GEOHYDROLOGY

GEOTECHNICAL

ENVIRONMENTAL

SOCIAL DEVELOPMENT

30 years of Purpose With Passion

Draft EIA Report **14/12/16/3/3/2/2169**

PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON PORTION 10 and 1 OF THE FARM LICHTENBURG TOWN AND TOWNLANDS 27 IP, DITSOBOTLA LOCAL MUNICIPALITY, NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY, NORTHWEST PROVINCE

Short name: LICHTENBURG SOLAR PARK

13 October 2022

Commissioned by: Matrigenix (Pty) Ltd
Document version 1.0 – Draft
Compiled by: A von Well

AGES
Purpose with Passion

Proudly Supporting
TOUCHING AFRICA

Prepared by

PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON PORTION 10 and 1 OF THE FARM LICHTENBURG TOWN AND TOWNLANDS 27 IP, DITSOBOTLA LOCAL MUNICIPALITY, NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY, NORTHWEST PROVINCE
Short name: LICHTENBURG SOLAR PARK

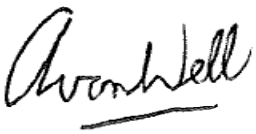
13 October 2022

PROJECT APPLICANT

Company name:	**Matrigenix (Proprietary) Limited**
Contact Person:	Mr Ernst Jordaan Burger
Physical Address:	No. 49, 14th Street, Menlo Park, Pretoria, 0044 - South Africa
Postal Address:	P.O. BOX 5, BRITS, 0250 - South Africa
Telephone Number:	+27 (0) 082 449 7626
E-mail:	development@lewton.co.za

ENVIRONMENTAL ASSESSMENT PRACTITIONER

Company Name:	AGES Limpopo (Pty) Ltd (Reg: 2006/020831/07)
Contact Persons:	Mr. Anton von Well
Physical Address:	120 Marshall Street, Polokwane, 0699, South Africa
Postal Address:	P.O. Box 2526, Polokwane, 0700, South Africa
Telephone Number:	+27 (82) 872 5258 / +27 0(15) 291 1577Tel
E-mail:	avonwell@ages-group.com



A. von Well
Senior Environmental Assessment Practitioner
Registered EAP (EAPASA Ref. 2019/934)

Although AGES Limpopo (Pty) Ltd exercises due care and diligence in rendering services and preparing documents, AGES Limpopo (Pty) Ltd accepts no liability, and the client, by receiving this document, indemnifies AGES Limpopo (Pty) Ltd and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by AGES Limpopo (Pty) Ltd and by the use of the information contained in this document.

This document contains confidential and proprietary information of AGES Limpopo (Pty) Ltd and is protected by copyright in favour of AGES Limpopo (Pty) Ltd and may not be reproduced or used without the written consent of AGES Limpopo (Pty) Ltd, which has been obtained beforehand. This document is prepared exclusively for ***Matrigenix (Pty) Ltd*** and is subject to all confidentiality, copyright and trade secrets, rules, intellectual property law and practices of South Africa.

REPORT DISTRIBUTION LIST

Name	Institution
Mr Ernst Jordaan Burger	Matrigenix (Pty) Ltd
Ms. Bathandwa Ncube	National Department of Forestry, Fisheries and the Environment (DFFE)
	Department of Water and Sanitation (DWS)
	Department of Agriculture, Land Reform and Rural Development (DALRRD)
	North-West Department of Economic Development, Environment, Conservation and Tourism (DEDECT)
	Ngaka Modiri Molema District Municipality
Municipal Manager	Ditsobotla Local Municipality
	South African Heritage Resources Agency (SAHRA)
	Eskom Land & Rights
	Registered Interested and Affected Parties (I&AP's)

DOCUMENT HISTORY

Report No	Date	Version	Status
14/12/16/3/3/2/2169	13 October 2022	1.0	Draft EIA Report

Table of Contents

List of Figures

LIST OF ANNEXURES

Annexure A Layout and technical drawings of the Lichtenburg PV Power Plant and connection infrastructure:

Annexure B – Public Participation Process – Comments & Responses Report

Annexure C – Terrestrial Biodiversity Impact Assessment

Annexure D – Avifaunal Assessment

Annexure E – Wetland Riparian and Aquatic Assessment

Annexure F – Agro-Ecosystem Specialist Report

Annexure G – Archaeological Impact Assessment

Annexure H – Palaeontological Impact Assessment

Annexure I – Visual Impact Assessment

Annexure J –Traffic Impact Assessment Report

Annexure K – Radio Frequency Interference (RFI) Assessment

Annexure L – Aviation Impact Assessment

Annexure M – Socio-Economic Assessment

Annexure N – Fire Management Plan

Annexure O – Stormwater Management Plan

Annexure P1 – Environmental Management Programme (EMPr)
Annexure P2 – EMPr – Generic – Powerline
Annexure P3 – EMPr – Generic - Substation

Annexure Q – Screening Report

Annexure R – Curriculum Vitae (EAP)

ABBREVIATIONS AND ACRONYMS

AGES	Africa Geo-Environmental and Engineering Services (Pty) Ltd
BID	Background Information Document
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSP	Concentrating Solar Power
DALRRD	Department of Agriculture, Land Reform and Rural Development
DFFE	National Department of Forestry, Fisheries and the Environment,
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environment Impact Assessment Report
EMPr	Environmental Management Programme
ESS	Environmental Scoping Study
GHG	Green House Gases
GIS	Geographic Information Systems
GN	Government Notice
GWh	Giga Watt hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
kV	kiloVolt
Matrigenix	Matrigenix (Pty) Ltd (Applicant)
MW	Mega Watt
MWp	Mega Watt peak
NEMA	National Environmental Management Act - Act no. 107 of 1998
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act - Act no. 25 of 1999
NWA	National Water Act - Act no. 36 of 1998
PoS	Plan of Study
Property / Project site	Portion 10 and 1 of Lichtenburg Town and Townlands 27 IP (Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North West Province)
PV	Photovoltaic
RFP	Request For Proposal
REIPPPP	Renewable Energy IPP Procurement Programme
RMIPPPP	Risk Mitigation IPP Procurement Programme
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
SANS	South African National Standard
UPS	Uninterruptible Power Supply

1 OBJECTIVE OF THE EIA PROCESS

According to Regulation No R 982 of 4 December 2014, of the EIA Regulations, 2014, as amended, the objective of the EIA process is to, through a process of consultation:

a. Identify the policies and legislation relevant to the study and how the study complies with the policies and legislation.
b. Motivate the need and desirability of the proposed activity including the need and desirability of the activity in the context of the preferred location.
c. Identify the location of the development footprint within the preferred site, based on an impact assessment and risk ranking process which includes cumulative impacts and a ranking process of all the identified alternatives focussing on the geographical, physical, biological, social, economic and cultural aspects of the environment.
d. Determine the
    a. Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform preferred alternatives; and
    b. Degree to which these impacts
        i. Can be reversed;
        ii. May cause irreplaceable loss of resources, and
        iii. can be avoided, managed or mitigated.
e. Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment.
f. Identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity.
g. Identify suitable measures to avoid, manage or mitigate identified impacts.
h. Identify risks that need to be managed and monitored.

2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Name of EAP: AGES – Anton von Well
Contact details of EAP:
Physical Address: 120 Marshall Street,
Polokwane, 0699
Telephone number: 015 291 1577
Fax number: 015 291 1577

Expertise of EAP: The EAP is registered as an Environmental Assessment Practitioner at EAPASA and has 22 years of experience with management and conducting of EIA's. Curriculum Vitae of EAP is included in Annexure R.

3 LOCATION OF ACTIVITY

3.1 SURVEYOR GENERAL 21 DIGIT CODES OF DEVELOPMENT AREAS

Site location - Surveyor-general 21-digit site code:

T	0	I	P	0	0	0	0	0	0	0	0	0	0	2	7	0	0	0	1	0
1	2			3				4								5				

3.2 PHYSICAL ADDRESS AND FARM NAME

MATRIGENIX (PTY) LTD is proposing the establishment of a **renewable energy generation facility (Photovoltaic Power Plant)** with associated infrastructure and structures on:

- **Portion 10 and 1 of the Farm Lichtenburg Town and Townlands 27 IP**

located within the **Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North West Province.**

The renewable energy generation facility will be a **Photovoltaic (PV) Power Plant** with a **maximum generation capacity up to 165 MW** at the point of connection (**Export Capacity**).

The name of the facility will be **LICHTENBURG SOLAR PARK.**

The **footprint (fenced area)** of the proposed development is approximately **261 ha in extent.**

The corner co-ordinates of the proposed Lichtenburg Solar Park include the following:

1	26°03'14.0"S	26°07'34.1"E
2	26°02'51.0"S	26°08'35.6"E
3	26°03'49.8"S	26°08'36.7"E
4	26°04'05.8"S	26°07'58.0"E
5	26°03'14.0"S	26°07'34.1"E

Access to the Lichtenburg Solar Park will be from the provincial road R505, which connects Lichtenburg with Ottoshoop.

In order to develop the facility, Matrigenix (Pty) Ltd must undertake an Environmental Impact Assessment (EIA) process and acquire environmental authorisation from the *National Department of Forestry, Fisheries and the Environment (DFFE)*, in consultation with the *North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT)*, in terms of the EIA Regulations, 2014 published on 4 December 2014, as amended under section 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

Matrigenix (Pty) Ltd is the applicant for the Lichtenburg Solar Park (the proposed project) which will be connected to the Eskom **Watershed Substation (MTS)** which is located approximately 3km south of the project site.

The powerline from the proposed PV Solar Park to the substation forms part of this application and runs for the most part over portion 10 of the farm Lichtenburg Town and Townlands 27 IP.

However, a small section of the powerline route will be on portion 1 of the Lichtenburg Town and Townlands 27 IP, which is the same farm portion on which the substation is located in the **Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North-West Province.**

Site location - Surveyor-general 21-digit site code:

T	0	I	P	0	0	0	0	0	0	0	0	0	0	2	7	0	0	0	0	1
1	2			3				4								5				

The independent Environmental Assessment Practitioners (EAPs) which have been appointed for the undertaking of the detailed environmental studies in compliance with the 2014 EIA Regulations, as amended, are **AGES Limpopo (Pty) Ltd** (AGES).

With the aim of identifying and assessing all potential environmental impacts related to the development as well as suggesting possible mitigation measures and alternatives, AGES has appointed specialist sub-consultants to compile detailed reports and to study the activities necessary for the assessment of the specific impacts related to their field of expertise.

AGES and the other specialist consultants are in a position of independency from Matrigenix (Pty) Ltd and not subsidiaries or affiliated to the latter. AGES and the specialist consultants have no secondary interest connected with the development of this project or of other projects which may originate from the authorization of the project.

The characteristics, the technology and the extent of the Lichtenburg Solar Park is defined and evaluated in this EIA Report and its annexures.

4 PLAN OF THE PROPOSED ACTIVITY

Figure 1. Regional Locality Map

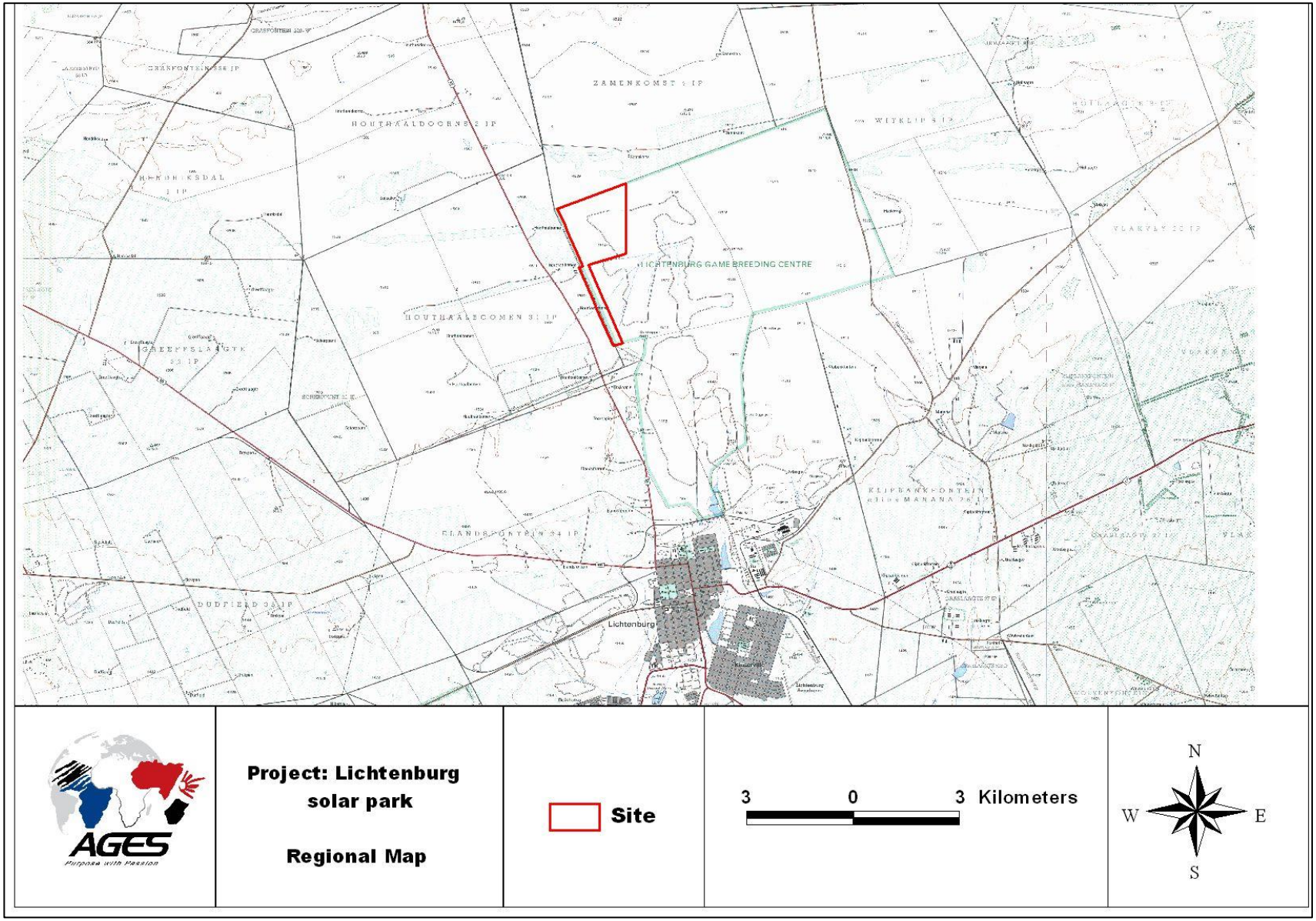


Figure 2. Topographical Map

5 SCOPE OF THE PROPOSED ACTIVITY

5.1 LISTED ACTIVITIES TRIGGERED IN TERMS OF NEMA

The "listed activities" in terms of sections 24 and 24D of NEMA, included in **Listing Notices 1, 2 & 3 of the EIA Regulations, 2014, as amended,** involved in the proposed development, are detailed in table below.

Table 1. Listed Activities in terms of EIA Regulations 2014 triggered by the proposed development

GN R.983 Item 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.**	Alternative Connection 1: On-site 132 kV substation, located outside urban areas or industrial complexes will be connected via a new 132 kV power line, ±3.4 km long, to Watershed Substation, south of the development site. Alternative 2: 132kV powerline, 1.6 km long, up to future (planned) switching station of the Lichtenburg 1, 2 and 3 PV projects, proposed by another developer on Ptn 2 of Zamenkomst 4 IP.
GN R.983 Item 12 **The development of –** **(xii) infrastructure or structures with a physical footprint of 100m² or more;** **(c) within 32m of a watercourse, measured from the edge of a watercourse.**	The access road from the south towards Lichtenburg Solar Park will cross a drainage line / watercourse and the new proposed powerline to the Eskom Watershed MTS will also cross the drainage line and will be 32m from the edge of the water course.
GN R.983, Item 24 (ii) **The development of -** **(ii) a road with a reserve wider than 13,5m, or where no reserve exists where the road is wider than 8m**	During construction phase, access road will have a reserve wider than 13.5 m to allow the transportation of abnormal goods (*e.g.* power transformers, *etc.*).
GN R.983, Item 28(ii) **Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:** **Will occur outside an urban area, where the total land to be developed is bigger than 1 ha.**	The proposed PV Solar Park is considered an industrial development and is being planned in an area which was previously used for game breeding and game farming. The proposed development site is situated outside the Lichtenburg urban area and will be 261 ha in size.
GN R.984 Item 1 **The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within an urban area.**	The project will consist of construction, operation and maintenance of a Photovoltaic (PV) Power Plant with a Maximum Export Capacity up to 165 MW with associated infrastructure and structures, to be partially located outside an urban area.

GN R.984 Item 15 **The clearance of an area of 20 ha or more of indigenous vegetation**	The PV Power Plant with associated infrastructure and structures will be constructed and operated on a footprint of approximately 261 ha. The required footprint should be cleared from the existing vegetation.

