"E
	C	27° 0'9.52"S	26°43'50.57"E
	D	27° 0'13.36"S	26°43'50.59"E

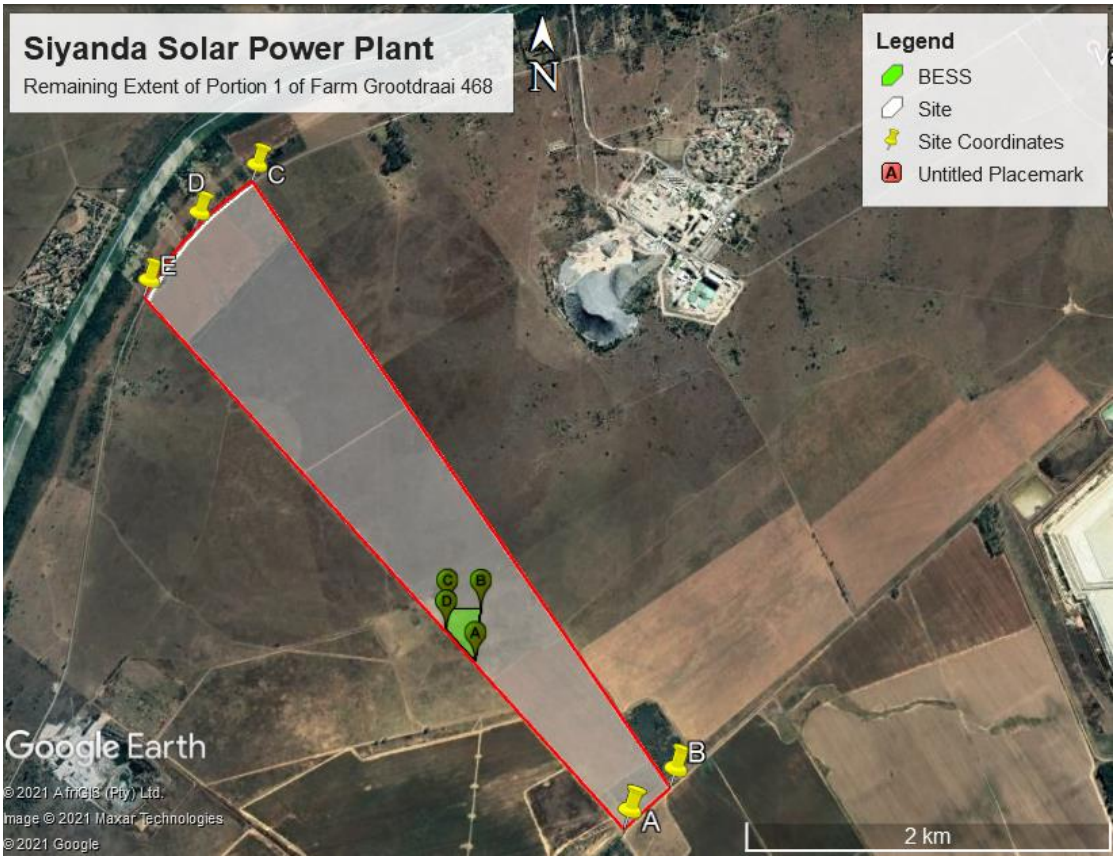


Figure 9: Map indicating coordinate points of the proposed Siyanda Solar Power Plant (including project site and BESS)

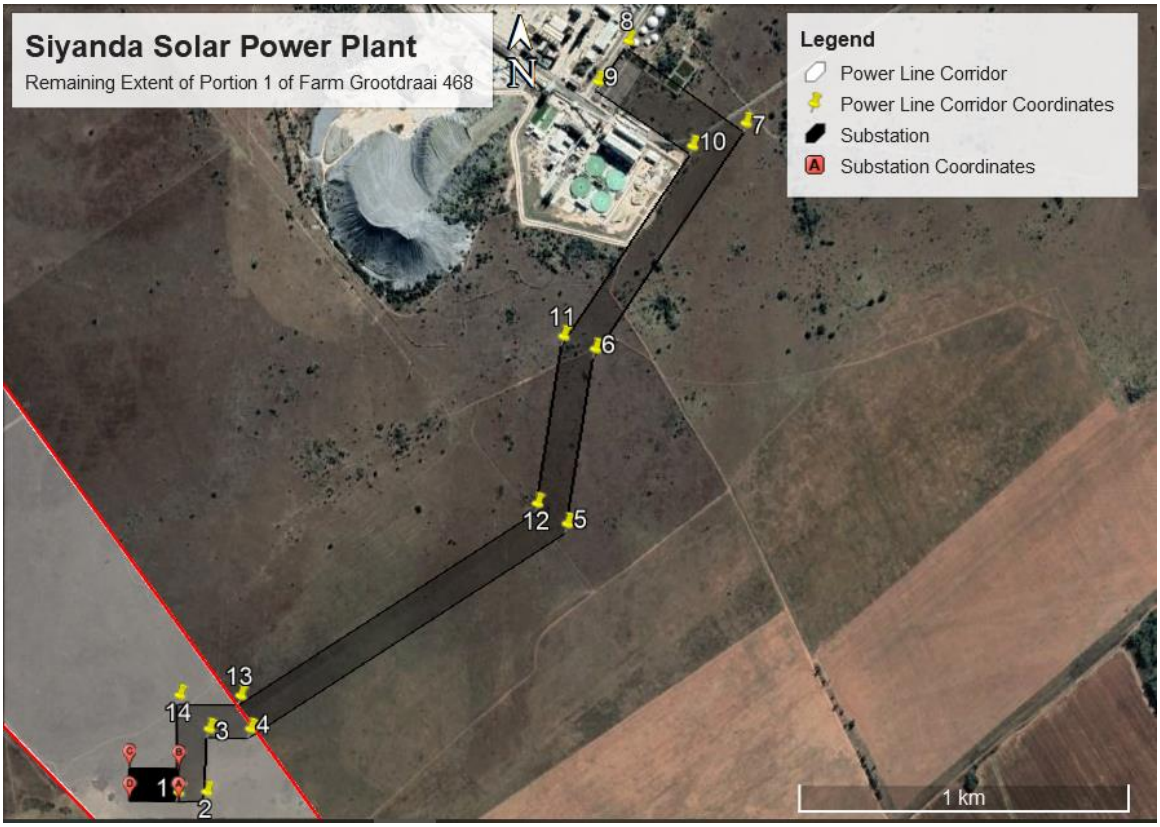


Figure 10: Map indicating coordinate points of the proposed Siyanda Solar Power Plant proposed grid connection corridor and substation

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 the local municipality, or alternatively from ground water resources. The Department of Water and Sanitation has been asked by the Applicant 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 obtained preferred bidder status by the Department of Mineral Resources and Energy for the development of the project.

The estimated maximum amount of water required during construction is 1200m³ per month during the 12 - 18 months of construction. The estimated maximum amount of water required during the facility's 20 years of production is 4200m³ per annum. The majority of this usage is for the cleaning of the solar panels during the operation phase. Since each panel requires approximately 2 litres of water for cleaning, the total amount of 460000 panels will require 920 000 litres 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 4,200,000 litres per annum for washing and allows 200,000 litres per annum (or 548 litres per day) for toilet use, drinking water, etc as part of operations. This total to approximately 4 200m^3 of water required per annum. Drinking water supplied will comply with the SANS:241 quality requirements and it is noted that the Moqhaka Local Municipality remains the Water Service Authority in the area.

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 would 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. Storm water management and mitigation measures are included in the Environmental Management Programme (EMPr) – refer to Appendix F.

2.5.3 Sanitation and waste removal

Portable chemical toilets will be utilised, that will be serviced privately or by the local municipality. Waste will be disposed at a licensed landfill site. The construction- and hazardous waste will be removed and disposed of at 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) will be contacted to formally confirm that it has the capacity to provide the proposed development with these services for the lifetime of the project (20 years).

2.5.4 Electricity

During the construction phase of the development electricity will either be generated on site through a small solar system or through the use of generators or the existing Eskom supply on the farm will be utilised. This will depend on the Engineering, Procurement, and Construction (EPC) contractor appointed. During operation 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 will be considered by the developer. During the day, electricity will be sourced from 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 of the operation phase. 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 to improve the efficiency of the facility as the technology improves. The specifications of these new panels will be the same as the current panels under consideration, but the conversion efficiency of sunlight to energy will be greater (comparable to new computer chips, that are 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 decommissioning process will consist of the following steps:

- The PV facility would be disconnected from the Eskom grid.
- The inverters and PV modules would be disconnected and disassembled.
- Concrete foundations (if used) would be removed and the structures would be dismantled.
- Wastewater storage conservancy tank would be responsibly removed and the area would be rehabilitated.
- The underground cables would be unearthed and removed and buildings would be demolished and removed.
- The fencing would be dismantled and removed.
- The roads can be retained should the landowner choose to retain them, alternatively the roads will be removed and the compaction will be reversed.
- Most of the wires, steel and PV modules are recyclable and would be recycled to a reasonable extent. The Silicon and Aluminium in PV modules can be removed and reused in the production of new modules.
- Any rubble and non-recyclable materials will be disposed of at a registered landfill facility.

The rehabilitation of the site would form part of the decommissioning phase. The aim would be to restore the land to its original form (or as close as possible). The rehabilitation activities would include the following:

- Removal of all structures and rubble;
- Breaking up compaction where required, loosening of the soil and the redistribution of topsoil; and
- Restoration of the surface to the original contours and application of hydro seeding.

3 LEGISLATIVE AND POLICY CONTEXT

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

Appendix 1. (3) A BAR (...) 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 and associated infrastructure is based on numerous policy and legislative documents. These documents inform decisions on project level environmental authorisations issued by the National Department of Forestry, Fisheries and the Environment (DFFE) 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 and their applicability to the proposed development 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)
- The National Forests Act, 1998 (Act 84 of 1998)
- 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)
- National Development Plan of 2030
- National Infrastructure Plan of South Africa

- New Growth Path Framework
- Free state Provincial Spatial Development Framework (PSDF) (2012)
- Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa (2014)
- Fezile Dabi District Municipality Final Draft Integrated Development Plan (IDP) 2020-2021 (2020)
- Moqhaka Local Municipality Draft Integrated Development Plan 2020/2021 (2020)

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 country's 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 development of the Siyanda Solar Power Plant and the aspects related thereto considers the creation of an environment which is not harmful or degraded through the implementation of appropriate mitigation measures.
The National Environmental Management Act **(Act No. 107 of 1998)**	National Department of Forestry, Fisheries and the Environment (DFFE) and the Free State Province Department of	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;

	Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA)		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. 324, 325, 326, and 327 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. The BA process undertaken for the Siyanda Solar Power Plant is in-line with the requirements of NEMA for the Application for Environmental Authorisation.
The National Energy Act (Act No. 34 of 2008)	Department of Mineral Resources 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). Considering that the Siyanda Solar Power Plant is proposed to make use of PV technology and the solar resource for the generation of electricity, the proposed project is in-line with the Act.
The National Water Act (Act No. 36 of 1998)	Department of Water and Sanitation (DWS)	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 C24B quaternary drainage region, this drainage region falls under Zone H, which refers to the amount of water that may be taken from the ground water resource, per hectare. Also, should a water use license be required for the project, the National Water Act will be applicable in terms of obtaining the relevant license.
National Environmental Management: Waste Act **(Act No. 59 of 2008)**	National Department of Forestry, Fisheries and the Environment (DFFE)	2008	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. Regulations No. R921 (of 2013) promulgated in terms of Section 19(1) of the National Environmental Management: Waste Act (59 of 2008) determines 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 as no listed activities in terms of waste management are expected to be triggered. .
National Environment Management: Air Quality Act	National Department of Forestry, Fisheries and the Environment (DFFE)	2004	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. 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

(Act No. 39 of 2004)			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.
The National Heritage Resources Act **(Act No. 25 of 1999)**	South African Heritage Resources Agency (SAHRA)	1999	The Act aims to introduce an integrated and interactive system for the management of heritage resources, to promote good governance 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 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. 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. A case file has been opened on SAHRIS for the Siyanda Solar Power Plant and all relevant documents were submitted for their comments and approval. The Heritage Impact Assessment undertaken for the solar power plant is included as Appendix D5 and the Paleontological Impact Assessment report is included as Appendix D6 to this BAR.
Conservation of Agricultural Resources Act	National and Provincial Government	1983	The objective of the Act is to provide control over the utilisation 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.

(Act No. 85 of 1983)			Consent will be required from the Department of Rural Development and Land Reform in order to confirm that the proposed development is not located on high potential agricultural land and to approve the long-term lease agreement. A Agriculture Agro-Ecosystem Specialist Assessment has been undertaken for the Siyanda Solar Power Plant and is included as Appendix D4 of this BAR.
The National Forests Act, 1998 (Act 84 of 1998)	Department of Agriculture, Forestry and Fisheries	1998	The purposes of this Act are to: (a) promote the sustainable management and development of forests for the benefit of all; (b) create the conditions necessary to restructure forestry in State forests; (c) provide special measures for the protection of certain forests and trees: (d) promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes. (e) promote community forestry; (f) promote greater participation in all aspects of forestry and the forest products industry by persons disadvantaged by unfair discrimination. Section 12(1) read with s15(1) of the NFA stated that the Minister may declare a particular tree, group of trees, woodland; or trees belonging to a particular species, to be a protected tree, group of trees, woodland or species. A list of protected tree species was gazetted in GN 635 of 6 December 2019. The effect of the declaration is that no person may (a) cut, disturb, damage or destroy; or (b) possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except under a license granted by the Minister; or in terms of an exemption published by the Minister in the Gazette.

			A Terrestrial Biodiversity, Plant and Animal Impact Assessment has been undertaken for the Siyanda Solar Power Plant and is included in Appendix D1 of this BAR.
Free State Nature Conservation Ordinance, 1969 (Act 8 of 1969)	Free State Province Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA)	1969	The Act provides for the conservation of fauna and flora and the hunting of animals causing damage and for matters incidental thereto. This includes wild animals, fish, indigenous plants, as well as nature reserves. The Act also provides for the permitting of the disturbance of such species. A Terrestrial Biodiversity, Plant and Animal has been undertaken for the Siyanda Solar Power Plant and is included in Appendix D1 of this BAR.

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
The White Paper on the Energy Policy of the Republic of South Africa	Department of Mineral Resources and Energy	1998	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: • Increasing access to affordable energy services • Improving energy governance • 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 Siyanda Solar Power Plant is in line with this policy as it proposes the generation of renewable energy from the solar resource.
The White Paper on Renewable Energy	Department of Mineral Resources and Energy 2003	This White Paper on Renewable Energy supplements the *White Paper on Energy Policy*, which recognises 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). The Siyanda Solar Power Plant is in line with this policy as it proposes the generation of renewable energy from the solar resource.
Integrated Resource Plan (IRP) for South Africa	Department of Mineral Resources and Energy	2010-2030	The Integrated Resource Plan for Electricity for South Africa of 2010–2030 (further referred to as the IRP) is a "living plan" which is expected to be revised and updated continuously as necessary due to changing circumstances. According to the Summary of the plan the current IRP for South Africa, which was originally initiated by the Department of Energy (DoE) in June 2010 (the Department is now known as Department of Mineral Resources and Energy), led to the Revised Balanced Scenarios (RBS) for the period 2010–2030. "*This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), 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 11,4 GW of renewables, which relates to the proposed Siyanda SPP. In 2010 several changes were made to the IRP model. The main changes in the IRP were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP), and wind options"* (RSA, 2011a). The summary of the IRP further explains that traditional cost-optimal scenarios were developed based on the previously mentioned changes in the IRP. This resulted in the Policy-Adjusted IRP, which stated that: "*The installation of renewables (solar PV, CSP and wind) have been brought forward in order to accelerate a local industry*;

To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW is included in the IRP; [SEP]

The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) is maintained; and

Energy efficiency demand-side management (EEDSM) measures are maintained at the level of the RBS" (RSA, 2011a:6).

"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 renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources" (RSA, 2011a:6).

The IRP highlights the commitments before the next IRP. The commitments pertaining to the purpose of the proposed project in renewable energy is:

"*Solar PV programme 2012-2015: In order to facilitate the connection of the first solar PV units to the grid in 2012 a firm commitment to this capacity is necessary. Furthermore, to provide the security of investment to ramp up a sustainable local industry cluster, the first four years from 2012 to 2015 require firm commitment."*

"*Solar PV 2016 to 2019: As with wind, grid upgrades might become necessary for the second round of solar PV installations from 2016 to 2019, depending on their location. To trigger the associated tasks in a timely manner, a firm commitment to these capacities is necessary in the next round of the IRP at the latest. By then, the assumed cost decreases for solar PV will be confirmed*" (IRP, 2011a:17).

In conclusion the IRP recommends that an accelerated roll-out in renewable energy options should be allowed with regards to the benefits of the localization in renewable energy technologies (RSA, 2011a). It is however important to take note that since the release of the IRP in 2011 there has been a number of developments in the energy sector of South Africa. Therefore, the IRP has been updated and were open for comments until March of 2017. The new IRP of 2019 was formally published in October 2019. The draft

IRP of 2018 was open for comments until the end of October 2018. For the revision scenario analysis were conducted and the results thereof are included in the draft IRP of 2018. The results revealed that for the period ending 2030 that: *"The committed Renewable Energy Independent Power Producers Programme, including the 27 signed projects and Eskom capacity rollout ending with the last unit of Kusile in 2022, will provide more than sufficient capacity to cover the projected demand and decommissioning of plants up to approximately 2025"; "Imposing annual build limits on renewable energy will not affect the total cumulative capacity and the energy mix for the period up to 2030*"; and *"the scenario without renewable energy annual build limits provides the least-cost option by 2030*" (RSA, 2018:34).

Lastly, the draft IRP of 2018 also included the scenario analysis for the period post 2030. Here it was observed that: "*Imposing annual build limits on renewable energy will restrict the cumulative renewable installed capacity and the energy mix for this period; adopting no annual build limits on renewables or imposing a more stringent strategy to reduce greenhouse gas emissions implies that no new coal power plants will be built in the future unless affordable cleaner forms of coal-to-power are available; and the scenario without renewable energy annual build limits provides the least-cost option by 2050*" (RSA, 2018:34–35).

In the final IRP of 2019 key considerations were taken into consideration together with required actions to be taken for the IRP of 2019 to be credible. In terms of renewable energy technologies like solar and wind, the IRP stated that *"The application of renewable build limits 'smoothes out' the capacity allocations for wind and solar PV which provides a constant pipeline of projects to investment; this addresses investor confidence*". The decision stated against this key consideration is to *"retain the current annual build limits on renewables (wind and PV) pending the finalization of a just transition plan"* (RSA, 2019:46). Hereby the IRP also recognises renewable technologies' potential to diversify the electricity mix, create new industries and job opportunities and localize across the value chain (RSA, 2019:13).

The Siyanda Solar Power Plant is in line with this plan as it proposes the generation of renewable energy from the solar resource and will contribute to the energy mix of the country as set out in this plan.

National Development Plan of 2030	The Presidency: National Planning Commission	-	The National Development Plan aims to "eliminate poverty and reduce inequality by 2030" (RSA, undated). In order to eliminate or reduce inequality, the economy of South Africa need to grow faster in order to benefit all South Africans. In May 2010 a draft national development plan was drafted, which highlighted the nine (9) key challenges for South Africa. The highest priority areas according to the plan are considered to be the creation of employment opportunities and to improve the quality of national education. In this regard, the plan sets out three (3) priority areas, namely to raise employment by a faster growing economy, improve the quality of education, and to build the capability of the state in order to play a more developmental and transformative role. One of the key challenges identified was that the economy is unsustainably resource intensive and the acceleration and expansion of renewable energy was identified as a key intervention strategy to address this challenge. The development of the Siyanda Solar Power Plant will contribute to the intervention strategy as identified within the plan.
National Infrastructure Plan of South Africa	Presidential Infrastructure Coordinating Commission	2012	In the year 2012 the South African Government adopted a National Infrastructure Plan (hereafter referred to as the Plan). The aim of this Plan is to transform the economic landscape, while strengthening the delivery of basic services and creating new employment opportunities. This Plan also supports the integration of African communities, and also sets out the challenges and enablers that our country needs in order to respond to the planning and development of infrastructure with regards to fostering economic growth (RSA, 2012). The Plan has developed eighteen (18) strategic integrated projects (further referred to as SIPs). These SIPs stretches over all nine (9) provinces, covering social and economic infrastructure, and projects that enhances development and growth. Of the eighteen (18), five (5) are geographically focused, three (3) spatial, three (3) energy, three (3) social infrastructure, two (2) knowledge, one (1) regional integration, and one (1) water and sanitation focussed. The three (3) SIPs according to the Plan, which are energy focused and correlate to the proposed project are as follow: - SIP 8: Green energy in support of the South African economy; - SIP 9: Electricity generation to support socio-economic development; and

		- SIP 10: Electricity transmission and distribution for all. SIP 8 according to the Plan "*support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the IRP 2010 and support bio-fuel production facilities*". The purpose of SIP 9 according to the Plan is to "*accelerate the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances*". SIP 9 should also monitor the implementation of major projects such as new power stations like Medupi, Kusile and Ingula. Lastly, SIP 10 aims to "*expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development*" (RSA, 2012:20). The development of the Siyanda Solar Power Plant in line with SIP 8 and SIP 9 as it will provide "Green" energy in support of the South African Economy and will generate electricity which supports socio-economic development. The power line associated with the Siyanda Solar Power Plant is in line with SIP 10 as it will facilitate electricity transmission and distribution for all.
New Growth Path Framework	Department of - Economic Development	The New Growth Path was developed after 16 years of South Africa's democracy, to respond to emerging opportunities and risks while building on policies. This framework provides a dynamic vision on how to collectively achieve a more developed, equitable and democratic society and economy. This framework mainly reflects the commitment of the South African Government to create employment opportunities for its people in all economic policies (RSA, 2011b). This framework sets out the markers for job creation and growth and also identify where there are viable changes in the character and structure of production, in order to create a more inclusive, greener economy on the long-term. It is stated in the framework that in order for this framework to reach its objectives, the Government is committed to: - Identify the possible areas of employment creation; and - Develop a policy to facilitate employment creation especially with regards to social equity, sustainable employment and growth in the creation of employment activities (RSA, 2011b).

			This framework also identifies investments in five key areas, one of which is energy. This framework also states that the green economy is a priority area, which includes the construction of and investment in renewable energy technologies like solar (RSA, 2011b). In this regard it will also assist creating employment opportunities over the medium- and long-term. Considering that the construction of and investment in renewable energy is a key area identified within the framework, the Siyanda Solar Power Plant is considered to be in-line with the framework.
Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa	National Department of Forestry, Fisheries and the Environment (DFFE)	2014	The then 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. Pro-active investment in grid infrastructure is the 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 falls within the Klerksdorp REDZ (refer to Figure 8).

Free State Provincial Spatial Development Framework (PSDF)	Free State Provincial Government	2012	The Free State PSDF is a policy document that promotes a 'developmental state' in accordance with national and provincial legislation and directives. It aligns with the Free State Provincial Growth and Development Strategy which has committed the Free State to 'building a prosperous, sustainable and growing provincial economy which reduces poverty and improves social development'. The PSDF includes comprehensive plans and strategies that collectively indicate which type of land-use should be promoted in the Province, where such land-use should take place, and how it should be implemented and managed. In broad terms, the PSDF: • Indicates the spatial implications of the core development objectives of the Free State Provincial Growth and Development Strategy. • Serves as a spatial plan that facilitates local economic development. • Lays down strategies, proposals and guidelines as it relates to sustainable development. • Facilitates cross-boundary co-operation between municipalities, adjoining provinces, and bordering countries. • Serves as a manual for integration and standardisation of the planning frameworks of all spheres of government in the Province. The Free State Provincial Growth and Development Strategy states that sustainable economic development is the only effective means by which the most significant challenge of the Free State, namely poverty, can be addressed is. The PSDF gives practical effect to sustainable development, which is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The PSDF is prepared in accordance with bioregional planning principles that were adapted to suit the site-specific requirements of the Free State. It incorporates and complies with the relevant protocols, conventions, agreements, legislation and policy at all applicable levels of planning, ranging from international to the local level.

			The PSDF builds upon achievements and learns from mistakes of the past, reacts to the challenges, incorporates the traditional knowledge of the people of the Free State, and builds upon international best-practice and technology. The development of the Siyanda Solar Power Plant is in-line with the framework based on the contributions and opportunities presented by a development of this nature.
Fezile Dabi District Municipality Final Draft Integrated Development Plan (IDP)	Fezile Dabi District Municipality	2020 - 2021	The long-term vision of the Fezile Dabi DM is: "Improving the lives of citizens and progressively meeting their basic, social and economic needs, thereby restoring community confidence and trust in government". The above stated vision defines what Fezile Dabi District Municipality would like to attain over medium to long-term, and for that achievement to effectively materialise, their mission is that: "Fezile Dabi District Municipality will strive to be a more responsive and accountable municipality towards sustainable development". Of the eighteen (18) SIPs that are contained in the National Infrastructure Plan (NIP), there are eight which impacts on the Fezile Dabi District and therefore need to be recognised and where appropriate; the municipality's plans will be aligned with these SIPs in an effort to respond to national government's service delivery initiatives. Furthermore, work is to be done to align key cross-cutting areas, namely human settlement planning and skills development in line with each of the Strategic Infrastructure Projects, especially: • Green Energy in support of the South African economy (SIP 8): Supporting sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010). • Electricity Generation to support socio-economic development (SIP 9): acceleration of the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy; and addressing historical imbalances. Considering the plans for the alignment of the DM's plans with SIP 8 and SIP 9 it is confirmed that the Siyanda Solar Power Plant is in line with the plan.

Moqhaka Local Municipality Draft Integrated Development Plan (IDP)	Moqhaka Local Municipality	2020-2021	The vision of the Moqhaka LM is to "…strive to *be a Municipality that creates an enabling environment for socio-economic growth and sustainable development."* The Mission Statement is *"To maintain and enhance quality of life by providing effective, efficient quality and affordable services equitably and facilitating sustainable socio-economic growth through active community participation."* The vision and mission of the municipality have led to the conceptualisation of the following strategic objectives below: • Broaden access and improve quality of municipal services. • Create an environment that promotes the development of the local economy an facilitates job creation. • Build united, non-racial, integrated and safer communities. • Promote a culture of participatory and good governance. • Improved organisational cohesion and effectiveness. • Improve overall financial management by developing and implementing appropriate financial managements policies, procedures, and systems. The development of the Siyanda Solar Power Plant will contribute to the local economy of the area and therefore assist (albeit to a limited extent) with socio-economic growth and therefore contribute to the strategic objectives of the LM.

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 BA:

- 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

[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.

- BirdLife, (2017). Best Practise Guidelines Birds & Solar Energy: Guidelines for assessing and monitoring the impact of solar power generating facilities on bird in southern Africa.

3.6 CONCLUSION

The Basic Assessment was undertaken in accordance with the EIA Regulations (2017) published in GNR 326, 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.

The legislative and policy context plays an important role in identifying and assessing the potential social impacts associated with the proposed development. For this reason, the proposed development project will be assessed and has been considered in terms of its fit with the key legislative, policy and planning documents discussed above.