There are layout and site plans included in Annexure A. These layout plans are based on the results of both the Environmental Screening Tool as well as inputs and recommendations from the specialists and have been subject to a public participation process and no comments were received which led to a change in the site layout plans from the Scoping Report to the Draft EIA Report. However, the Draft EIA Report will be made available for comments and the site layout plans will be finalized once inputs, via public participation have been received, analysed and reviewed. All information acquired will be analysed in order to determine the proposed final development layout and site plans. Such approach will ensure a holistic view of future requirements of the site and that resources are utilised to their full availability in terms of social and environmental sustainability. This application and all other development applications, in the area, are considered together in order to ensure general sustainability in the Local and District Municipal areas.

5.2 DESCRIPTION OF ASSOCIATED STRUCTURES AND INFRASTRUCTURE RELATED TO THE DEVELOPMENT

The project envisages the establishment of a solar power plant with a maximum generation capacity at the delivery point (Maximum Export Capacity) of up to 165MW.

The construction timeframe is estimated to be between 8 and 12 months.

The preferred technical solutions entail:

- **mono/polycrystalline PV modules, mono or bi-facial.**
- **fixed mounting systems** or **horizontal 1-axis trackers.**

The energy generated by the Lichtenburg Solar Park will reduce the quantity of pollutants and greenhouse gases emitted into the atmosphere. The reduced amount of CO_2 will be the emissions that would have been generated by a thermal power plant using fossil fuels for producing the same quantity of energy that produced by the Lichtenburg Solar Park.

The detailed description of the characteristic and functioning of the PV plant and its connection is given in the following paragraphs.

5.3 LAYOUT OF INFRASTRUCTURE AND STRUCTURES ON SITE

The layout of the proposed development is the result of a comparative study of various layout alternatives and had been defined in consideration of the results of some specialist studies conducted during this EIA phase.

The PV plant is designed and conceived in order to minimize visual and noise impacts, as well as to operate safely and assuring a high level of reliability, with low water consumption and the need only for easy and quick maintenance and repair for approximately 30 years.

The footprint (fenced area) of the Lichtenburg Solar Park will be up to 261ha.

The main drives of the proposed layout are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies; mono or bi-facial mono/polycrystalline solar modules mounted on single-axis horizontal trackers (SAT) or on fixed mounting systems.
- to develop the PV power plant in the north-western corner of the farm, partially on croplands area and partially on natural areas.
- to avoid and/or restrict encroachment on Critical Biodiversity Areas (CBAs).

The proposed layout plan (attached as Annexure A and also shown in Figure 3 below) was drawn using PV modules mounted on trackers. In the case of PV modules mounted on fixed mounting systems, the layout plans will not change, except for the orientation of the PV arrays: East-West instead of North-South.

The required footprint - corresponding on the fenced area - will be up to 261 ha, and the maximum height of the structures (PV modules and support frames) will be approximately 4.5m above the ground level.

The project layout and the other plant components are detailed in the following drawings:

- Locality Map - Regional
- Locality Map – Surrounding Projects
- Sensitivity Map
- Site Layout Alternative 1 (Preferred)
- Site Layout Alternative 2
- Mounting System Options
- MV Stations
- On-site substation design
- Warehouse designs
- Steel Monopole structure - illustration

5.4 TECHNICAL DETAILS OF THE PROPOSED FACILITY

Table 2. Technical Details of the proposed facility

Component	Description/dimensions
Contracted capacity of the facility	165MW
PV panels	4.5m in Height
Number of Inverters required	To be confirmed
Total Extent of the Affected Property (Study Area)	271 ha
Total Development Area (total area occupied by the PV facility)	261 ha
Area occupied by inverter/transformer stations/substations	To be confirmed
On-site substation	Capacity: 132 MW Footprint: 1 ha
BESS	Capacity: 165 MW/990 MVA; Footprint: 15 ha
Area occupied by both permanent and construction laydown areas	10 ha
Area occupied by buildings	To be confirmed
Powerline	Export capacity Alt 1 & 2: 132 kV; Proximity to grid connection: Alternative 1: 3.4 km to Watershed MTS; Alternative 2: 1.6 km north connecting with the assistance of another developer on Ptn 2 of Zamenkomst 4 IP, Pylon height Alt 1 & 2: 18 m; Servitude: 30 m (powerline corridor already in place on western boundary)
Internal access roads	Access Road width during construction: 16 m Access Road width during operation: 8 m
Fencing	Type and height - To be confirmed

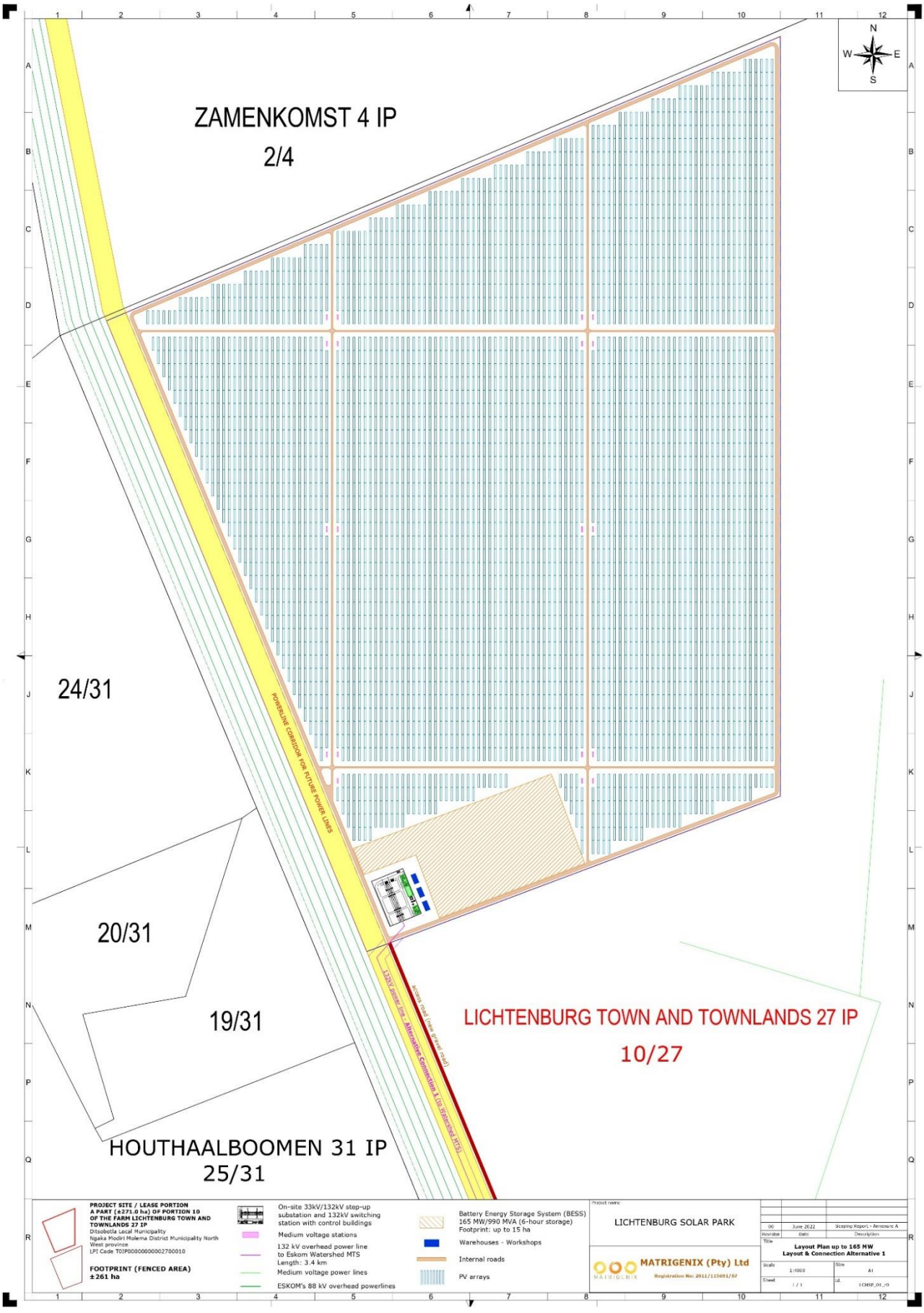


Figure 3. Proposed Draft Layout Plan of the Lichtenburg Solar Park – Alternative 1 (Preferred)

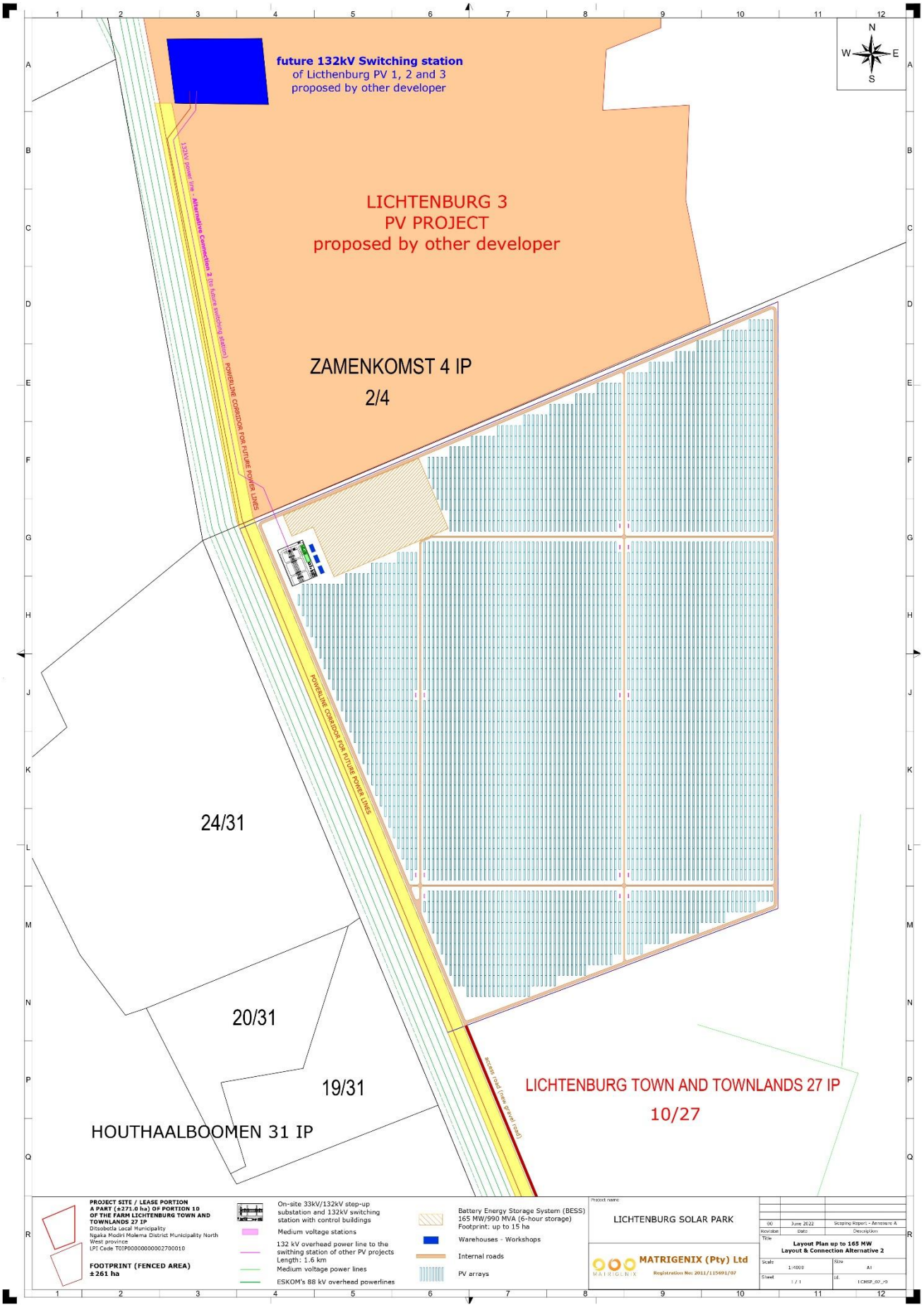


Figure 4. Proposed Draft Layout Plan of the Lichtenburg Solar Park – Alternative 2

5.5 PRIMARY COMPONENTS

The proposed development (the Photovoltaic (PV) Power Plant and its connection infrastructure) consists of the installation of the following equipment:

- Photovoltaic modules (mono-crystalline, poly-crystalline, mono or bi-facial modules)
- Mounting systems for the PV arrays (single-axis horizontal trackers or fixed structures) and related foundations
- Internal cabling and string boxes
- Medium voltage stations, hosting DC/AC inverters and LV/MV power transformers
- Medium voltage receiving station(s)
- Workshops & warehouses (including parking areas and staff ablutions)
- One on-site high-voltage substation with high-voltage power transformers, stepping up voltage, and one high-voltage busbar with metering and protection devices (switching station)
- One 132 kV power line, approximately 3.4 km long, connecting the on-site switching station to the busbar of the **Watershed Substation.** OR
- One 132 kV powerline, approximately 1.6 km going north to a planned switching station as proposed by another developer.
- **Battery Energy Storage System (BESS)**
- Electrical system and UPS (Uninterruptible Power Supply) devices
- Lighting system
- Grounding system
- Internal roads
- Fencing of the site and alarm and video-surveillance system
- Water access point, water supply pipelines, water treatment facilities
- Patented sewage system

The connection alternatives will be a 132kV powerline with monopole structures up to 18m in height, positioned 200m between each pole, with a 30m servitude.

5.5.1 PROJECT FUNCTIONING

Solar energy facilities using PV technology convert sun energy to generate electricity through a process called Photovoltaic Effect, which consists of the generation of electrons by photons of sunlight in order to create electrical energy. Preferred technical solutions are:

- Mono / bi-facial mono / polycrystalline modules, mounted on:
- fixed mounting systems or mounted on horizontal 1-axis trackers,

which represent the best performing options in terms of reliability and costs/efficiency.

The PV technology is in constant and rapid evolution, this means that the final choice of the type of solar modules (mono-crystalline or polycrystalline, mono or bi-facial) and mounting system (fixed or tracker) can be taken at the time of the commission date, on the basis of the availability of PV modules and mounting systems, of the worldwide market and of the cost-efficiency curve.

The required footprint - corresponding to the fenced area - will not exceed 261 ha, and the maximum height of structures (PV modules and support frames) will be approximately 4.5 m above ground level. PV modules will be assembled on zinced steel or aluminium frames, to form PV arrays. The metal frames that sustain PV arrays are set to the ground by fixed support poles.

Figure 5. Front views of the PV arrays mounted on horizontal 1-axis tracker

String Boxes monitor the currents in photovoltaic modules and can promptly diagnose faults. String boxes are also designed with a circuit breaker in order to disconnect the photovoltaic sub-fields from the inverters. The PV sub-fields are thought to be linked to central inverters, located in medium voltage stations. Each station comprises prefabricate buildings designed to host DC/AC inverters and a medium voltage power transformer. The DC/AC inverters are deemed to convert direct current (DC) into alternate current (AC) at low voltage; subsequently the AC will pass through a medium-voltage transformer in order to increase the voltage up to 132 kV.

The energy delivered from the medium voltage stations will be collected into one (or more) medium voltage receiving station(s), parallel connecting all the PV fields of the PV generator. From the medium voltage receiving station, the energy will be delivered to two high-voltage power transformers (250 MVA, plus one as spare), which will step up the electric energy from the medium voltage level (132 kV) to the required connecting voltage. The power transformers will be connected to an on-site 132 kV busbar (the so called “switching station”), to be equipped with protection and metering devices.

The new on-site HV substation will need to be equipped with circuit breakers upstream and downstream, in order to disconnect the PV power plant and/or the power line in case of failure or grid problems. **Lichtenburg Solar Park** will be connected to the 132 kV busbar of the **Eskom Watershed Main Transmission Substation (MTS)** via a new 132 kV power line up to 3.4 km long.

The power generation capacity at delivery point (Maximum Export Capacity) will be 165 MW.

5.5.2 BATTERY ENERGY STORAGE SYSTEM (BESS)

A Battery Energy Storage System (BESS) with an output capacity up to 165 MWac and a storage system will be installed next to the on-site step-up substation and switching station, within the footprint and fenced area of the Lichtenburg Solar Park.

The lithium-ion batteries will store energy at times of low energy demand and release the energy to the grid at times of pick demand. The battery energy storage system can also provide other grid services (if required by Eskom) aimed to improve grid stability and power quality, by turning on and off in fractions of a second, such as "Fast Frequency Response" (FFR).

The Battery Storage Facility will comprise of the following equipment:

- Containers, on a concrete platform, will house the batteries, management system and auxiliaries.
- Transformer stations.
- Additional area is required for the container for cooling units.
- Internal access roads up to 8.0 m wide between rows of containers. Where required, internal access roads will be constructed.
- BESS will be connected:
  - to the PV plant by means of DC/DC inverters, and
  - to the bus-bay of the on-site step-up substation by means of kiosk transformers, medium-voltage overhead lines and/or underground cables;
- Temporary infrastructure including a site camp and a laydown area.

The batteries to be installed in the containers will be of the Lithium-ion type and the battery cells will be pre-assembled at the supplier factory prior to delivery to the site. NO electrolytes will be transported to and handled on site.