The main findings of the review of the policy documents on all spheres of Government indicated that strong support was given towards renewable energy, specifically PV solar energy and therefore it is concluded that there is support for the development of the Siyanda Solar Power Plant. The White Paper on the Energy Policy of the Republic of South Africa of 1998 stated that due to the fact that renewable energy resources operate from an unlimited resource base, i.e. the sun, renewable energy can increasingly contribute towards a long-term sustainable energy supply for future generations. This policy further highlights that due to the unlimited resources base of renewable energy in South Africa, renewable energy applications like PV solar energy and associated infrastructure are more sustainable in terms of social and environmental costs. The Integrated Resource Planning for Electricity for South Africa of 2010–2030, the National Infrastructure Plan of South Africa and the New Growth Path Framework all support the development of the renewable energy sector. In particular, the IRP also indicated that 43% of the energy generations in South Africa is allocated to renewable energy applications. On a District and Local level limited attention is given explicitly to renewable sources like PV solar energy, however the documents reviewed do make provision for increase energy supply and efficiency in improving the quality of lives in terms of efficient physical infrastructure as well as socio-economic growth. At Provincial, District and Local level the policy documents indirectly support the applications of renewables as it will contribute to surety of electricity supply and improving the lives of the community.

The review of the relevant policies and documents related to the energy sector therefore indicate that renewables, like solar energy and the establishment of solar energy facilities and associated infrastructure, are supported on all spheres of Government. The proposed Siyanda Solar Power Plant is therefore supported by the related policy and planning documents reviewed in this section of the report.

4 THE NEED AND DESIRABILITY

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

> **Appendix 1.** (3) An BAR (...) 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 Word bank estimates that these results in an annual, per capita carbon emission of ~8.9 tons per person. Based on 2008 fossil-fuel CO_2 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 (Boden, et al. 2011).

The primary rationale for the Siyanda SPP 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 Mineral Resources and Energy (DMRE) (Integrated Resource Plan 2010-2030). 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 Moqhaka Local Municipality's Integrated Development Plan such as creating an environment that promotes the development of the local economy and facilitating job creation (IDP, 2020-2021).

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 Free State 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 14 725 MW of electricity from renewable energy as per the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme of the Department of Mineral Resources and Energy. The Government will soon be initiating the procurement of an additional 11 800 MW of renewable energy as stated during the 2021 State of the Nation Address.
- 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 Greenhouse Gas (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 CO_2 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 885 employment opportunities will be created during the construction and 15 - 70 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 and soil limitations, the site has limited suitability for cultivated crops, and viable agricultural land use is limited to grazing only. The site assessment has found that the soils across most of the site are unsuitable, or at best very marginal, for the production of cultivated crops, and are therefore only suited to grazing. Limitations within the site includes numerous surface rock outcrops and soils that are shallow on underlying rock. At a carrying capacity of 7 hectares per large stock unit, the site has a productivity of 29 head of cattle. 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 by the landowner. The areas of the farm that are cultivated are avoided by the development footprint and will not be utilised for the development. Therefore, the agricultural activities will continue on the rest of the farm.

- Location of the activity within a REDZ - The Renewable Energy Development Zones (REDZ) have a key role to play in the South Africa's just energy transition. The REDZ create priority areas for investment in the electricity grid. Since the site is located within a REDZ it contributes to the desirability of the project.

- Cumulative impacts of low to medium significance – No cumulative impacts with a high residual risk have been identified. In terms of the desirability of the development of sources of renewable energy therefore, it may be preferable to incur a higher cumulative loss in such a region as this one, than to lose land with a higher environmental value elsewhere in the country.

5 DESCRIPTION OF ENVIRONMENTAL ISSUES

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

Appendix 1. (3) A BAR (...) must include-

(g) A motivation for the preferred site, activity and technology alternative;

(h) a full description of the process followed to reach the proposed preferred alternative, 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;

(viii) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;

(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 DFFE 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 E3) was conducted by the developer on the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468 and the project site was found to be favourable due to its proximity to grid connections, environmental conditions, relatively flat terrain, high solar radiation values and adequate site access. Some areas of the farm have been deemed less suitable for the proposed development such as areas with cultivated areas and existing infrastructure such as roads and power line infrastructure. These factors were taken into consideration and avoided as far as possible. The site selection also took the site geology, land capability, water availability and land use into consideration before deciding the specific site (Subsolar Energy, 2021).

The following sections explore different types of alternatives in relation to the proposed project, including the power line.

5.1.1 No-go alternative

This alternative considers the option of 'do nothing' and maintaining the *status quo* of the site. The description provided in section 5.3 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, and includes pockets of cultivated areas. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for grazing of cattle and cultivation (refer to the photographs of the site). However, it should be noted that the area surrounding the proposed project is already impacted by gold and dolomite mining activities, as well as agricultural activities. The site has limited agricultural potential due to soil limitations which includes numerous surface rock outcrops and shallow soils on underlying rock (see Agricultural Agro-Ecosystem Specialist Assessment in appendix D4). The potential opportunity costs in terms of alternative land use income through rental for the energy facility and the supporting social and economic development in the area would be lost if the *status quo* persists.

5.1.2 Location alternatives

This alternative asks the question, if there is not, from an environmental perspective, a more suitable location for the project. No other properties have at this stage been secured by Siyanda Solar Power Plant (RF) (Pty) Ltd in the Orkney/ Viljoenskroon area to potentially establish the solar energy facility. From a local perspective, the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468 is preferred due to its suitable climatic conditions, topography (i.e. in terms of gradient), environmental conditions (i.e. agricultural potential, ecological sensitivity), proximity to a feasible 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 considered to have limited environmental sensitivity as a result. It must be noted that the cultivated areas in the north and south of the affected property is not considered suitable for the placement of infrastructure and has therefore been avoided. No alternative areas on the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468 have been considered. Therefore, there is a single preferred location alternative that will be assessed – refer to Figure 11.

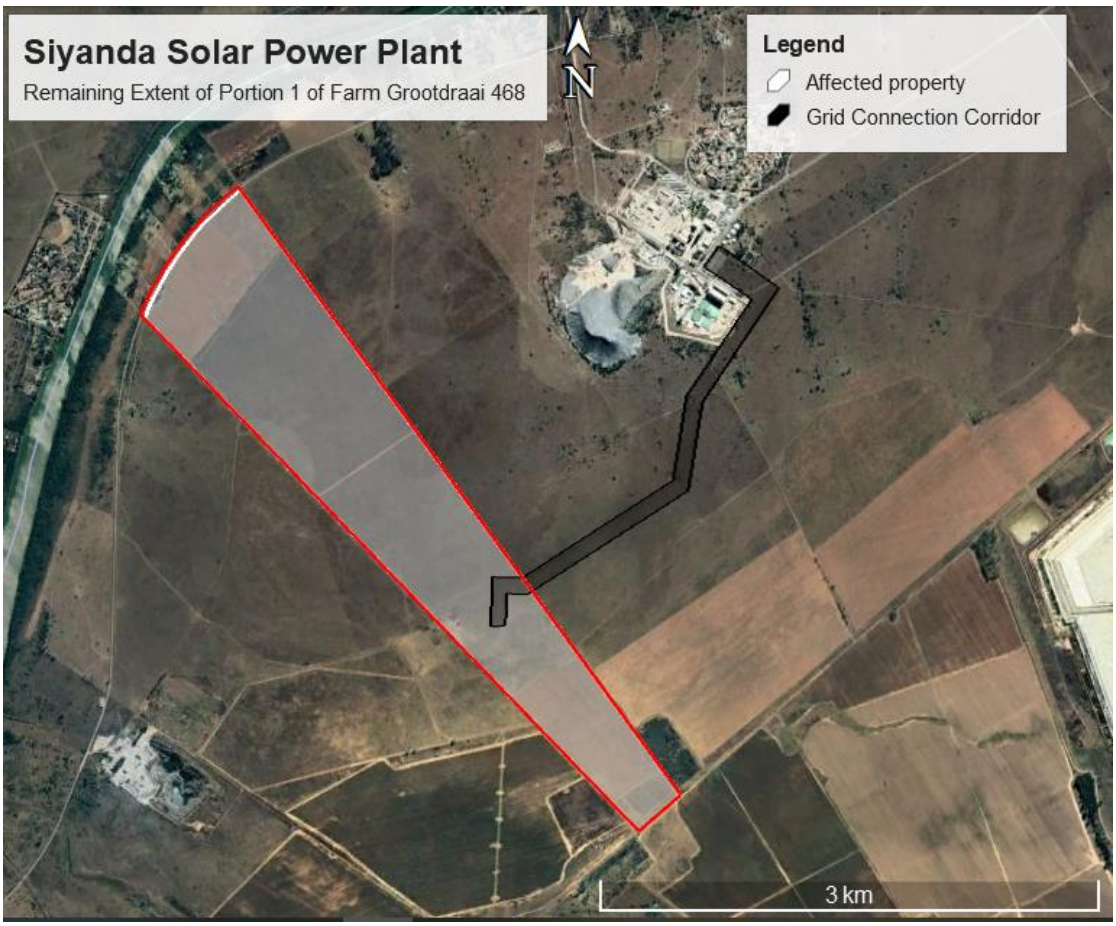


Figure 11: Location of the preferred alternative for the Siyanda Solar Power Plant on the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468. The map illustrates the entire extent of the property.

5.1.3 Activity alternatives

The BA 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** – Siyanda Solar Power Plant (RF) (Pty) Ltd is part of a portfolio of solar PV projects throughout South Africa. Siyanda 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 Orkney / Viljoenskroon area – refer to Figure 12. The technology furthermore entails low visual impacts, have relatively low water requirements, is a simple and reliable type of technology and all the components can be recycled.

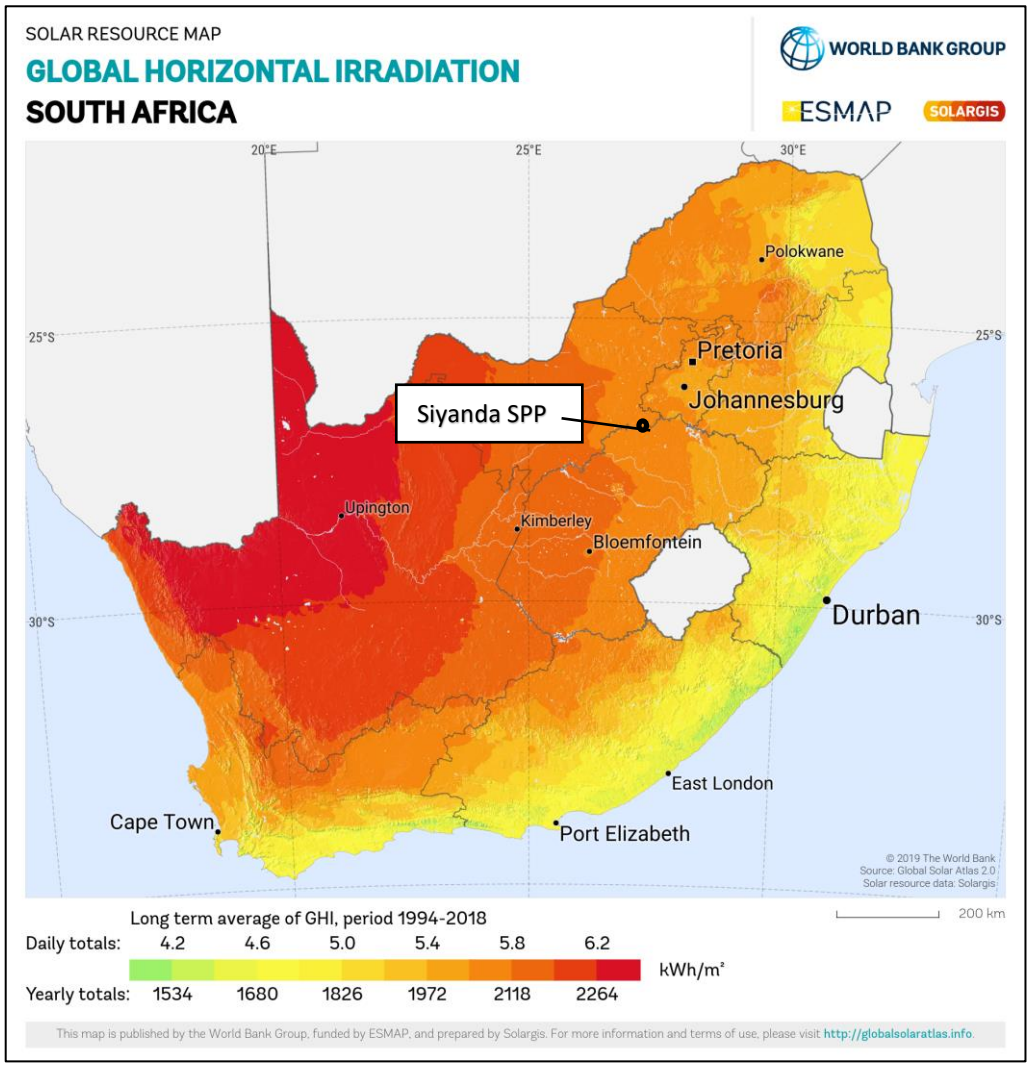


Figure 12: Global horizontal irradiation values for South Africa (SolarGIS, 2021) and the location of the Siyanda Solar Power Plant

- **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

Possible technical alternatives for the development of a solar PV facility needs to be considered during the BA process.

5.1.4.1 Power lines

It is expected that the facility will tie in with either the Vaal Reefs Nine 132/6.6 kV Substation, the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or the Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line located on the site. It must be noted that the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line and the Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line is directly adjacent to one another. The power line will be constructed from the Siyanda Solar Power Plant on-site substation / switching station, within 100m wide and 3km long grid connection corridor and will connect into either of the three grid connection points mentioned above.

Considering the grid connection points available, two route alternatives have been identified within the grid connection corridor which are being considered to connect the facility to the national grid. The details of the route alternatives are as follow:

- Option 1: technical preferred by the proponent which is a connection to the Vaal Reefs Nine 132/6.6kV substation located 3km northeast from the site. The route will be 3km long. The connection point is located at the Vaal Reefs Nine mine.
- Option 2: this alternative is a second feasible option to connect the facility to the national grid. This includes a connection to either the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line located on the site. The route will be approximately 115 m long and will consist of a Loop-in Loop-out connection.

Both these alternative routes are being assessed at the same level by the independent specialists and within this BAR. The preferred alternative for authorisation from an environmental perspective will be identified through the consideration of the assessments made by the independent specialists of the route alternatives within the grid connection corridor, which will ultimately inform the preferred route proposed for approval by the EAP. It must be noted that the entire grid connection corridor has been assessed. Figure 13 provides a map of the route alternatives located within the grid connection corridor.

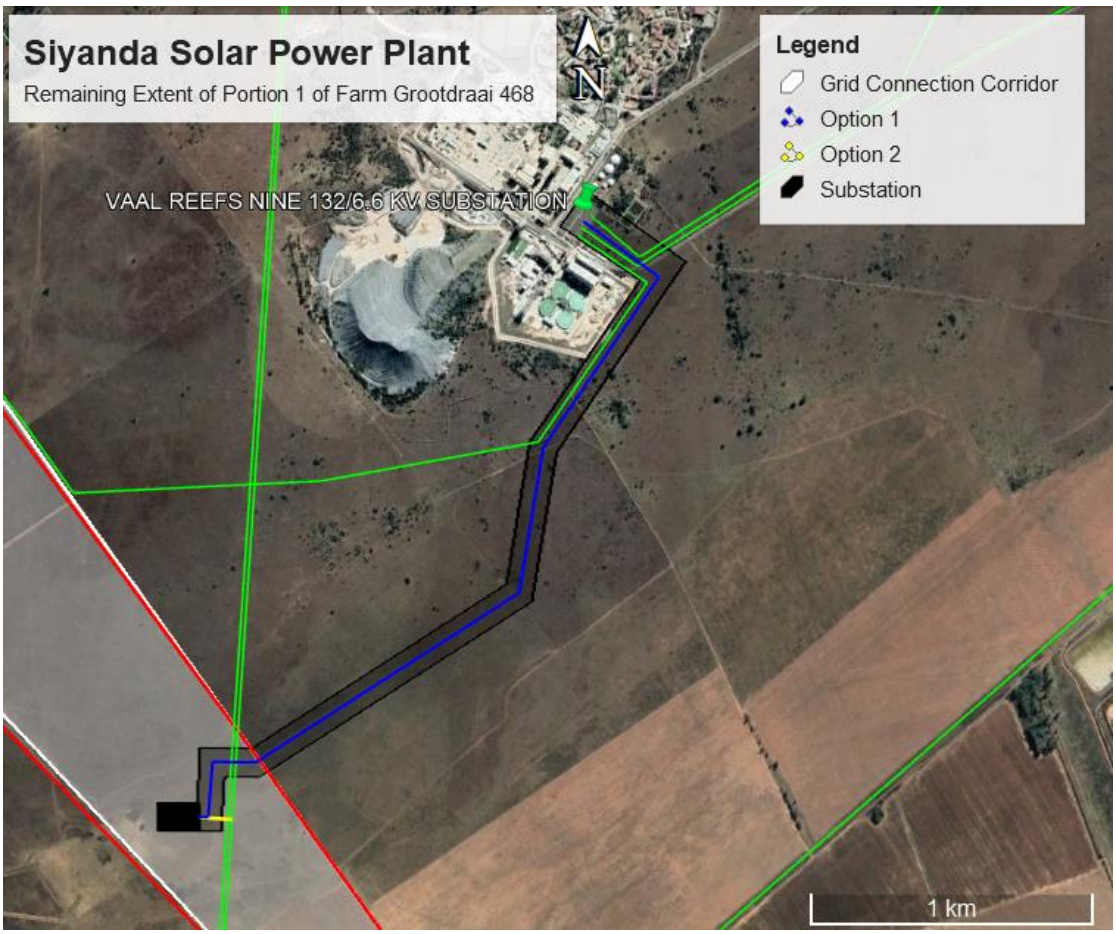


Figure 13: Route alternatives considered for the Siyanda Solar Power Plant assessed within the larger grid connection corridor

The power line will be constructed within the identified 100m wide corridor towards the Vaal Reefs Nine 132/6.6 kV Substation or towards either the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line. The development of a single-circuit 132kV overhead power line or the 132kV loop in – loop out overhead line are the two alternatives the applicant is considering to enable a connection to the national grid due to the following reasons:

- **Overhead Power Lines** - Overhead lines are less costly to construct than underground lines. Therefore, the preference for the development of overhead lines is mainly based 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 Free State Province are unlikely 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 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 Power 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 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.

5.1.4.2 Battery Energy Storage Facility (BESS)

It is proposed that a nominal up to 500 MWh Battery Energy Storage Facility for grid storage would be housed in stacked containers, or multi-storey building, with a maximum height of 8m and a maximum volume of 1,740m^3 of batteries and associated operational, safety and control infrastructure. Three types of battery technologies are being considered for the proposed project: Lithium-ion, Sodium-sulphur or Vanadium Redox flow battery. While there are various battery storage technologies available, the preferred alternative is the utility-scale Lithium-ion (Li-ion) battery energy storage. Li-ion batteries have emerged as the leading technology in utility-scale energy storage applications because it offers the best mix of performance specifications, such as high charge and discharge efficiency, low self-discharge, high energy density, and long cycle life (Divya KC et al., 2009).

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

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 in Appendix H.

The layout follows the limitations of the site and aspects such as environmental sensitive areas (supported by specialist input), roads, fencing and servitudes are considered. Areas not available for development, in this case areas of cultivated land, was also considered. 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, power lines and substations, BESS and perimeter fences). With regards to the 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.

The choice of pylon structure to be used for the power line will be determined in consultation with Eskom. The choice of pylon structure does not significantly affect the environmental impacts of the proposed development as provision has already been made for the visual, ecological, avifaunal and paleontological impacts of erecting a power line. No defined structure has been confirmed at this stage and will depend on Eskom's technical requirements. The 132kV power line must be constructed according to the authorised standards for a power line approved by Eskom Holdings SoC Ltd. The structure to be utilised for the power line towers will also be informed by the local geotechnical and topographical conditions. The following alternatives are considered with regards to the proposed structures:

Steel lattice towers:

The steel lattice towers provide the following advantages over the other tower types available:

- Enables multipath earthing which enhances the overall electrical performance of the power line.
- Is visually less obtrusive than the mono-pole options.
- Is more practicable that other options i.e. more cost effective and more practical to construct and maintain.
- Is safer to work on than the monopole and wood pole structures.
- Is more durable than the wood pole structures.

Steel monopoles:

The steel monopole is considered less suitable than the steel lattice towers for the following reasons:

- Is visually more intrusive than the lattice towers.
- Is more expensive than the lattice towers.
- Requires more steel than the lattice towers.
- Is more difficult to erect.
- Is not as safe to work on as the lattice towers.

Wood poles:

Wood pole structures are only used in extreme circumstances where a visual impact needs to be avoided. Wood pole structures may be cheaper to produce and to construct, but they have one tenth of the lifespan of the metal counterparts and are far more susceptible to weather conditions which makes them less efficient and practicable. The wood pole structure is also more susceptible to having the cross arms burnt off by electrical faults as well as being susceptible to deformation with height.

5.1.6 Technology alternatives

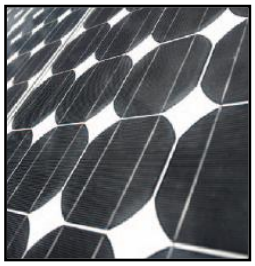
Technology alternatives for the development of a solar PV facility needs to be considered during the BA process.

5.1.6.1 Photovoltaic solar panels

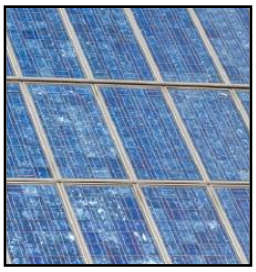
There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon, thin film or bifacial PV panels. These technologies are discussed in more detail below:

- **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.



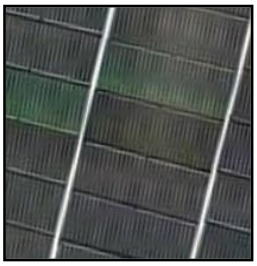
- ***Poly-crystalline Silicon*** – poly-crystalline panels use solar cells that are cut from multifaceted silicon crystals. They are less uniform in appearance than mono-crystalline cells, resembling pieces of shattered glass. These are the most common solar panels on the market, being less expensive 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).

- **Bifacial panels:**

  As the name suggests, bifacial solar panels have two faces, or rather, they can absorb light from both sides of the panel. A lot of potential energy transfer is lost in traditional solar cells when the light hits the back of a solar panel. Most bifacial solar panels use monocrystalline cells, whereas traditional cells use polycrystalline materials. The monocrystalline materials, alongside the clear light pathway on both sides of the panel, enable the light to be absorbed from either side of the cell, and it is thought that, that the overall efficiency of these cells can be up to 30% greater in commercial applications. Although, the exact amount is variable depending on the surface that they are installed on. The front side of the solar panel still absorbs most of the solar light, but the back side of the solar panel can absorb between 5-90% of the light absorbed by the front of the solar panel.

  Traditional solar panels use an opaque back sheet. By comparison, bifacial solar panels either have a clear/reflective back sheet or have dual panes of glass. Most of these solar panels are frameless so any issues with potential-induced degradation (PID) are reduced. To efficiently convert light into electricity from both sides, bifacial solar cells have selective-area metallization schemes that enable light to pass between the metallized areas, rather than the conventional thick metal collectors as seen with monofacial solar panels.

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, such as bifacial panels, will only be confirmed at the onset of the project.

5.1.6.2 Overhead powerline

The following alternatives may be considered for the overhead power line:

- **Single Circuit Overhead Power Line**

  The use of single circuit overhead power lines to distribute electricity is considered the most appropriate technology and has been designed over many years for the existing environmental conditions and terrain as specified by Eskom Specifications and best international practice. Based on all current technologies available, single circuit overhead power lines are considered the most environmentally practicable technology available for the distribution of power. This option is considered appropriate for the following reasons:

  - More cost-effective installation costs
  - Less environmental damage during installation
  - More effective and cheaper maintenance costs over the lifetime of the power line.

- **Double Circuit Overhead Power Line**

  Where sensitive environmental features are identified, and there is sufficient justification, Eskom will consider the use of double circuit (placing 2 power lines on either side of the same tower structure) to minimize impacts. However, the use of double-circuiting has a number of technical disadvantages:

  - Faults or problems on one power line may mean that the other power line is also disabled during maintenance, and this will affect the quality of supply to an area. Larger and taller towers as well as more towers are required for double-circuit power lines.

The double-circuit overhead power line proves more feasible since the single circuit may not have the capacity to transmit the large amount of electricity generated from the plant and during maintenance the entire plant would not have to be offline as one of the double circuit lines would still be able to supply electricity. However, due to the rapid requirement changes, this will only be determined before construction. For the layout of the Siyanda Solar Power Plant – refer to Appendix H.

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 (Klerksdorp Rekord) on the 24 March 2021 (see Appendix C1) notifying the public of the BA 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 until 26 April 2021.

- Site notices

  Site notices were placed on site in English on 21 March 2021 to inform surrounding communities and immediately adjacent landowners of the proposed development. I&APs were given the opportunity to raise comments by 26 April 2021. Photographic evidence of the site notices is included in Appendix C1.

- Direct notification of identified I&APs

  Identified and registered I&APs, including key stakeholders representing various sectors, has been directly informed of the Basic Assessment via telephone calls, WhatsApps and emails (as appropriate). For a complete list of I&APs with their contact details see Appendix C3 to this report.

- Direct notification of surrounding landowners and occupiers

  Written notices were provided via WhatsApp or email to all surrounding landowners and occupiers – refer to Figure 14. The surrounding landowners were given the opportunity to raise comments within 30 days. For a list of surrounding landowners see Appendix C3.