The Battery System shall be able to store electrical energy and charge and discharge electrical energy when connected to a Power Conversion Unit (PCU), which performs the current conversion from LV DC to MV AC (and vice versa). The battery is commonly connected at AC MV level to the Renewable Power Plant for HV conversion and grid interconnection.

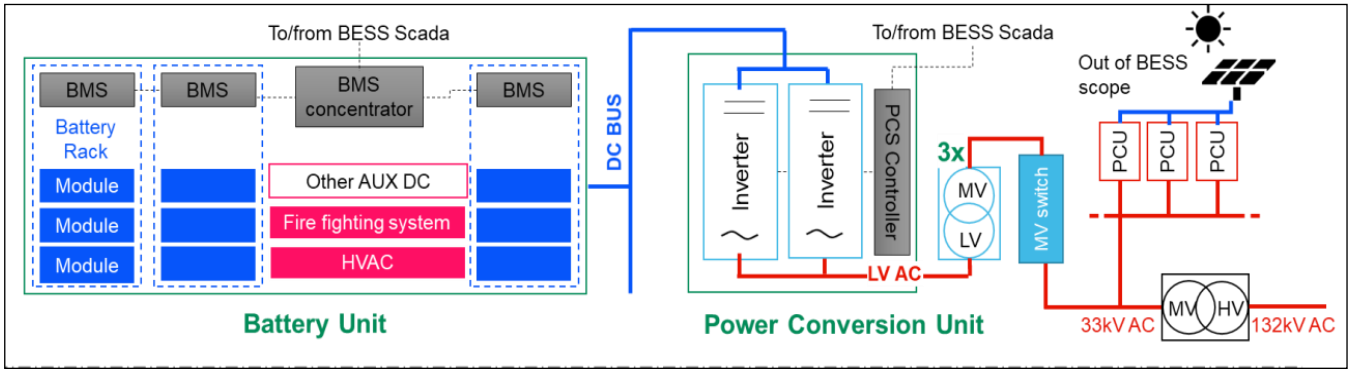


Figure 6. Battery Energy Storage System (BESS)

Battery Storage in combination to solar power plants is capable to provide multiple services to the plant and to the power transmission network adding flexibility to the system. Possible applications include amongst others: renewable generation time shifting, unbalancing reduction, curtailment avoidance, frequency regulation, voltage support, spinning reserve.

5.5.3 ACCESS ROAD AND INTERNAL ROADS

Access to the Lichtenburg Solar Park will be from the regional road R505, which runs along the Western corner of the project site.

Internal roads will consist of gravel roads designed in accordance with engineering standards. The roads will have a width of 4.0 m allowing for the slow-moving heavy vehicles. During construction phase, access roads will have a road reserve wider than 13.5 m (up to 16.0 m) to allow the transportation of abnormal goods (*e.g.* power transformers, *etc.*).

During operation, access roads will be up to 8m wide with a road reserve up to 13.5m.
Once the solar farm is in operation, the internal roads will mainly be used for maintenance and inspections.

The vertical alignment of the roads will not present significant challenges due to the flatness of the terrain. The entire development will be contained inside a fenced area and the roads are not intended for public use.

5.5.4 TRAFFIC IMPACT OF THE PROPOSED DEVELOPMENT

5.5.4.1 Traffic Impact – Construction Phase

Siyazi (Pty) Ltd was appointed to conduct a Traffic Impact Assessment in order to assess the possible impacts the proposed development might have on traffic in the area. The Traffic Impact Assessment report is included in Annexure J of this Draft EIA Report.

Approximately 100 people are expected to be employed during the construction period (15 months), although this number can increase to 150 during peak periods.

Overall traffic to and from the work site will amount to approximately 3 800 medium / heavy vehicle trips over the whole construction period. As indicated in the table below, the average number of medium and heavy trucks to and from the site will be 11.5 trucks per working day.

Medium and heavy trucks will access / leave the site only during the working days (Monday to Friday), during daytime. The provision of a fuelling area on the work site could reduce the load of heavy vehicles on public roads. The installation of one steel fuel tank (capacity of <30 000 litres) is recommended.

Table 3. Construction timeframe: Average daily trips of medium and heavy vehicles (*)

Transportation of:	months	1	2	3	4	5	6	7	8
Fencing and tools	trips/month	32	32	0	0	0	0	0	0
Clearance of the site (vegetation transportation)	trips/month	56	32	0	0	0	0	0	0
Piles / frames for mounting systems	trips/month	0	0	80	80	80	80	80	0
Sands & gravel for on-site concrete production	trips/month	0	120	192	192	192	208	208	216
PV modules	trips/month	0	0	0	0	0	0	0	0
MV stations	trips/month	0	0	0	0	0	48	48	48
HV substation components	trips/month	0	0	32	32	32	0	0	0
Cables	trips/month	0	0	0	0	0	0	0	64
Average trips per month	trips/month	**64**	**280**	**304**	**304**	**304**	**336**	**336**	**328**
Average trips per working day (*)	trips/day	**2.9**	**12.7**	**13.8**	**13.8**	**13.8**	**15.3**	**15.3**	**14.9**

Transportation of:	months	9	10	11	12	13	14	15	TOTAL
Fencing and tools	trips/month	0	0	0	0	0	0	0	**64**
Clearance of the site (vegetation transportation)	trips/month	0	0	0	0	0	0	0	**88**
Piles / frames for mounting systems	trips/month	0	0	0	0	0	0	0	**400**
Sands & gravel for on-site concrete production	trips/month	208	192	128	0	0	0	0	**1 856**
PV modules	trips/month	0	64	128	272	264	136	0	**864**
MV stations	trips/month	48	48	0	0	0	0	0	**240**
HV substation components	trips/month	0	0	0	0	0	0	0	**96**
Cables	trips/month	64	0	0	0	0	0	0	**128**
Average trips per month	trips/month	**320**	**304**	**256**	**272**	**264**	**136**	**0**	**3 808**
Average trips per working day (*)	trips/day	**14.5**	**13.8**	**11.6**	**12.4**	**12.0**	**6.2**	**0.0**	**11.54**

5.5.4.2 Traffic Impact – Operation Phase

The traffic impact during the operation phase will be insignificant, considering that about 60/70 people will work on the PV facility, in the following manner:

- during the daytime approximately 14 people;
- during the night-time 6 people.

A Traffic Impact Assessment report is included in Annexure J.

5.5.5 LIGHTING SYSTEM

The lighting system will consist of the following equipment:

- Floodlight-towers: maximum 10 meters high, with directional lamps (LED type) of 120 W, installed around the HV loop-in loop-out substation. Normal lighting: 15 lux; up to 40 lux in case of emergency.
- Street lighting along internal roads, for the stretch from the access point up to the HV substation inside the property: 1 streetlamp, maximum 5.5 meters high, every 20 meters, having a LED lamp of 120 W.
- 2x120 W spotlights (LED type) mounted on the top of medium-voltage stations.

The lighting of the MV stations and of the on-site HV substation will be on only in case of intrusion/emergency or necessity to reach the MV stations / HV substation during the night. During the night, the video-surveillance system will use infra-red (or micro-wave) video-cameras, which do not need a lighting system (which could reduce the functioning).

5.5.6 STORMWATER COLLECTION SYSTEM

Given the low rainfall, flat topography and low flow speed of run-off, no formal storm water structures are required as the proposed gravel roads will be developed at ground level so as not to disturb the natural flow of storm water. Run-off will not be concentrated, and existing drainage patterns will be left unchanged. A storm water management plan was compiled by qualified hydrologists to minimise potential negative impacts as a result of storm events. The purpose of this report is to provide an oversight of the hydrological setting of the projects, and to provide the scope of work for further hydrological assessment and the development of the Storm Water Management Plan for the Solar plant site.

Aspects of importance in the management plan are:

- Hydrological characteristics including flood volumes, possible flood line challenges and general flow patterns expected on site. (Topography and climatological drivers).
- Water quality due to site activities.
- Mitigating the hydrologic impact of the solar farm development.

The purpose of the Storm Water Management Plan (SWMP) must be to:

- provide guidance to align all phases of development and the eventual operation to the relevant Acts of Law.
- provide for rational thinking in concept development and design.
- minimise risk of on site and / or downstream damage due to hydrological impact. This includes exposure to runoff associated with normal rain, as well as during more extreme flood events.
- To minimise the risk to on site and / or downstream contamination through storm water due to waste on site.
- It needs to consider the impact of rain on the site, the impact of water entering the site from higher ground and the impact of water leaving the site.

The SWMP Report will not be a design report; guidance is given in it for compliance by the eventual design-implementation- and operational teams.

The **technical parameters** to be detailed in the stormwater management plan are

- Geographical orientation
- Topography of the site
- Surface conditions on site
- Climatic conditions in the area
- Hydrological setting of the area

A Storm Water Management Plan was compiled and is included in Annexure O.

5.5.7 WATER REQUIREMENTS

Water requirements during the construction phase

The construction phase will last approximately 12 months.

A) Construction of internal gravel roads

- Water is necessary for the construction of internal gravel roads, in order to get the gravel compacted to optimum moisture content (OMC).

B) Workers

- Approximately 100 people are estimated to be employed during the construction period but can increase to 150 during peak periods. This number can be higher if the construction period is shortened significantly, and more labour is required.
- Each worker needs 50 liters / 8 working hours for sanitary use.
- Water consumption will be:
    - 100 people x 50 l/person x 264 working days = 1 320 m^3 over 12 months.

C) Concrete production

- Concrete is necessary for the basements of the medium-voltage stations, the high-voltage loop-in loop-out substation, the control building, the warehouse and workshop, the basement of the Battery Energy Storage System (BESS) and for the foundations of the mounting systems. The overall amount of concrete to be produced will be *approximately* 15 000 m^3
- 200 litres of water are needed for 1 cubic meter of concrete.
- Water consumption will be: 15 000 m^3 x 200 liters / m^3 = **3 000 m^3**

D) Vehicle cleaning

As mitigation measure, the cleaning of vehicles like excavators, mechanical diggers and pile rammers will be done once or twice per month only and not during working days, in order to not increase the water requirement during construction activities. In order not to waste a large amount of water, high pressure cleaners will be used. Overall, the water requirement for cleaning activity is very low.

Overall and average water consumption during construction is detailed in the following table.

Table 4. Water consumption during the construction phase of the project

WATER REQUIREMENT DURING THE CONSTRUCTION PHASE OF THE PROJECT		
DESCRIPTION	**UNIT**	**TOTAL**
Timeframe of the construction activities	*months*	12
Timeframe of the construction activities - calendar days	*days*	360
Overall water consumption for internal roads	*m^3*	6,850
Overall water consumption for sanitary use	*m^3*	1,650
Overall water consumption for concrete production	*m^3*	3,000
OVERALL WATER CONSUMPTION	***m^3***	**11,500**
Daily water consumption (average over 450 calendar days)	***m^3/day***	**32.0**

Storage tanks will be sized in order to provide a reserve of water approximately **200m^3**.

Water requirements during the operational phase

During operation, water is only required for the operational team on site (sanitary use), as well as for the cleaning of the solar panels. Further water consumption may be only for routine washing of vehicles and other similar uses.

A) Water for sanitary use

Approximately 35/40 people will be employed during the operation phase of the PV power plant, which will have a lifetime of approximately 25-30 years.

Lichtenburg Solar Park will be in operation 7 days per week; therefore, personnel will operate in shifts. The surveillance team will be present during daytime, night-time and weekends. The average number of people working on site will be of 14 people daytime and 6 people at night. The average daily water consumption for sanitary use is estimated to be 150 litres/day/person for 20 people (14 people daytime and 6 people at night). The daily water consumption will be approximately 3000 litres/day.

B) Water consumption to clean the PV modules

The cleaning activities of the solar panels will take place twice per year. It is assumed that up to 1.0 litre per m^2 of PV panel surface will be needed. Therefore, the amount of water for cleaning is up to 850 m^3 per cleaning cycle and 1 700 m^3/year. PV modules cleaning activity can last less than 1 month. If the cleaning activity lasts approximately 2 weeks (12 working days), the daily water consumption will be approximately **71,000 liters/day**, **over 12 days**.

Conclusion

The daily water requirement will be approximately **3,000 liters/day** over 12 months for sanitary use (i.e. **90,000 l/month** and **1,095 m^3/year**).

The water consumption will increase up to **74,000 liters/day** during the cleaning of the solar modules (71,000 liters/day for cleaning activity and 3,000 for sanitary use), which will last less than a month and will occur twice per year during the dry period. Indeed PV modules are conceived as self-cleaning with the rain.

It is further proposed that **90,000 l** of water will be stored in **storage tanks** for fire, emergency and washing of panels twice a year. The overall and average water consumption during operation is detailed in the table below.

Table 5. Water consumption during the operational phase of the project

WATER REQUIREMENT DURING THE OPERATIONAL PHASE		
DESCRIPTION	**UNIT**	**TOTAL**
Average daily water consumption for sanitary use	*l/day*	3,000
Average daily water consumption during cleaning activity (*)	*l/day*	74,000
Average monthly water consumption for sanitary use (over 30 days)	*l/month*	90,000
Annual water consumption for sanitary use	***m^3/year***	**1,095**
Annual water consumption for PV modules cleaning activities (twice/year)	***m^3/year***	**1,700**
ANNUAL WATER CONSUMPTION DURING OPERATION	***m^3/year***	**2,795**
DAILY WATER CONSUMPTION DURING OPERATION (average over 365 day)	***m^3/day***	**7.66**

(*) over 12 working days, twice per year

C) Water provision during construction and operation

Water needs for the construction phase (11,500 m^3 over approximately 15 months) and the operational phase (2795 m^3/year) may be obtained from the Ditsobotla Local Municipality and/or from on-site boreholes. The Local Municipality will be consulted in this respect.

5.5.8 SEWERAGE

Considering that the proposed development will not include formal residential properties there is no need to connect to the municipal sewer reticulation system. Sewer reticulation will be handled by a suitable patented and commercially available wastewater treatment system, which will be a closed system. The sewer system will consist of an installation to serve the offices of the control building. The system will be installed in line with the requirements of the manufacturer. Typical systems consist of a conservancy tank (built underground on site), and a patented digester. Most systems require electricity to power the pumps and fans used in aeration process, although some systems use wind power (whirlybird). The system could require chlorine tablets available commercially.

The effluent from the wastewater treatment system will be suitable for irrigation, or re-use as water for the flushing of toilets, or for fire-fighting purposes. This could reduce the overall water requirement of the development substantially.

An application for a Water Use License for all water uses triggered according to Section 21 of the National Water Act, 1998 (Act No. 36 of 1998), will be submitted to the Department of Water and Sanitation.

5.5.9 REFUSE REMOVAL

During the construction phase, solid waste will mainly consist of vegetation material as a result of the clearance of vegetation. Other type of solid waste will include, amongst others, wood from packaging, boxboards, expanded polystyrene and household waste. Vegetation material from clearing activity can be recycled to be re-used as organic fertilizer. Other solid wastes will be recycled as much as possible. Non-recyclable waste will be delivered to the municipal landfill site.

During the operational phase (approx. 30 years), solid waste will mainly consist of household waste from the operational team. Other type of solid waste will come from the maintenance activity in case of failure of some components. At the end of the project lifetime, the PV plant will be decommissioned. Silicon of the PV modules and cables (copper and/or aluminium conductor) will be recycled, as well as the aluminium (or zinced steel) frames and piles of the mounting systems.

Matrigenix will enter into an agreement with the Ditsobotla Local Municipality for the PV plant's refuse at the nearby municipal refuse site. No refuse will be buried or incinerated on site. Measures to manage waste will be included in the Draft EMPr.

5.6 TEMPORARY CONSTRUCTION CAMP

The construction camp (approximately 10ha) will be located within the planned development area, close to the new on-site substation. Consequently, the construction site area will be gradually reduced at the completion of the last PV fields, and at the end of the works the construction area will be converted into the last PV arrays. The optimal location of the construction site is important during the planning phase in order to minimize impacts on the surrounding environment. The site's location is dictated by the nature of the works to be undertaken, specialist studies, site restrictions, town planning intended uses and access.

The area identified for the construction site had to meet the following requirements:

- sufficient size;
- proximity to existing roads;
- availability of water and energy;
- low environmental and landscape value;
- sufficient distance from residential areas; and
- proximity to the worksite.

To ensure environmental compatibility, the following factors have been considered:

- restrictions on land use (landscape, archaeological, natural, hydrological, etc.);
- terrain morphology;
- presence of high environmental value areas (*e.g.* wetlands); and
- sand & stone supply.

The establishment of the construction site will be divided into four phases. Steps included here do not follow a time sequence but considered overlapping and simultaneous events.

5.6.1 PHASE I

The area will be fenced to prevent intrusion of animals and to protect against materials theft within the site. A video surveillance system will be provided.

5.6.2 PHASE II

During the fencing operation as described in Phase I, trees with a conservation value, will be removed and placed temporarily in a safe location for future planting at the end of work. This procedure is required for environmental mitigation. The other tree species will be cut down and transferred to facilities for wood processing.

5.6.3 PHASE III

At completion of the works defined in Phases I and II, the following step will be the site clearing and the construction of internal roads. The internal road network should ensure a two-way traffic of heavy goods vehicles to minimize trips. The road system is planned for a width of 8 meters for access roads and 4 meters for internal roads. Roads will be of dry and compacted materials.

The facility will require constant access control, a weigh-house for heavy trucks, removable structures for the storage of yard tools and temporary storage areas. During Phase III, the installation of MV/LV transformers connected to the Eskom grid is also planned, as well as the laying of underground electrical cables.

5.6.4 PHASE IV

Temporary storage areas of materials and workshops will be constructed and used for:

- temporary storage of photovoltaic modules;
- temporary storage for frames and piles of the mounting systems of the PV arrays;
- storage and processing of building material for construction (sand, gravel, concrete batching and mixing plant, steel, etc.);
- drinking water storage for human consumption;
- worker care facilities and site management buildings,
- prefabricated housing modules for workers who may require accommodation inside the site (only key personnel will be allowed to stay overnight);
- technical cabins and management offices;
- medical care unit in a prefabricated module, in order to allow immediate first aid and minor surgical emergency;
- recreation area and canteen (prefabricated modules);
- parking lots for employees (located close to the staff housing), for visiting staff (located close to the offices area), and for trucks and work vehicles during inactivity;
- workshop and storage facilities on the site for contractors;
- electrical network for living units, offices and service structures;
- water supply for living units through polyethylene pipes connected to storage;
- wastewater treatment system. The treated water will be used to moisten dusty areas and reduce dust pollution during windy conditions;
- temporary chemical toilets; and
- solid waste collection point.

5.6.5 EARTHWORKS

Clearing activity is required to remove shrubs and trees from the planned footprint (±261 ha). Due to the flatness of the development area, no earthworks are envisaged for the installation of the PV module mounting systems. The mounting systems will consist of metallic frames to be assembled on-site, supported by pre-bored cast-in-situ concrete piles. Concrete ballasted footing foundations are also possible.

Earthworks will be required during the construction of internal roads and access road. The vertical alignment of the roads will not present any significant challenges due to the flatness of the terrain so that no deep cuts or fills will be required.

Given the low rainfall, flat topography and low flow speed of run-off - no formal storm water structures are required as the proposed gravel roads will be developed at ground level, so as not to disturb the natural flow of storm water. This means that run-off will not be concentrated, and the existing drainage patterns will be left undisturbed.

Small earthworks will be required for the installation of the medium-voltage stations. None of these activities should require earthworks in excess of 500 mm cut or fill. Only the foundation plate for the small high-voltage substation may require earthworks in excess of 500 mm cut or fill (the footprint will be up to 10 000 m^2). The topsoil stripping will result in temporary spoils heaps which must be spread over the site upon completion of the project.

Underground cables will be laid down along the internal roads.

The concrete necessary for the basements of the medium-voltage stations, the high-voltage substation, the control building and the warehouse will be provided from commercial sources in the vicinity of the development. Gravel necessary for the construction of internal roads may be provided from commercial sources in the vicinity of the development.
.

6 LEGAL AND POLICY REQUIREMENTS

The legislative and regulatory framework of reference for the solar power plant project includes statutory and non-statutory instruments by which National, Provincial and Local authorities exercise control throughout the development of the same project.

The development and the environmental assessment process of a solar power plant project involve various authorities dealing with the different issues related to the project (economic, social, cultural, biophysical etc.).

6.1 REGULATORY AUTHORITIES

6.1.1 NATIONAL AUTHORITIES

At national level, the main regulatory authorities and agencies are:

- *Department of Mineral Resources and Energy* (DMRE): the Department is competent and responsible for all policies related to energy, including renewable energy. Solar energy is contemplated and disciplined under the White Paper for Renewable Energy and the Department constantly conducts research activities in this respect;
- *National Department of Forestry, Fisheries and the Environment,* (DFFE): the Department is competent and responsible for all environmental policies and is the controlling authority under the terms of NEMA and EIA Regulations. The DFFE is also the competent authority for the proposed project, and is entrusted with granting the relevant environmental authorisation;
- *National Energy Regulator of South Africa* (NERSA): the Regulator is competent and responsible for regulating all aspects dealing with the electricity sector and, in particular, issues the licence for independent power producers;
- *South African Heritage Resources Agency (SAHRA):* The Agency is responsible for the protection and survey, in association with provincial authorities of listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes under the terms of the National Heritages Resources Act (Act no. 25 of 1999).
- *South African National Roads Agency Limited* (SANRAL): the Agency is responsible for all National road routes.

6.1.2 PROVINCIAL AUTHORITIES

At provincial level, the main regulatory authority is the *North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT);* this Department is responsible for environmental policies and is the Provincial authority in terms of NEMA and the EIA Regulations and is also the commenting authority for the proposed project.

6.1.3 LOCAL AUTHORITIES

At a local level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the North West Province, Municipalities and District Municipalities are involved in various aspects of planning and the environment related to solar energy facilities development. The Local Municipality is the *Ditsobotla Local Municipality* which is part of the *Ngaka Modiri Molema District Municipality*.

Under the terms of the Municipal System Act (Act no. 32 of 2000), all municipalities are deemed to go through an Integrated Development Planning (IDP) process to devise a five-year strategic development plan for the area of reference.

The identification of priority areas for conservation and their positioning within a planning framework of core, buffer, and transition areas is the subject of bioregional planning. Priority areas are individuated and defined with reference to visual and scenic resources and their identification and protection is granted through visual guidelines drafted for the area included in bioregional plans.

Local authorities also provide specific by-laws and policies to protect visual and aesthetic resources with reference to urban edge lines, scenic drives, special areas, signage, communication masts etc. Finally, there are also various non-statutory bodies and environmental groups, who are involved in the definition of various aspects of planning and the protection of the environment, which may influence in the development of the proposed project.

6.2 LEGISLATION, REGULATIONS AND GUIDELINES

A review of relevant legislation involved in the proposed development is in table 5 below.

Table 6. Review of relevant legislation

National Legislation	Sections applicable to the proposed project
Constitution of the Republic of South Africa (Act no. 108 of 1996)	• Bill of Rights (S2) • Rights to freedom of movement and residence (S22) • Environmental Rights (S24) • Property Rights (S25) • Access to information (S32) • Right to just administrative action (S33)
Fencing Act (Act no. 31 of 1963)	• Notice in respect of a boundary fence (S7) • Clearing bush for boundary fencing (S17) • Access to land for boundary fencing (S18)
Conservation of Agricultural Resources Act (Act no. 43 of 1983)	• Prohibition of the spreading of weeds (S5) • Classification of categories of weeds & invader plants and restrictions in terms of where these species may occur (Regulation 15 of GN R0148) • Requirement and methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R0148)

Environment Conservation Act (Act no. 73 of 1989)	• National Noise Control Regulations (GN R154 dated 10 January 1992)
National Water Act (Act no. 36 of 1998)	• Entrustment of the National Government to the protection of water resources (S3) • Entitlement to use water (S4) - Schedule 1 provides the purposes which entitle a person to use water (reasonable domestic use, domestic gardening, animal watering, fire-fighting and recreational use) • Duty of Care to prevent and remedy the effects of water pollution (S19) • Procedures to be followed in the event of an emergency incident which may impact on water resources (S20) • Definition of water use (S21) • Requirements for registration of water use (S26 and S34) • Definition of offences in terms of the Act (S151)
National Forests Act (Act no. 84 of 1998)	• Protected trees
National Environmental Management Act (Act no. 107 of 1998)	• Definition of National environmental principles (S2): strategic environmental management goals and objectives of the government applicable within the entire RSA to the actions of all organs of state, which may significantly affect the environment • **NEMA EIA Regulations 2014 (GN R. 982, 983, 984, 985 of 4 December 2014), as Amended** • Requirement for potential impact on the environment of listed activities to be considered, investigated, assessed and reported on to the competent authority (S24 - Environmental Authorisations) • Duty of Care (S28): requirement that all reasonable measures are taken in order to prevent pollution or degradation from occurring, continuing and recurring, or, where this is not possible, to minimise and rectify pollution or degradation of the environment • Procedures to be followed in the event of an emergency incident which may impact on the environment (S30)
National Heritage Resources Act (Act no. 25 of 1999)	• SAHRA, in consultation with the Minister and the MEC of every province must establish a system of grading places and objects which form part of the national estate (S7) • Provision for the protection of all archaeological objects, paleontological sites and material and meteorites entrusted to the provincial heritage resources authority (S35) • Provision for the conservation and care of cemeteries and graves by SAHRA, where this is not responsibility of any other authority (S36) • List of activities which require notification from the developer to the responsible heritage resources authority, with details regarding location, nature, extent of the proposed development (S38) • Requirement for compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites for promotion of tourism (S44)
National Environmental Management: Biodiversity Act (Act no. 10 of 2004)	• Provision for MEC for Environmental Affairs/Minister to publish a list of threatened ecosystems in need of protection (S52)

	• Provision for the MEC for Environmental Affairs/Minister to identify any process or activity which may threaten a listed ecosystem (S53) Provision for the Member of the Executive Council for Environmental Affairs/Minister to publish a list of: critical endangered species, endangered species, vulnerable species and protected species (S56(1) - see Government Gazette 29657 • Three government notices have been published up to date: GN R150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R151 (Lists of critically endangered, vulnerable and protected species) and GN R152 (Threatened Protected Species Regulations)
National Environmental Management: Air Quality Act (Act no. 39 of 2004)	• Provision for measures in respect of dust control (S32) • Provision for measures to control noise (S34)
National Environmental Management: Waste Management Act (Act no. 59 of 2008)	• Waste management measures • Regulations and schedules • Listed activities which require a waste licence
Occupational Health and Safety Act (Act No. 85 of 1993)	• Health and safety of all involved before and after construction must be protected.

Guideline Documents	Sections applicable to the proposed project
South African National Standard (SANS) 10328, Methods for environmental noise impact assessments in terms of NEMA no. 107 of 1998	• Impact of noise emanating from a proposed development may have on occupants of surrounding land by determining the rating level • Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	• Guidelines outline rules and conditions related to transport of abnormal loads and vehicles on public roads and detailed procedures to be followed for the grant of exemption permits

Policies and White Papers	Sections applicable to the proposed project
The White Paper on the Energy Policy of the Republic of South Africa (December 1998)	• The White Paper supports investment in renewable energy initiatives, such as the proposed solar power plant project
The White Paper on Renewable Energy (November 2003)	• The White Paper outlines the Government's vision, policy, principles, strategic goals and objectives for the promotion and the implementation of renewable energy in SA
Integrated Resource Plan (IRP1) Integrated Resources Plan 2010-2030 (IRP 2010).	• The first Integrated Resource Plan (IRP1) was released late 2009. Subsequently the DoE decided to undertake a detailed process to determine South Africa's 20-year electricity plan, the Integrated Resources Plan 2010-2030 (IRP 2010). • IRP1. IRP 2010 and IRP 2019 outline the Government's vision, policy and strategy in matter of the use of energy resources and current status of energy policies in South Africa. • In the **IRP 2019**, published in October 2019, provision has been made to procure an additional **6 000 MW** of solar PV and 14 400 MW of wind between **2022** and **2030**.
Renewable Energy IPP Procurement Programme (REIPPPP)	• The IPP Procurement Programme, issued on 3rd August 2011 by the DoE.
Equator Principles (July 2006)	• The Equator Principles provide that future developments with total project capital costs of US$10 million or more shall be financed only if socially and environmentally sustainable.

7 NEED/DESIRABILITY OF THE PROJECT

South Africa currently relies principally on fossil fuels (coal and oil) for the generation of electricity. At the present date, Eskom generates approximately 90% of the electricity used in South Africa. On the other hand, South Africa has a largely unexploited potential in renewable energy resources such as solar, wind, biomass and hydro to produce electricity as opposed to other energy types (liquid fuel or coal).

South Africa's electricity supply still heavily relies upon coal power plants, whereas the current number of renewable energy power plants is still limited. In the last few years, the demand for electricity in South Africa has been growing at a rate approximately 3% per annum.

These factors, if coupled with the rapid advancement in community development, have determined the growing consciousness of the significance of environmental impacts, climate change and the need for sustainable development. The use of renewable energy technologies is a sustainable way in which to meet future energy requirements.

The development of clean, *green* and renewable energy has been qualified as a priority by the Government of South Africa with a target for 2013 of 10 000 GWh, as planned in the Integrated Resource Plan 1 (IRP1) and with the Kyoto Protocol. Subsequently the Department of Energy of South Africa (DoE) decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called **Integrated Resources Plan 2010-2030** (**IRP 2010**). The IRP1 (2009) and the IRP 2010 (2011, updated in March 2014 and in October 2019) outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa.

In order to achieve this goal, the DoE announced a Renewable Energy IPP (Independent Power Producers) Procurement Programme.

The Renewable Energy IPP Procurement Programme (REIPPPP), issued on 3rd of August 2011, envisaged the commissioning of 3725 MW of renewable projects (1450 MW with solar photovoltaic technology) capable of beginning commercial operation before the end of 2017. This goal has not been fully fulfilled.

On 2014, the Department of Energy announced the intention to procure an additional **3 600 MW** of renewable energy projects by **2020** (DOE Media Statement of 12 December 2014).

In the **IRP 2019**, issued by the Department of Energy (now **Department of Mineral Resources and Energy (DMRE)**) under Notice No. 1360 dated 18 October 2019 in *Government Gazette* 42784, pursuant to the Electricity Regulation Act, provision has been made to procure an additional **6 000 MW** of solar PV and 14 400 MW of wind between **2022** and **2030**.

The purpose of the proposed Solar Photovoltaic Plant is to add new capacity for the generation of renewable electric energy to the national electricity supply in compliance with the Renewable Energy IPP Procurement Programme (REIPPPP) and in order to meet the growth of the North-West Province.

The use of solar radiation for power generation is considered a non-consumptive use and a renewable natural resource which does not produce greenhouse gas emissions. The generation of renewable energy will contribute to the growth of South Africa's electricity market, which has been primarily dominated up to this date by coal-based power generation. With specific reference to photovoltaic energy, and the proposed project, it is important to consider that South Africa has one of the highest levels of solar radiation in the world.

The proposed solar park will assist the Eskom grid to meet the high energy demand related to activities conducted in the Lichtenburg areas. Furthermore, being a renewable energy project, which does not generate greenhouse gases, it will assist to compensate the greenhouse gas emissions arising from these mining and industrial activities.

The purpose of the proposed **Lichtenburg Solar Park** is to add new capacity for the generation of electrical energy to the national electricity supply, in compliance with the Minister of Energy's Determinations and in order to meet the "electricity consumptions' growth" of the North-West Province.

The use of solar radiation for power generation is considered as a non-consumptive use and a renewable natural resource which does not produce greenhouse gas emissions. The generation of renewable energy will contribute to the growth of South Africa's electricity market, which has been primarily dominated up to this date by coal-based power generation. With specific reference to photovoltaic energy, and the proposed project, it is important to consider that South Africa has one of the highest levels of solar radiation in the world.

The reasons for the location of the project in the selected area can be synthesized as follows:

- low requirement for municipal services;
- compliance with national and provincial energy policies and strategies;
- no impact on people health and wellbeing;
- no waste and noise;
- no impact on air quality;
- compatibility with the ecosystem and the surrounding landscape;
- likelihood of social and economic development of marginalized, rural communities; and
- attraction of environmentally aware (green) tourists to the area.

7.1 FUTURE NEED AND DESIRABILITY

In 20-30 years' time certain of the infrastructure of the solar facility will probably be not be functioning with the same effectivity as when newly constructed. The energy requirements of the country will certainly not become less, but instead will become more dependent on renewable sources like solar and wind energy. It will be the same in this case. Lichtenburg Solar Park will most probably never decommission completely as the country and area around it will be dependent on its energy generation. It will rather upgrade then or constantly go through a process of upgrading of technology so that the facility stays abreast of technology and energy needs and requirements in the area. Applications and studies to support upgrades to the solar facility will be done in future when required.

8 MOTIVATION FOR PREFERRED DEVELOPMENT FOOTPRINT IN THE PREFERRED SITE

8.1 THE CHOICE OF THE NORTH WEST PROVINCE AND SITE LOCATION

The Lichtenburg Solar Park will be located near the city of Lichtenburg, in the North West Province. During the previous Rounds of the REIPP Procurement Programme, very few projects were selected by the Department of Energy (now Department of Mineral Resources and Energy) in the North-West Province. Therefore, the macro-area where the project is planned never received the benefits - in terms of socio-economic development and local content, arising from the previous Rounds of the REIPP Procurement Programme.

The North-West Province has been identified by Matrigenix as an ideal area for establishing a solar PV plant on the basis of several important considerations:

- there are few green projects currently operating in the North-West Province and it is clear that the "green energy quota" can be achieved mainly by means of solar projects, considering the high solar resources and the availability of lands with low ecological and agricultural value;
- available Eskom grid capacity;
- other infrastructure nearby to develop a renewable energy project.