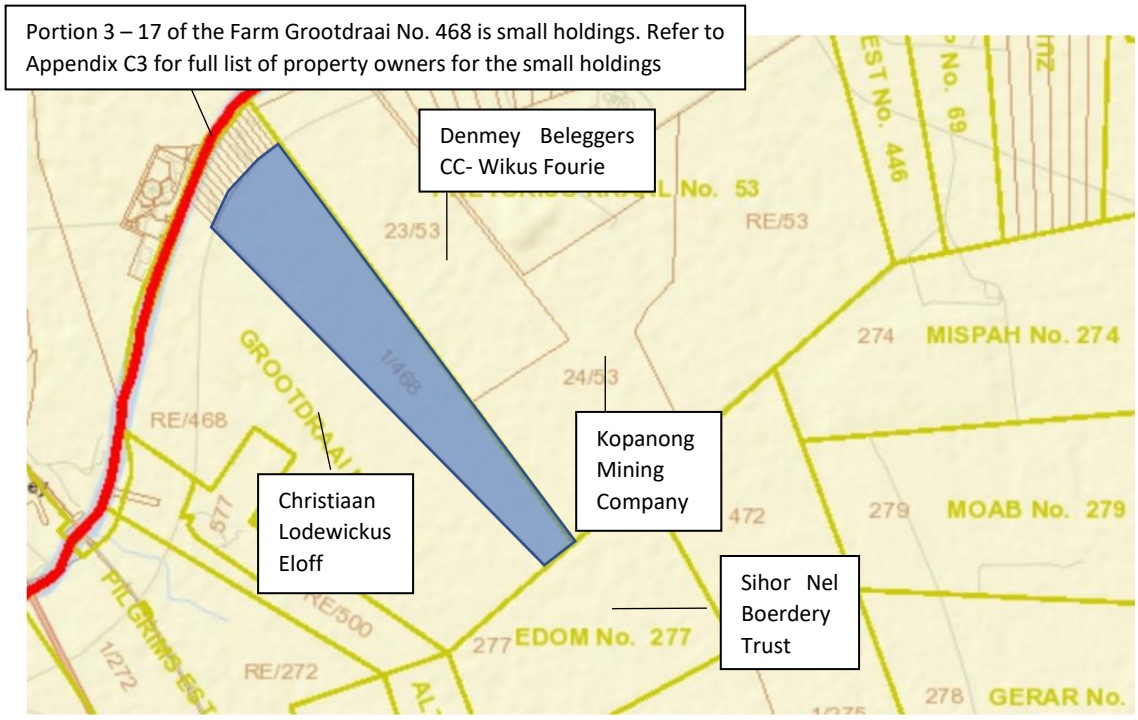


Figure 14: Surrounding landowners

- <u>Circulation of Draft Basic Assessment Report</u>

  The registered I&APs were notified of the availability of the BAR at the commencement of the 30-day review and comment period. This included the details of where the report can be accessed. They have been requested to provide their comments on the report within 30 days (12 July 2021 – 12 August 2021). All issues identified, raised and recorded will be documented and compiled into a Comments and Responses Report to be included as part of the Final Basic Assessment Report. Hard copies of the report can be made available on request and will be sanitized prior to it being posted or couriered.

- <u>Circulation of decision and submission of appeals:</u>

  Notice will be given to all identified and registered I&APs of the decision taken by the DFFE. The attention of all registered I&APs will also be drawn to the fact that an appeal may be lodged against the decision in terms of the National Appeals Regulations. In accordance with the provisions of Regulation 4(1) of Government Notice No. 993, an appellant must submit the appeal to the appeal administrator, and a copy of the appeal to the applicant, any registered I&APs and any organ of state with interest in the matter within 20 days from the date that the notification of the decision was sent to the applicant by the competent authority.

5.2.2 Consultation process

Regulation 41 requires that the landowner, surrounding landowners, municipality, relevant ward councillor, any organ of state having jurisdiction in respect of any aspect of the activity and any other party as required by the competent authority 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 C.

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 I&APs and consultation bodies

To date no comments have been received from consultation bodies. Any comments received during the circulation of the BAR will be summarized in the final BAR and included in the Comments and Responses Report. The full wording and original correspondence will be included in Appendix C.

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, soils, agricultural potential, 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 the 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 the wetland located on site and the close proximity to the Vaal River.

5.3.1.1 Geology, soils and agricultural potential

According to the Agricultural Agro-Ecosystem Specialist Assessment (attached in Appendix D4) the site is covered by two land types. Most of the site is covered by Fa13, which is dominated by shallow soils on underlying rock (dolomite and chert belonging to the Chuniespoort Group) of the Mispah and Glenrosa soil forms, although patches of deeper Hutton soils do occur (such as the cultivated land in the northern part of the farm portion). The southern end of the farm portion is land type Bd13, which is dominated by deeper soils of the Avalon, Clovelley and Hutton soil forms that are suitable for cultivation. Almost all cultivated land in the surrounding area is located only on this land type.

The field investigation confirmed the general soil patterns and soil dominance of the different land types. However, investigation of soil conditions, just to the north of the southern area of cultivation, confirmed that the northern boundary of cultivation corresponds to the boundary between arable and non-arable soils. In other words, although the land type boundary runs slightly north of the cultivation boundary, there is no arable soil beyond the cultivation boundary, and the land type boundary should more accurately run on the cultivation boundary. The proposed development site does not therefore include the arable soil types,

that occur further south on the farm. The site is situated on flat terrain at an altitude of 1,300 metres with slight elevation in the central part and an average slope of approximately 1% across it. Natural vegetation of the site is Vaal-Vet Sandy Grassland of the Grassland biome. Vegetation has been disturbed by agricultural activities.

The site assessment has found that the areas of cultivated soil in the north and south of the farm portion are deep soils that are suitable for cultivation. Across the rest of the site, soils are unsuitable for the production of cultivated crops, and are therefore only suited to grazing. Limitations are numerous surface rock outcrops and that most soils are shallow on underlying rock. Evidence for this, in addition to the site investigation, is the fact that the Fa13 land type across the site and surrounds supports almost no cultivation on it, in contrast to the Bd13 land type to the south, that supports much cultivation. The Fa13 land type across the site is rated in the land capability data with values between 6 and 9. This assessment has however found that, due to the identified soil limitations, and the non-suitability of the soils for cultivation, land capability values, other than in the patch of deeper, cultivated soils, should only be between 6 and 7.

The long-term grazing capacity of the site is 7 hectares per large stock unit. The development footprint is 206 hectares in extent. At a carrying capacity of 7 hectares per large stock unit, the footprint has a productivity of 29 head of cattle.

5.3.1.2 Vegetation and landscape features

The site is situated in the Grassland biome (Mucina & Rutherford, 2006), which is characterised by herbaceous vegetation of relatively short and simple structure that is dominated by graminoids, usually of the family *Poaceae*. Woody plants are rare (usually low to medium-sized shrubs) or absent or are confined to specific habitats, such as smaller escarpments or koppies. Core grassland areas usually have deep, fertile soils although a wide spectrum of soil types occurs. Precipitation is strongly seasonal, and the growing season lasts approximately half the year (Mucina & Rutherford, 2006). The conservation status of the Vaal-Vet Sandy Grassland vegetation unit, in which the project area is located, is Endangered (Mucina & Rutherford, 2006). It is also listed as an Endangered ecosystem (SANBI, 2011)..

The site falls into the Vaal Reefs Dolomite Sinkhole Woodland vegetation unit and the Vaal-Vet Sandy Grasslands vegetation unit (Mucina et al., 2018) (Figure 6). Mucina and Rutherford (2006) describe the Vaal Reefs Dolomite Sinkhole Woodland vegetation unit as slightly undulating plains dissected by prominent rocky chert ridges and supporting a grassland-woodland vegetation complex. The most typical vegetation feature is the woodland, which occurs naturally in clumps around sinkholes. This vegetation unit was however not seen in the site proposed for development.

The Vaal-Vet Sandy Grasslands vegetation unit is described as plains-dominated landscape with some scattered slightly irregular undulating plains and hills. Mainly low tussock grasslands with an abundant karroid element. *Themeda triandra* is dominant in this vegetation unit. The conservation status of this vegetation unit is Endangered. The site rather falls into this vegetation unit (and not the Vaal Reefs Dolomite Sinkhole Woodland). Most of the site falls into an Ecological Support Area (ESA) 1 and 2 and a small section in the south represent the Class “Other and degraded”. The site is within 500 m from the Vaal River, which is a NFEPA river. The riparian area next to the river is a NFEPA wetland. There is however no NFEPA wetlands in the project area. The site does not fall into a Protected Area or a National

Protected Area Expansion Strategy (NPAES) area, but it is located 5 km east of the Vaal Grassland NPAES.

The topography is characterised by slightly undulating plains. The proposed development land is used for livestock farming at present. The site is located within the C24B quaternary catchment and is situated in the Middle Vaal Water Management Area. Drainage occurs as sheet-wash into the Vaal River.

Vegetation Units:

A vegetation survey was completed on the site (including the grid connection corridor). According to the Terrestrial Biodiversity, Plant and Animal Impact Assessment (Appendix D1) three different vegetation units were identified (Figure 16), namely:

1) *Pogonarthria squarrosa - Elephantorrhiza elephantina* grassland

2) Eragrostis curvula old cultivated land

3) Agricultural land (maize)

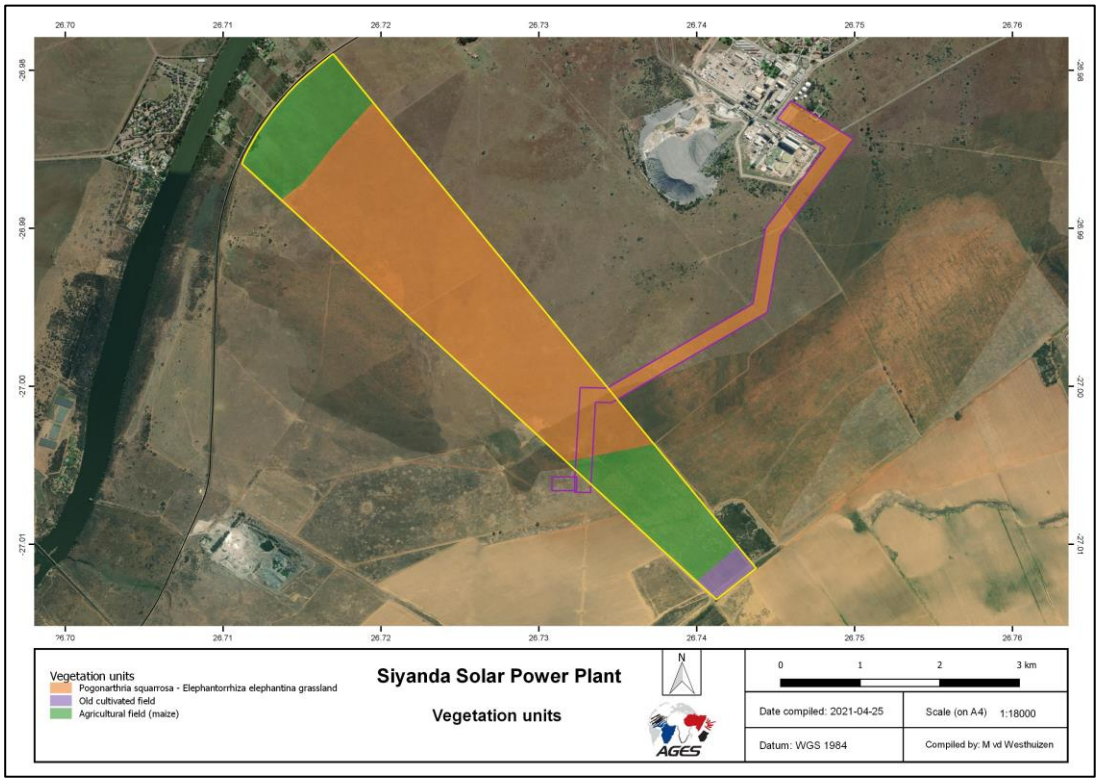


Figure 15: Vegetation units on the site.

The *Pogonarthria squarrosa - Elephantorrhiza elephantina* grassland vegetation unit occurs on slightly undulating plains and makes up the majority of the vegetation at the proposed development site. The substrate consists of sandy soil and dolomite rocks. The vegetation is characterised by grassland dominated by the *Pogonarthria squarrosa, Themeda triandra, Trachypogon spicatus* and *Schizachyrium sanguineum* and the forbs *Elephantorrhiza elephantina, Helichrysum species* and *Hermannia species*. The greater part of the vegetation unit is in a pristine condition, while the part next to the tar road is more disturbed. The vegetation unit is classified as having a Medium-High sensitivity due to the fact that it represents the Endangered Vaal-Vet Sandy Grassland vegetation unit, is in a natural condition

and the species diversity is high. No Species of Conservation Concern or protected trees were recorded.

The *Disturbed Eragrostis curvula– Crotalaria sphaerocarpa* old cultivated field vegetation unit is located in the valley bottom. It was cultivated in the past and is very disturbed with a high percentage of alien plant species and species that are typically associated with disturbance. Vegetation consists of a grass and forb layer without trees or shrubs. Dominant plants include the grasses *Eragrostis curvula, Urochloa mosambicensis, Cynodon dactylon* and *Panicum schinzii*, the *sedge Cyperus leptocladus* and the *forbs Crotalaria sphaerocarpa*, *Cleome rubella, Bidens bipinata* and *Tagetes minuta*. The substrate consists of yellow sandy soil. The vegetation unit is classified as having a Low sensitivity due to the fact that it is very disturbed and the species diversity is low. No Species of Conservation Concern or protected trees were recorded. The development of the solar plant is considered suitable in this area.

Maize is planted in two areas in the proposed development area. There is very little indigenous plants in the agricultural land. Species diversity and sensitivity is low. A detail description of this unit is not given as it is completely disturbed.

Red Data, Protected and Endemic Plant Species

According to the Terrestrial Biodiversity, Plant and Animal Impact Assessment (Appendix D1) no nationally protected plants (NEMBA listed species, 2005) were recorded on site. The following plants that are protected according to Free State Nature Conservation Ordinance 8 of 1969 were recorded at the site:

Table 5.1: Protected plants according to Free State Nature Conservation Ordinance 8 of 1969 relevant to the site

Scientific name	**Common name**
Aloe zebrina	Transvaal Spotted Aloe
Bonatea speciosa	
Helichrysum nudifolium	Hottentot's tea
Helichrysum rugulosum	Marotole (ss)
Helichrysum caespititium	Speelwonderboom
Helichrysum kraussii	Straw Everlasting
Schizocarphus nervosus	White Scilla

All species of the genus Aloe, Helichrysum and Scilla and the family Orchidaceae are protected in the Free State Province. (Free State Province, 1969). A permit should be obtained from authorities should any of these species be eradicated during the construction process.

It is further proposed that a part (30 %) of the *Aloe zebrina, Bonatea speciosa* and *Schizocapphus nervosus* plants on the proposed development area be relocated to suitable habitat on the same farm or to another farm nearby. *Aloe zebrina* is mostly found in rocky areas. A walkthrough survey should be conducted to determine the number and location of individuals. Then a translocation management plan should be written, and plants translocated before development commences. It is not deemed necessary to translocate Helichrysum plants as they are relatively common and rarely successfully translocated.

Three endemic species were recorded, namely *Cucumis heptadactylus*, *Cyperus rupestris* and *Hermannia cordata*. No protected trees were recorded.

Declared Invaders

The following declared invaders were recorded in the site and should be controlled.

Table 5.2: Declared invader species recorded on the site (NEMBA, 2016)

Scientific name	Common name	Invader category
Araujia sericifera	Moth catcher	1b
Datura ferox	Large thorn apple	1b
Malvastrum coromandelianum	Prickly Malvastrum	1b
Verbena bonariensis	Purple top	1b

Category 1 plants are prohibited plants which must be controlled or eradicated. These plants serve no economic purpose and possess characteristics that are harmful to humans, animals or the environment.

- Category 1a: Plants are high-priority emerging species requiring compulsory control. All breeding, growing, moving and selling are banned
- Category 1b: Plants are widespread invasive species controlled by a management program.

Category 2 plants are invaders with certain useful qualities, such as commercial use or for woodlots, animal fodder, soil stabilisation, etc. These plants are allowed in demarcated areas under controlled conditions and in biocontrol reserves.

Category 3 plants are alien plants that are currently growing in, or have escaped from areas such as gardens, but that are proven invaders. No further planting is allowed (except with special permission), nor trade in propagative material. Existing plants may remain but must be prevented from spreading. Plants within the flood line and watercourses must be removed (Bromilow, 2010).

5.3.1.3 Climate

A summary diagram of the climate encountered within the Vaal-Vet Sandy Grassland (which dominates the proposed site) is shown in Figure 16 below. The climate is strongly seasonal and semi-arid, with an average rainfall volume of 530 mm/annum, falling between October and May. The summers are hot and wet, with summer temperatures ranging typically between 14-30°C. The winters are cold and dry, with wintertime temperatures ranging typically between -1 to 19°C. An average of 37 frost days occur each winter. The soils are perpetually moisture stressed, with mean annual evaporation of 2,423 mm, resulting in 79% of days where the soils lose more moisture than they receive from precipitation.

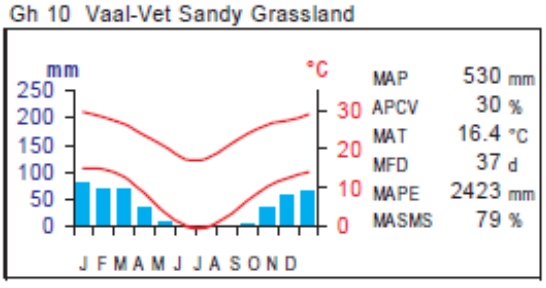


Figure 16: Climatic diagram representative of the Siyanda SPP area (Mucina & Rutherford, 2007)

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 and birds on site. The following section will discuss the state of biodiversity on the site in more detail.

Avifaunal

According to the Avifaunal Impact Assessment (Appendix D2) the typical species occurring on the SPP site are common across the western highveld, with good representation from the widespread larks, pipits, cisticolas, finches widowbirds, bishops and whydahs in particular. Aerial feeding bee-eaters, swallows and swifts were also well represented. Many palearctic migrants were still present on the site, however most intra-African migrants appear to have departed. Raptors were very poorly represented, as were gamebirds. There are Red Data species that could possibly occur on site, even as vagrants and the likelihood of their occurrence must be assessed. The potential red data species for the Siyanda SPP site, along with probability estimates and notes are presented. No Red Data species were recorded during the surveys, although suitable habitat exist on site for the following species with a reasonable likelihood of occasionally occurring on site:

- Secretary bird- Vulnerable. Not recorded in the pentads or during the site visit but has been seen within a 15 km radius of the site and, therefore, has reasonable likelihood of occasionally occurring on site.

- Lanner Falcon- Vulnerable. Recorded in one SABAP2 pentad assessment. It is not clear whether the record will have been on the SPP site, however suitable habitat exists on site and it should be expected to have a reasonable likelihood of occasionally occurring on site.

- Red-footed Falcon- Near Threatened. Not recorded in the pentads or during the site visit but has been seen within a 15 km radius of the site and, therefore, has reasonable likelihood of occasionally occurring on site.

- African Marsh Harrier- Endangered. Vulnerable. Not recorded in the pentads or during the site visit but has been seen within a 15 km radius of the site and, therefore, has reasonable likelihood of occasionally occurring on site.

The following endemic or near-endemic (most of the global range is within South Africa's borders) species were recorded either during prior SABAP2 assessments or during the assessment:

- Cloud Cisticola- recorded on site at numerous transects. Near-endemic.

- Fiscal Flycatcher- recorded on site at numerous transects. Near-endemic.

- Melodious Lark- recorded on site at numerous transects.

- Pied Starling- recorded on site as an incidental occurrence outside of structured surveys. Endemic to South Africa, Lesotho and Swaziland.

- South African Cliff Swallow- recorded on site at numerous transects.

- Karoo Thrush- not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Near-endemic.

- Cape White-eye- not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Near-endemic.

- Jackal Buzzard- not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Near-endemic.

All of the endemic or near-endemic species listed above that have either been confirmed as occurring on site during this assessment or during past SABAP2 assessments have wide distributional ranges and reportedly healthy populations and should not present substantial threats as a result of development of this site.

Fauna

According to the Terrestrial Biodiversity, Plant and Animal Impact Assessment (Appendix D1) a survey was conducted during March 2021 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the quarter degree grid.

Three habitat types were identified:

- Grassland

- Agricultural field (maize)

- Riparian Areas

This vegetation unit is in a good condition, but fragmented. There are powerline pylons, which some birds of prey use for nesting. There are some burrowing species, probably aardvarks (*Orycteropus afer*) and ground squirrels (*Xerus inauris*), which in turn provides burrows systems and bolt holes for other species, such as suricates and snakes to live in. Some birds and rodents are drawn to maize field, as it is a source of food. These animals then attract predator species such as birds of prey and snakes. Wetlands and open water habitats often form fragmented and specialised habitats. They are essential breeding grounds for many frogs, and serve as feeding grounds for threatened cranes, other waterbirds, otters and numerous frog-eating snakes. They are easily impacted by water abstraction for commercial farming, siltation from soil erosion caused by overgrazing, pollution from urban sewage, insecticide and herbicide run-off from agricultural lands, and petroleum spillage on roads. With burgeoning human populations, isolated yet essential water sources are under increasing pressure. The Vaal River next to the project area is moderately modified, but still creates habitats for some species.

According to the Terrestrial Biodiversity, Plant and Animal Impact Assessment (Appendix D1) much of the large and medium-sized mammal fauna that previously occurred on the site is now locally extinct or occurs in small fragmented populations in reserves. The majority of the habitat types are fragmented. Therefore, the expected mammalian richness on these areas is

considered low. Breeding habitat of frogs and toads can be found mostly in the permanent wet zone of the wetlands. Amphibian species potentially occurring in the larger area include Common River Frog, Gutteral Toad, Raucous Toad and Bubbling Kassina. These species are non-threatened and widespread, and as such the development will not have any impact on amphibian conservation within the region. Several reptile species are likely to be present in the area. They are common and widespread, and as such the development will not have any impact on reptile conservation within the region.

According to the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended, two listed fauna species may occur in the site. These are the spotted-necked otter (*Hydrictis maculicollis*) and the African marsh harrier (*Circus ranivorus*). The spotted-necked otter has not been recorded on site. It is unlikely to occur at to the Vaal River next to the proposed site, as the water of the Vaal River is polluted. It has however, in some cases been recorded at polluted rivers and its occurrence can therefore not be definitively excluded. The proposed development will be across the road from the river and riparian area and will therefore not impact on otters, should they be present. Suitable habitat for the African Marsh Harrier is found next to the Vaal River close to the proposed site. It was however not recorded. See the Avifauna Assessment specialist report (Appendix D2) for more details. Should this species be present, the development will not negatively impact on it, as the river and riparian area will not be disturbed by the proposed development.

5.3.1.5 Visual landscape

The proposed SPP development is located in close proximity to the Vaal River. The area drains to the north west, towards the Vaal River approximately 400m from the affected property. The site is located in an area with relatively low significance in elevation, meaning that the site is not located on a mountain, at the foot of a mountain or in an area with a significant difference in elevation. The site is located at an above mean sea level (amsl) of approximately 1304m at the highest elevation and at an amsl of 1294m at the lowest 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 into account (refer to Figure 17 – 18). The observers in a 5km radius include:

- Stokkiesdraai Road
- Vaalbrug Dolomite Mine
- Orkney
- Orkney Vaal
- Visarend Caravan Park
- Serenity Place of Restoration.
- Vaal River Holiday homes.
- Vaal de Grace.
- Vaal River Boating Club.
- R30 (on certain stretches of the road)

- Railway Line

The landscape does not have any specific protection or importance and is characterised by mining activities.

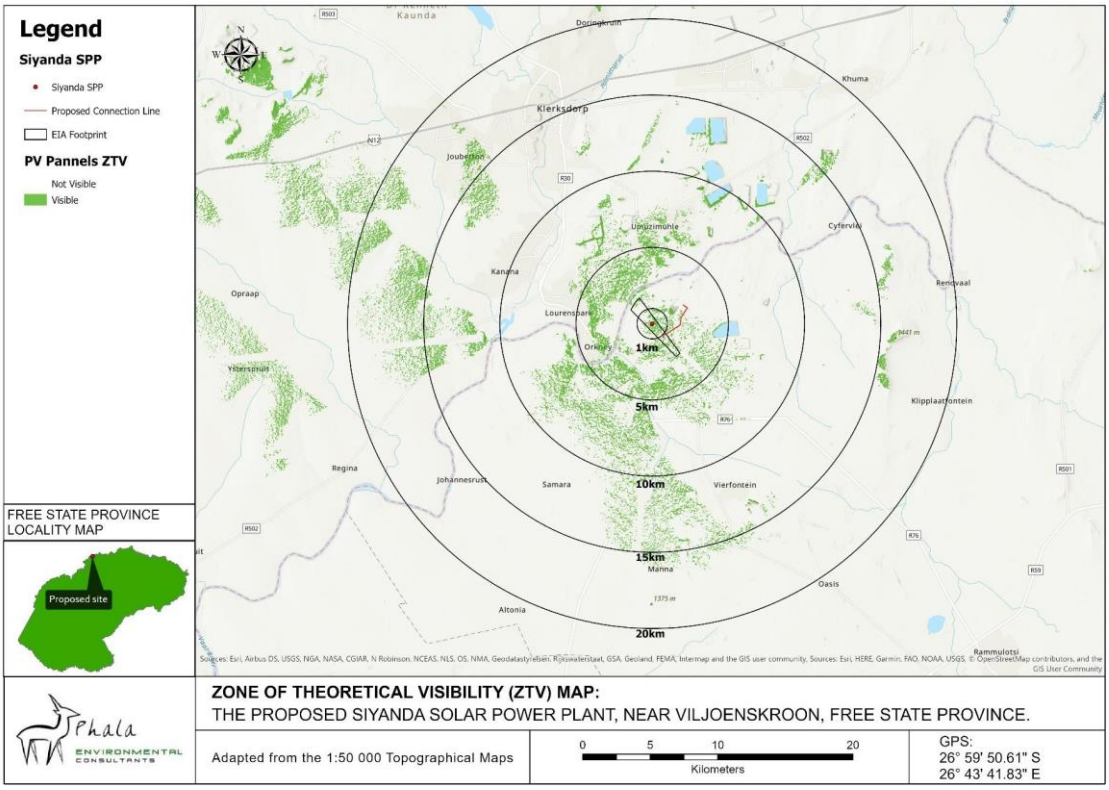


Figure 17: Zone of Theoretical Visibility (ZTV) for the Siyanda Solar Power Plant.

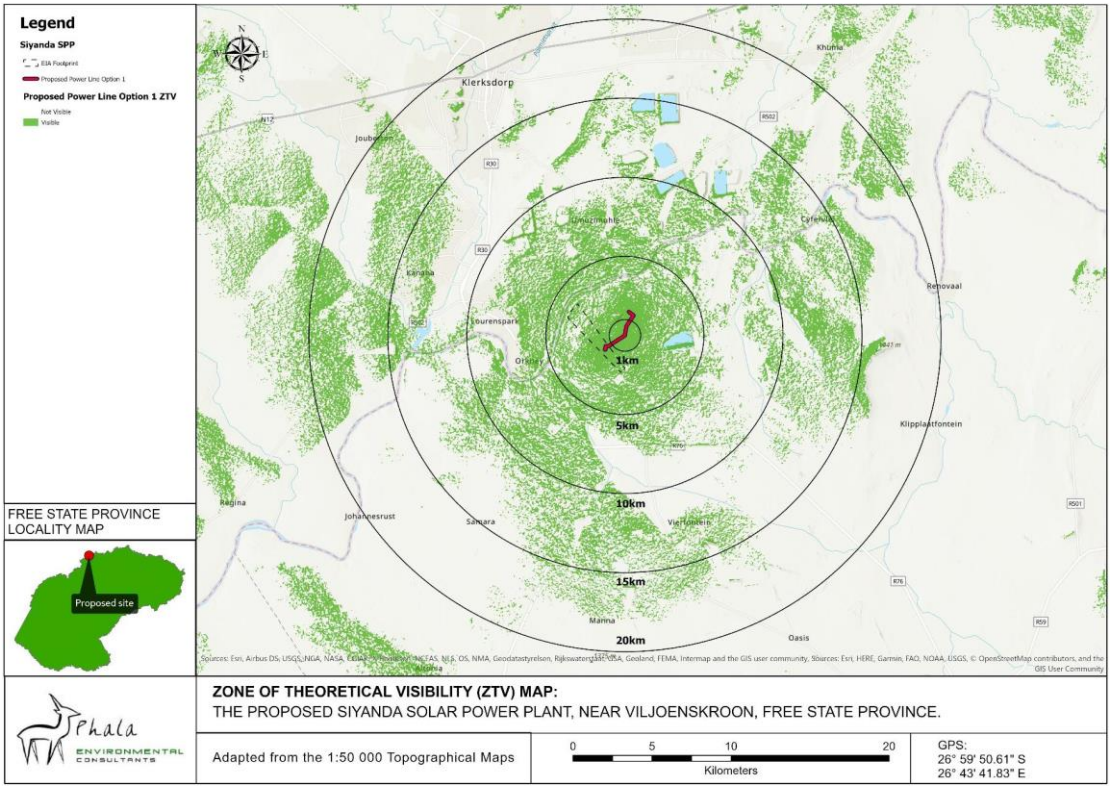


Figure 18: Zone of Theoretical Visibility (ZTV) for the power line – Option 1.