In addition to these favourable conditions in terms of desirability of a renewable solar energy projects in the North-West Province, the site of the Lichtenburg Solar Park has been chosen on the basis of several elements:

- the chosen site is also suitable for the installation of a photovoltaic (PV) power plant due to its appropriate morphologically (flat terrain) and regarding favourable radiation conditions;
- the available radiation allows a high rate of electric energy production, as a combination of latitude-longitude and climatic conditions;
- the low to medium ecological sensitivity of the proposed project site (old fields, degraded / modified land) and
- available Eskom grid connectivity.

9 CONSIDERATION OF ALTERNATIVES

9.1 DETAILS OF ALTERNATIVES CONSIDERED

The EIA Regulations, 2014, as amended, Section 28(1)(c) and NEMA, Section 24(4), require investigation and consideration of feasible and reasonable alternatives for any proposed development as part of the environmental impact assessment process. Therefore, a number of possible alternatives for accomplishing the same objectives must be identified and investigated. In particular:

- the property on which, or location where, it is proposed to undertake the activity;
- the location within the current identified site;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity (schedule, process);
- the sustainability of other alternatives, and
- the option of not implementing the activity (No Go Alternative).

9.1.1 PROJECT ALTERNATIVES AND LAYOUT

The layout of the proposed development is the result of an extensive comparative study of various layout alternatives and had been defined in consideration of the results of some specialist studies conducted during this scoping phase.

The PV plant is designed and conceived in order to minimize visual and noise impacts, as well as to operate safely and assuring a high level of reliability, with low water consumption and the need only for easy and quick maintenance and repair for approximately 30 years.

The footprint (fenced area) of the Lichtenburg Solar Park will be up to 261 ha.

The main drives of the proposed layout are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies; mono or bi-facial mono/polycrystalline solar modules mounted on single-axis horizontal trackers (SAT) or on fixed mounting systems.
- to develop the PV power plant in the southern section of the farm, avoiding high potential agricultural land and natural areas.
- to avoid the Critical Biodiversity Areas (CBAs).

The proposed layout plan (attached as Annexure A and also shown below) was drawn using PV modules mounted on trackers. In the case of PV modules mounted on fixed mounting systems, the layout plans will not change, except for the orientation of the PV arrays: East-West instead of North-South. The site layout plan included in Annexure A is more detailed.

The required footprint - corresponding on the fenced area - will be up to 261 ha, and the maximum height of the structures (PV modules and support frames) will be approximately 4.5 m above the ground level.

The location of the planned footprint was assessed and included in this Draft Environmental Impact Assessment Report. No comments were received as a result of the Public Participation Process. However, all specialists' inputs were evaluated in order to confirm that the site layout as is, is acceptable from results from the specialists' reports. No amendments were made to the site layout plan as it was found to be in line with the findings of the specialists.

9.1.2 SITE ALTERNATIVES

Initially, at the start of the application process the applicant intended to develop the proposed Lichtenburg Solar Park in the south-western corner of the farm. The landowner, Ditsobotla Local Municipality, did not approve this position as this site will not be in line with any future planning.

The north-western corner of the farm was agreed on to develop the proposed solar park.

The site alternative was based on the landowner's direction, which in this case, is the local municipality. The sit location is solely based on the direction given by the local municipality.

Several sites have been inspected to find out the best solution for the PV power plant. The following selection criteria were applied:

- Connection availability and proximity

Alternative Connection 1: On-site 132 kV substation, located outside urban areas or industrial complexes will be connected via a new 132 kV power line, ±3.4 km long, to Watershed Substation, south of the development site.

Alternative Connection 2: 132kV powerline, 1.6 km long, up to future (planned) switching station of the Lichtenburg 1, 2 and 3 PV projects, proposed by another developer on Ptn 2 of Zamenkomst 4 IP.

- Land availability

The land is available for the development of the proposed Lichtenburg Solar Park and the landowner has this area available for the development of a PV solar park. There are very few drainage lines on the farm and can be avoided, leaving the majority of the land available for the proposed development.

- Sufficient land surface area (±261 ha)

The area, without any drainage lines and excluding all other sensitive areas and features, which is earmarked for the proposed development is still large to develop a 165MW PV solar park.

- Current land use

The proposed development land is used for wildlife grazing at present. The natural vegetation of the site is mostly intact.

- Environmental impact (biodiversity)

The proposed development site occurs on a landscape on slightly undulating to flat plains. The site forms part of a larger farm used for wildlife grazing. The vegetation units on the site vary according to soil characteristics, topography, and land-use. Vegetation units were identified on the footprint development sites and can be divided into 3 distinct vegetation units according to soil types and topography.

The development of the solar development is considered suitable in all three these areas.

- Agricultural potential

The proposed development area is currently be used for wildlife grazing.

- Solar radiance

The proposed development site is suitable for the erection of solar panels as it is in a sunny area. The gradient of the proposed development area is suitable for the development of a solar park.

- Socio-economic issues (land cost and local community unemployment)

The North-West Province has a high number of unemployment. The project will comply with all relevant Economic Development Requirements. This economic development programme identifies needs of the surrounding communities in order to have a positive socio-economic impact. Job creation will benefit from the proposed development.

- Occurrence of Heritage Resources

No heritage sites of significance occur within the impact area and no adverse impact to heritage resources is expected. Any additional effects to subsurface heritage resources can be successfully mitigated by implementing a chance find procedure. Mitigation measures as recommended in this report should be implemented during all phases of the project. Impacts of the project on heritage resources is expected to be low during all phases of the development.

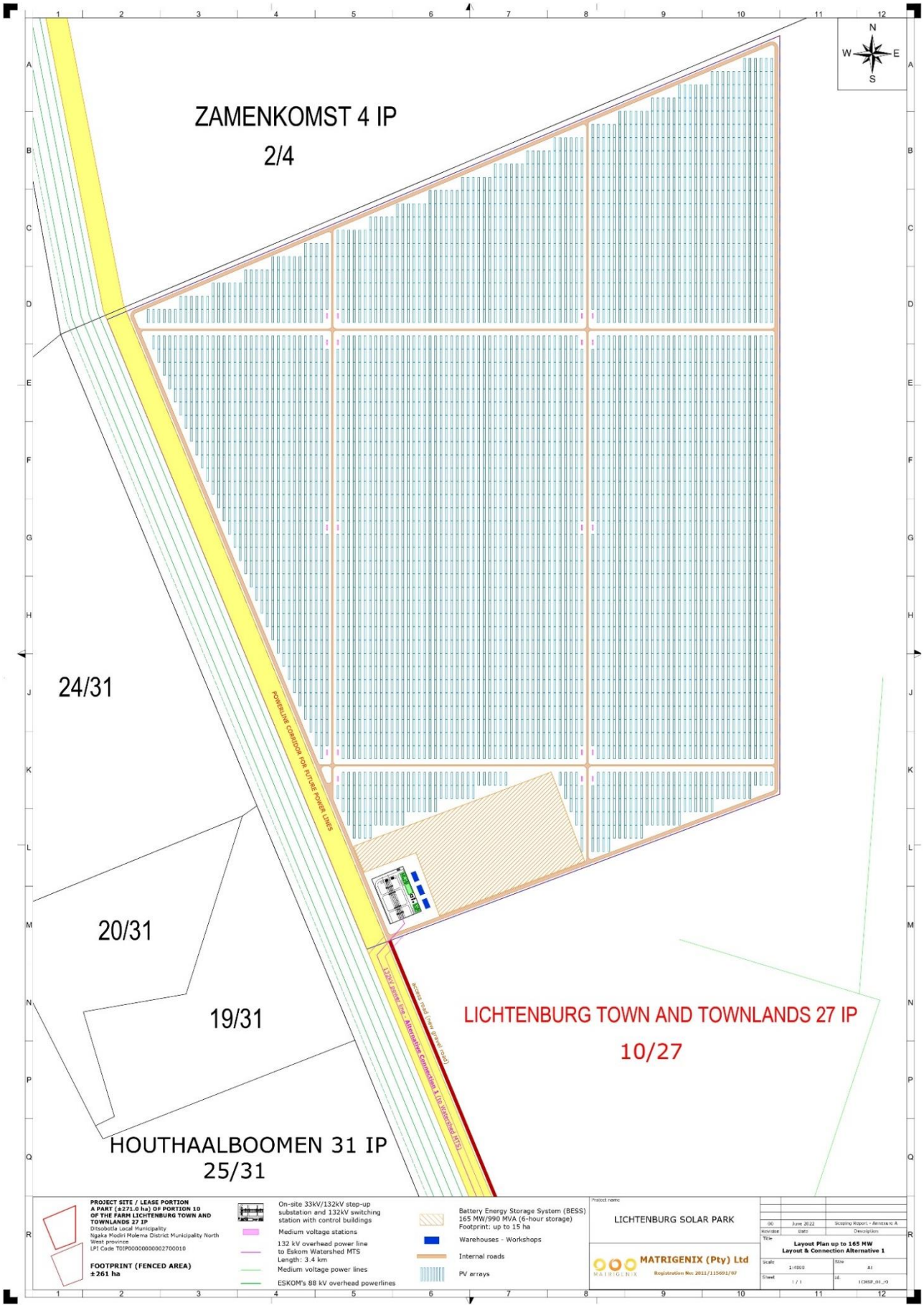


Figure 7. Proposed Draft Layout Plan of the Lichtenburg Solar Park – Alternative 1

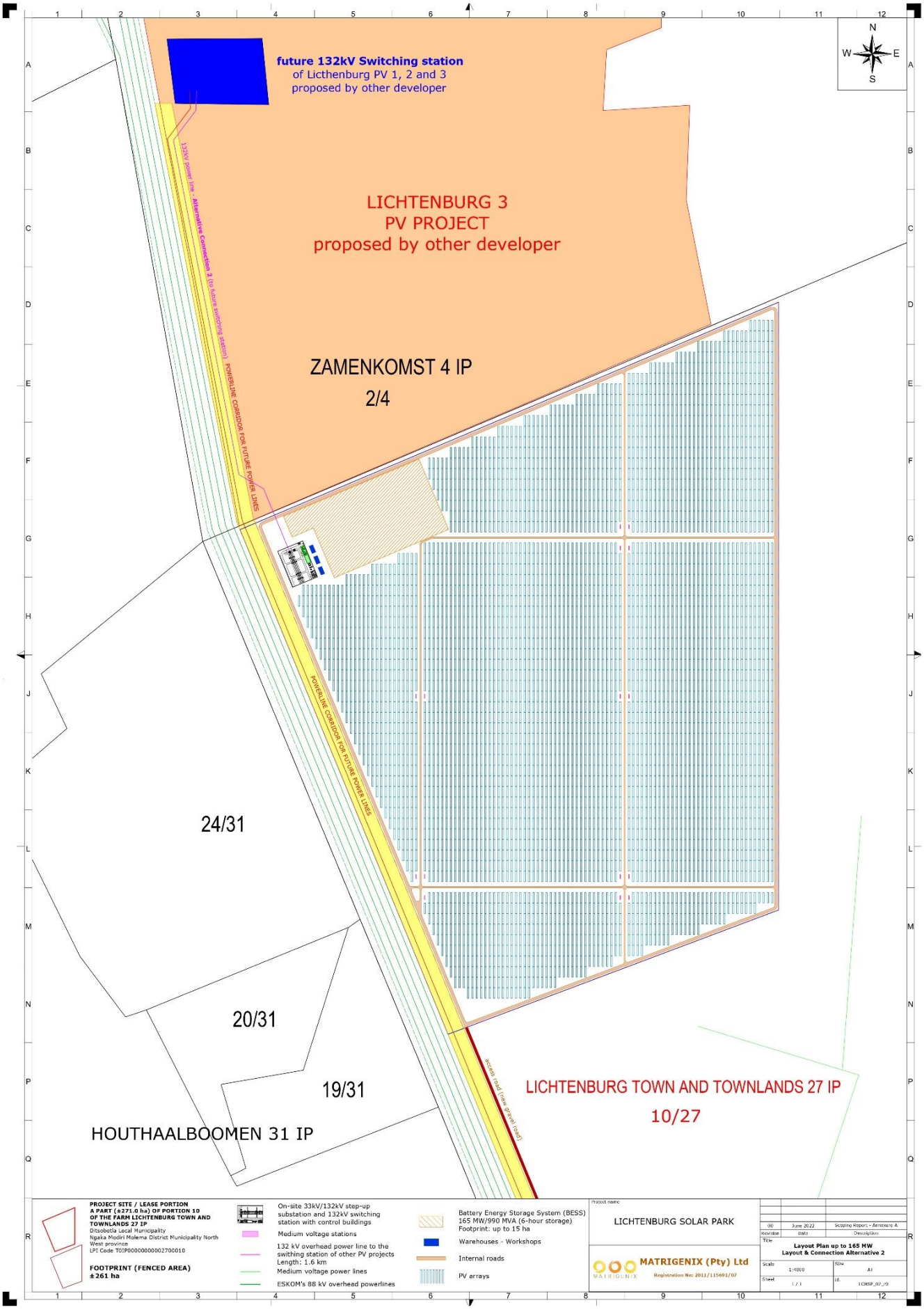


Figure 8. Proposed Draft Layout Plan of the Lichtenburg Solar Park – Alternative 2

9.1.3 ACTIVITY ALTERNATIVES

Activity alternatives were not considered. The North-West Province is currently an area which is available for renewable energy projects. While the country is in a crisis with the generation of electrical energy, the selection of an activity such as the generation of electricity from renewable sources like solar in this case is the correct way to go to relieve the crisis and to mitigate global warming caused by the burning of fossil fuels for generation of electricity.

Further activity alternatives were not investigated as the landowner is only in accordance with the proposed activity and did not give permission for any other activity to be considered.

9.1.4 TECHNOLOGY ALTERNATIVES

PV Plant and Solar Thermal Power Plant

The alternative to PV for producing energy from the sun is the thermal solution. There are different forms of this technology: linear Fresnel, parabolic trough or tower. These technologies can also be with or without thermal storage and they can use diathermic oils or, the more sophisticated ones can use water and/or molten salts. The final choice is the PV option because these kinds of project result in:

- lower construction costs;
- lower operating and maintenance costs (O&M);
- it is a simpler, quicker and more experienced technology; and
- lower environmental impact, considering that, a PV solution requires a minor quantity of water.

Wind Power Plant

Another alternative to PV for producing energy from the sun is electrical energy form wind. A wind energy facility has a significant visual impact especially where it is located in a relative flat topographical area. Most important, the project site is not windy enough to be considered suitable for a wind farm. The PV option is thus still a better choice than wind energy based on the same reasons given above.

Alternatives for the Mounting System of the PV Modules

Preferred technical solutions for the proposed solar park entail PV modules mounted on fixed mounting systems or horizontal single-axis trackers.

The tracking solution is the best performing in terms of efficiency, because its energy production is approximately 20% more if compared with fixed systems. This type of technology is characterized by higher technical complexity and higher installing and maintenance costs, if compared with the fixed mounting solution. The selected tracking system is the horizontal single-axis tracker (SAT), which doesn't differ from the fixed system, except for the presence of the tracking devices and the orientation of the rows of the PV arrays (north - south instead of west – east direction).

The technology of mounting systems is under continuous evolution. Consequently, the final decision about the mounting system technology will be taken only at the commissioning date. The selection of fixed mounting system or horizontal single-axis trackers will not affect the layout of the PV power plant or imply any additional visual or environmental impacts that will necessitate specific or different mitigation measures. The development will not exceed the currently planned footprint (261 ha) and the height of the structures (PV modules and support frames) will be maximum 4.5 m above ground level.

Both fixed and horizontal single-axis tracking solutions grant the reversibility of the development in respect of the terrain's morphology, geology and hydrogeology. This means that at the end of the PV plant's lifetime, the site can easily be returned to its status prior to the establishment of the PV plant.

BESS Technology alternatives and the Risk/Benefit of using Lithium-Ion Batteries

Batteries store electrical energy in chemical form. The range of electrochemical technologies include:

a) batteries with solid electrolyte, as Lithium-ion battery;
b) batteries with liquid electrolyte, as Na–S battery, Lead–Acid (PbA) battery, nickel - cadmium (Ni–Cd) battery or other types of liquid metal battery

The preferred technology for the Battery Energy Storage System (BESS) is **Lithium-ion battery cells**, which will be pre-assembled and installed in the containers prior to delivery to the site. Lithium-ion cells technology offers the highest energy density (compared to other cell technologies), does not suffer from memory effect and is low maintenance. Typical lithium-ion cells used for BESS hold a solid rechargeable electrolyte (the energy accumulator), therefore they don't hold any liquid or gas.

The main benefit of solid ceramic electrolytes is that there is no risk of leaks, which is a serious safety issue for batteries with liquid electrolytes.

A BESS does not emit any gas to the atmosphere during construction and/or normal operation. The containers of the batteries are equipped with a firefighting system conceived to effectively detect smoke and high temperatures and automatically activate the extinguishers to prevent fire. Furthermore, the external metallic surface of the cells is conceived to resist fire.

The preferred technology is therefore Lithium-ion battery cells with solid rechargeable electrolyte.