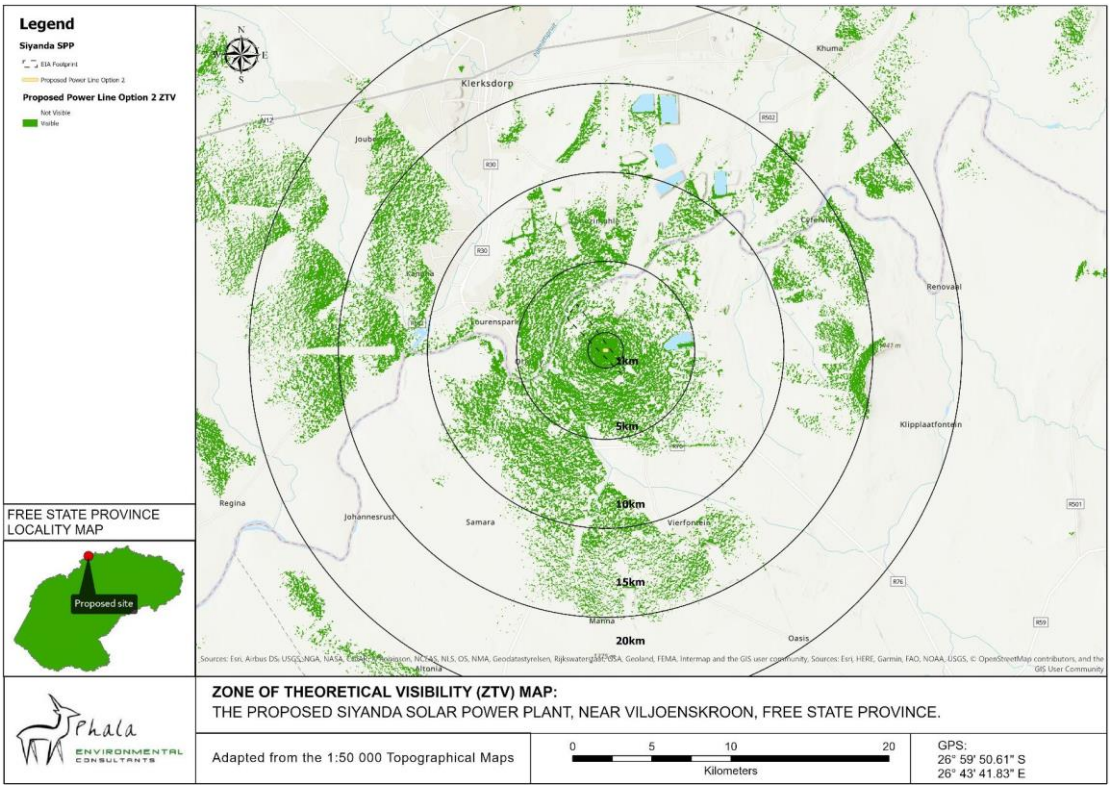


Figure 19: Zone of Theoretical Visibility (ZTV) for the power line – Option 2.

5.3.1.6 Traffic consideration

The site is located off Stokkiesdraai Road, where an existing gravel road will be utilised to access the Remaining Extent of Portion 1 of the farm Grootdraai No. 468. The photovoltaic components will be delivered to site from two (2) possible locations, either from the Port of Saldanha (1450 km) or from the Port of Durban (660 km). The construction phase of the solar power plant is expected to take place over a period of between twelve (12) and eighteen (18) months, during which local traffic will be affected minimally.

Transformer and substation components are envisaged to form part of the local trips. It is anticipated that these components would be imported and transported from the preferred harbour (Saldanha or Durban) as abnormal loads. It would then be assembled in Johannesburg and transported to the Siyanda SPP site, also requiring abnormal load transport. The distance from Johannesburg to Siyanda SPP is approximately 167 km, along the N12. It should be noted that only one abnormal load trip per transformer is expected for the Siyanda SPP. Abnormal load transportation is therefore considered to be isolated and would have a negligible impact on traffic over the construction phase of the project. Cement will be sourced from local manufacturers within the town of Orkney and Viljoenskroon. All other civil construction materials, needed for concrete and wearing course, will be obtained on-site. These trips can be classified as local trips as vehicles will not be travelling over a very long distance. It is anticipated that construction personnel and labour would originate from neighbouring towns such as Viljoenskroon, Orkney, Klerksdorp and Jouberton. These trips can be classified as local trips as vehicles will not be travelling over a very long distance. The vehicles used to transport the photovoltaic (PV) equipment are standard container trucks and not abnormal load vehicles. No obstacles (e.g. low overhead services, cattle grids, narrow bridges, etc.) are

expected, as these routes are travelled by the same type of vehicle throughout.

Table 5.3: Traffic impact on Saldanha route (delivery and construction trips)

Route Description (all traffic)	Est. Adt on Route (vpd)	Construction Trips (vpd)	Total trips (vpd)
N7	8899	36	8935
R27	862	36	898
N14	5412	36	5484

Table 5.4: Traffic impact on Durban route (delivery and construction trips)

Route Description (all traffic)	Est. Adt on Route (vpd)	Construction Trips (vpd)	Total trips (vpd)
N3	16939	36	16975
N5	7187	36	7259

It can be seen from the tables above and overleaf that the delivery and construction trips will be insignificant when compared to the Average Daily Traffic (ADT) and will not affect the existing Level of Service (LOS).

Table 5.5: Traffic impact on Saldanha/Durban routes (commuter trips)

Route Description (all traffic)	Est. Adt on Route (vpd)	Construction Trips (vpd)	Total trips (vpd)
R30	2833	146	2979

From historic traffic count data, it was observed that the R30 around Orkney have abundance spare capacity. The current ADT along this roadway is less than 3200 vpd. It can be concluded from the table above that the estimated additional traffic generated by the construction staff, when travelling to/ from Siyanda SPP, can be accommodated on the existing road network.

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

According to the Social Impact Assessment (Appendix D7) Free State Province is the landlocked core of the country. It is centrally placed, with good transport corridors to the north and the coast. It is the third biggest of South Africa's nine provinces in terms of size, and primary agriculture is a key economic sector. Mining is also important but has been declining

steadily since 2008. Although the Free State is the third-largest province in South Africa, it has the second-smallest population and the second-lowest population density. It covers an area of 129 825km² and has a population of 2 834 714 – 5.1% of the national population. Languages spoken include Sesotho (64.4%), Afrikaans (11.9%) and Zulu (9.1%). The Free State Province contributes 5.4% to South Africa's total gross domestic product (2006).

Agriculture is a key economic sector – 8% of the country's produce comes from Free State. In 2010, agriculture provided 19.2% of all formal employment opportunities in the region. The economy is dominated by agriculture, mining and manufacturing. Known as the 'bread-basket' of South Africa, about 90% of the province is under cultivation for crop production. It produces approximately 34% of the total maize production of South Africa, 37% of wheat, 53% of sorghum, 33% of potatoes, 18% of red meat, 30% of groundnuts and 15% of wool. The province is the world's fifth-largest gold producer, with mining the major employer.

The Fezile Dabi District Municipality is a Category C municipality, formerly known as the Northern Free State District Municipality, situated in the north of the Free State. It is bordered by the North West, Gauteng and Mpumalanga Provinces to the north, Thabo Mofutsanyana District to the south, and Lejweleputswa District to the west. In 2011 the Municipality had a population of 488 036 with an unemployment rate of 33.9% and a youth unemployment rate of 44.4%. By 2016 only 48.3% of dwellings had piped water inside their dwellings and 7.7% of household still did not have electricity in their dwellings.

The Moqhaka Local Municipality is a Category B municipality situated within the southern part of the Fezile Dabi District in the Free State Province. It is the largest of four municipalities in the district, making up over a third of its geographical area and covering an area of 7 925m^2. The former Kroonstad, Steynsrus and Viljoenskroon Transitional Local Councils and sections of the Riemland, Kroonkop and Koepel Transitional Rural Councils are included in the municipality. The general tendency of migration from rural to urban areas is also occurring in the area, as is the case in the rest of the Free State Province. In comparison to the other municipalities within the Fezile Dabi District, it appears as if Moqhaka is significantly less urbanised. The population dwindled from 2011 at 160 532 to 154 732 in 2016. In 2011 the unemployment rate stood at 35.2% and the youth unemployment rate at 47.2%. In 2016 89.7% of households had flush toilets connected to sewerage and 96.3% of households had electricity for lighting in their dwellings. The main economic sectors in the municipality are agriculture, commercial transport, business services and mining.

In the Moqhaka LM there are 55 594 economically active (employed or unemployed but looking for work) people, and of these 35,2% are unemployed. Of the 27 349 economically active youth (15–34 years) in the area, 47,2% are unemployed. The creation of employment opportunities within the formal sector as a result of the development of Siyanda SPP could therefore contribute towards growing employment within the formal sector in both the LM and DM, which could lead to greater levels of job security than may typically be associated with employment in the informal sector.

5.3.2.2 Cultural and heritage aspects

According to the Heritage Impact Assessment (Appendix D5) special attention was given to the identification of possible cultural or heritage resources on site.

Stone Age

Very little habitation of the 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 in sheltered areas such as the mountainous regions north of Klerksdorp and as far east as the Vredefort Dome area. During Middle Stone Age (MSA) times (c. 150 000 – 30 000 BP), people became more mobile, occupying areas formerly avoided. 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. Open sites were still preferred near watercourses.

Late Stone Age (LSA) people had even more advanced technology than the MSA people and therefore succeeded in occupying even more diverse habitats. Also, for the first time we 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 believes. A number of sites containing rock engravings are known to exist to the east and south of the site.

Iron Age

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.

As far as is known, no Early Iron Age sites have yet been identified in the Free State Province. The occupation of the larger geographical area (including the site and surrounding 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 the Mpumalanga highveld. This wet period came to a sudden end sometime between 1800 and 1820 by a major drought lasting 3 to 5 years. The drought must have caused an agricultural collapse on a large, subcontinent scale.

The stone walled settlements dating to the Late Iron Age occur on a wide front over much of the central interior plateau area. In the larger vicinity of the site, these sites conform to Maggs' (1976) type Z settlements. Such site consists mostly of a number of large primary enclosures clustered together, with, associated but on the outside, smaller primary enclosures.

This was also a period of great military tension. Military pressure from Zululand spilled onto the highveld by at least 1821. Various marauding groups of displaced Sotho-Tswana moved across the plateau in the 1820s. Mzilikazi raided the plateau extensively between 1825 and 1837. The Boers trekked into this area in the 1830s. And throughout this time settled communities of Tswana people also attacked each other. As a result of this troubled period, Sotho-Tswana people concentrated into large towns for defensive purposes. Because of the lack of trees, they built their settlements in stone. These stone-walled villages were almost

always located near cultivatable soil and a source of water. Such sites are known to occur north of Klerksdorp and in the Vredefort Dome area.

Historic period

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. Pretoria was started in 1850, but Johannesburg only dates to the 1880s, after the discovery of gold.

In 1837 the establishment of a trekker settlement at Klerksdorp marked the beginning of a new phase in the history of the region. Originally twelve trekker families settled on the farm Elandsheuvel, belonging to C.M. du Plooy. This settlement, known as 'Oude Dorp', had its first landdros Jacob de Clercq, after which the settlement was then named. In 1853, the name was changed to Klerksdorp. With the discovery of gold in 1886 on the farm Rietpoort, the gold rush gave rise to a new settlement called 'Nieuwe Dorp'. In 1897 the railway line from Krugersdorp reached Klerksdorp. The railway line from Fourteen Streams (Warden region), on the main line from Kimberley to Zimbabwe (Then Rhodesia) was completed in 1906. (SESA 1973).

The town of Orkney was established in 1940 at the junction of the various railway lines. It was named after the old gold mine opened by Thomas Leask, who came from the Orkney Islands, in 1880 (SESA 1973).

Site Specific Review:

From the Deed of Transfer, it can be seen that the farm Grootdraai was subdivided from the original farm Pretoriuskraal in 1920. Apart from the farm boundaries, it does not indicate any other development or the existence of built features.

From a review of the available old maps and aerial photographs it can be seen that the project area has always been open space, with the main activity being grazing or the making of agricultural fields. The only built structure development visible is on the 1953 version of the 1:50 000 topographic map, where it is indicated as "murasie" (ruin), as well as on the 1961 version of the official aerial photograph. On later maps, this feature has been removed. Currently, the area is totally overgrown. and it is impossible to locate this feature.

No sites, features or objects of cultural significance dating to the Stone Age, Iron Age or the Historic Period were identified on site.

Palaeontology

The site on the Remaining Extent of Portion 1 of the Farm Grootdraai 468 as well as the associated grid connection corridor are underlain near surface and at depth by shallow marine platform carbonate bedrocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) of Precambrian (late Archaean) age. In the Vaalbrug area south of Orkney only the two lowermost subunits of the Malmani Subgroup succession are mapped, namely the Oaktree and Monte Christo Formations. According to the 1: 250 000 geological maps, the Malmani carbonates near Orkney rest unconformably on Archaean volcanics of the Rietgat Formation (Ventersdorp Supergroup). Basal Transvaal Supergroup quartzites of the Black Reef Formation are not mapped along the contact here.

The Oaktree Formation on the site comprises basal black mudrocks followed by c. 300 m of chocolate brown-weathering, chert free and occasional stromatolitic dolomite with local development of quartzite facies. A volcanic tuff unit within the Oaktree Formation has been

dated to 2.6 Ga (billion years ago). Patchy, low exposures of grey- and brown-weathering Oaktree carbonates are dispersed over the site. More prominent, kartsified exposures of typical chocolate-hued Oaktree bedrocks are well seen along the north-eastern edge of the site; some of these show well-developed stylolitic surfaces generated by diagenetic solution.

The overlying Monte Christo Formation consists largely of paler dolomites, stromatolitic and oolitic in part, with abundant secondary chert which gives rise to surface gravels of downwasted cherty material. Possible occurrences of these younger Malmani carbonate rocks are seen in a low rocky scarp traversing the southern sector of the project area just south of the proposed on-site substation location and north of the existing powerline, although this is not shown by the geological map and requires confirmation since the beds here are often brownish-weathering.

Over most of the solar plant project area the Precambrian bedrocks are overlain by a thin veneer of sandy soils with sparse downwasted gravels dominated by pale grey to yellowish secondary chert. The bedrocks in the southern sector of the project area are mantled by aeolian sands of probable Pleistocene age. These wind-blown sands are broadly equivalent to those of the Kalahari Group and overlie a regional land surface incised across the Precambrian bedrocks that is inferred to be of Paleogene (Early Tertiary) age. On satellite images these sandy areas are striated (due to agriculture) and prominently spotted, perhaps due to insect or mammal bioturbation . Pleistocene and younger alluvial deposits occur along the densely-wooded banks of the Vaal River (ibid.) and extend into the north-western borders of the project area adjacent to the Stokkiesdraai Road; this area has now been largely transformed for agriculture. Older, semi-consolidated fine-grained alluvium will not be directly impacted by the proposed development and such deposits were not encountered within the solar power plant and grid connection project area during the recent site visit. However, local concentrations of well-rounded boulders of pale quartzite as well as chert overlying Malmani bedrocks in the southern part of the project area might represent downwasted old terrace gravels of the Vaal River and its tributaries. Blocks of well-developed, coffee-brown glaebular ferricrete suggest the previous presence of swampy vlei areas in this southern region.

Fossils within Precambrian carbonate bedrocks

The Malmani Subgroup platform carbonates of the Transvaal Basin host a variety of stromatolites (microbial laminites or laminated bio-sedimentary structures), ranging from supratidal mats to intertidal columns and large subtidal domes. These biogenic structures are of biostratigraphic as well as of palaeoecological interest; for example, the successive Malmani dolomite formations are in part differentiated by their stromatolite biotas.

Many of the low karstified exposures of greyish to brown-weathering Oaktree Formation carbonates encountered during the site visit to the Remaining Extent of Portion 1 of the Farm Grootdraai 468 display microbial laminites, including crinkly laminites as well as small- (few cm diam.) to medium-scale (few dm diam) domical stromatolites and rarer columnar stromatolites. In many cases the stromatolitic zones have been secondarily silicified during diagenesis and it is consequently likely that they are over-represented on karstified land surfaces such as present here compared to intervening non-stromatolitic facies. Since most of these biosedimentary structures are of widespread occurrence within the outcrop area of the formation and are not particularly well preserved, they are not considered to be of high conservation value (Proposed Field Rating IIIC Local Resource).

Possible (but equivocal) larger-scale, low stromatolitic domes that are several meters across and not secondarily silicified are seen in the only area of well-exposed carbonate bedrocks in the southern sector of the project area north of the existing power line (Locs. 108, 110). Some of the domes are asymmetrical, their growth perhaps influenced by tidal currents. It is unclear if these interesting undulose beds should be assigned to the Oaktree Formation (as mapped), as perhaps suggested by their brownish weathering, or might belong to the slightly younger Monte Christo Formation. It is likely, however, that similar subtle domal features are also represented within the low rocky scarp stretching several hundred meters to the west and east of the recorded sites. Occasional oblate sphaeroidal concretions of diagenetic ferruginous carbonate have a stromatolite-like concentric internal lamination. However, the laminae are convex down as well as up, so these may be regarded as potentially-misleading pseudofossils. More problematic are large blocks of weathering-resistant, pale yellowish to grey, vuggy chert showing very regular to convolute, millimeter-scale lamination which sometimes resembles zones of small-scale stromatolites. An alternative interpretation of this facies is that it results from the abiogenic precipitation of isopachous cement from carbonate saturated seawater overlying the sea floor; i.e. these nested sets of convex-upwards laminae may also be a form of pseudofossil. Zones of convolute lamination may be due to slumping or seismic activity. It is notable that the microlaminated beds are intensely silicified, as is the case with stromatolite-rich horizons.

Fossils within Late Caenozoic superficial sediments

The mainly Pleistocene to Recent superficial deposits in the project area - viz. sandy soils, downwasted surface gravels, possible pedocretes (such as ferricretes observed in the southern part of the grid connection corridor), alluvium – are poorly known in palaeontological terms. They are likely to be of Low to Very Low palaeosensitivity for the most part. However, these younger sediments may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals. These may include ancient human remains of considerable paleoanthropological significance. Other potential late Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (e.g. calcretised termitaria and other insect burrows or nests, coprolites, rhizoliths), and plant remains such as peats or palynomorphs (pollens) in fine-grained, organic-rich alluvial horizons. Quaternary alluvial sediments may contain reworked Stone Age artifacts that are useful for constraining their maximum age.

No fossil mammalian or invertebrate remains or trace fossils were recorded from the superficial sediments during the site visit. Potentially fossiliferous alluvial deposits along the banks of the Vaal River lie outside the project footprint. Surface gravels of downwasted or high energy fluvial origin are unlikely to contain fossils.

Figure 20: Google Earth© satellite image of the Siyanda Solar Power Plant project area (red polygon) showing selected occurrences of fossil stromatolites recorded within the Malmani Subgroup carbonate bedrocks in relation to the final layout

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 Free State 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. The Remaining Extent of the Farm Grootdraai No. 468 where the project is proposed to be located is considered favourable 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 Free State receives a high average of direct normal and global horizontal irradiation daily. This is an indication that 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 2118 kwh/m^2 per year is relevant in the area.

- **Renewable Energy Development Zone (REDZ):** The site is also located in the Klerksdorp 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.

- **Site availability and access:** The land is available for lease by the developer and consent has been provided by the affected landowner for the undertaking of the BA process. Reluctant farm owners or farmers over capitalizing hamper efforts to find suitable farms. Access will be easily obtained via the Stokkiesdraai road.

- **Grid connection**: In order for the PV facility to connect to the national grid a 132kV power line will be constructed within an identified 100m wide corridor either towards the Vaal Reefs Nine 132/6.6 kV substation or a loop in loop out connection to the Western Reef SWS / Jersey DS 1 or 2 88 kV HV Overhead Line. 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 ecological features and the visual landscape – refer to Section 5.3.1 of this report. Nothing of note was identified from an ecological or conservation point of view on the site apart from the non-perennial pans and a few cultural and heritage resources.

It is evident from the discussion above that Remaining Extent of Portion 1 of the Farm Grootdraai No. 468 may be considered favourable and suitable in terms of these site characteristics. As mentioned previously, no alternative areas on Remaining Extent of Portion 1 of the Farm Grootdraai No. 468 have been considered. However, provision was made after the initial investigation and specialist studies to exclude the areas surrounding the agricultural land.

5.5 CONCLUDING STATEMENT ON ALTERNATIVES

When considering the information provided by the specialists with regards to the site selection criteria and the comparison, the site is identified as preferred due to the fact that the opportunities presented on the site to develop the project in such a way which avoids the areas and features (including the associated buffers) of environmental sensitivity.

Therefore, development of the 150 MW Siyanda Solar Power Plant on the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468, is the preferred option. The preferred layout on the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468 included in the attached Appendix H. It is therefore concluded that no other alternatives are considered as part of the BA process.

6 DESCRIPTION OF THE IMPACTS AND RISKS

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

Appendix 1. (3)(i) An BAR (...) must include-

(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 report;

6.1 SCOPING METHODOLOGY

The contents and methodology of the basic assessment report aimed 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 05 March 2021. The site visit was conducted to ensure a proper analysis of the site specific characteristics of the site. Table 6.1 provides a checklist, which is designed to stimulate thought regarding possible consequences of specific actions and to 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	×			The Vaal river is located along the northern boundary of the site.
II. A conservation or open space area	×			The site falls within the Ecological Support Area 1 and 2.
III. An area that is of cultural importance		×		No sites of cultural or historical importance were found on site.
IV. Site of geological/palaeontological significance	×			Large domal stromatolitic and several laminated chert blocks features of conservation value are present on site. The site is underlain by fossiliferous sedimentary rocks of Precambrian and younger, Pleistocene to Holocene age.
V. Areas of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.
VII. Floodplain	×			The Vaal river is located along the northern boundary of the site.
VIII. Indigenous forest		×		None.
IX. Grass land	×			The site falls within the Vaal-Vet Sandy Grasslands vegetation unit which is classified by Mucina and Rutherford as Endangered.
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 Annexure D3) confirmed that the development of the solar power plant and associated power lines will have a visual impact on observers.
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 and will be temporary in nature.
IV. Construction of an access road	×			Access will be obtained via the Stokkiesdraai Road off of the R30. Internal access roads will be constructed for the facility.
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 885 employment opportunities will be created during the construction and 15 - 70 employment opportunities during the operation phase of the SPP 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 4200 m^3 per annum.
VIII. Job creation	×			Approximately 885 employment opportunities will be created during the construction and 15 - 70 employment opportunities during the operational phases for the SPP.
IX. Traffic generation	×			It is estimated that 72 trips per day will be generated over the 12-18 month construction period for the SPP.

X. Soil erosion	×			The site will need to be cleared or graded, 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. No existing areas of erosion was identified.
XI. Installation of additional bulk telecommunication transmission lines or facilities	×			There is existing Eskom infrastructure in the area and the Solar Power Plant will require additional power lines to be constructed.
3. Is the proposed project located near the following?				
I. A river, stream, dam or wetland	×			The Vaal River is located along the northern boundary of the site.
II. A conservation or open space area	×			The site falls within the Ecological Support Area 1 and 2.
III. An area that is of cultural importance		×		No sites of cultural or historical importance were found on site.
IV. A site of geological/palaeontological resources significance	×			Large domal stromatolitic and several laminated chert blocks features of conservation value are present on site. The site is underlain by fossiliferous sedimentary rocks of Precambrian and younger, Pleistocene to Holocene age.
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 proposed SPP development is located approximately 3km from the town of Orkney

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 were 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 E** 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															
Activity 11(i) (GN.R. 327): *"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 14 (GN.R 327): *"The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters."* Activity 24 (ii) (GN.R 327): *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve*	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 The main civil works are: • 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 were reasonably possible.	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	• Habitat destruction caused by clearance of vegetation • Habitat fragmentation caused by clearance of vegetation • Increased soil erosion and sedimentation • Soil and water pollution • Spread and establishment of alien invasive species • Negative effect of human activities on fauna and road mortalities		-	S	L	D	PR	ML	Yes	- Peripheral impacts around the development footprint, on the surrounding vegetation of the area, should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum, while the rehabilitation of the site must be prioritised after construction has been completed. - During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, to reduce potential	L	Terrestrial biodiversity, plant and animal impact assessment (Appendix D1)

exists where the road is wider than 8 meters" Activity 28 (ii) (GN.R. 327): *"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 56 (ii) (GN.R 327): *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* Activity 1 (GN.R 325): *"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 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation."*	Additionally, the turning circle for trucks will also be taken into consideration. Transportation and installation of PV panels into an Array 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. Wiring to the Central Inverters 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.												impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. - All development activities should be restricted to specific recommended areas. The Environment Control Officer (ECO) should control these areas. Storage of equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries. The entire development footprint must be clearly demarcated prior to initial site clearance and prevent construction personnel from leaving the demarcated area. This would only be applicable to the construction phase of the proposed development. - The Environmental Site Officer (ESO)		

<u>Activity 12 (b)(i) (GN.R 324):</u> *"The clearance of an area of 300 square metres or more of indigenous vegetation… …(b) in the Free State (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004."*													should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO must enforce any measures that he/she deem necessary. Regular environmental training must be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. - Where holes for poles pose a risk to animal safety, they must be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling during planting of the poles along the lines. - Poisons for the control of problem animals must be avoided since the wrong use thereof can have disastrous consequences for birds of prey. The use		

													of poisons for the control of rats, mice or other vermin must only be used after approval from an ecologist. - Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. - Monitoring must be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna and flora of the area.		
			Wetland/ Riparian areas	• Soil compaction, erosion and sedimentation for the river and riparian area • Soil and water pollution for the river and riparian area • Spread and establishment of alien invasive species for the river and riparian area		-	S	L	D	PR	ML	Yes	- Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. - Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and any alien plants which establish should be cleared and follow-up undertaken for at	L	Wetland Assessment (Appendix D9)

													least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., “ripping” the affected area). - Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion. - Erosion control mechanisms must be established as soon as possible. - A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-construction and post-decommissioning. - If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is		

														preferable as it will not be associated with the nitrogen negative period associated with organic material that is not composted. - Vehicle traffic should not be allowed on the rehabilitated areas, except on allocated roads. It will have a negative impact due to the dispersive / compaction characteristics of soils and its implications on the long term. - Appropriate design and mitigation measures must be developed and implemented to minimise impacts on the natural flow regime of the watercourse i.e., through placement of structures/supports and to minimise turbulent flow in the watercourse. - The indiscriminate use of machinery within the riparian area will lead to compaction of soils and destruction of vegetation and must therefore be strictly controlled. - Alien and invader vegetation must not		

														be allowed to colonise the area. Control involves killing alien invasive plants present, seedlings and establishing an alternative plant cover to limit re-growth. The use of indigenous plants must be encouraged in the rehabilitated areas (stormwater canals). Control should begin prior to construction phase considering small populations of invader plant species occur around the site. - Institute strict control over materials brought onto site, which should be inspected for seeds and steps taken to eradicate these before transport to the site. The contractor is responsible for the control of weeds and invader plants. - Rehabilitate disturbed areas as quickly as possible. - Institute a monitoring programme to detect alien invasive species early. - Institute an eradication/control programme for early		

													intervention if invasive species are detected. The use of indigenous plants must be encouraged in the rehabilitated areas. Active management and eradication of exotic / alien plant species should also occur when seedlings are found.		
			Avifauna	• Displacement of priority avian species from important habitats. • Displacement of resident avifauna through increased disturbance. • Loss of important avian habitats		-	S	M	Pr	PR	ML	Yes	• Limit construction footprint and retain indigenous vegetation wherever possible. • Limit access to remainder of area, avoid breeding season (summer). • Lay-down areas must only be located on disturbed zones. • Construct in shortest timeframe. • Control noise to minimum.	L	Avifaunal Assessment (Appendix D2)
			Air	• Air pollution due to the increase of traffic of construction vehicles and the undertaking of construction activities.	-		S	S	D	CR	NL	Yes	• A speed limit should be enforced on dirt roads (preferably 30-40km/h). • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions,	L	Terrestrial biodiversity, plant and animal impact assessment (Appendix D1)

													soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.		
			Soil	• Loss of agricultural potential by occupation of land • Loss of agricultural potential by soil degradation • Loss of agricultural potential by dust generation		-	S	S	Pr	PR	ML	Yes	- Implement an effective system of storm water run-off control, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended, to prevent further erosion from occurring there. - Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas	L	Agricultural Agro-Ecosystem Specialist Assessment (Appendix D4)

														throughout the site, to stabilize disturbed soil against erosion. - If an activity will mechanically disturb the soil profile below surface, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation, which may be after construction or only at decommissioning. The depth of topsoil stripping is dependent on the specific field conditions. The maximum depth should be 30cm. If additional unconsolidated material exists below 30cm and needs to be removed for construction purposes, it must be stripped and stockpiled separately from the upper 30cm topsoil. Such material should only be used for fill below a topsoil layer, and not used for spreading on the surface. If there is less than 30cm of unconsolidated soil material above a limiting layer of rock		

														or hardpan, then the entire depth must be stripped and stockpiled as topsoil, even if it contains a high proportion of course fragments. - Topsoil should be retained in the area below the panels (or mirrors). It is not desirable to strip and stockpile this topsoil for the whole of the operational phase. It will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase for the following reasons: conservation of topsoil, dust suppression and erosion control. - It is only in areas where topsoil cannot		

														be retained on the surface during the operational phase, and where the area will be rehabilitated back to veld after decommissioning, that it should be stripped and stockpiled for the duration of the operational phase for re-spreading during de-commissioning. - Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. - Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. - During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. - If there is compaction, either in re-spread topsoil or in areas where topsoil was retained during the operational phase, it must be loosened through an appropriate plough action.		

														- If topsoil has been stockpiled for the duration of the operational phase, re-vegetation is likely to require seeding and / or planting. • Erosion must be carefully controlled where necessary on topsoiled areas. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil.		
			Existing services infrastructure	• 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.		-	L	S	D	PR	ML	Yes	-	L	Confirmation from the Local Municipality to provide services
			Groundwater	• Pollution due to construction vehicles and the storage and handling of dangerous goods.	-		S	S	Pr	CR	ML	Yes	• A groundwater monitoring programme (quality and groundwater levels) should be designed and installed for the site. Monitoring boreholes should be securely capped (where used), and must be fitted with a suitable sanitary seal to prevent surface water flowing down the outside of the casing.	L	-

														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 / Riparian	• Soil and water pollution of the river and riparian area • Soil compaction, erosion and sedimentation of the river and riparian area • Spread and establishment of alien invasive species to the river and riparian area		-	L	S	Pr	PR	ML	Yes	• Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • No dumping of waste should take place within the riparian area. If any spills occur, they should be cleaned up immediately. • Contain all dirty water in the dirty water system and contain all dirty stormwater up to a 1:50 year flood event as a minimum. Ensure that all activities impacting	L	Wetland Assessment Appendix D9

														on groundwater resources of the subject property are managed according to the relevant DWS Licensing regulations and groundwater monitoring and management requirements. • Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility. • Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The Environmental Site Officer (ESO) should enforce this rule rigorously. • Hazardous chemicals to be stored on an impervious surface protected from rainfall and stormwater run-off. • Spill kits should be on-hand to deal with spills immediately. • All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on		

														site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier. • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. • A speed limit (preferably 40 km/hour) should be enforced on dirt roads. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with the label and application permit directions and stipulations for		

													terrestrial and aquatic applications.		
		SOCIAL/ECONOMIC ENVIRONMENT	Local unemployment rate	• Job creation. • Business opportunities. • Skills development.		+	P	S	D	I	N/A	Yes	• Where reasonable and practical, the SPP service providers should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories	L	Social Impact Assessment (Appendix D7)
			Visual landscape	• Potential visual impact on residents of farmsteads and motorists in close proximity to proposed facility.									• Ensure that vegetation is not unnecessarily removed during the construction phase. • Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) where possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. • Ensure that rubble, litter, etc. are appropriately stored (if it can't be removed daily) and then disposed of regularly at a licenced waste site.		
					-		L	S	D	CR	NL	Yes		L	Visual Impact Assessment (Appendix D3)

													• Reduce and control dust during construction by utilising dust suppression measures. • Construction activities should be limited to between the hours of 07:00 and 18:00, where possible, in order to reduce the impacts of construction lighting. • Rehabilitate all disturbed areas immediately after the completion of construction work and maintain good housekeeping.		
			Traffic volumes	• Increase in construction vehicles.	-		L	S	Pr	CR	NL	Yes	• Delivery and construction trips will be insignificant when compared to the Average Daily Traffic (ADT) and will not affect the existing Level of Service (LOS). It can therefore be concluded that, on both routes, no mitigation measures will be necessary.	L	Traffic Impact Assessment (Appendix D8)
			Health & Safety	• Air/dust pollution. • Road safety. • Impacts associated with the presence of construction workers on site and in the area. • Influx of job seekers to the area.		-	L	L	Pr	PR	ML	Yes	• Develop and implement a local procurement policy which prioritises “locals first” to prevent the movement of people	L	Social Impact Assessment (Appendix D7)

				• Increased safety risk to farmers, risk of stock theft and damage to farm infrastructure associated with presence of construction workers on the site. • Increased risk of veld fires.								into the area in search of work. • Engage with local community representatives prior to construction to facilitate the adoption of the locals first procurement policy. • Provide transportation for workers (from Orkney/Viljoenskroon) to ensure workers can easily access their place of employment and do not need to move closer to the site. Working hours should be kept between daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities. • Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour. • Prevent the recruitment of workers at the site. • Implement a method of communication whereby procedures to lodge complaints are set out in order for the local community to express any		

														complaints or grievances with the construction process (i.e. grievance mechanism). • Establish clear rules and regulations for access to the proposed site. • Appoint a security company and implement appropriate security procedures to ensure that workers do not remain onsite after working hours. • A firebreak should be implemented before the construction phase. The firebreak should be controlled and constructed around the perimeters of the development footprint. • Adequate fire-fighting equipment should be provided and readily available on site and all staff should be trained in firefighting and how to use the fire-fighting equipment.		
			Noise levels	• The generation of noise as a result of construction vehicles, the use of	-		L	S	D	CR	NL	Yes	• During construction care should be taken to ensure that noise from construction vehicles and plant	L	Social Impact Assessment (Appendix D7)

				machinery such as drills and people working on the site.									equipment does not intrude on the surrounding residential areas. Plant equipment such as generators, compressors, concrete mixers as well as vehicles should be kept in good operating order and where appropriate have effective exhaust mufflers.		
			Tourism industry	• 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	• Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries –	-		S	S	U	PR	NL	Yes	- No features or objects of heritage or cultural significance were recorded onsite. - Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation to ensure that no accidental damaged is caused to the features or that undetected heritage/remains are destroyed.	L	Heritage Impact Assessment (Appendix D5)
			Paleontological Heritage	• Disturbance, damage or destruction of legally-protected fossil heritage within the		-	S	P	U	IR	ML	Yes	- Protection of recorded sensitive fossil sites.	L	Paleontological Impact Assessment

				development footprint during the construction phase									- Safeguarding of stromatolitic block at site 101 by removal at least 5m outside project footprint. - Limit disturbance in vicinity of sites 108-110 to existing farm tracks with the powerline spanning sensitive area, if feasible. - Implementation of recommended Chance Fossil Finds Procedure. Chance fossil finds during the construction phase of the solar facility and associated grid connection involves safeguarding of the fossils (preferably in situ) by the responsible ECO and reporting of finds to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27(0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). - The ECO should monitor all substantial surface clearance operations and excavations into sedimentary rocks for fossil remains such as well-preserved		(Appendix D6)

													stromatolites on an on-going basis during the construction phase.		
OPERATIONAL PHASE																
Activity 11(i) (GN.R. 327): *"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 14 (GN.R 327): *"The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters."* Activity 1 (GN.R 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."*	The key components of the proposed project are described below: • PV Panel Array - To produce 150 MW, 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. • 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	BIOPHYSICAL ENVIRONMENT	Fauna and Flora	• Soil and water pollution • Spread and establishment of alien invasive species • Negative effect of human activities on fauna and road mortalities		-	L	L	Po	PR	ML	Yes	- Any excess or waste material or chemicals should be removed from the site and discarded in an environmentally friendly way. This rule must be enforced rigorously. - Hazardous chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. - Spill kits should be on-hand to deal with spills immediately. - All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.	L	Terrestrial biodiversity, plant and animal impact assessment (Appendix D1)
			Avifauna	• Displacement of priority avian species from important habitats		-	S	L	Pr	PR	ML	Yes	• Limit ongoing human activity to the minimum required for ongoing operation.	M	Avifaunal Impact Assessment (Appendix D2)

	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 and switching station will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. • <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, protection circuitry and Battery Energy Storage Systems (BESS). • <u>Roads</u> – Access will be obtained via the Stokkiesdraai road of the R30. 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 6 m – 12 m.			• Displacement of resident avifauna through increased disturbance • Collisions with PV panels leading to injury or loss of avian life • Collision when flying into power line infrastructure • Electrocution when perched on power line infrastructure								• Control noise to minimum. • Rehabilitate with indigenous vegetation. • Limit roadways and vehicle speeds. • Panels to be flat at night, preferably low sheen/matt surfaces. • Undertake quarterly fatality monitoring. • Require a walk-through after power line pole positions are determined to demarcate sections requiring bird deterrents/flappers. • Install flappers on all required sections of powerlines (as directed by avifaunal specialist) on or directly adjacent to site.		
			Air quality	• The proposed development will not result in any air 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
			Soil and Agriculture	• Increased financial security for farming operations • Impacts on agricultural production and employment		-	L	L	D	PR	SL	Yes	- No mitigation required. The development will result in the loss of productivity of 57 head of cattle from the farm. Although there is a one farm worker allocated to the site, he is likely to be utilised for work elsewhere in the	L	Agricultural Agro-Ecosystem Specialist Assessment (Appendix D4)

	• Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm.												farming enterprise, and so the development is likely to have no impact on agricultural employment.		
			Groundwater	• Leakage of hazardous materials. The development will comprise of a distribution substation and switching station 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 bunded (impermeable floor and sides) to prevent accidental discharge to groundwater.	L	-
			Surface water / wetlands	• Soil and water pollution of the river and riparian area • Soil compaction, erosion and sedimentation of the river and riparian area • Spread and establishment of alien invasive species in the river and riparian area		-	L	L	Pr	PR	ML	Yes	• Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • No dumping of waste should take place within the riparian area If any spills occur, they should be cleaned up immediately. • Contain all dirty water in the dirty water system and contain all	L	Wetland Assessment (Appendix D9)

														dirty stormwater up to a 1:50 year flood event as a minimum. Ensure that all activities impacting on groundwater resources of the subject property are managed according to the relevant DWS Licensing regulations and groundwater monitoring and management requirements. • Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility. • Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The Environmental Site Officer (ESO) should enforce this rule rigorously. • Hazardous chemicals to be stored on an impervious surface protected from rainfall and stormwater run-off. • Spill kits should be on-hand to deal with spills immediately.		

													• All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier. • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. • A speed limit (preferably 40 km/hour) should be enforced on dirt roads.		
		SOCIAL/ECONOMIC	Visual landscape	• Visual impact on observers travelling along the roads and residents at homesteads		-	L	L	D	PR	ML	Yes	*Planning* - Retain/re-establish and maintain natural vegetation immediately	L	Visual Impact Assessment (Appendix D3)

				within a 5km radius of the SPP. • Visual impact on observers travelling along the roads and residents at homesteads within a 5-10km radius of the SPP. • Visual impacts of lighting at night on sensitive visual receptors in close proximity to the proposed facility. • Visual impacts of glint and glare on sensitive visual receptors in close proximity to the proposed facility. • Visual impacts on observers travelling along the roads and residents at homesteads in close proximity to the power line structures. • Visual impacts and sense of place impacts associated with the operation phase of Siyanda SPP.								adjacent to the development footprint. - Where insufficient natural vegetation exists next to the property, a 'screen' can be planted using endemic, fast growers that are water efficient. *Operations* - Maintain the general appearance of the facility as a whole. Screening should be implemented by means of vegetation in conjunction with security fencing. - Shield the source of light by physical barriers (walls, vegetation etc.) - Limit mounting heights of lighting fixtures, or alternatively use footlights or bollard level lights. - Make use of minimum lumen or wattage in fixtures. - Make use of down-lighters, or shield fixtures. - Make use of low-pressure sodium lighting or other types of low impact lighting.		

													- Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. - Maintain the general appearance of the servitude as a whole.		
			Traffic volumes	• The proposed development will not result in any traffic impacts during the operational phase.	-		L	L	Po	CR	NL	Yes	-	L	Traffic Impact Assessment (Appendix D8)
			Health & Safety	• 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
			Noise levels	• 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
			Heritage resources	• Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries – Grave/ Burial sites and Farmstead	-		S	S	U	PR	ML	Yes	- Avoidance/Preserve: This is viewed to be the primary form of mitigation and applies where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. This measure often includes the change / alteration of development planning and therefore impact	L	Heritage Impact Assessment (Appendix D5)

													zones in order not to impact on resources. - Avoidance/Preserve the homestead: This is viewed to be the primary form of mitigation and the site should be retained in situ and a buffer zone should be created around it, either temporary (by means of danger tape) or permanently (wire fence or built wall) of 100m. - Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation to ensure that no accidental damaged is caused to the features or that undetected heritage/remains are destroyed.		
			Electricity supply	• Generation of additional electricity. The power line will transport generated electricity into the grid.	+		I	L	D	I	N/A	Yes	-	N/A	-
			Electrical infrastructure	• Additional electrical infrastructure. The proposed solar facility will add to the existing electrical infrastructure and aid to lessen the reliance of electricity generation from coal-fired power stations.	+		I	L	D	I	N/A	Yes	-	N/A	-
DECOMMISSIONING PHASE															

-	<u>Dismantlement of infrastructure</u> During the decommissioning phase the Solar PV Energy facility and its associated infrastructure will be dismantled. <u>Rehabilitation of biophysical environment</u> The biophysical environment will be rehabilitated.	BIOPHYSICAL ENVIRONMENT	Fauna and Flora	• Habitat destruction caused by clearance of vegetation • Soil and water pollution • Spread and establishment of alien invasive species • Negative effect of human activities on fauna and road mortalities		-	L	L	Po	PR	ML	Yes	- Any excess or waste material or chemicals should be removed from the site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously. - Hazardous chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. - Spill kits should be on-hand to deal with spills immediately. - All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier. - All disturbed areas must be rehabilitated to an appropriate condition	L	Terrestrial biodiversity, plant and animal impact assessment (Appendix D1)
			Air quality	• Air pollution due to the increase of traffic of construction vehicles	-		S	S	D	CR	NL	Yes	- Regular maintenance of equipment to ensure reduced exhaust emissions.	L	-
			Soil	• Soil degradation, including erosion		-	S	S	Pr	PR	M	Yes	- Implement an effective system of stormwater	L	Agriculture and Soils

				• Disturbance of soils and existing land use (soil compaction) • Physical and chemical degradation of the soils by construction vehicles (hydrocarbon spills)								run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion. - Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion. - If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. - During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.		Compliance Statement (Appendix D4)
			Existing services infrastructure	• Generation of waste that needs to be accommodated at a licensed landfill site	-		L	S	D	I	NL	Yes	-	L	-

				• Generation of sewage that needs to be accommodated by the municipal sewerage system and the local sewage plant • Increase in construction vehicles											
			Groundwater	• Pollution due to construction vehicles	-		S	S	Pr	CR	ML	Yes	- All vehicles should be inspected for oil and fuel leaks on a regular basis. - Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.	L	-
			Surface water / riparian	• Increase in stormwater run-off • Pollution of water sources due to soil erosion • Destruction of watercourses		-	L	S	Pr	PR	ML	Yes	- 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.	L	Wetland Assessment (Appendix D9)
			Visual landscape	• Potential visual impact on visual receptors in close proximity to proposed facility	-		L	S	D	CR	NL	Yes	- Locate laydown and storage areas in zones of low visibility i.e.	L	Visual Impact Assessment (Appendix D3)

				• The decommissioning phase of the project will result in the same visual impacts experienced during the construction phase of the project. However, in the case of Siyanda SPP it is anticipated that the proposed facility will be refurbished and upgraded to prolong its life									behind tall trees or in lower lying areas.		
			Traffic volumes	• Increase in construction vehicles	-		L	S	Pr	CR	NL	Yes	- 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 Impact Assessment (Appendix D8)
			Health & Safety	• 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	- 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 must be enforced. - Any infrastructure that would not be decommissioned must	L	Social Impact Assessment (Appendix D7)

														be appropriately locked and/or fenced off to ensure that it does not pose any danger to the community. - Components that are dismantled, these must be recycled / reduced as far as possible.		
			Noise levels	• 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	- The decommissioning phase must aim to adhere to the relevant noise regulations and limit noise within standard working hours in order to reduce disturbance of dwellings in close proximity to the development.	L	Social Impact Assessment (Appendix D7)
			Tourism industry	• 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
			Heritage resources	• It is not foreseen that the decommissioning phase will impact on any heritage resources.	-		S	S	U	PR	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	L	Heritage Impact Assessment (Appendix D5)

													any heritage sites are to be destroyed or altered.		

Nature of the impact:	(N/A) No impact	(+) Positive Impact	(-) Negative Impact		
Geographical extent:	(S) Site;	(L) Local/District;	(P) Province/Region;	(I) International and National	
Probability:	(U) Unlikely;	(Po) Possible;	(Pr) Probable;	(D) Definite	
Duration:	(S) Short Term;	(M) Medium Term;	(L) Long Term;	(P) Permanent	
Intensity / Magnitude:	(L) Low;	(M) Medium;	(H) High;	(VH) Very High	
Reversibility:	(CR) Completely Reversible;	(PR) Partly Reversible;	(BR) Barely Reversible;	-	
Irreplaceable loss of resources:	(IR) Irreversible	(NL) No Loss;	(ML) Marginal Loss;	(SL) Significant Loss;	(CL) Complete Loss
Level of residual risk:	(L) Low;	(M) Medium;	(H) High;	(VH) Very High	-

An Environmental Awareness and Fire Management Plan is included in Appendix I as part of the EMPr

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 were addressed in more detail in the BA 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) (GN.R. 327): *"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 14 (GN.R 327): "*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters."*
- Activity 24 (ii) (GN.R 327): *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters"*
- Activity 28 (ii) (GN.R. 327): *"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 56 (ii) (GN.R 327): *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"*
- Activity 1 (GN.R 325): *"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 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation."*
- Activity 12 (b)(i) (GN.R 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation… …(b) in the Free State (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004*

During the construction phase minor negative impacts are foreseen over the short term. The latter refers to a period of months. Table 6.3 summarises the potentially most significant impacts and the mitigation measures that are proposed during the construction phase.

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Table 6.3: Impacts and the mitigation measures during the construction phase

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial biodiversity, plant and animal impact assessment (Appendix D1)	Habitat destruction caused by clearance of vegetation	Negative Medium	Negative Low	• The riparian area with its associated 32 m buffer zone must not be disturbed as far as possible. • Peripheral impacts around the development footprint, on the surrounding vegetation of the area, should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum, while the rehabilitation of the site should be prioritised after construction has been completed. • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. • All development activities should be restricted to specific recommended areas. The Environment Control Officer (ECO) should control these areas. Storage of equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries. The entire development footprint should be clearly demarcated prior to initial site clearance and prevent construction personnel from leaving the demarcated area. This would only be applicable to the construction phase of the proposed development.

				• The Environmental Site Officer (ESO) should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. • It is further proposed that a part (30 %) of the *Aloe zebrina, Bonatea speciosa* and *Schizocarphus nervosus* plants on the proposed development area be relocated to suitable habitat on the same farm or to another farm nearby. A walkthrough survey should be conducted to determine the number and location of individuals. Then a translocation management plan should be written, and plants translocated before development commences. • Where holes for poles pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling during planting of the poles along the lines. • Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for birds of prey. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

				• Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna and flora of the area.
	Habitat fragmentation caused by clearance of vegetation	Negative Low	Negative Low	• Use existing facilities (e.g., impacted areas) to the extent possible to minimise the amount of new disturbance. • Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive features such as the riparian area during construction. • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. • Construction activities must remain within defined construction areas. No construction / disturbance will occur outside these areas.
	Increased soil erosion and sedimentation	Negative Medium	Negative Low	• The project should be divided into as many phases as possible, to ensure that the exposed areas prone to erosion are minimal at any specific time. • Cover disturbed soils as completely as possible, using vegetation or other materials. • Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices.

				• Protect sloping areas and drainage channel banks that are susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas. • Repair all erosion damage as soon as possible to allow for sufficient rehabilitation growth. • Gravel roads to the construction sites must be well drained to limit soil erosion. • Control the flow of runoff to move the water safely off the site without destructive gully formation. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas.
	Soil and water pollution	Negative High	Negative Low	• Any excess or waste material or chemicals should be removed from the site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously. • Hazardous chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. • Spill kits should be on-hand to deal with spills immediately. • All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier

	Air pollution	Negative Low	Negative Low	• A speed limit should be enforced on dirt roads (preferably 30-40km/h). • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
	Spread and establishment of alien invasive species	Negative Medium	Negative Low	• Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the CARA or in terms of Working for Water guidelines. The control of these species should even begin prior to the construction phase considering that small populations of these species was observed during the field surveys. • Institute strict control over materials brought onto site, which should be inspected for seeds of noxious plants and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual herbicides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species listed by the CARA regulations should be eradicated. • Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.

				• Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme should be implemented to ensure that the species' do not spread to surrounding natural ecosystems.
	Negative effect of human activities on fauna and road mortalities	Negative Low	Negative Low	• No staff should be accommodated on the site. If practical, construction workers should stay in one of the nearby towns / villages and transported daily to the site. • The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around the entire development footprint. • Educate construction workers regarding risks and correct disposal of cigarettes. • More fauna is normally killed the faster vehicles travel. A speed limit should be enforced (preferably 40 km/hour). It can be considered to install speed bumps in sections where the speed limit tends to be disobeyed. (Speed limits will also lessen the probability of road accidents and their negative consequences). • Travelling at night should be avoided or limited as much as possible.
Wetland Assessment (Appendix D9)	Soil compaction, erosion and sedimentation of the	Negative Low	Negative Low	• Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and

	river and riparian area			any alien plants which establish should be cleared and follow-up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., “ripping” the affected area). • Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion. • Erosion control mechanisms must be established as soon as possible. • A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-construction and post-decommissioning. • If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is preferable as it will not be associated with the nitrogen negative period associated with organic material that is not composted. • Vehicle traffic should not be allowed on the rehabilitated areas, except on allocated roads. It will have a negative impact due to the dispersive/compaction characteristics of soils and its implications on the long term. • Appropriate design and mitigation measures must be developed and implemented to minimise impacts on the natural flow regime of the

				watercourse i.e., through placement of structures/supports and to minimise turbulent flow in the watercourse. • The indiscriminate use of machinery within the riparian area will lead to compaction of soils and destruction of vegetation and must therefore be strictly controlled. • Perform scheduled maintenance to be prepared for storm events. Ensure that culverts have their maximum capacity, ditches are cleaned, and that channels are free of debris and brush than can plug structures.
	Soil and water pollution of the river and riparian area	Negative High	Negative Low	• Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • Contain all dirty water in the dirty water system and contain all dirty stormwater up to a 1:50 year flood event as a minimum. Ensure that all activities impacting on groundwater resources of the subject property are managed according to the relevant DWS Licensing regulations and groundwater monitoring and management requirements. • Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility. • Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The Environmental Site Officer (ESO) should enforce this rule rigorously.

				• Hazardous chemicals to be stored on an impervious surface protected from rainfall and stormwater run-off. • Spill kits should be on-hand to deal with spills immediately. • All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier. • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. • A speed limit (preferably 40 km/hour) should be enforced on dirt roads. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with the label and application permit directions and stipulations for terrestrial and aquatic applications.
	Spread and establishment of alien invasive species in the river and riparian area	Negative Medium	Negative Low	• Alien and invader vegetation must not be allowed to colonise the area. Control involves killing alien invasive plants present, seedlings and establishing an alternative plant cover to limit re-growth. The use of indigenous plants must be encouraged in the rehabilitated areas (stormwater canals). Control should begin prior to construction phase considering small populations of invader plant species occur around the project area.

				• Institute strict control over materials brought onto site, which should be inspected for seeds and steps taken to eradicate these before transport to the site. The contractor is responsible for the control of weeds and invader plants. • Rehabilitate disturbed areas as quickly as possible. • Institute a monitoring programme to detect alien invasive species early. • Institute an eradication/control programme for early intervention if invasive species are detected. The use of indigenous plants must be encouraged in the rehabilitated areas. Active management and eradication of exotic / alien plant species should also occur when seedlings are found.
Avifaunal Assessment (Appendix D2)	Displacement of priority avian species from important habitats (PV array and associated infrastructure)	Negative Medium	Negative Low	• Limit construction footprint and retain indigenous vegetation wherever possible. • Limit access to remainder of area outside of the construction footprint. • Avoid construction during the breeding season (summer). • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Control noise to minimum.
	Displacement of resident avifauna through increased	Negative Medium	Negative Low	• Limit construction footprint and retain indigenous vegetation wherever possible.

	disturbance (PV array and associated infrastructure)			• Limit access to remainder of area outside of the construction footprint. • Avoid construction during the breeding season (summer). • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Control noise to minimum.
	Loss of important avian habitats (PV array and associated infrastructure)	Negative Medium	Negative Low	• Limit construction footprint. • Limit access to remainder of area outside of the construction footprint. • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Use existing roads as far as possible. • Rehabilitate with indigenous vegetation.
	Displacement of priority avian species from important habitats (Power Line)	Negative Medium	Negative Low	• Limit construction footprint and retain indigenous vegetation wherever possible. • Limit access to remainder of area outside of the construction footprint. • Avoid construction during the breeding season (summer). • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Control noise to minimum.