Batteries with liquid electrolytes are not preferred for the risk of leakage and consequent potential impacts on environment.

9.1.5 NO-GO ALTERNATIVE

The no-go alternative is the option of not establishing a Photovoltaic Power Plant on the site, or any of its alternatives. The environment will remain in its current state (status quo). This will not create any new employment opportunities, and therefore the anticipated economic benefits of the project will accrue to the study area (see the paragraph 6.4 *Socio-Economic Environment*).

Should this alternative be selected the socio-economic and environmental benefits related to the use of renewable energy resources will not be realised with prejudice to the development of the area. The benefits related to the establishment of a renewable energy power plant are for example analysed in detail in the REFIT Regulatory Guideline published by NERSA (March 2009):

- *Enhanced and increased energy security*.
- *Resource economy and saving*.
- *Support of new technologies and new industrial sectors*.
- *Exploitation and capitalization of South Africa's renewable resources*.
- *Employment creation and career opportunities*.
- *Pollution reduction*.
- *Contrast to Global warming and climate mitigation*.
- *Protection of natural foundations of life for future generations*.
- *Acceptability to society and community*.
- *Commitment to and respect of international agreements*.

9.2 DETAILS OF PUBLIC PARTICIPATION PROCESS UNDERTAKEN

All relevant I&AP's have been identified and involved in the public participation process from the beginning of the project as per sections 54, 55, 56 and 57 of the EIA regulations 2014, as amended. The public participation process offers the opportunity to become actively involved through constant sharing of information. The main purposes of the public participation process are to ensure that:

- all relevant information in respect of the application is made available to I&APs for their evaluation and review;
- reasonable opportunity is given to I&AP's to comment and to submit queries related to the proposed project;
- comments and queries by the I&APs to the Draft Scoping and to the EIA Reports are submitted and evaluated in a reasonable timeframe and in predetermined terms.

The initial stage of the public participation was conducted from 3 March 2022 until 11 April 2022.

In the enclosed Annexure B, there is a list of all components of the public participation process. The public was informed of the project by means of:

- Site notices, which were put up at the proposed development site;
- Background Information Documents (BID) sent to all adjacent landowners;
- A Notice was published in a local newspaper, which is distributed locally;
- Sending of BIDs to other possible interested and affected parties/stakeholders.

An I&AP Register was created and opened which is maintained and added to as required.
Site notices were put up at the proposed development site at 2 areas on the fences at the proposed development area on 3 March 2022.

After a Deed Search was done on the surrounding properties a Background Information Document was sent to the adjacent landowners. Proof of this is attached in Annexure B. A number of these documents were also distributed to the relevant governmental departments including *inter alia* Department of Water and Sanitation, Department of Agriculture, Land Reform & Rural Development, *etc*. Other identified interested and/or affected parties/stakeholders include Eskom, the Local municipality, the District municipality etc. Proof of all correspondence is included in Annexure B.

A newspaper advertisement was published in the Noordwester local newspaper, appearing on Friday 4 March 2022 which is distributed in the general area.

Several people registered as I&AP's. Please refer to Section 9.3 of this report.

The Draft Scoping Report (in electronic format) was made available for a 30-day commenting period for comments and was also provided as hard copy on request. The commenting period on the Draft Scoping Report was from 27 June 2022 until 27 July 2022.

The Final Scoping Report and the Plan of Study for EIA was submitted to the DFFE for review and approval on 28 July 2022. It was accepted by the competent authority on 9 September 2022.

9.2.1 FURTHER STEPS IN PUBLIC PARTICIPATION PROCESS

To ensure a transparent and complete public participation process the following steps are still to be taken during the rest of the EIA process:

- The Draft EIA Report will be made available for a commenting period of 30 days from 03 October 2022 until 03 November 2022.
- Notifications will be sent out to inform registered I&APs and governmental organizations that the Draft EIA Report was submitted and is available for comments.
- Registered I&APs and governmental organizations will be notified about the final decision by the DFFE (Environmental Authorisation granted or not).

9.3 SUMMARY OF ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES

Organ of state & IAPs	Date	Comments and/recommendations	Response from EAP
03 March 2022 Site Notice			
04 March 2022 Noordwester Newspaper			
BID forwarded via email 08 March 2022			
Frank Thandeka Botswe	07/03/2022	Sent comments	08/03/2022 EAP responded
Elijah Dumisani Katsetse - SAHRA	09/03/2022	Requested that an application be created on SAHRIS	18/03/2022 EAP responded
DFFE Biodiversity Conservation, Mainstreaming EIA (Admin)	09/03/2022	Acknowledged BID notification	18/03/2022 EAP replied
Elijah Dumisani Katsetse - SAHRA	09/03/2022	Responded with requirements to be sent to SAHRA	09/03/2022 EAP replied
Raesibe Nolivia Mashiane from Department of Agriculture, Land Reform and Rural Development	11/03/2022	Registered as I&AP	11/03/2022 EAP acknowledged
Ria Barkhuizen - SANRAL	15/03/2022	Acknowledged email	
David Núñez Blundell	17/05/2022	Registered as I&AP	18/05/2022 EAP acknowledged and sent a BID
Application and Draft Scoping Report submitted to DFFE 24 June 2022			
Draft Scoping Report circulated for comments via email (link or PDF) 27 June to 26 July 2022			
Lydia Kutu Department of Forestry, Fisheries & the Environment	28/06/2022	DFFE acknowledged receipt of application and DSR	
Frank Malape	08/07/2022	Requested an update	11/07/2022 EAP responded to update I&AP
Ms Milicent Solomons - Integrated Environmental Authorisations DFFE	25/07/2022	Comments on the DSR were received	Response to these comments was included in the FSR
Mr Seoka Lekota - DFFE: Biodiversity Conservation	25/07/2022	Comments on the DSR were received	28/07/2022 Response was emailed to Biodiversity
Lydia Kutu Department of Forestry, Fisheries & the Environment	01/08/2022	Acknowledged receipt of the FSR	

9.4 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PROPOSED PV SOLAR PARK

The receiving environment has been described using a combination of specialist inputs, on-site observations, a review of existing literature and utilizing Geographic Information Systems (GIS) planning tools.

9.4.1 PROPERTY DESCRIPTION AND CURRENT LAND USE

The proposed development will be on Portions 1 and 10 of the farm Lichtenburg Town and Townlands 27 IP located within the Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North-West Province. Access to the Lichtenburg Solar Park will be from the provincial road R505, which connects Lichtenburg with Ottoshoop.

Table 7. Site location and Property details

Site location and Property details	
Farm	**Lichtenburg Town and Townlands 27 IP**
Portion	**Portion 1**
LPI code	T0IP00000000002700001
Overall Extent	4206.1414 hectares
Landowner	Ditsobotla Local Municipality
Diagram deed number	G117/1909
Title deed number	T130024/2005
Registration date	2003/02/26
Current land use	Grazing, game farming

Site location and Property details	
Farm	**Lichtenburg Town and Townlands 27 IP**
Portion	**Portion 10**
LPI code	T0IP00000000002700010
Overall Extent	3426.1280 hectares
Landowner	Ditsobotla Local Municipality
Diagram deed number	T26084/953
Title deed number	T95766/2008
Registration date	2008/10/21
Current land use	Grazing, game farming

9.4.2 ENVIRONMENTAL FEATURES

Environmental Screening Report – Annexure Q.

Table 8. Environmental Screening Tool Table

Theme	Very high	High	Medium	Low	Specialist studies conducted	Motivation for no Specialist Studies
Agriculture	X				X	
Animal species				X	X	
Aquatic biodiversity	X				X	
Archaeological and Cultural Heritage				X	X	
Avian		X			X	
Civil Aviation				X		An application for approval will be submitted to the CAA.
Defence				X		
Landscape	X				X	
Paleonthology	X				X	
Plant Species			X		X	
RFI			X			
Terrestrial Biodiversity	X				X	

The following environmental sensitivities are identified for the project area:

- **Agriculture Theme**

  Sensitivity - Very High land capability

  A sensitivity analyses was conducted to identify the most suitable site for the development. Results and mitigation measures included in Agro-Ecosystem Specialist Report (Annexure F).

- **Animal species Theme**

  Sensitivity - Low

  A sensitivity analyses was conducted to identify the most suitable site for the development. Results and mitigation measures included in Terrestrial Biodiversity Impact Assessment (Annexure C).

- **Aquatic Biodiversity Theme**

  Sensitivity - Very high

  Although the project area is located within Strategic Water Source Area, there are no wetland features located within the proposed development area. See Terrestrial Biodiversity Impact Assessment (Annexure C) and Wetland Riparian and Aquatic Statement in Annexure E.

- **Avian Species Theme**

  Sensitivity - High

  The avifaunal assessment conducted (Annexure D) concluded that the development of the proposed Lichtenburg Solar Park would have a medium impact on the bird communities and will cause a slight impact on the ecological process of the overall bird community. The biggest concern is the threat the power lines within this area hold to threatened species such as the three vulture species present at the site.

- **Civil Aviation Theme**

  Sensitivity - Low

  An application for approval will be submitted to the Civil Aviation Authority. A Civil Aviation assessment was done and is attached in Annexure L.

- **Defence Theme**

  Sensitivity - Low

  Combined with Radio Frequency Assessment.

- **Paleontological Theme**

  Sensitivity - Very High

  Based on the fossil record but confirmed by the site visit and walk through there are NO FOSSILS or trace fossils visible even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. From a palaeontological perspective the proposed PV development should proceed (see Annexure H).

- **Plant Species Theme**

  Sensitivity - Medium

  The botanist concluded that the development can be supported provided that the mitigation measures and sensitivity map are implemented (Terrestrial Biodiversity Impact Assessment - Annexure C).

- **RFI Theme**

  Sensitivity - Medium

  Combined Defence and Radio Frequency Assessment was done, and the report is attached in Annexure K.

- **Terrestrial Biodiversity Theme (Annexure C)**

  Sensitivity - Very High because of nearby CBA and ESA areas

  The proposed development footprint area is in ONA (Other natural Areas). The management objective for this area is to maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern (see Annexure C).

9.4.3 WIND AND SOLAR DEVELOPMENTS WITH ENVIRONMENTAL AUTHORISATION OR APPLICATIONS UNDER CONSIDERATION WITHIN 30 KM OF THE PROPOSED AREA

The following wind and solar projects, proposed with 30km from the project site, received and/or applied for Environmental Authorisation according to the DFFE database:

Table 9. List of Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No	EIA Reference No	Classification	Status of Application	Distance from proposed area (km)
1	14/12/16/3/3/1/1062/AM1	Solar PV	Approved	19.0
2	14/12/16/3/3/2/1062	Solar PV	Approved	18.1
3	14/12/16/3/3/1/1062/AM1	Solar PV	Approved	16.5
4	14/12/16/3/3/2/1093	Solar PV	Approved	12.0
5	12/12/20/2149/A3	Solar PV	Approved	14.0
6	14/12/16/3/3/2/975/AM1	Solar PV	Approved	1.5
7	14/12/16/3/3/2/557	Solar PV	Approved	4.3
8	14/12/16/3/3/2/1092	Solar PV	Approved	1.0
9	14/12/16/3/3/2/1091	Solar PV	Approved	2.0

Table 10. Details of Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No	EIA Reference No	Project Name	Project Capacity [MW]	Applicant	Date of application
1	14/12/16/3/3/1/1062/AM1	Proposed Hibernia Solar Energy Facility, Ditsobotla Local Municipality, North-West Province.		Hibernia Solar (Pty) Ltd	2015/03/15
2	14/12/16/3/3/2/1062	Proposed Hibernia Solar Energy Facility, Ditsobotla Local Municipality, North-West Province.		South African Mainstream Renewable Power Developments (Pty) Ltd	2014/01/06
3	14/12/16/3/3/1/1062/AM1	Proposed Hibernia Solar Energy Facility, Ditsobotla Local Municipality, North-West Province.		Hibernia Solar (Pty) Ltd	2015/03/15
4	14/12/16/3/3/2/1093	Proposed development of Lichtenburg 3 PV solar energy facility and associated infrastructure, Ditsobotla Local Municipality, North-West Province.	100	ABO Wind Lichtenburg 3 PV (Pty) Ltd	2018/08/24

5	12/12/20/2149/A3	Proposed establishment of a photovoltaic (PV) installation at the Bloemfontein Airport, Free State Province.		ACSA PV	2014/05/29
6	14/12/16/3/3/2/975/AM1	The 75MW Tlisitseng PV2 SEF and its associated infrastructure near Lichtenburg, Ditsobotla Local Municipality, North-West Province.	75	BioTherm Energy (Pty) Ltd	2017/09/26
7	14/12/16/3/3/2/557	Proposed Watershed Solar Energy Facility, Ditsobotla Local Municipality, Northwest-Province.	75		2013/08/06
8	14/12/16/3/3/2/1092	Proposed development of the Lichtenburg 2 solar energy facility and its associated infrastructure, Ditsobotla Local Municipality, North-West Province.	100	ABO Wind Lichtenburg 2 PV (Pty) Ltd	2018/08/14
9	14/12/16/3/3/2/1091	Proposed development of Lichtenburg 1 solar PV energy and associated infrastructure, Ditsobotla Local Municipality, North-West Province.	100	ABO Wind Lichtenburg 1 PV (Pty) Ltd	2018/08/24