				• Maintain a single access and maintenance road within power line servitude.
	Displacement of resident avifauna through increased disturbance (Power Line)	Negative Low	Negative Low	• None required due to low significance
	Loss of important avian habitats (Power Line)	Negative Low	Negative Low	• None required due to low significance
Agricultural Agro-Ecosystem Specialist Assessment (Appendix D4)	Loss of agricultural potential by occupation of land	Negative Low	Negative Low	• No mitigation measures based on the low impact significance. Agricultural land directly occupied by the development infrastructure will become unavailable for agricultural use, with consequent potential loss of agricultural productivity and employment. The site assessment has found that the soils across most of the site are unsuitable, or at best very marginal, for the production of cultivated crops, and are therefore only suited to grazing.
	Loss of agricultural potential by soil degradation	Negative Low	Negative Low	• Implement an effective system of storm water run-off control, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended, to prevent further erosion from occurring there.

				• Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion. • If an activity will mechanically disturb the soil profile below surface, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation, which may be after construction or only at decommissioning. The depth of topsoil stripping is dependent on the specific field conditions. The maximum depth should be 30cm. If additional unconsolidated material exists below 30cm and needs to be removed for construction purposes, it must be stripped and stockpiled separately from the upper 30cm topsoil. Such material should only be used for fill below a topsoil layer, and not used for spreading on the surface. If there is less than 30cm of unconsolidated soil material above a limiting layer of rock or hardpan, then the entire depth must be stripped and stockpiled as topsoil, even if it contains a high proportion of course fragments. • Topsoil should be retained in the area below the panels (or mirrors). It is not desirable to strip and stockpile this topsoil for the whole of the operational phase. It will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase

				for the following reasons: conservation of topsoil, dust suppression and erosion control. • It is only in areas where topsoil cannot be retained on the surface during the operational phase, and where the area will be rehabilitated back to veld after decommissioning, that it should be stripped and stockpiled for the duration of the operational phase for re-spreading during de-commissioning. • Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. • Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. • During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. • If there is compaction, either in re-spread topsoil or in areas where topsoil was retained during the operational phase, it must be loosened through an appropriate plough action. • If topsoil has been stockpiled for the duration of the operational phase, re-vegetation is likely to require seeding and / or planting. • Erosion must be carefully controlled where necessary on topsoiled areas.
	Loss of agricultural potential by dust generation	Negative Low	Negative Low	• Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil.

Heritage Impact Assessment (Appendix D5)	Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries	Negative Low	Negative Low	• No sites, features or objects of cultural significance were identified, no mitigation measures are proposed.
Palaeontological Impact Assessment (Appendix D6)	Disturbance, damage or destruction of legally protected fossil heritage within the development footprint during the construction phase	Negative Medium	Negative Low	• Protection of recorded sensitive fossil sites. Safeguarding of stromatolitic blocks either side of farm track at site 101 by removal at least 5m outside project footprint; • Limit disturbance in vicinity of sites 108- 110 to existing farm tracks. • Implementation of recommended Chance Fossil Finds Procedure. Chance fossil finds during the construction phase of the solar facility and associated grid connection involves safeguarding of the fossils (preferably in situ) by the responsible ECO and reporting of finds to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27(0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). • The ECO should monitor all substantial surface clearance operations and excavations into sedimentary rocks for fossil remains such as well-preserved stromatolites on an on-going basis during the construction phase.
Visual Impact Assessment	Visual impact of construction activities on sensitive	Negative Medium	Negative Low	Planning

(Appendix D3)	visual receptors in close proximity to the proposed Siyanda SPP			• Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction • Ensure that vegetation is not unnecessarily removed during the construction phase. • Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) where possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. • Ensure that rubble, litter, etc. are appropriately stored (if it can't be removed daily) and then disposed of regularly at a licenced waste site. • Reduce and control dust during construction by utilising dust suppression measures. • Reduce construction activities between 07:00 and 18:00, where possible, in order to reduce the impacts of construction lighting. • Rehabilitate all disturbed areas immediately after the completion of construction work and maintain good housekeeping.
Social Impact Assessment (Appendix D7)	Direct and indirect employment opportunities and skills development	Positive Low	Positive Medium	Enhancement: • A local employment policy should be adopted to maximise opportunities made available to the local labour force.

				• Labour should be sourced from the local labour pool, and only if the necessary skills are unavailable should labour be sourced from (in order of preference) the greater Moqhaka LM, Fezile Dabi DM, Free State Province, South Africa, or elsewhere. • Where feasible, training and skills development programmes should be initiated prior to the commencement of the construction phase. • As with the labour force, suppliers should also as far as possible be sourced locally. • As far as possible local contractors that are compliant with Broad-Based Black Economic Empowerment (B-BBEE) criteria should be used. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
	Economic Multiplier effect	Positive Low	Positive Medium	Enhancement: • It is recommended that a local procurement policy is adopted to maximise the benefit to the local economy. • A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g., construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable. • Local procurement is encouraged along with engagement with local authorities and business organisations to investigate the possibility of

				procurement of construction materials, goods and products from local suppliers where feasible.
	Potential loss of productive farmland	Negative Medium	Negative Low	• The proposed site for the Siyanda SPP needs to be fenced off prior to the construction phase and all construction related activities should be confined in this fenced off area. • Livestock grazing on the proposed site need to be relocated. • All affected areas, which are disturbed during the construction phase, need to be rehabilitated prior to the operational phase and should be continuously monitored by the Environmental Control Officer (ECO). • Implement, manage and monitor a grievance mechanism for the recording and management of social issues and complaints.
	Influx of jobseekers and change in population	Negative Medium	Negative Low	• Develop and implement a local procurement policy which prioritises "locals first" to prevent the movement of people into the area in search of work. • Engage with local community representatives prior to construction to facilitate the adoption of the locals first procurement policy. • Provide transportation for workers (from Viljoenskroon, Orkney and surrounds) to ensure workers can easily access their place of employment and do not need to move closer to the project site. • Working hours should be kept between daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities.

				• Compile and implement a grievance mechanism. • Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour. • Prevent the recruitment of workers at the project site. • Implement, manage and monitor a grievance mechanism for the recording and management of social issues and complaints. • Establish clear rules and regulations for access to the proposed site. • Appoint a security company and implement appropriate security procedures to ensure that workers do not remain onsite after working hours. • Inform local community organisations and policing forums of construction times and the duration of the construction phase. • Establish procedures for the control and removal of loiterers from the construction site.
	Safety and security impacts	Negative Medium	Negative Low	• Working hours should be kept within daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities. • Provide transportation for workers to prevent loitering within or near the project site outside of working hours. • The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site. The fencing of the site should be maintained throughout the construction period.

				• The appointed EPC Contractor must appoint a security company to ensure appropriate security procedures and measures are implemented. • Access in and out of the construction site should be strictly controlled by a security company appointed to the project. • A CLO should be appointed as a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process. • The EPC Contractor should implement a stakeholder management plan to address neighbouring farmer concerns regarding safety and security. • The project proposed must prepare and implement a Fire Management Plan; this must be done in conjunction with surrounding landowners. • The EPC Contractor must prepare a Method Statement which deals with fire prevention and management.
	Impacts on daily living and movement patterns	Negative Medium	Negative Medium	• All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. • Heavy vehicles should be inspected regularly to ensure their road worthiness. • Provision of adequate and strategically placed traffic warning signs, that have to be maintained for the duration of the construction phase, and control measures along the R30 and Stokkiesdraai roads to warn

				road users of the construction activities taking place for the duration of the construction phase. Warning signs must be always visible, especially at night. • Implement penalties for reckless driving to enforce compliance to traffic rules. • Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work). • The developer and EPC Contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities. • The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if disturbed due to construction activities. • The EPC Contractor must ensure that damage / wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase. • A method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.
	Nuisance impacts (noise and dust)	Negative Medium	Negative Low	• The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible.

				• 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. • Ensure all vehicles are road worthy, drivers are qualified and are made aware of the potential noise and dust issues. • A CLO should be appointed, and a grievance mechanism implemented.
	Increased risk of potential veld fires	Negative Medium	Negative Low	• A firebreak should be implemented before the construction phase. The firebreak should be controlled and implemented around the perimeters of the project site. • Adequate fire-fighting equipment should be provided and readily available on site and all staff should be trained in firefighting and how to use the fire-fighting equipment. • No staff (except security) should be accommodated overnight on site and the contractor should ensure that no open fires are allowed on site. The use of cooking or heating implements should only be used in designated areas. • Contractors need to ensure that any construction related activities that might pose potential fire risks, are done in the designated areas where it is also managed properly. • Precautionary measures need to be taken during high wind conditions or during the winter months when the fields are dry.

				• The contractor should enter an agreement with the local farmers before the construction phase that any damages or losses during the construction phase related to the risk of fire and that are created by staff during the construction phase, are borne by the contractor.
	Visual and sense of place impacts	Negative Low	Negative Low	• Implement mitigation measures identified in the Visual Impact Assessment (VIA) prepared for the project. • Limit noise generating activities to normal daylight working hours and avoid weekends and public holidays. • The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible. • 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. • All vehicles must be road-worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits. • Communication, complaints, and grievance channels must be implemented and contact details of the CLO must be provided to the local community in the study area.
Traffic Impact Assessment	Increased construction traffic	Negative Low	Negative Low	• Negligible negative effects will require no mitigation.

(Appendix D8)				

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

- Activity 11(i) (GN.R. 327): *"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 14 (GN.R 327): "*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters."*
- Activity 1 (GN.R 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."*

Table 6.4 summarised the negative impacts are generally associated with the Solar Power Plant (including other associated infrastructure) and power line, which include impacts on the fauna and flora, soils, geology, surface water, 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.

Table 6.4: Impacts and the mitigation measures during the operational phase

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial biodiversity, plant and animal impact assessment (Appendix D1)	Habitat destruction caused by clearance of vegetation	Negative Medium	Negative Low	• Peripheral impacts around the development footprint, on the surrounding vegetation of the area, should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum, while the rehabilitation of the site should be prioritised after construction has been completed. • Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for birds of prey. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
	Soil and water pollution	Negative Medium	Negative Low	• Any excess or waste material or chemicals should be removed from the site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously. • Hazardous chemicals to be stored on an impervious surface protected from rainfall and storm water run-off.

				• Spill kits should be on-hand to deal with spills immediately. • All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.
	Air Pollution	Negative Low	Negative Low	• A speed limit should be enforced on dirt roads (preferably 30-40km/h). • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of access roads, and ensure that these are continuously monitored to ensure effective implementation.
	Spread and establishment of alien invasive species	Negative Low	Negative Low	• Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the CARA or in terms of Working for Water guidelines. The control of these species should begin prior to the construction phase considering that small populations of these species was observed during the field surveys.

				• Institute strict control over materials brought onto site, which should be inspected for seeds of noxious plants and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual herbicides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species listed by the CARA regulations should be eradicated. • Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme should be implemented to ensure that the species' do not spread to surrounding natural ecosystems.
	Negative effect of human activities on fauna and road mortalities	Negative Low	Negative Low	• No staff should be accommodated on the site. If practical, construction workers should stay in one of the nearby villages and transported daily to the site. • The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals.

				• Maintain proper firebreaks around the entire development footprint. • Educate construction workers regarding risks and correct disposal of cigarettes. • More fauna is normally killed the faster vehicles travel. A speed limit should be enforced (preferably 40 km/hour). It can be considered to install speed bumps in sections where the speed limit tends to be disobeyed. (Speed limits will also lessen the probability of road accidents and their negative consequences). • Travelling at night should be avoided or limited as much as possible
Wetland Assessment (Appendix D9)	Soil compaction, erosion and sedimentation of the river and riparian area	Negative Low	Negative Low	• Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and any alien plants which establish should be cleared and follow-up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area). • Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion.

				• Erosion control mechanisms must be established as soon as possible. • A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-construction and post-decommissioning. • If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is preferable as it will not be associated with the nitrogen negative period associated with organic material that is not composted. • Vehicle traffic should not be allowed on the rehabilitated areas, except on allocated roads. It will have a negative impact due to the dispersive/compaction characteristics of soils and its implications on the long term. • Appropriate design and mitigation measures must be developed and implemented to minimise impacts on the natural flow regime of the watercourse i.e., through placement of structures/supports and to minimise turbulent flow in the watercourse. • Perform scheduled maintenance to be prepared for storm events. Ensure that culverts have their maximum

				capacity, ditches are cleaned, and that channels are free of debris and brush than can plug structures.
	Soil and water pollution of the river and riparian area	Negative Medium	Negative Low	• Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • Contain all dirty water in the dirty water system and contain all dirty stormwater up to a 1:50 year flood event as a minimum. Ensure that all activities impacting on groundwater resources of the subject property are managed according to the relevant DWS Licensing regulations and groundwater monitoring and management requirements. • Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility. • Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The Environmental Site Officer (ESO) should enforce this rule rigorously. • Hazardous chemicals to be stored on an impervious surface protected from rainfall and stormwater run-off.

				• Spill kits should be on-hand to deal with spills immediately. • All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier. • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. • A speed limit (preferably 40 km/hour) should be enforced on dirt roads. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with the label and application permit directions and stipulations for terrestrial and aquatic applications.
	Spread and establishment of alien invasive species in the river and riparian area	Negative Medium	Negative Low	• Alien and invader vegetation must not be allowed to colonise the area. Control involves killing alien invasive plants present, seedlings and establishing an alternative plant cover to limit re-growth. The use of indigenous plants must be encouraged in the rehabilitated areas

				(stormwater canals). Control should begin prior to construction phase considering small populations of invader plant species occur around the project area. • Institute strict control over materials brought onto site, which should be inspected for seeds and steps taken to eradicate these before transport to the site. The contractor is responsible for the control of weeds and invader plants. • Rehabilitate disturbed areas as quickly as possible. • Institute a monitoring programme to detect alien invasive species early. • Institute an eradication/control programme for early intervention if invasive species are detected. The use of indigenous plants must be encouraged in the rehabilitated areas. Active management and eradication of exotic / alien plant species should also occur when seedlings are found.
Avifaunal Assessment (Appendix D2)	Displacement of priority avian species from important habitats	Negative Medium	Negative Medium	• Limit ongoing human activity to the minimum required for ongoing operation. • Control noise to minimum. • Rehabilitate with indigenous vegetation. • Limit roadways and vehicle speeds.

	Displacement of resident avifauna through increased disturbance	Negative Medium	Negative Low	• Limit ongoing human activity to the minimum required for ongoing operation. • Control noise to minimum. • Rehabilitate with indigenous vegetation. • Limit roadways and vehicle speeds.
	Collisions with PV panels leading to injury or loss of avian life	Negative Medium	Negative Low	• Panels to be flat at night. • Preferably low sheen/matt surfaces. • Quarterly fatality monitoring.
	Displacement of priority avian species from important habitats (Power Line)	Negative Low	Negative Low	• None required due to low significance.
	Displacement of resident avifauna through increased disturbance (Power Line)	Negative Low	Negative Low	• None required due to low significance.
	Collision when flying into power line infrastructure	Very High Negative	Medium Negative	• Require walk-through after pole positions are determined to demarcate sections requiring bird deterrents/flappers. • Install flappers on all required sections of power line (as directed by avifaunal specialist) on or directly adjacent to site. • Quarterly fatality monitoring and record-keeping throughout project life

	Electrocution when perched on power line infrastructure	High Negative	Medium Negative	• Pole designs to discourage bird perching and to be signed off by avifaunal specialist. • Quarterly fatality monitoring and record-keeping throughout project life.
Agricultural Agro-Ecosystem Specialist Assessment (Appendix D4)	Increased financial security for farming operations	Low Positive	Low Positive	• No mitigation measures required.
	Impacts on agricultural production and employment	Negative Low	Negative Low	• No mitigation required. The development will result in the loss of productivity of 57 head of cattle from the farm. Although there is a one farm worker allocated to the site, he is likely to be utilised for work elsewhere in the farming enterprise, and so the development is likely to have no impact on agricultural employment.
Visual Impact Assessment (Appendix D3)	Potential visual impacts on sensitive visual receptors located within a 5km radius of the SPP	Negative Medium	Negative Low	Planning • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. • Where insufficient natural vegetation exists next to the property, a 'screen' can be planted using endemic, fast growers that are water efficient. Operations • Maintain general appearance of the facility as a whole.
	Visual impact on observers travelling along the roads	Negative Low	Negative Low	Planning

	and residents at homesteads within a 5-10km radius of the SPP.			• Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. • Where insufficient natural vegetation exists next to the property, a 'screen' can be planted using endemic, fast growers that are water efficient. Operations • Maintain general appearance of the facility as a whole.
	Visual impacts of lighting at night on sensitive visual receptors in close proximity to the proposed facility.	Negative Medium	Negative Low	Planning & Operation • Shield the source of light by physical barriers (walls, vegetation etc.) • Limit mounting heights of lighting fixtures, or alternatively use footlights or bollard level lights. • Make use of minimum lumen or wattage in fixtures. • Make use of down-lighters, or shield fixtures. • Make use of low-pressure sodium lighting or other types of low impact lighting. • Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

	Visual impacts of solar glint and glare as a visual distraction and possible air travel hazard.	Negative Low	Negative Low	• No mitigation measures are required.
	Visual impact on sensitive visual receptors in close proximity to the 132kV overhead power line – Option 1	Negative Medium	Negative Medium	Planning • Retain/re-establish and maintain natural vegetation immediately adjacent to the power line servitude. Operations • Maintain the general appearance of the servitude as a whole.
	Visual impact on sensitive visual receptors in close proximity to the 132kV overhead power line – Option 2	Negative Low	Negative Low	Planning • Retain/re-establish and maintain natural vegetation immediately adjacent to the power line servitude. Operations • Maintain the general appearance of the servitude as a whole.
	Visual impact and impacts on sense of place	Negative Low	Negative Low	• The subjectivity towards the project in its entirety can be influenced by creating a "Green Energy" awareness campaign, educating the local community and potentially tourists on the benefits of renewable energy. This can be achieved by also hosting an 'open day' where the local community can have the opportunity to view the

				completed project which may enlist a sense of pride in the renewable energy project in their area. • Implement good housekeeping measures.
Social Impact Assessment (Appendix D7)	Direct and Indirect employment opportunities and skills development	Positive Low	Positive Medium	Enhancement: • It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. • Vocational training programs should be established to promote the development of skills.
	Development of non-polluting, renewable energy infrastructure	Positive Medium	Positive Medium	• No enhancement identified
	Potential loss of agricultural land	Negative Medium	Negative Low	• The proposed mitigation measures for the construction phase should have been implemented at this stage. • Mitigation measures from the Agricultural and Soil Report, should also be implemented.
	Contribution to Local Economic Development (LED) and social upliftment	Positive Medium	Positive High	Enhancement:

						• A CNA must be conducted to ensure that the LED and social upliftment programmes proposed by the project are meaningful. • Ongoing communication and reporting are required to ensure that maximum benefit is obtained from the programmes identified, and to prevent the possibility for such programmes to be misused. • The programmes should be reviewed on an ongoing basis to ensure that they are best suited to the needs of the community at the time (bearing in mind that these are likely to change over time).
	Impact on tourism	Negative Low	Positive Low	Negative Low	Positive Low	• The impact rating is dependent on how the development is perceived by tourism. In some cases, renewable energy developments can be seen as an addition to the tourist industry in the area (positive low) or it can be viewed as a negative. The rating is subjective. • Due to the extent of the project no viable mitigation measures can be implemented to eliminate the visual impact of the PV panels, but the subjectivity towards the PV panels can be influenced by creating a "Green Energy" awareness campaign, educating the local community and tourists on the benefits of renewable energy. Tourists visiting the area should be made aware of South Africa's movement towards renewable energy. This might create a positive feeling of a country moving forward in terms of environmental sustainability. This could be implemented

				by constructing a visitor's centre on the property allocated to the proposed solar farm which should be open to school fieldtrips, the local community, and tourists
	Visual and sense of place impacts	Negative Low	Negative Low	• To effectively mitigate the visual impact and the impact on sense of place during the operational phase of the proposed Siyanda SPP, it is suggested that the recommendations made in the Visual Impact Assessment (specialist study) should be followed in this regard
Traffic Impact Assessment (Appendix D8)	Increased commuter traffic	Negative Low	Negative Low	• Negligible negative effects will require no mitigation.

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. Table 6.5 provides a summary of the impacts during the decommissioning phase. The decommissioning phase will however potentially result in impact on soils, pressure on existing service infrastructure, surface water 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. Decommissioning of a PV facility will leave a positive impact on the habitat and biodiversity in the area as the area will be rehabilitated to its natural state.

Table 6.5: Impacts and the mitigation measures during the decommissioning phase

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Wetland Assessment (Appendix D9)	Soil compaction, erosion and sedimentation of the river and riparian area	Negative Low	Negative Low	• Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and any alien plants which establish should be cleared and follow-up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area). • Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion. • A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-construction and post-decommissioning. • If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is preferable as it will not be associated with the nitrogen negative period associated with organic material that is not composted. • Vehicle traffic should not be allowed on the rehabilitated areas, except on allocated roads. It will have a negative impact due to the

				dispersive/compaction characteristics of soils and its implications on the long term.
	Soil and water pollution of the river and riparian area	Negative High	Negative Low	• After decommissioning all materials have to be disposed of in a responsible manner
	Spread and establishment of alien invasive species in the river and riparian area	Negative Medium	Negative Low	• After decommissioning, the site must be rehabilitated by sowing indigenous grass species. The control and monitoring of declared invaders must continue for five years after decommissioning.
Avifaunal Assessment (Appendix D2)	Displacement of priority avian species from important habitats	Negative Low	Negative Low	• None required due to low significance
	Displacement of resident avifauna through increased disturbance	Negative Low	Negative Low	• None required due to low significance
Agricultural Agro-Ecosystem Specialist Assessment (Appendix D4	Loss of agricultural potential by occupation of land	Negative Low	Negative Low	• No mitigation measures.
	Loss of agricultural potential by soil degradation	Negative Low	Negative Low	• Implement an effective system of storm water run-off control, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. Any occurrences of erosion must be attended to

				immediately and the integrity of the erosion control system at that point must be amended, to prevent further erosion from occurring there. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion. • If an activity will mechanically disturb the soil profile below surface, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation, which may be after construction or only at decommissioning. The depth of topsoil stripping is dependent on the specific field conditions. The maximum depth should be 30cm. If additional unconsolidated material exists below 30cm and needs to be removed for construction purposes, it must be stripped and stockpiled separately from the upper 30cm topsoil. Such material should only be used for fill below a topsoil layer, and not used for spreading on the surface. If there is less than 30cm of unconsolidated soil material above a limiting layer of rock or hardpan, then the entire depth must be stripped and stockpiled as topsoil, even if it contains a high proportion of course fragments. • Topsoil should be retained in the area below the panels (or mirrors). It is not desirable to strip and stockpile this topsoil for the whole of the operational phase. It will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted. It will be advantageous to have topsoil and vegetation cover

				below the panels during the operational phase for the following reasons: conservation of topsoil, dust suppression and erosion control. • It is only in areas where topsoil cannot be retained on the surface during the operational phase, and where the area will be rehabilitated back to veld after decommissioning, that it should be stripped and stockpiled for the duration of the operational phase for re-spreading during de-commissioning. • Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. • Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. • During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. • If there is compaction, either in re-spread topsoil or in areas where topsoil was retained during the operational phase, it must be loosened through an appropriate plough action. • If topsoil has been stockpiled for the duration of the operational phase, re-vegetation is likely to require seeding and / or planting. • Erosion must be carefully controlled where necessary on topsoiled areas.
	Loss of agricultural potential by dust generation	Negative Low	Negative Low	• Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil.

6.3 SUMMARY OF RECOMMENDATIONS FROM SPECIALIST STUDIES

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

- Terrestrial Biodiversity, plant and animal impact assessment – AGES (see Appendix D1)
- Avifaunal Impact Assessment – Agreenco Environmental Projects (see Appendix D2)
- Visual Impact Assessment – Phala Environmental Consultants (see Appendix D3)
- Agricultural Agro-Ecosystem Specialist Assessment – Johann Lanz (see Appendix D4)
- Heritage Impact Assessment – JA van Schalkwyk (see Appendix D5)
- Palaeontological Impact Assessment – Natura Viva CC (see Appendix D6)
- Social Impact Assessment – Phala Environmental Consultants (see Appendix D7)
- Traffic Impact Assessment – Bvi Consulting Engineers (see Appendix D8)
- Wetland Assessment – AGES (see Appendix D9)
- Geotechnical Feasibility Assessment – SMEC (see appendix D10)

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

6.3.1 Issue 1: Geotechnical suitability

The geotechnical suitability for the Siyanda SPP site was determined. The main question had to be addressed was:

"Are the geotechnical conditions favourable for the development of a PV solar plant?"

According to the Geotechnical Feasibility Assessment (Appendix D10) the profiles within the trial pits at the site are generally consistent and comprise loose sandy topsoil overlying medium dense to dense sandy gravel. Over much of the site horizon of transported silty sand of variable thickness was found between the topsoil and gravel horizons, where present observed to depths of between 0.6-2.9+ m below Existing Ground Level (EGL). Occasional cobbles and boulders were observed within the gravels, all of which generally comprised weathered chert. The trial pits generally refused on these cobbles and boulders, with dolomitic pinnacles intermittently observed. The profiles were not consistent in the vicinity of the areas with agricultural crops. It may be assumed that these areas will also comprise relatively deep sandy soils.

No groundwater was observed within the trial pits. The gravelly soils classify as G8 and will find use as general fill and for pavement selected layer material. Due to the low plasticity of the gravelly soils they are anticipated to revel if used as gravel wearing course. Based on the abundance of this material, it is anticipated the general fill material requirements can be met by the resources on site. Additional testing during the detailed investigation phase (after the EIA process, however prior to the commencement of the construction phase) is required to confirm the suitability of in-situ soils and it is anticipated this testing may designate the gravelly soils as better-quality material (G7/ G6). The sandy soils classify as >G9 but may find use as service and cable bedding material, pending compatibility and thermal resistivity testing.

"Soft Excavation" conditions are anticipated within the soils, with some "Boulder Class Excavation" conditions also anticipated. The rock mass, specifically the pinnacles, will classify as "Hard Excavation". (SANS 1200D) The results of the chemical analyses indicate the soils to be slightly acidic, and the conductivity tests show the soils to be generally mildly to moderately corrosive towards buried steel.

From the trial pits profiles, it would appear that the preferred driven pile founding method is not achievable over the majority of the site due to the presence of boulders and intermittent shallow, pinnacled rock mass. The PV foundations for the site are suitable for predrilled piles, either anchored in the rock mass (if present), or grouted into the soil profile, which will provide sufficient pull-out resistance.

The building foundations will be dependent on the location, however based on the observed profiles will likely comprise shallow strip footings, either bearing on competent ground or bearing on a soil raft constructed from the in-situ gravelly soils, as described above. Where shallow dolomite pinnacles are present, foundations may bridge between the pinnacles with appropriate compaction and refilling between the pinnacles. The majority of the site is directly underlain by dolomitic rocks of the Malmani Subgroup. It is imperative that a Competent Person inspects all excavations and earthworks materials to ensure that conditions at variance with those predicted are exposed and accommodated in the structural design and to undertake reinterpretation of the facts supplied in the report where necessary. The geotechnical report is sufficient to for the Environmental Authorisation to proceed.

6.3.2 Issue 2: Heritage and archaeological 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 appointed 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 archaeological artefacts?"

According to the Heritage Impact Assessment (Appendix D5) during the site survey no sites, features or objects of cultural significance were identified.

From a heritage point of view, it is recommended that the Proposed Project be allowed to continue on acceptance of the mitigation measures presented above and the conditions proposed below. It is proposed that once the power line route has been confirmed within the 100m corridor a heritage walk-though needs to be undertaken. 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.

6.3.3 Issue 3: Ecological Impacts

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

"How will the proposed development impact on the ecology?"

According to the Terrestrial Biodiversity, Plant and Animal Impact Assessment (Appendix D1) the majority of the impacts will occur during the construction phase. The assessment determined that there

are three vegetation units present on the site, including the *pogonarthria squarrosa - elephantorrhiza elephantina grassland, eragrostis curvula* old cultivated land and Agricultural land (maize).

Seven plant species that are protected according to Free State Nature Conservation Ordinance 8 of 1969 were recorded at the project area, namely: A*loe zebrina, Bonatea speciosa, Helichrysum caespititium, Helichrysum kraussii, Helichrysum rugulosum* and *Helichrysum nudifolium* and *Schizocarphus nervosus*. It is proposed that at least 30% of the *Aloe zebrina plants, Bonatea speciosa* plants and *Schizocarphus nervosus* plants in the proposed development area be translocated. It is proposed that a part (30 %) of the *Aloe zebrina, Bonatea speciosa* and *Schizocapphus nervosus* plants on the proposed development area be relocated to suitable habitat. Three endemic plant species were recorded. No other species of conservation concern or protected trees were recorded. The EIA screening tool lists one vulnerable plant species that may occur in the project area, it was however not recorded during the survey. Five declared invader plant species were recorded.

The most significant impact will be the soil and water pollution, then habitat destruction, soil erosion and spread of alien invasive species. These impacts can be successfully mitigated. The sensitivity analysis indicated that the grassland area has a medium-high sensitivity. The previously cultivated field and maize fields have a low sensitivity, because it is very disturbed (Figure 21).

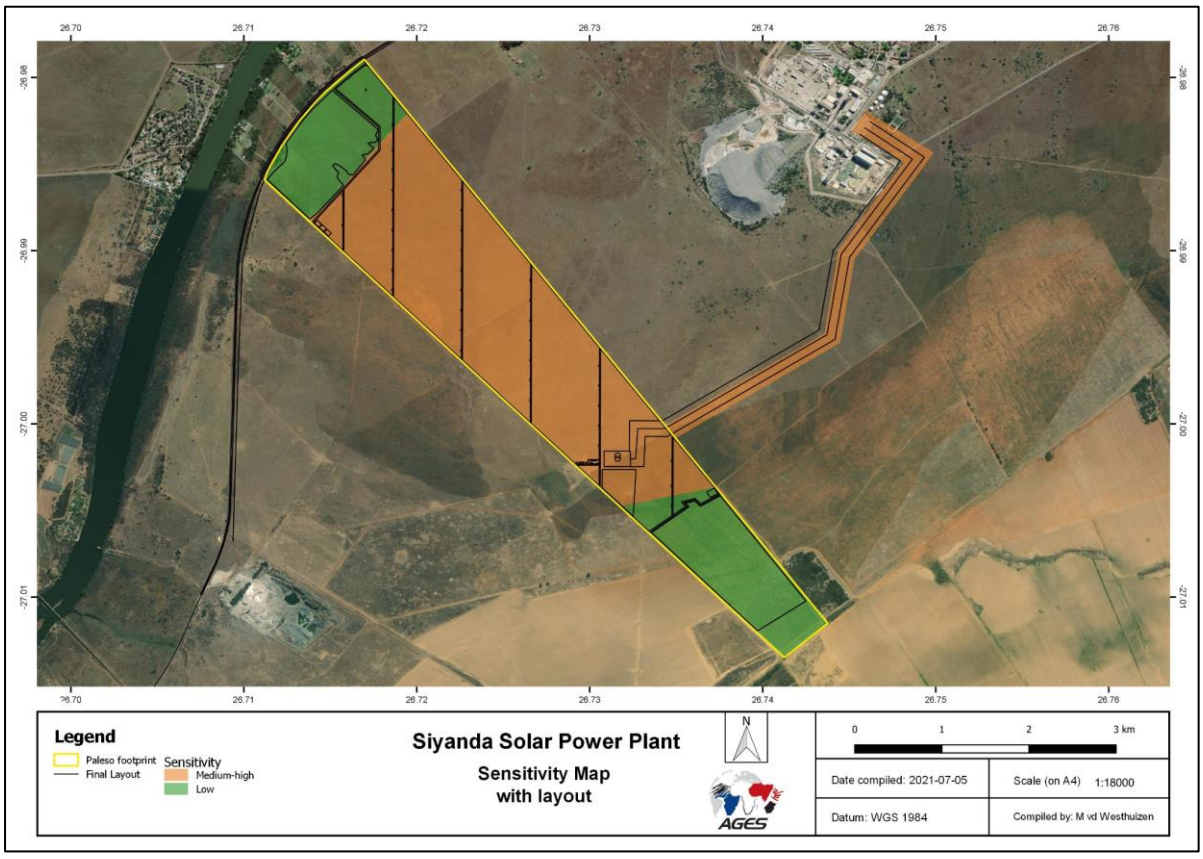

Figure 21: Vegetation sensitivity map with the proposed layout.

A desktop survey was completed to determine which fauna species may occur in the project area according to its distribution and habitat requirements. According to the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended, two listed fauna species may occur in the project area. These are the spotted-necked otter (*Hydrictis maculicollis*) (Vulnerable) and the African marsh harrier (*Circus ranivorus*) (Endangered). Both are very unlikely to occur in the project

area, but should they occur, they will not be impacted by the development, as their habitat is in the riparian area which is outside of the proposed development.

If the mitigation measures are adhered to the proposed development can be supported.

6.3.4 Issue 4: Wetland Impacts

The potential impact of the proposed development on wetlands known to occur on site, had to be determined. The main question which needs to be addressed is:

"How will the proposed development impact on the wetlands?"

According to the Wetland Assessment (Appendix D9) the site borders the Vaal River to the north of the site and was classified as a floodplain river (active channel and riparian area). The floodplain river and riparian area is not located in the proposed development footprint, but across a tar road (Stokkiesdraai Road) from it. The riparian area was delineated, and the proposed development will be outside the riparian area. It is also more than 100m from the bank of the Vaal River. Therefore, it is not necessary to apply for a Water Use License. Baseline soil information, landscape profile and vegetation were used to confirm wetland (riparian) and terrestrial properties within the study area. The river has a Class C Present Ecological State (PES): moderately modified and a moderate Ecological Importance and Sensitivity (EIS).

Significance rating of the impacts indicate that soil and water pollution has a high significance (without mitigation) in the river and riparian area. The spread and establishment of alien invasive species has a medium significance (without mitigation) in the river and riparian area. With mitigation all impacts have a low significance. Specific mitigation measures need to be implemented in the areas surrounding the riparian area to prevent any negative impacts. Provided that all the mitigation measures and recommendations surrounding the riparian area are strictly adhered to, the development of the solar power plant can be supported.

6.3.5 Issue 5: Avifaunal Impacts

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

"How will the proposed development impact on the avifauna?"

According to the Avifaunal Assessment (Appendix D2) the site is not located within an IBA, however it has been identified as 'High Avian Sensitivity' and 'Very High Sensitivity' by DFFE's screening tool. No priority species were recorded on the site; however some have been confirmed for the wider SABAP2 pentads (Lanner Falcon) in similar habitat and nearby areas (within 15 km- Secretary bird, Red-Footed Falcon, African Marsh-Harrier) or have a reasonable chance of at least occasional occurrence based on habitat and distribution (Black-winged Pratincole) in previous assessments. The resident avifaunal community is diverse, with relatively high species richness and abundances. There are numerous endemic species that have been confirmed as present on site (Cloud Cisticola, Fiscal Flycatcher, Melodious Lark, Pied Starling, South African Cliff Swallow) or have been recorded in the wider SABAP2 pentads (Karoo Thrush, Cape White-eye, Jackal Buzzard) in similar habitat.

The site contains two threatened habitat types, namely the Vaal-Vet Sandy Grassland (Gh10) classified as Endangered, and the Vaal Reefs Dolomite Sinkhole Woodland (Gh12) classified as Vulnerable. These habitat types are considered to be important avian habitats and are expected to be disturbed during construction. The proposed 132 kV power line are expected to be quite high and some species that are sensitive to powerline collisions occur on site such as the Egyptian Goose, Pied Crow, Hadeda Ibis, Northern Black Korhaan, Orange River Francolin, Swainson's Spurfowl and the Western Cattle Egret.

These impacts are expected to start during the construction phase, will last through the operational phase, into and after decommissioning. The habitats have low likelihood to be directly impacted/disturbed but the increased disturbance is likely to deter protected species from accessing the area. The overall impact of the project on avifauna can be effectively mitigated, should the controls prescribed in the Avifaunal Report be adequately followed, with sufficient monitoring of mitigation effectiveness.

Despite some residual impacts, there is no objection, from an avifaunal perspective to the development of the proposed Siyanda SPP development, should the controls prescribed by the independent specialist be adequately followed, with sufficient monitoring of mitigation effectiveness.

6.3.6 Issue 6: Visual Impacts

Due to the extent of the proposed photovoltaic solar plant 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 what extent will the landscape provides any significant visual absorption capacity"

The construction and operational phase of the proposed Siyanda SPP and its associated infrastructure, may have a visual impact on the study area, especially within (but not restricted to) a 5km radius of the proposed SPP. The visual impact will differ amongst places, depending on the distance of the SPP.

The proposed development is located in a close proximity of existing Eskom power infrastructure and mines and might have a cumulative impact on viewers. Other SPPs are also proposed in the area and the potential for cumulative impacts to occur as a result of the projects is therefore likely. On the other hand, the location of the SPPs within close proximity to the Klerksdorp REDZ will contribute to the consolidation of SPP structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region.

Due to the height of the power line (32m) and extent of the project, no viable mitigation measures can be implemented to eliminate the visual impact of the PV facility and power lines, but the possible visual impacts can be reduced. A number of mitigation measures have however been proposed regardless of whether or not mitigation measures will reduce the significance of the of the anticipated impacts, they are considered good practice and should be implemented and maintained throughout the construction, operational and decommissioning phases of the project.

In terms of possible landscape degradation, the landscape does not appear to have any specific protection or importance and is characterised by mines. No buffer areas or areas to be avoided are applicable for this development.

Aesthetic issues are subjective, and some people find solar farms and their associated infrastructure pleasant and optimistic while others may find it visually invasive; it is mostly perceived as symbols of energy independence; and local prosperity. The visual impact is also dependent on the land use of an area and the sensitivity thereof in terms of visual impact, such as protected areas, parks and other tourism related activities.

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

The specialist has recommended that the project be approved.

6.3.7 Issue 7: 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:

"To what extent will the proposed development compromise (negative impacts) or enhance (positive impacts) current and/or potential future agricultural production?"

The Agricultural Agro-Ecosystem Specialist Assessment (Appendix D4) states that the proposed development will not have an unacceptable negative impact on the agricultural production capability of the site. The proposed development is therefore acceptable. This is substantiated by the following points:

- All arable land on the site has been deliberately avoided by the development footprint. The proposed development will therefore occupy only land that is of limited land capability and is not suitable for the production of cultivated crops. There is not a scarcity of such agricultural land in South Africa and its conservation for agriculture is not therefore a priority.
- The proposed development offers some positive impact on agriculture by way of improved financial security for farming operations, as well as wider, societal benefits.
- The proposed development poses a low risk in terms of causing soil degradation, which can be adequately and fairly easily managed by mitigation management actions

Therefore, from an agricultural impact point of view, it is recommended that the development be approved.

6.3.8 Issue 8: 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 D7). The main question which needs to be addressed is:

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

There are some vulnerable communities within the project area that may be affected by the development of Siyanda SPP and its associated infrastructure. Traditionally, the construction phase of a PV solar development is associated with most social impacts. Many of the social impacts are unavoidable and will take place to some extent but can be managed through the careful planning and implementation of appropriate mitigation measures. Several potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are sufficiently significant to allow them to be classified as "fatal flaws".

Based on the social impact assessment, the following general conclusions and findings can be made:

- The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focussed on the construction of solar PV projects (these relate to an influx of non-local workforce and jobseekers, intrusion and disturbance impacts (i.e., noise and dust, wear and tear on roads) and safety and security risks), and could

be reduced with the implementation of the mitigation measures proposed. The significance of such impacts on the local communities can therefore be mitigated.

- The development will introduce employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during operation phase.
- The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases. This positive impact is likely to be compounded by the cumulative impact associated with the development of several other solar facilities within the surrounding area, and because of the project's location within an area which is characterised by high levels of solar irradiation, and which is therefore well suited to the development of commercial solar energy facilities.
- The proposed development also represents an investment in infrastructure for the generation of non-polluting, Renewable Energy, which, when compared to energy generated because of burning polluting fossil fuels, represents a positive social benefit for society.
- It should be noted that the perceived benefits associated with the project, which include Renewable Energy generation and local economic and social development, outweigh the perceived impacts associated with the project.

The following recommendations are made based on the SIA. The proposed mitigation measures should be implemented to limit the negative impacts and enhance the positive impacts associated with the project. Based on the social assessment, the following recommendations are made:

- The appointment of a CLO to assist with the management of social impacts and to deal with community issues, if feasible.
- It is imperative that local labour be sourced, wherever possible, to ensure that benefits accrue to the local communities. Efforts should be made to involve local businesses during the construction activities, where possible. Local procurement of labour and services / products would greatly benefit the community during the construction and operational phases of the project.
- Local procurement of services and equipment is required where possible in order to enhance the multiplier effect.
- Involve the community in the process as far as possible (encourage co-operative decision making and partnerships with local entrepreneurs).
- Employ mitigation measures to minimise the dust and noise pollution and damage to existing roads.
- Safety and security risks should be considered during the planning / construction phase of the proposed project. Access control, security and management should be implemented to limit the risk of crime increasing in the area.

The proposed project and associated infrastructure are unlikely to result in permanent damaging social impacts. From a social perspective it is concluded that the project could be developed subject to the implementation of recommended mitigation measures and management actions identified for the project.

6.3.9 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 D6) The Siyanda Solar Power Plant project area is located in a region that is underlain by fossiliferous sedimentary rocks of Precambrian and younger, Pleistocene to Holocene age. Existing impacts to palaeontological heritage within the project area are likely to be minimal, largely comprising occasional damage to stromatolite fossils exposed at the ground surface through agricultural activities. These on-going impacts are offset by the slow exposure of fresh stromatolites through bedrock weathering.

The construction phase of the proposed solar energy facility will entail substantial excavations into the superficial sediment cover and locally into the underlying bedrock as well. These include, for example, surface clearance and excavations for the PV panel footings, laydown areas, internal and access roads, underground cables, power line pylon footings, on-site electrical substation and battery storage facility, auxiliary buildings and construction camp. All these activities may adversely affect potential legally-protected fossil heritage within the project footprint as a result of excavations and surface disturbance (e.g. surface clearing and vehicle activity) during the construction phase by destroying, disturbing or permanently sealing-in fossils preserved at or beneath the surface of the ground that are then no longer available for scientific research or other public good.

This assessment of the impacts applies only to the construction phase of the development since further significant impacts on fossil heritage during the planning, operational and decommissioning phases of the facilities are not anticipated. The assessment also applies equally to the PV solar project area as well as to the short associated 132 kV grid connection (as assessed within a 100m wide grid connection corridor). Confidence levels in this assessment are medium, given the limited palaeontological literature on the Precambrian bedrocks concerned in addition to very low levels of bedrock exposure within the solar facility and power line project areas and the unpredictable distribution of well-preserved fossils in the subsurface.

The impact significance of the proposed development in terms of palaeontological heritage is assessed as Medium (Negative) without mitigation and Low (Negative) following mitigation. Should the recommended mitigation measures for the construction phase of the solar facility development be consistently followed-though, the impact significance would remain low (negative) but would entail both positive and negative impacts. Residual negative impacts from inevitable loss of some valuable fossil heritage would be partially offset by an improved palaeontological database for the study region as a direct result of appropriate mitigation. The latter is a positive outcome because any new, well-recorded and suitably curated fossil material from this palaeontologically little-known region would constitute a useful addition to our scientific understanding of the fossil heritage of the Transvaal Basin in southern Africa.

There are no fatal flaws associated with the proposed PV solar project from a palaeontological heritage viewpoint and no objects to authorisation of the development, provided that the recommended mitigation measures are fully implemented

6.3.10 Issue 10: 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 D8) the trips generated by the delivery of equipment and components to site are insignificant when compared to the Average Daily Traffic (ADT) of the immediate road network. The additional trips do not affect the Levels of Service (LOS) in any substantial way. The R30 near the solar power plant has an abundance of spare capacity and will be able to accommodate the estimated traffic generated by delivery vehicles, construction vehicles and on-site staff. The construction of the solar power plant will have a positive impact on the surrounding communities, as it creates more job opportunities.

The impact of the construction trip generation, on the predicted 2023 traffic volumes near the town of Orkney and along the transportation routes, are expected to be low. No mitigation measures (upgrading of existing intersections) will be necessary. The photovoltaic (PV) components will be delivered to site from two possible ports, either from Saldanha (1450 km) or from Durban (660 km). All construction materials and PV components will be transported by truck. Transformer and substation components will be transported via abnormal loads. The access point to the site is situated off of the Stokkiesdraai Rd. The formalisation of this access point, to the standard, will in all probability be a requirement as part of the wayleave approval of Moqhaka Local Municipality and the Free State Department: Police, Roads and Transport.

This will mitigate the destructive impact of repetitive heavy turning vehicles on the public road pavement. Adequate traffic accommodation signage must be erected and maintained on either side of the access, on Stokkiesdraai Rd, throughout the construction period of the project.

The direct impact and significance of the Siyanda Solar Power Plant is considered low negative and low positive for the traffic and community parameters, respectively. Therefore, the development of the Siyanda Solar Power Plant can be supported from a traffic perspective.

6.4 COMPARATIVE ASSESSMENT OF THE ALTERNATIVE POWER LINE ROUTES

Two power line route alternatives have been assessed for the development of the 132kV overhead power line within the grid connection corridor. The details of these options are as follow:

- Option 1: technical preferred by the proponent which is a connection to the Vaal Reefs Nine 132/6.6kV substation located 3km northeast from the site. The route will be approximately 3 km long. The connection point is located at the Vaal Reefs Nine mine.
- Option 2: this alternative is a second feasible option to connect the facility to the national grid. This includes a connection to either the Western Reef SWS / Jersey DS 1 88 kV HV Overhead Line or Western Reef SWS / Jersey DS 2 88 kV HV Overhead Line located on the site. The route will be approximately 100 m long and will consist of a Loop-in Loop-out connection.

The independent specialists assessed the alternative routes on the same level and have provided an indication of the preferred option within the various fields of study considered as part of this BA process. The results of the specialist feedback will then determine the environmentally preferred option in terms of the power line route proposed.

The results of the specialist studies in this regard are included in the table below.

Table 6.6: Specialist input on the Power Line alternatives

Field of Study	**Option 1**	**Option 2**
Terrestrial Biodiversity	Least Preferred	Preferred • Less disturbance within pristine vegetation
Wetlands	Least Preferred	Preferred • Less disturbance on the environment • Less indirect impacts
Agriculture	Due to the negligible agricultural impact of electrical grid infrastructure, there will effectively be absolutely no material difference to the significance of the agricultural impacts associated with the alternatives. There are therefore no preferred alternatives from an agricultural impact perspective. All alternatives are considered acceptable.	
Avifauna	Least Preferred	Preferred • Shorter length is preferred.
Archaeology	From a cultural heritage point of view all of the identified power line routes would be equally suitable for use.	
Palaeontology	Least Preferred	Preferred • Less disturbance of fossils within the gid corridor
Social	No preferred alternatives from a Social Impact perspective	
Visual	Least preferred	Preferred • Extent of visibility is less
Traffic	No preferred alternatives from a Traffic Impact perspective	

From the above it can be concluded that power line alternative option 2 is the preferred route alternative from an overall environmental perspective. This is mainly due to the route being the shortest possible route and thereby also represents the least disturbance to the environment.

It must however be noted that Option 1 is not considered as unacceptable for development, but will require more intensive mitigation measures.

6.5 METHOD OF ENVIRONMENTAL ASSESSMENT

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its 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 6.6.

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.

6.5.1 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 6.7: 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		
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.		
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

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.

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.

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 following requirements of the regulations:

Appendix 1. (3)(i) An BAR (...) must include-

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

7.1 INTRODUCTION

The EIA Regulations (as amended in 2017) 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 Basic Assessment 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. 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 18 below.

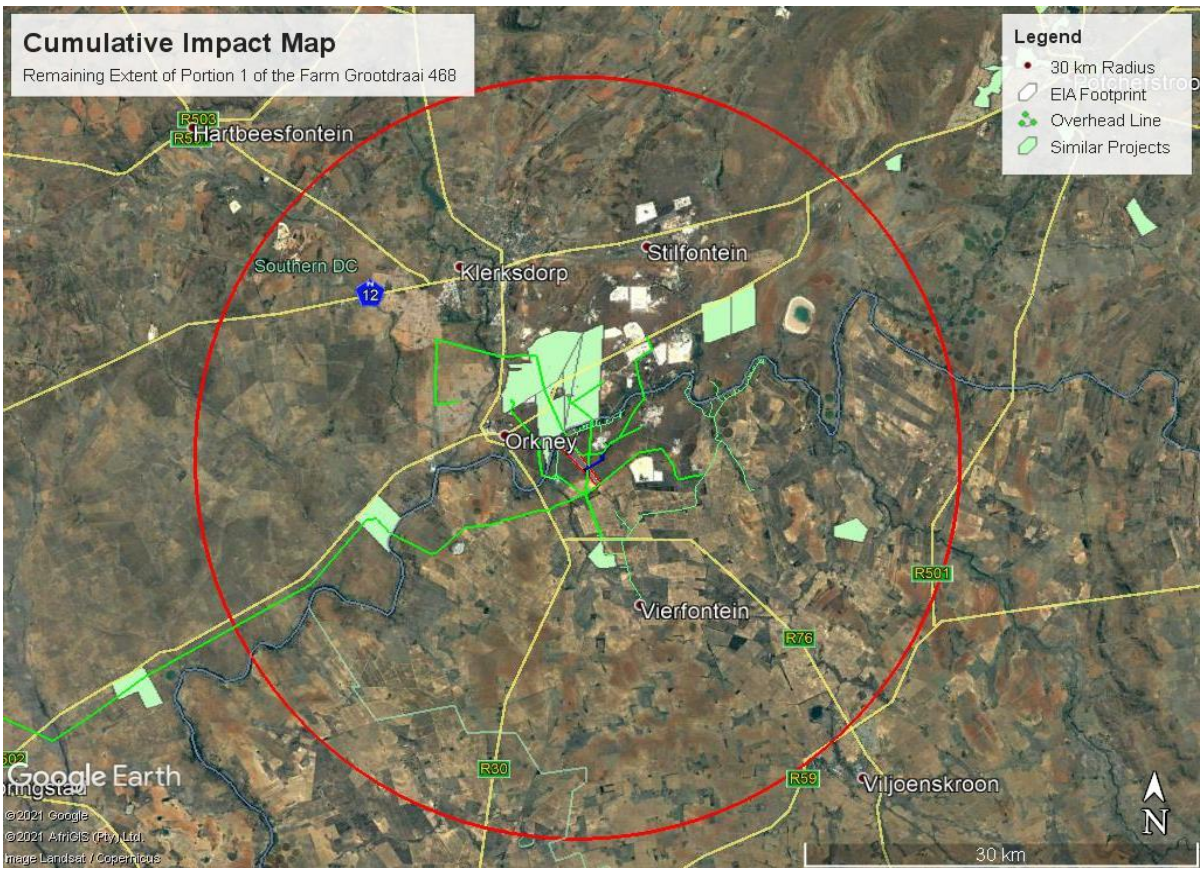

Figure 22: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines

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. The geographic area includes projects located within the Northern Cape Province. A larger geographic area may be used to analyse cumulative impacts based on the specific temporal or spatial impacts of a resource. 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 where 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 2022 and extending out at least 20 years, which is the minimum expected project life of the proposed project. Where appropriate, particular focus is on near-term cumulative impacts of overlapping construction schedules for proposed projects in the area of evaluation.

7.4 OTHER PROJECTS IN THE AREA

The following section provides details on existing and project being proposed in the geographical area of evaluation.

7.4.1 Existing projects in the area

According to the DFFE's database ten (10) PV solar plant applications (of which two applications have lapsed) have been submitted to the Department within the geographic area of investigation, – refer to table 7.1. It should be noted that there is uncertainty with regards to the accuracy and validity of the information obtained from the Departments

Table 7.1: A summary of related facilities, that may have a cumulative impact, in a 30 km radius of the study area

Site name	Distance from study area	Proposed generating capacity	DEFF reference	EIA process	Project status
Kabi Vaalkop PV 3	1.4km	75 MW	12/12/20/2513/3	Scoping and EIA	Approved
Kabi Vaalkop PV 2	5.4 km	75 MW	12/12/20/2513/2	Scoping and EIA	Approved
Kabi Vaalkop PV[4]	1.4 km	75 MW	12/12/20/2513/4	Scoping and EIA	Approved
Kabi Vaalkop PV 1	1.4 km	75 MW	12/12/20/2513/1	Scoping and EIA	Approved
Buffels Solar PV 1	15.3 km	100MW	14/12/16/3/3/2/777	Scoping and EIA	Approved
Buffels Solar PV 2	16 km	100 MW	14/12/16/3/3/2/778	Amendment	Approved
Witkop Solar[5]	2 km	61 MW	12/12/20/2507/2	Scoping and EIA	In Process
Rietvlei solar	7 km	-	14/12/16/3/3/2/450	Scoping and EIA	Withdrawn/Lapsed
Genesis Orkney Solar (Pty) Ltd	14 km	100MW	14/12/16/3/3/2/954	Scoping and EIA	Approved
Afropulse 538 Pty Ltd	22 km	50MW	12/12/20/2280	BAR	Withdrawn/Lapsed

[4] The application was only for transmission infrastructure (i.e. substation and power lines) and not a PV solar power plant.

[5] There is uncertainty regarding the project and whether the EIA process was completed. This is based on the lack of information available for the project.