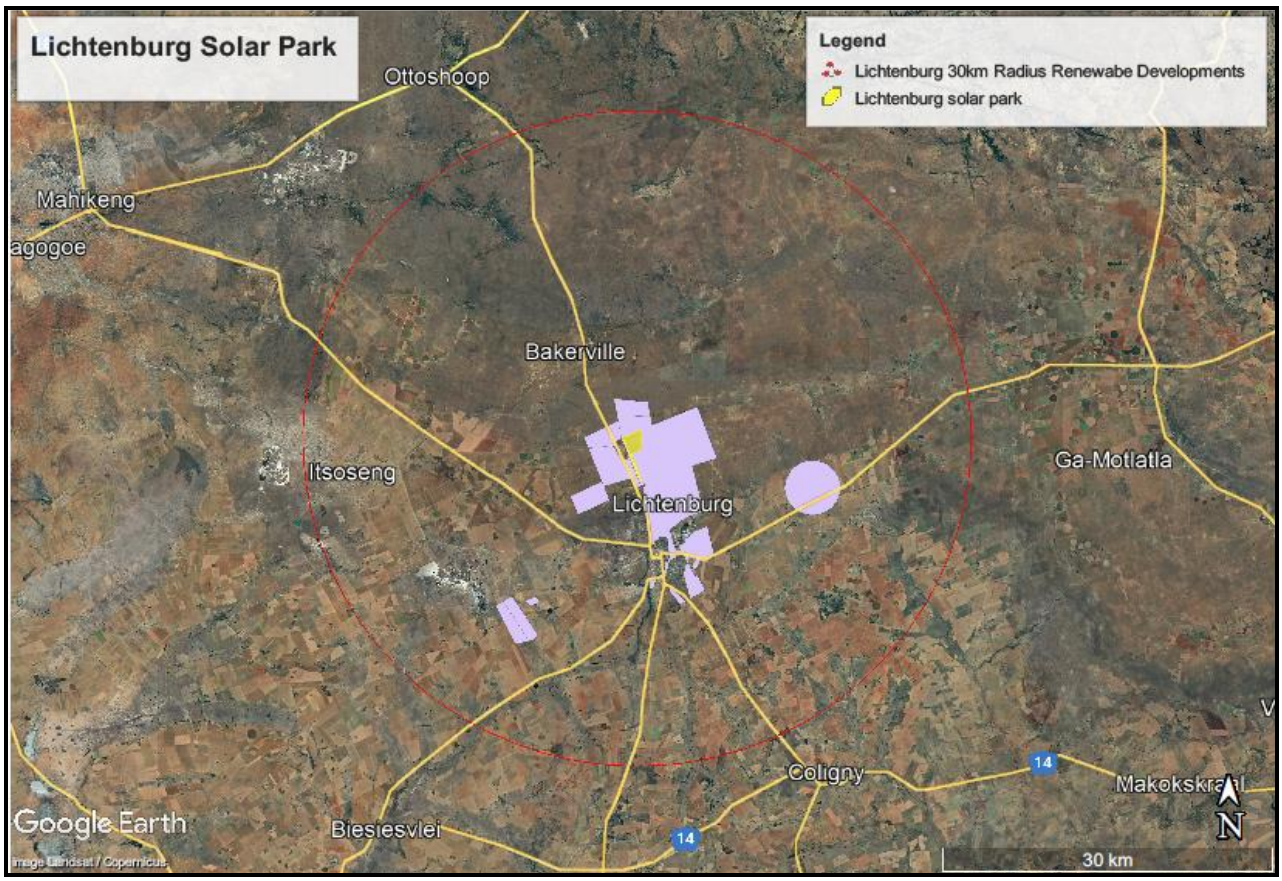


Figure 9. Map of Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

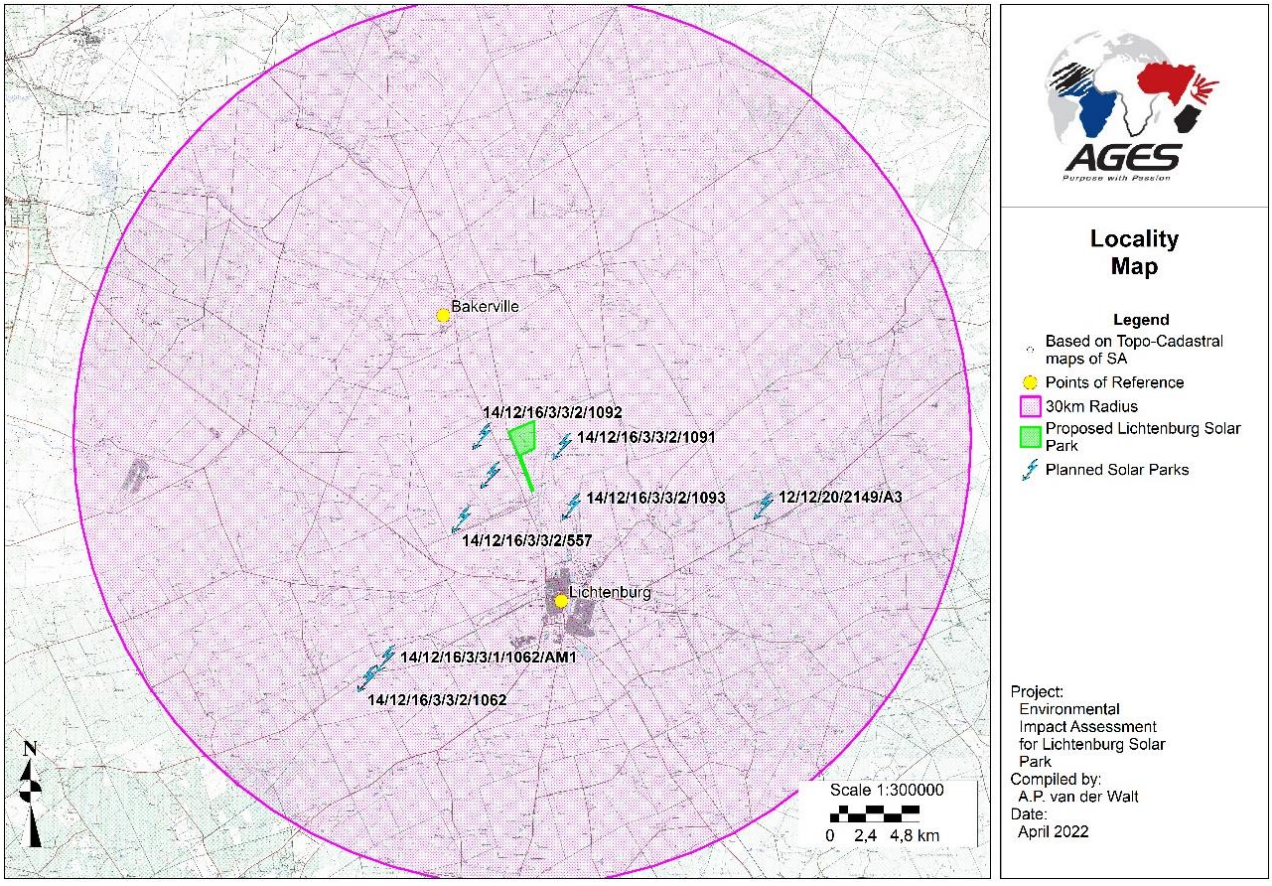


Figure 10. Map of Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

9.4.4 CLIMATE

The climate for the region can be described as warm-temperate. In terrestrial environments, limitations related to water availability are always important to plants and plant communities. The study area is situated within the summer rainfall region with very dry winters and severe frost that occurs fairly frequently (37 days) during the colder winter months.

The mean annual precipitation is 593mm, while the mean annual temperature is 16,1˚C. The monthly distribution of average daily maximum temperatures for Lichtenburg ranges from 17.7°C in June to 30°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night.

9.4.5 TOPOGRAPHY AND DRAINAGE

The topography of the site can be described as generally favourable, when considering that most of the area consists of slopes of less than 1:5.
Site is located at an altitude of 1520 meters above mean sea level (AMSL).
Most properties situated within a 500m radius are being used for livestock and game farming. The proposed development land is used for wildlife grazing at present. The natural vegetation of the site is mostly intact.

The site is located within the C31A quaternary catchment and is situated in the Lower Vaal Water Management Area. Drainage occurs as sheet-wash into the drainage channels to the south of the site, namely the Klein Harts River that eventually drains into the major river namely the Vaal River that occurs to the south of the site.

9.4.6 SOILS AND GEOLOGY

Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). A Land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The land type unit represented within the study area include the Fa11 land type (Land Type Survey Staff, 1987) (ENPAT, 2001). The land type, geology and associated soil types is presented in Table 6 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000).

Soils associated with the site are mostly very shallow Mispah or Glenrosa soils associated with chert bedrock.

Table 11. Land types, geology, and dominant soil types of the proposed development site

Landtype	Soils	Geology
Fa11	Glenrosa and/or Mispah forms (other soils may occur), lime rare or absent in the entire landscape	Dolomite and chert belonging to the Chuniespoort Group; chert gravels are abundant on middle and footslopes including valley bottoms.

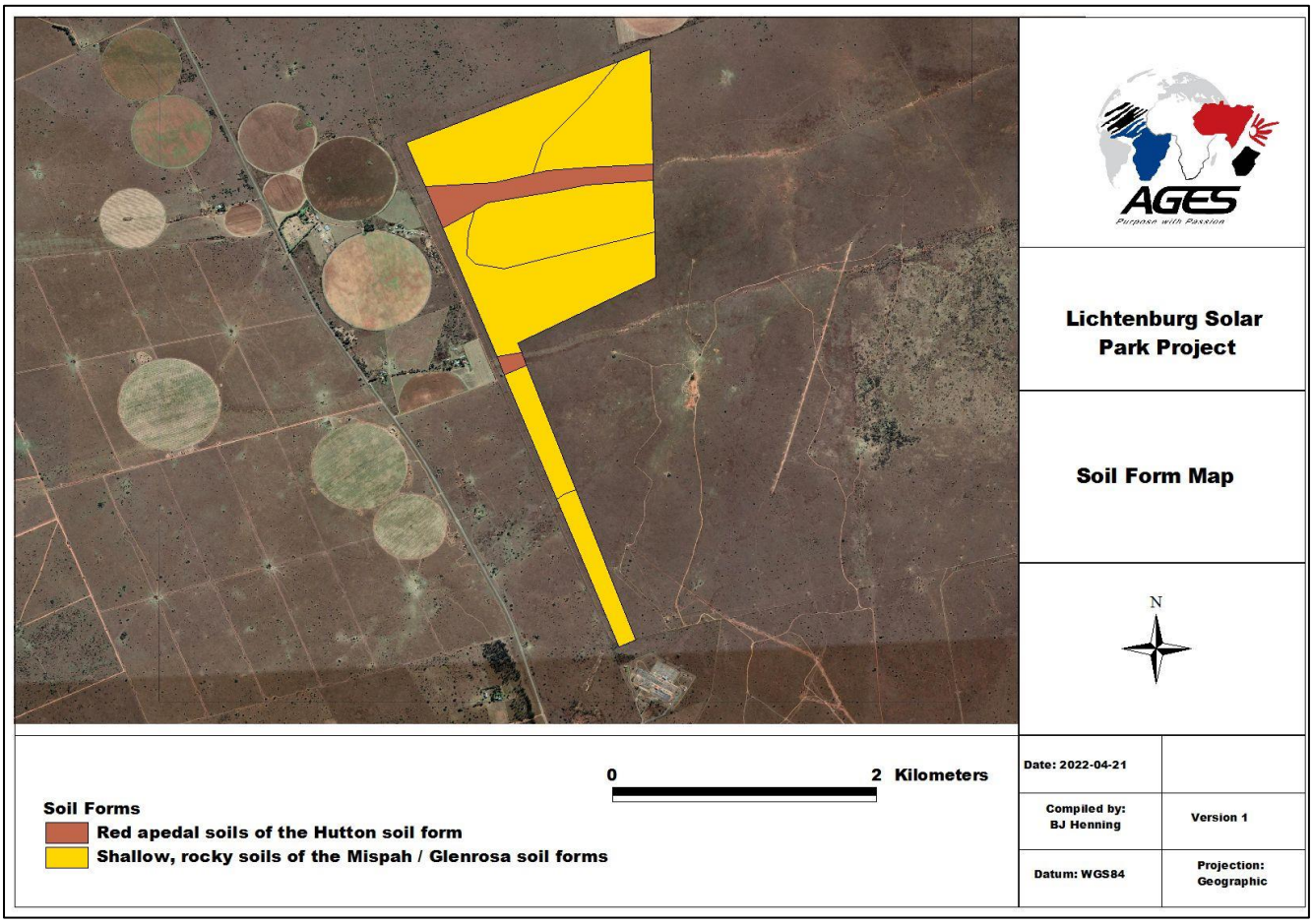


Figure 11. Soil Form Map

9.4.7 ECOLOGY (FAUNA & FLORA)

A Terrestrial Biodiversity Impact Assessment (Annexure C) was conducted by AGES to describe the ecology (fauna and flora) present in the site, to assess its ecological sensitivity and to indicate the most suitable areas for the proposed development. A pre-screening site visit was conducted to determine if the assessment was accurate and if the studies recommended should be conducted. After the site visit the following was concluded:

- The site has a HIGH Sensitivity from a terrestrial biodiversity perspective due to the presence of indigenous grassland with protected trees.
- The site has a Medium Sensitivity from an Animal Species Theme Perspective due to the presence of natural fauna habitats.
- The site has a Medium Sensitivity from a Plant Species Theme Perspective due to the presence of indigenous grassland with protected tree species.

After the assessment, it was concluded that a detailed terrestrial biodiversity, plant species theme and animal species theme assessment should be conducted. For this purpose, detailed ecological surveys were conducted on 11 April 2022 to verify the ecological sensitivity and ecological components of the site at ground level. This report is included in Annexure C of this Draft EIA Report.

9.4.7.1 Vegetation Types

The development site lies within the Grassland biome. The Grassland Biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu Natal and the Eastern Cape. The topography is flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level. Grasslands (also known locally as Grassveld) are dominated by a single layer of grasses.

The most recent classification of the area by Mucina & Rutherford shows that the site is classified as Carletonville Dolomite Grassland. The landscape features of this vegetation type are slightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands form a complex mosaic pattern dominated by many species. The conservation status of the Carletonville Dolomite Grassland is Least Concern with small extent conserved in statutory reserves and almost 25% already transformed for cultivation, urban sprawl or mining activities (Sanbi, 2018).

The proposed development site occurs on a landscape on slightly undulating to flat plains. The importance to survey the area to have a better understanding of the ecosystem and the potential impact of the solar development on the natural environment was identified as a key factor, and subsequently the footprint areas was completely surveyed. The site forms part of a larger farm used for wildlife grazing. The vegetation units on the site vary according to soil characteristics, topography, and land-use. Vegetation units were identified on the footprint development sites and can be divided into 3 distinct vegetation units according to soil types and topography.

The vegetation communities identified on the proposed development site are classified as physiographic physiognomic units, where physiognomic refers to the outer appearance of the vegetation, and physiographic refers to the position of the plant communities in the landscape. The physiographic-physiognomic units will be referred to as vegetation units in the following sections. These vegetation units are divided in terms of the land-use, plant species composition, topographical and soil differences that had the most definitive influence on the vegetation units. Each unit is described in terms of its characteristics and detailed descriptions of vegetation units are included in the following section.

A species list for the site is included in Appendix A, while a plant species list for the quarter degree grid square (QDS) is included in Appendix B. Photographs of each unit is included in the next section to illustrate the grass layer, woody structure, and substrate (soil, geology etc.). The following vegetation units were identified during the survey:

1. *Loudetia flavida – Elionorus muticus* rocky grassland.
2. Rocky grassland with bushclumps.
3. *Cymbopogon pospischilii – Schizachyrium sanguineum* dyke grassland.

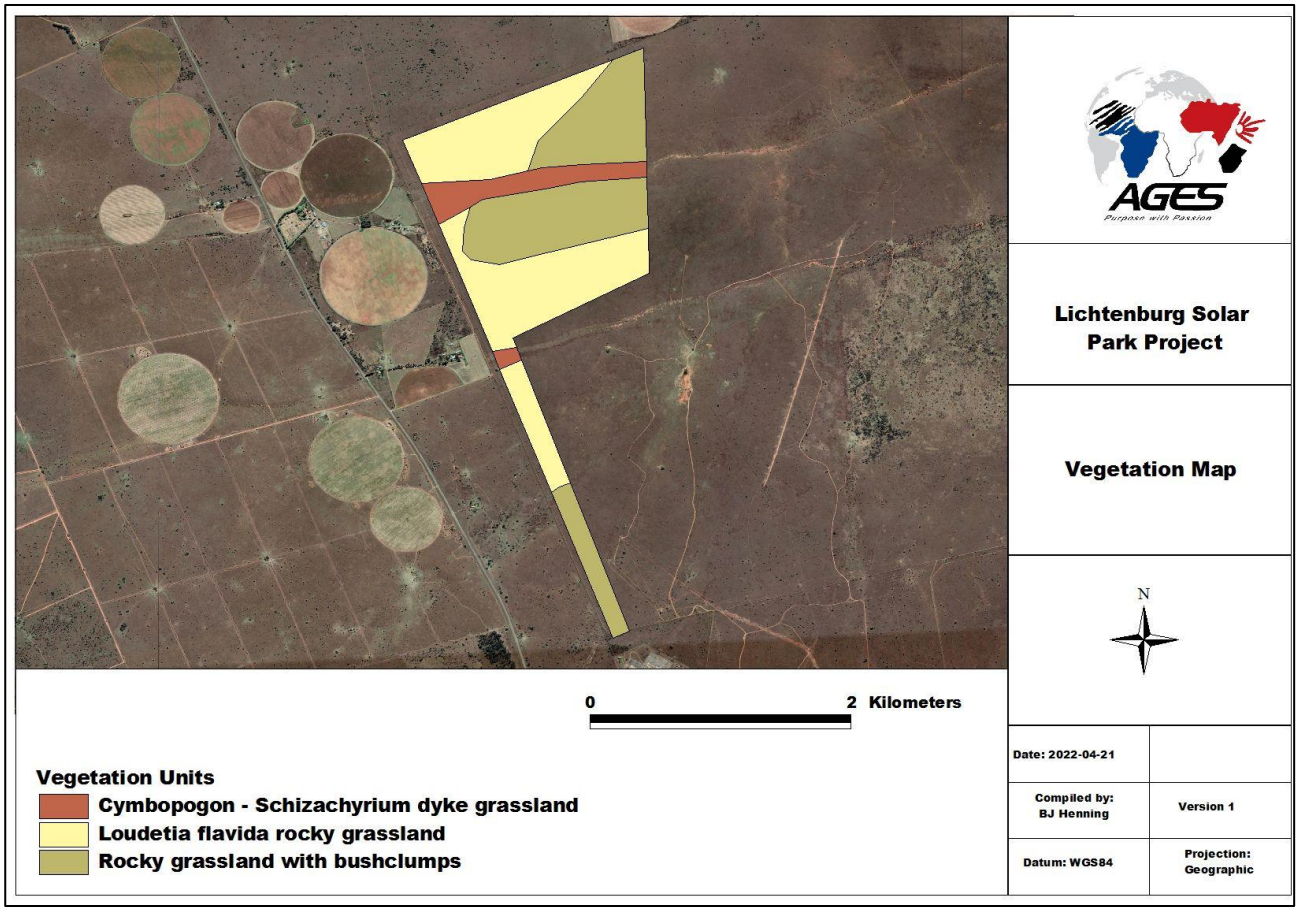


Figure 12. Vegetation Unit Map of the proposed development area (From Biodiversity report)

- *Loudetia flavida – Elionorus muticus* rocky grassland.

This vegetation unit comprises a large part of the study area and occurs on slightly undulating terrain within the southern and northern sections of the study area. The soil is shallow rocky soils derived from chert with rocks covering 20-30% of the area. There are no trees present with the grasses having the highest cover. The grass layer is dominated by species such as *Schizachyrium sanguineum, Loudetia flavida, Themeda triandra, Elionorus muticus* and *Eragrostis lehmanniana*.

The vegetation unit is classified as having a medium sensitivity due to the due to the widespread status of this vegetation unit within the larger project area. The development of the solar development is considered suitable in this area.

- Rocky grassland with bushclumps

This vegetation variation is characterized by the same herbaceous layer as rocky grassland but differs due to the presence of scattered bushclumps occurring through the area. Typical tree and shrub species include *S lancea, S pyroides, G flava* and *D lycioides*. Substrate is shallow soils, although slightly deeper patches of Hutton soils occur where the bushclumps occur.
The vegetation unit is classified as having a medium sensitivity due its widespread occurrence in the Grassland Biome. The eradication of protected trees would need a permit from DAFF. Where possible the larger protected trees such could be incorporated as part of the solar development. The development of the solar development is considered suitable in this area.