It is unclear whether other projects not related to renewable energy is or has been or will be constructed in this area. In general, development activity in the area is focused on industrial development and agriculture. Agriculture in the area is primarily associated with cattle grazing. The next section of this report will aim to evaluate the potential for solar projects for this area in the foreseeable future.

7.4.2 Projects in the foreseeable future

As part of the SEA for Wind and Solar Energy in South Africa, the CSIR and the DFFE mapped the location of all EIA applications submitted within South Africa. According to this database approximately ten (10) applications have been submitted for renewable energy projects within the geographical area of investigation, with six (6) of these being considered valid in terms of an Environmental authorisation as two (2) applications have lapsed or was withdrawn, one (1) application is only for transmission infrastructure and there is uncertainty regarding the completion of the EIA process for one (1) project which seems to be incorrectly listed on the DFFE database based on the lack of information available for the project.. The majority of these projects are located in close proximity to Orkney, and to the north of the site considered for the Siyanda Solar Power Plant.

7.5 SPECIALIST INFORMATION ON CUMULATIVE EFFECTS

In line with the Terms of Reference (ToR) provided, 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 – refer to Figure 23 for a process flow. The following sections present their findings.

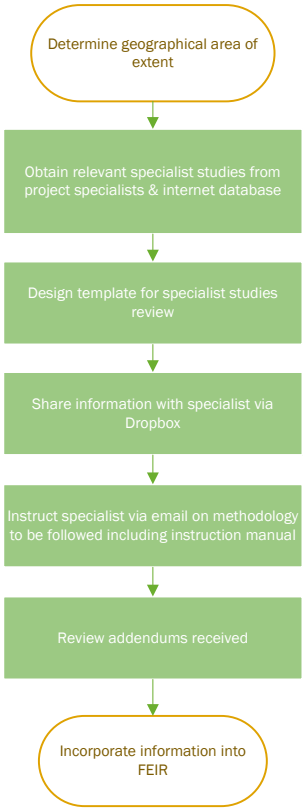

Figure 23: Process flow diagram for determining cumulative effects

7.5.1 Soil, Land Capability and Agricultural Potential

According to the Agricultural Agro-Ecosystem Specialist Assessment (Appendix D4) this project requires considering all renewable energy project applications within a 30 km radius. There are eight such other renewable energy projects.

In quantifying the cumulative impact, the area of land taken out of agricultural use (grazing) as a result of these eight projects plus this one (total generation capacity of 786 MW) will amount to a total of approximately 1,965 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to only 0.70% of the surface area. That is considered to be well within an acceptable limit in terms of loss of agricultural land that is only suitable for grazing, of which there is no scarcity in the country. This is particularly so when considered within the context of the following point:

In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land, which has very little cultivation potential, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country.

As discussed above, the risk of a loss of agricultural potential by soil degradation is low and can effectively be mitigated for renewable energy developments. If the risk for each individual development is low, then the cumulative risk is also low. Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it be approved.

Because of the negligible agricultural impact of grid connection infrastructure, its cumulative impact is also assessed as negligible.

7.5.2 Terrestrial Biodiversity and Wetland Assessment

The development will result in loss of and damage to natural habitats if the vegetation is cleared for the development of the solar plant. Rehabilitation of some areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction phase. Vegetation communities are likely to be impacted on a small spatial scale in comparison to the extent of the vegetation communities' total area in the region. Natural movement patterns will be disrupted for a limited period and, to a varying degree depending on how different species react to these barriers will result in the fragmentation of natural populations, although the impact will be minimal and restricted to the construction phase.

Construction work for the proposed development will always carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or groundwater, leading to potential medium/long-term impacts on fauna and flora. The cumulative impact on the

An increase in human activity on the site and surrounding areas is anticipated. The risk of snaring, killing, and hunting of certain faunal species is increased. If staff compounds are erected for construction workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive fauna and flora are increased. The presence of many construction workers or regular workers during the construction and decommissioning phases on site and within the surrounding areas associated with other projects over a protracted period will result in a greatly increased risk of uncontrolled fires arising from cooking fires, improperly disposed cigarettes etc. Large numbers of fauna are also killed daily on roads. The impact is intensified at night, especially for flying insects, as result of their attraction to the lights of vehicles.

The river and riparian area are located on a part of the farm that will not be developed and is separated from the rest of the farm with a tar road. Therefore, the cumulative impact on the river and riparian area are considered to be negligible.

Overall, the cumulative impact of the proposed development is rated as being negative medium, but with proper mitigation for the proposed site and the other proposed projects the cumulative impact can be reduced to negative low.

7.5.3 Avifaunal Assessment

Cumulative impacts associated with displacement of priority avian species from important habitats scored high-negative, as did the cumulative loss of important avian habitats whilst the cumulative displacement of resident avifauna scored medium-negative. Cumulative impacts associated with displacement of priority avian species from important habitats scored high-negative, whilst the cumulative displacement of resident avifauna scored medium-negative. Cumulative impacts associated with powerline collisions and electrocutions scored very high-negative.

It is the cumulative impacts, when considering the existing transformation of the threatened habitats to croplands and mining, in addition to the prevalence of planned solar developments, that increase the cumulative risks and, therefore, warrant mitigations.

Mitigating the cumulative impacts would require limiting the impact of the Siyanda Solar Power Plant to an absolute minimum, which is not necessarily feasible but should be pursued. The mitigations to reduce cumulative impacts involve limiting the disturbance footprint (overall size), focussing the development on already disturbed zones, limiting human activity and noise throughout the project life, disturbing as little natural vegetation as possible, retaining the natural vegetation beneath the panels and around infrastructure, limiting the extent and width of roadways, reducing the speeds that vehicles travel, and then thoroughly rehabilitating the entire footprint back to natural grassland representing the Vaal-Vet Sandy Grassland after decommissioning. An alternative would be to create a buffer of acceptable size (proposed 25%), where no development takes place and where intact habitats are present but this is not possible for the Siyanda Solar Power Plant as it is surrounded by transformed habitats or proposed development. Buffers are not necessarily feasible due to their small size and large ‘edge effect’.

Implementing successful mitigations would reduce the cumulative impacts of displacement of priority species by 32% to medium-negative, would reduce the cumulative impacts of displacement of resident avifauna by 29% to an acceptable low-negative score, and would reduce the cumulative impacts of loss of important avian habitats by 33% to medium-negative.

Implementing successful mitigations along the power line should reduce the impact rating for cumulative displacement of resident avifauna by 19% down to an acceptable low-negative score,

however cumulative displacement of priority avian species would reduce by 28% but would still be in the medium-negative category.

7.5.4 Social Impact Assessment

The potential for cumulative impacts to occur as a result of the surrounding projects, agricultural and mining activities are likely. Potential cumulative impacts identified for the project include positive impacts on the economy, business development, and employment, as well as negative impacts such as an influx of jobseekers and change in the area's sense of place.

Siyanda SPP and the establishment of other solar power projects within the area has the potential to result in significant positive cumulative impacts, specifically with regards to the creation of a number of socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local, regional, and national economy through employment and procurement of services are more considerable than that of Siyanda SPP alone.

While the development of a single solar power project may not result in a major influx of people into an area, the development of several projects may have a cumulative impact on the in-migration and movement of people. In addition, the fact that the project is proposed within an area characterised by good levels of solar irradiation suitable for the development of commercial solar energy facilities implies that the surrounding area is likely to be subject to considerable future applications for PV energy facilities. Levels of unemployment, and the low level of earning potential may attract individuals to the area in search of better employment opportunities and higher standards of living. It is exceedingly difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring.

7.5.5 Visual Impact Assessment

The potential for cumulative impacts to occur as a result of the project is likely. On the other hand, the location of the solar power plants within the Klerksdorp REDZ will contribute to the consolidation of SPP structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region. The anticipated cumulative visual impact of the proposed SPP is expected to include the change in sense of place, as well as the precedent being set for SPP development in the area where currently there is only a precedent for agricultural and mining related activities. Due to the number of mines in the area, the scenic quality of the region is low, further construction and operation of the SPP in the area is likely to have a negative impact.

7.5.6 Heritage Impact Assessment

The cumulative impact of the proposed Siyanda Solar Power Plant is to be assessed by adding impacts from this proposed development to existing and other proposed developments with similar impacts within a 30 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of 8 other plants. However, meaningful assessment of cumulative impacts require a comprehensive review of all developments in the larger region of the site and not only those involving renewable energy.

Heritage resources are sparsely distributed on the wider landscape with highly significant (Grade 1) sites being rare. Because of the low likelihood of finding further significant heritage resources in the area of the proposed for development and the generally low density of sites in the wider landscape the overall impacts to heritage are expected to be of generally low significance before mitigation.

For the project area, the impacts to heritage sites are expected to be of medium significance. However, this can be ameliorated by implementing mitigation measures, include isolating sites, relocating sites (e.g. burials) and excavating or sampling any significant archaeological material found to occur within the project area. The chances of further such material being found, however, are considered to be negligible. After mitigation, the overall impact significance would therefore be low.

7.5.7 Paleontological Impact Assessment

Based on the SAHRIS website palaeontological heritage assessments (PIAs) are available only for the Kabi Vaalkop PV Solar project (Bamford 2012), Orkney Solar Farm (Butler 2015) as well as the Buffels Solar 1 and 2 PV projects (Millsteed 2015a, 2015b). It is noted that all of the available PIA reports are desktop studies with no field-based ground truthing and a low palaeontological impact significance is inferred for all the projects concerned, including those involving Precambrian stromatolitic bedrocks comparable to those mapped in the present site of Siyanda SPP. Recent fieldwork for the - geologically similar- neighbouring Paleso Solar Power Plant project area on the Remaining Extent of Farm Grootdraai 468 supports a Medium (negative) impact significance for this development (Almond 2021, in prep.). The Paleontological Impact Assessment (Appendix D6) states the following:

- Palaeontological impact significances inferred for renewable energy projects, where these are assessed at all, may well reflect different assessment approaches rather than contrasting palaeontological sensitivities and impact levels;
- Meaningful cumulative impact assessments require comprehensive data on all major developments within a region, not just those involving renewable energy, as well as an understanding of the extent to which recommended mitigation measures are followed through;
- Trying to assess cumulative impacts on different fossil assemblages from different stratigraphic units (for example, Precambrian stromatolites from 2.6 billion years ago versus Pleistocene alluvial deposits less than 2.5 million years old) has limited value.

Given the comparatively small combined footprint of the renewable energy projects under consideration compared with the very extensive outcrop areas of Malmani Group stromatolitic carbonate bedrocks as well as the probable (albeit unconfirmed) rarity of scientifically valuable occurrences of well-preserved stromatolites within flat-lying terrain preferred for solar energy projects, the cumulative impact of the proposed or authorized solar power plant developments in the Orkney/ Viljoenskroon region - including the proposed Siyanda Solar Power Plant as well as the proposed neighbouring Paleso Solar Power Plant on the Remaining Extent of the farm Grootdraai 468- is assessed as medium (without mitigation), potentially falling to low (with full mitigation).

There are therefore no objections on palaeontological grounds to authorization of this project.

7.5.8 Traffic Impact Assessment

The cumulative impact and significance of the development of six (6) solar power plants (incl. Siyanda SPP) are considered low negative and medium positive impacts. Traffic will be negatively impacted, while the construction of the solar power plants and related infrastructure has a possible positive

impact on communities, through job creation. It is unlikely that the other solar power plants will be constructed within the exact same period as the Siyanda SPP but overlapping of construction periods is a possibility. The development of the Siyanda Solar Power Plant on the Remaining Extent of Portion 1 of the farm Grootdraai No. 468 in the Free State Province, can be supported from a cumulative traffic perspective.

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 7.2. There have been 22 specific VECs identified with reference to the Solar Project (Table 6.2), which relates to the biophysical and socio-economic environments. Table 7.2 indicates the potential cumulative effects VECs and the rationale for inclusion/exclusion.

Table 7.2: Potential Cumulative Effects for the proposed project

	Valued Ecosystem Components (VECs)	Rationale for Inclusion / Exclusion	Level of Cumulative Effect
	Construction Phase		
Terrestrial biodiversity, plant and animal impact assessment	Habitat destruction caused by clearance of vegetation	The construction phase of the development and associated infrastructure will result in loss of and damage to natural habitats if the vegetation is cleared for the development of the solar plant. Rehabilitation of some areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction phase. Vegetation communities are likely to be impacted on a small spatial scale in comparison to the extent of the vegetation communities' total area in the region. The impact is considered as cumulative as it will influence the vegetation communities in the area.	- Low
	Habitat fragmentation caused by clearance of vegetation	The construction of the solar development and associated infrastructure will result in natural movement patterns being disrupted for a limited period and, to a varying degree	- Low

		depending on how different species react to these barriers will result in the fragmentation of natural populations, although the impact will be minimal and restricted to the construction phase. The grassland in the project area is however already partly fragmented, by mines, roads and crop fields around it and therefore considered to have a cumulative impact.	
	Increased soil erosion and sedimentation	The construction activities associated with the solar power plant will result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil erosion promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora. The wider area is already impacted by soil erosion and sedimentation due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of erosion and sedimentation.	- Low
	Soil and water Pollution	Construction work for the proposed development will always carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or groundwater, leading to potential medium/long-term impacts on fauna and flora. During the construction phase, heavy machinery and vehicles would be the main contributors to potential pollution problems. The wider area is already impacted by soil and water pollution due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of soil and water pollution.	- Low
	Air Pollution	The environmental impacts of wind-borne dust, gases and particulates from the construction activities associated with the proposed development are primarily related to human health and ecosystem damage. From a cumulative impact perspective, the development will have a low impact on air	- Low

		pollution if mitigation measures are implemented.	
	Spread and establishment of alien invasive species	Continued movement of vehicles on and off the site during the construction phase will result in a risk of importation of alien species. Vehicles often transport many seeds, and some may be of invader species, which may become established along the access road, especially where the area is disturbed. The construction carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites. The wider area is already impacted by the spread of alien invasive species due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of spread of alien invasive species. The impact will be low as the mitigation measures proposed will reduce the overall impact of the development.	- Low
	Negative effect of human activities on fauna and road mortalities	An increase in human activity on the site and surrounding areas is anticipated for construction. The risk of snaring, killing, and hunting of certain faunal species is increased. If staff compounds are erected for construction workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive fauna and flora are increased. The presence of many construction workers or regular workers during the construction phases on site over a protracted period will result in a greatly increased risk of uncontrolled fires arising from cooking fires, improperly disposed cigarettes etc. The impact is considered to be cumulative due to proposed development contributing to the human activities in the area.	- Low

Wetland Assessment	Soil Compaction and increased risk of sediment transport and erosion	The use of heavy machinery during the construction and decommissioning phases of the development will result in the compaction of soil, resulting in decreased infiltration of rainwater and increased surface run-off volumes and velocities leading to a greater erosion risk. The hardened surfaces of the road and compacted soils of the proposed development area will also lead to an increase in surface run-off during storm events which will likely be discharged via stormwater outlet points, concentrating flows leaving the exposed areas. This can lead to erosion in the cleared areas and channel forming where culverts concentrate water on the side of the road where the river and riparian area are located. It can lead to sedimentation, in the river. The impact is considered to be cumulative due to proposed development contributing to the risk of sediment transport and erosion in the area.	- Low
	Soil and water pollution	Construction work will also carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface- or groundwater, leading to potential medium/long-term impacts on fauna and flora. The impact is considered to be cumulative due to proposed development contributing to the risk of soil and water pollution in the area.	- Low

	Spread and establishment of alien invasive species	The construction almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites. Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. Furthermore, the spread of the alien invasive species through the area will be accelerated when seeds are carried by stormwater into the drainage features on the site that will cause environmental degradation and indigenous species to be displaced. The wider area is already impacted by the spread of alien invasive species due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of spread of alien invasive species. The impact will be low as the mitigation measures proposed will reduce the overall impact of the development.	- Low
Avifaunal Impact Assessment	Displacement of priority avian species from important habitats	The displacement of resident avifauna through increased disturbance and possible collisions with PV panels leading to injury or loss of avian life are considered as a cumulative impact due to the large number of planned solar development in a 30 km radius.	- Medium
	Displacement of resident avifauna	The displacement of resident avifauna through increased disturbance and possible collisions with PV panels leading to injury or loss of avian life are considered as a cumulative impact due to the large number of planned solar development in a 30 km radius.	- Low

	Loss of important avian habitats	The loss of important avian habitats through increased disturbance and possible collisions with PV panels leading to injury or loss of avian life are considered as a cumulative impact due to the large number of planned solar development in a 30 km radius.	- Medium
Agricultural Agro-Ecosystem Specialist Assessment	Loss of agricultural land	The cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved. Because of the negligible agricultural impact of grid connection infrastructure, its cumulative impact is also assessed as negligible.	- Low
Heritage Impact Assessment	Loss or damage to sites, features or objects of cultural heritage significance	The impacts to heritage sites are expected to be of medium significance. However, this can be ameliorated by implementing mitigation measures, include isolating sites, relocating sites (e.g. burials) and excavating or sampling any significant archaeological material found to occur within the project area. The chances of further such material being found, however, are considered to be negligible. After mitigation, the overall impact significance would therefore be low.	- Low

Palaeontological Impact Assessment	Disturbance, damage or destruction of legally-protected fossil heritage within the development footprints during the construction phase (impacts on well-preserved and / or rare fossils of scientific and conservation value)	Given the comparatively small combined footprint of the renewable energy projects under consideration compared with the very extensive outcrop areas of Malmani Group stromatolitic carbonate bedrocks as well as the probable (albeit unconfirmed) rarity of scientifically valuable occurrences of well-preserved stromatolites within flat-lying terrain preferred for solar energy projects, the cumulative impact of the proposed or authorised solar power plant developments in the Viljoenskroon/Orkney region - including the proposed Siyanda Solar Power Plant as well as the proposed neighbouring Paleso Solar Power Plant on the Remaining Extent of the Farm Grootdraai 468 - is assessed as medium (without mitigation), potentially falling to low (with full mitigation).	- Low
Social Impact Assessment	Impacts of employment opportunities, business opportunities and skills development	Siyanda SPP and the establishment of other solar power projects within the area has the potential to result in significant positive cumulative impacts, specifically with regards to the creation of a number of socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local, regional, and national economy through employment and procurement of services are more considerable than that of Siyanda SPP alone.	+ Medium
	Impact with large-scale in-migration of people	While the development of a single solar power project may not result in a major influx of people into an area, the development of several projects may have a cumulative impact on the in-migration and movement of people. In addition, the fact that the project is proposed within an area characterised by good levels of solar irradiation suitable for the development of commercial solar energy facilities implies that the surrounding area is likely to be subject to considerable future applications for PV energy facilities. Levels of unemployment, and the low level of earning potential may attract individuals	- Medium

		to the area in search of better employment opportunities and higher standards of living. It is exceedingly difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring.	
Traffic Impact Study	Increase in construction vehicles	The construction of the solar power plants will have a minimal impact on the current traffic volumes for long distance transportation routes. The chances of local traffic being adversely affected by the construction traffic is considered extremely low. The construction of the solar power plants will have a definite positive impact on communities of the surrounding towns. As the construction of the solar power plants is of short-term duration, the impacts on the surrounding area will only be temporary. All of the impacts are completely reversible, as the project is of short duration. The significance of the above-mentioned impacts is low, as they are only temporary and extend over a short time period.	- Low
	Operational Phase		
Wetland Assessment	Spread and establishment of alien invasive species	Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. Furthermore, the spread of the alien invasive species through the area will be accelerated when seeds are carried by stormwater into the drainage features on the site that will cause environmental degradation and indigenous species to be displaced. The wider area is already impacted by the spread of alien invasive species due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of spread of alien invasive species. The impact will be low as the mitigation measures proposed will reduce the overall impact of the development.	- Low

Avifaunal Impact Assessment	Collisions when flying into power line infrastructure	Collisions with power line infrastructure leading to injury or loss of avian life are cumulative impacts due to the large number of planned solar developments and power lines in a 30 km radius.	- Medium
	Electrocutions when perched on power line infrastructure	Electrocutions when perched on power line infrastructure are cumulative impacts due to the large number of planned solar developments and power lines in a 30 km radius.	- Medium
Visual Impact Assessment	Visual impacts related to the SPP and power line	The anticipated cumulative visual impact of the proposed SPP is expected to include the change in sense of place, as well as the precedent being set for SPP in the area where currently there is only a precedent for agricultural and mining related activities. Due to the number of mines in the area, the scenic quality of the region is low, further construction and operation of the SPP in the area is likely to have a negative impact.	- Medium
	Decommissioning Phase		
Terrestrial biodiversity, plant and animal impact assessment	Increased soil erosion and sedimentation	The decommissioning activities associated with the solar power plant will result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil erosion promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora. The wider area is already impacted by soil erosion and sedimentation due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of erosion and sedimentation.	- Low

	Soil and water pollution	Photovoltaic panels may contain hazardous materials, and although they are sealed under normal operating conditions, there is the potential for environmental contamination if they were damaged or improperly disposed upon decommissioning. The impact is considered to be cumulative due to proposed development contributing to the risk of soil and water pollution in the area.	- Low
	Air Pollution	The environmental impacts of wind-borne dust, gases and particulates from the decommissioning activities associated with the proposed development are primarily related to human health and ecosystem damage. From a cumulative impact perspective, the development will have a low impact on air pollution if mitigation measures are implemented.	- Low
	Negative effect of human activities on fauna and road mortalities	An increase in human activity on the site and surrounding areas is anticipated for the decommissioning phases. The risk of snaring, killing, and hunting of certain faunal species is increased. If staff compounds are erected for construction workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive fauna and flora are increased. The presence of many construction workers or regular workers during the decommissioning phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires arising from cooking fires, improperly disposed cigarettes etc. The impact is considered to be cumulative due to proposed development contributing to the human activities in the area	- Low
Visual Impact Assessment	Visual Intrusion	The decommissioning of the PV plant and 132kV power line may increase the cumulative visual impact together with farming activities and people using the existing gravel roads adjacent to site increasing the amount of dust generated. Dust control and housekeeping will be the main factors to consider.	- Low

Other	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 Basic Assessment Report (BAR) 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:
  - Habitat destruction and fragmentation caused by clearance of vegetation (- Low)
  - Spread and establishment of alien invasive species (- Low)
  - Avifauna (- Low)
  - Loss of agricultural land (- Low)
  - Impacts of employment opportunities, business opportunities and skills development (+ Medium)
  - Impact with large-scale in-migration of people (- Medium)
- Cumulative effects during the operational phase:
  - Spread and establishment of alien invasive species (- Low)
  - Avifauna collisions when flying into power line infrastructure (- Medium)
  - Electrocutions when perched on power line infrastructure (- Medium)
  - Visual intrusion (- Medium)
- Cumulative effects during the decommissioning phase:
  - Soil and water Pollution (- Low)
  - Air pollution (- Low)
  - Visual intrusion (- Low)
  - Generation of waste (- Medium)

The cumulative impacts for the proposed development is medium to low and no high, unacceptable impacts related to the project is expected. Considering the extent of the project and information presented in section 7 of this report, it can be concluded that the cumulative impacts will not result in large scale changes and impacts on the environment. Photovoltaic solar energy technology is a clean

technology which contributes toward a better-quality environment. 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 Free State Province. No cumulative impacts with a high residual risk have been identified. In terms of the desirability of the development of sources of renewable energy therefore, it may be preferable to incur a higher cumulative loss in such a region as this one, than to lose land with a higher environmental value elsewhere in the country.

8 ENVIRONMENTAL IMPACT STATEMENT

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

Appendix 3. (3) An BAR (...) 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, impact management measures from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;

(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;

(o) 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 BA report. The ratings provided gives an indication of the impact significance with the implementation of the recommended mitigation measures.

- Impacts during construction phase:
  - Habitat destruction and fragmentation (- Low)
  - Spread and establishment of alien and invasive species (- Low)
  - Displacement of resident and priority avifauna (- Low)
  - Loss of important avian habitats (- Low)
  - Loss of productive agricultural land (- Low)

- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries (- Low)
- Disturbance, damage or destruction of legally protected fossil heritage within the development footprint during the construction phase (- Low)
- Visual impact (- Low)
- Direct and indirect employment opportunities and skills development (+ Medium)
- Economic multiplier effect (+ Medium)
- Influx of jobseekers and change in population (- Low)
- Impacts on daily living and movement patterns (- Medium)
- Increased risk of potential veld fires (- Low)

➢ Impacts during the operational phase:

- Habitat destruction and fragmentation (- Low)
- Spread and establishment of alien and invasive species (- Low)
- Displacement of priority avifauna (- Medium)
- Collision when flying into power line infrastructure (- Medium)
- Electrocution when perched on power line infrastructure (- Medium)
- Increased financial security for farming operations (+ Low)
- Visual impact on sensitive visual receptors in close proximity to the Solar Power Plant (- Low)
- Visual impact on sensitive visual receptors in close proximity to the 132kV overhead power line (- Medium)
- Direct and Indirect employment opportunities and skills development (+ Medium)
- Development of non-polluting, renewable energy infrastructure (+ Medium)
- Contribution to Local Economic Development (LED) and social upliftment (+ High)

➢ Impacts during the decommissioning phase:

- Habitat destruction and fragmentation (- Low)
- Soil and water pollution (- Low)

➢ Cumulative biophysical impacts resulting from similar development in close proximity to the proposed activity (Negative Medium to Negative Low)

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 BA report. In terms of the legal requirements, it is concluded that:

- All key consultees have been consulted as required by Chapter 6 of the EIA Regulations (as amended in 2017)
- The Basic Assessment process has been conducted as required by the EIA Regulations (as amended in 2017), Regulations 19 and Appendix 1.
- The EMPr was compiled in conjunction with the Generic EMPr for overhead electricity transmission and distribution infrastructure as per Government Notice 435, which was published in Government Gazette 42323 on 22 March 2019.
- The EMPr was compiled in conjunction with the Generic EMPr for the development of the associated substation infrastructure for transmission and distribution of electricity as per Government Notice 435, which was published in Government Gazette 42323 on 22 March 2019.
- The EMPr was compiled for the Siyanda Solar Power Plant as per Appendix 4 of the EIA Regulations (GN.R. 326), published in Government Gazette 40772 on 07 April 2017.
- 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 therefore, no terms of reference are provided for such studies.
- Option 2 of the power line route alternatives (assessed within the 100m wide grid connection corridor) is preferred from an environmental perspective and is therefore recommended for approval as part of the EA.

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

- All key environmental issues were identified. These key issues were adequately assessed during the BA process to provide the competent 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 Siyanda Solar Power Plant and associated infrastructure on the Remaining Extent of Portion 1 of the Farm Grootdraai No. 468, Registration Division Viljoenskroon, Free State Province be approved subject to the following conditions:

- Implementation of the proposed mitigation measures set out in the EMPr(s).
- 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 tasks allocated in the EMPr(s) should not be neglected and a copy of the EMPr(s) should be made available onsite at all times.
- Should archaeological/ heritage 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.
- It is proposed that a part (30 %) of the *Aloe zebrina, Bonatea speciosa and Schizocapphus nervosus* plants on the proposed development area be relocated to suitable habitat on the same farm or to another farm nearby. A walkthrough survey should be conducted to determine the number and location of individuals. Then a translocation management plan should be written, and plants translocated before development commences.

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

Christia van Dyk

Environamics - Environmental Consultants

ENVIRONAMICS

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