- *Cymbopogon pospischilii – Schizachyrium sanguineum* dyke grassland

This grassland variation occurs on narrow sections of the project area for the solar plant and powerline and represent dolerite dykes characterised by deeper, more fertile loamy soils of the Hutton soil form. The grass layer is characterised by species such as *Themeda triandra, Cymbopogon pospischilii, Hyparrhenia hirta, Cynodon dactylon* and *Schizachyrium sanguineum,* while isolated individuals of *Vachellia erioloba* also occur in the area.

The vegetation unit is classified as having a medium sensitivity due its widespread occurrence in the Grassland Biome. The eradication of protected trees would need a permit from DEFF. Where possible the larger protected trees should be incorporated as part of the solar development. The development of the solar development is considered suitable in this area.

9.4.7.2 Red Data Species

The potential that *Plinthus rehmanni* occur on the proposed development site is considered medium to low. Ecological monitoring should however still be implemented during the construction phase and specific sensitive habitats (riparian) needs to be avoided to ensure that any potential red data species potentially missed during the field surveys are preserved and not potentially impacted on.

9.4.7.3 Protected Species

Plant species are also protected in the Northwest Province according to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). According to this legislation, no person may pick, import, export, transport, possess, cultivate, or trade in a specimen of a specially protected or protected plant species. The Regulations, in the Act, provide an extensive list of species that are protected, comprising a significant component of flora expected to occur on site. If applicable, applications for permits will be submitted to the Provincial authorities.
After a detailed survey was conducted during April 2022, no listed protected species in the Act was found in the footprint areas of the project area.

9.4.7.4 Protected Trees Species (NFA)

The National Forest Act,1998 (Act No.84 of 1998) provides a list of tree species that are considered important in a South African perspective because of scarcity, high utilization, common value, etc. In terms of the National Forest Act of 1998, these tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by DWS (or delegated authority). Obtaining relevant permits are therefore required prior to any impact on these individuals.

One tree species listed as protected under the national list of declared protected tree species as promulgated by the National Forest Act (NFA), 1998 (No. 84 of 1998) was observed in the project area. *Vachellia erioloba* is a protected tree species of concern that occurs in the area.

9.4.7.5 Alien Invasive Species

The following alien invasive and exotic plant species were recorded on site during the surveys as stipulated in the Alien and Invasive Species Regulations (GNR 599 of 2014).

Table 12. Declared weeds and invader plants of the study area.

Species	Category
Achyranthes aspera	1b
Opuntia ficus-indica	1b

According to the amended regulations (No. R280) of March 2001 of the Conservation of Agricultural Resources Act 1983 (Act no. 43 of 1983), it is the legal duty of the land user/landowner to control invasive alien plants occurring on the land under their control.

9.4.7.6 Conclusions

An important aspect relating to the proposed development site should be to protect and manage the biodiversity (structure and species composition) of the vegetation types which surround the project area.

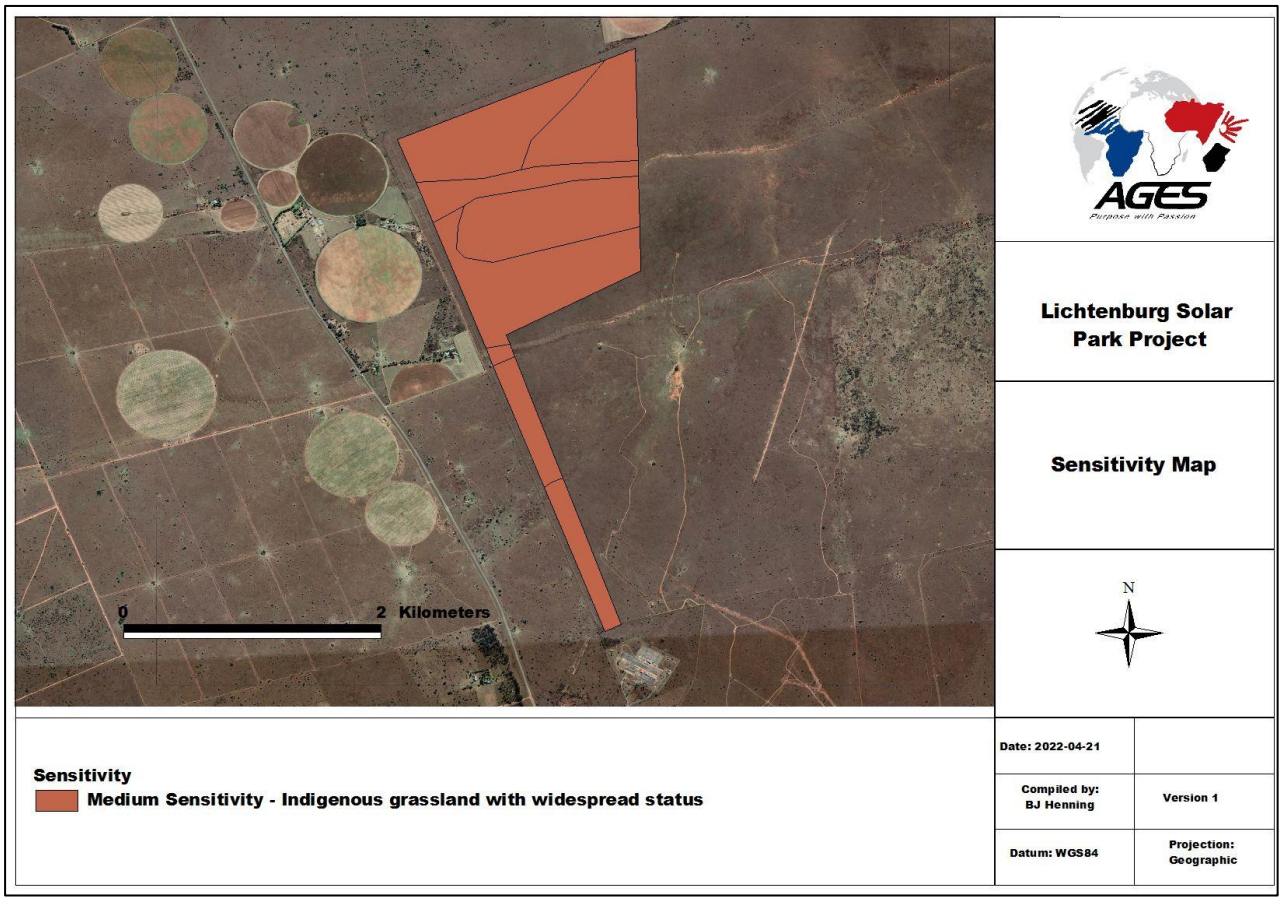


Figure 13. Sensitivity Map

9.4.7.7 Fauna

A survey was conducted during April 2022 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. During the site visit mammals, birds, reptiles, and amphibians were identified by visual sightings through random transect walks. Mammals were also recognized as present by means of spoor, droppings, burrows or roosting sites.

Mammals

Much of the large and medium-sized mammal fauna that previously occurred on the project site is now locally extinct or occurs in small, fragmented populations in reserves. Most of the habitat types on the respective study sites are fragmented. The expected mammalian richness on the area is considered low, although slightly higher richness values are expected from more intact grassland habitats. Antelope species that have been introduced into the fenced area include eland, blue wildebeest, blesbok, red hartebeest, gemsbok, springbok and waterbuck.

The Highveld Ecoregion contains a higher number of mammals, although only the orange mouse is restricted to the ecoregion, and the rough-haired golden mole is near-endemic. The ecoregion also supports populations of several large mammal species, some of which are rare in southern Africa. Among these are the brown hyena, African civet, leopard, pangolin, honey badger, striped weasel, aardwolf, oribi, and mountain zebra.

Predators that still roam freely in the area include larger predators such brown hyena, while smaller predators such as caracal, serval and honey badger are common throughout the larger area. Antelope species such as duiker and steenbok will roam freely through the area and are not restricted by game fences. Smaller mammal species such as honey badgers and serval can become habituated to anthropogenic influences, while other species such as brown hyena will move away from the construction activities and will seldom use the area.

Most mammal species are mobile and will move away during construction of any development. The most important corridors that need to be preserved for free-roaming mammal species in the area include the indigenous grasslands and wetlands surrounding the development site.

Avifauna

One major bird habitat system was identified within the project area, including the grassland. Bird species richness is high within the Highveld Ecoregion (Harrison *et al*. 1997). However, Botha's lark is the only bird species strictly endemic to the ecoregion, where it inhabits heavily grazed grassland. Another six bird species are near-endemics including whitewinged flufftail, blue korhaan, southern whitebellied korhaan, Rudd's lark, melodious lark, buff-streaked chat, and yellow-breasted pipit (Harrison *et al*. 1997).

Many grassland birds, several of which are endemic to southern Africa, show a clear preference for sour over sweet and mixed grassland, and some of these are essentially absent from the last two grassland types, e.g. Bald Ibis, Redwing Francolin, Black-winged Plover, Rudd's Lark, Botha's Lark, Blue Swallow, Buff-streaked Chat, Pale-crowned Cisticola and Yellow-breasted Pipit. Examples of grassland species preferring sweet and mixed grasslands appear fewer but include Melodious Lark and South African Cliff Swallow. The extensive human pressures on the grassland biome have severe conservation implications for its avifauna: many of the globally threatened species present on the mainland of South Africa, Lesotho and Swaziland have major strongholds in the grassland biome and five of these (Bald Ibis, White-winged Flufftail, Rudd's and Botha's larks, and Yellow-breasted Pipit) are entirely restricted to this biome in the region.

There is a long list of red data bird species that have a geographical distribution with the site. The presence of the habitat of these species is mostly confined to the open water habitat that was not observed on site, although the probability of finding these species in degraded habitats is very low in general. More than 250 bird species have been recorded in the project area and surroundings. Globally threatened species include Secretary bird and Black-winged Pratincole. Congregatory birds are Egyptian Goose, Western Cattle Egret, Spur-winged Goose, South African Shelduck, Cape Shoveler and African Spoonbill.

According to Birdlife South Africa, the study area falls outside of any Important Bird Areas (IBA), identified within South Africa (www.birdlife.org.za). The conservation status of many of the bird species that are dependent on wetlands reflects critical status of wetland nationally, with many having already been destroyed. In the study area, no wetlands were identified.

Herpetofauna

Twenty-nine amphibians occur within the ecoregion, but none are endemic (Passmore and Carruthers 1995). No habitat occurs on site for frogs and toads. Amphibian species potentially occurring in the larger area include Common River Frog, Natal Sand Frog, Gutteral Toad, Raucous Toad and Bubbling Kassina. These species are non-threatened and widespread, and the development will not have any impact on amphibian conservation in the region. Few reptile species occur within the Highveld Ecoregion, due to its cool climate.

Ecoregion supports some of Africa's most characteristic reptile species, including Nile crocodile, African rock-python, water monitor and veld monitor. There are also two strictly endemic reptiles: giant girdled lizard, and *Agama distanti* (Branch 1998). Several additional reptile species are near-endemics, including Drakensberg rock gecko, giant spinytail lizard, and Breyer's whiptail (Branch 1998).

In the presence of dead termitaria, small geckos may be found on site. Some lizards (Yellow-throated Plated Lizard, Variegate Skink), typical for Highveld Grassveld, are expected on site. A variety of smaller snake species characteristic for Highveld Grassveld will be present (Common Wolf Snake, Brown House Snake), although some might be dependent on by the presence of dead termitaria. The only venomous snakes, which has been reported present and common, is, the Rinkhals, Mozambique spitting cobra, snouted cobra and the Puffadder for this QDS. All the reptile species are common and widespread, and as such the development will not have any impact on reptile conservation in the region. Sun-gazer lizard occurs in some grassland areas, while southern spiny agama and striped harlequin snake may occur in small numbers in suitable habitat.

According to the existing databases and field survey the following number of fauna species included in the IUCN red data lists can potentially be found in the study area:

Table 13. Red data list of potential fauna for the study area

English Name	Conservation Status	Probability of occurrence on site
BIRDS (SABAP 2 LIST SPECIES)		
Abdim's Stork	Near Threatened	Moderate
African Marsh Harrier	Endangered	Moderate
European Roller	Near Threatened	Low
Black-winged Pratincole	Near Threatened	Moderate
Yellow-billed Stork	Endangered	Moderate
Martial Eagle	Endangered	Moderate
Secretarybird	Vulnerable	High
MAMMALS		
Bontebok	Vulnerable (2016)	Low - confined to protected areas / game farms
African Clawless Otter	Near Threatened (2016)	Low – confined to perennial rivers outside development footprint
Spotted Necked otter	Near Threatened (2016)	Low – confined to perennial rivers outside development footprint
HERPETOFAUNA		
Giant Bull Frog	Near Threatened	Moderate

The **cumulative negative impacts** of the proposed development will have a medium to low impact on the fauna of the area.

There are three major categories of impacts on biodiversity namely:

- Impacts on habitat resulting in loss, degradation and / or fragmentation.
- Direct impacts on fauna and flora species, for example plants and animals that are endemic / threatened/special to a habitat will not be able to survive if that habitat is destroyed or altered by the development.
- Impact on natural environmental processes and ecosystem functioning. This can lead to an accumulated effect on both habitat and species.

9.4.7.8 Summary and results of the Terrestrial Biodiversity Impact Assessment

Detailed ecological (fauna habitat & flora) surveys were conducted during April 2022 to verify the ecological sensitivity and ecological components of the site at ground level (Annexure C). The vegetation was in a good condition and most species could be identified, although some species might have been missed because of the dense vegetation cover on the plains.

Most sensitive sections: It is evident from the distribution of biodiversity, presence of threatened species and sites of scientific interest, that the proposed development has the potential for negative impact on the flora and faunal of the study area. This is particularly true of the sensitive vegetation associated with the natural grasslands in the project area.

Most sensitive habitats: Many threatened species are grassland specialists, linked to these habitats either for breeding, feeding or shelter. Major impacts on sensitive grassland areas should be avoided wherever possible during construction. Where unavoidable impacts will occur on grassland, strict mitigation measures and legislation should be implemented (DAFF licence for eradication of protected trees etc.).

Monitoring of threatened species: Many endemic and protected species have been recorded in region. The EMP for the development should highlight the conservation status of these species and note that steps must be undertaken in conjunction with conservation authorities to protect or translocate any populations encountered during project actions. Ecological monitoring is recommended for the construction phase of the development considering the presence of protected trees and potential red data fauna on areas surrounding the site. The importance of rehabilitation and implementation of mitigation processes to prevent negative impacts on the environment during and after the construction phase of the solar development should be considered a high priority. The proposed site for the development varies from being in a slightly degraded to pristine state.

A sensitivity analyses was conducted to identify the most suitable site for the development. From this investigation and ecological surveys, the following observations were made:

- All the grassland areas have a Medium Sensitivity and development can be supported in the area provided certain mitigation measures are implemented. Where the clearance of the vegetation would cause protected trees or other fauna to be removed, permits should be obtained from the relevant authorities.

No red data plant species were found on the site due to the state of the vegetation and physical environment of the larger area mostly not being suitable for any of the red data plant species that may be found in the area.

Some potential rare fauna may also occur in the area, and specific mitigation measures need to be implemented to ensure that the impact of the development on the species' habitat will be low. Specific mitigation relating to red data fauna includes the following:

- Disturbances in close vicinity of the development (periphery) should be limited to the smallest possible area to protect species habitat.
- Corridors are important to allow fauna to move freely between the areas of disturbance.

Several ecological potential impacts were identified and assessed. A few of these were assessed as having potentially medium or high significance, including the following:

- Destruction or disturbance to sensitive ecosystems leading to reduction in the overall extent of a particular habitat;
- Increased soil erosion;
- Impairment of the movement and/or migration of animal species resulting in genetic and/or ecological impacts;
- Destruction/permanent loss of individuals of rare, endangered, endemic and/or protected species;
- Establishment and spread of declared weeds and alien invader plants;
- Soil and water pollution through spillages;
- Establishment and spread of declared weeds and alien invader plants;
- Impacts of human activities on fauna and flora of the area during construction;
- Air pollution through dusts and fumes from construction vehicles (construction phase).

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. A monitoring plan is recommended for the construction phase of the development should the proposed application be approved.

The proposed development should avoid sensitive areas such as wetland and riverine areas, while also allowing corridors of indigenous woodland on areas outside the development footprint to be preserved. Where sensitive areas of natural vegetation cannot be avoided, a few mitigation measures have been recommended to minimise and/or offset impacts (licence application for eradication of protected species.).

Negative impacts can be minimised by strict enforcement and compliance with an Environmental Management Plan which considers the recommendations for managing impacts detailed above.

According to the Ecological Specialist, provided that the proposed development is consistent with the sensitivity map, guidelines stipulated and provided by North West and take all the mitigation measures into consideration stipulated in this report, the planned development can be supported.

9.4.8 AVIFAUNA

An Avifauna Impact Assessment (Annexure D) was conducted by Ryno Kemp *(Cand.Sci.Nat.)* and Prof. Derek Engelbrecht *(Pr.Sci.Nat.)* in order to determine whether the proposed development would have negative impacts on avifauna in the area.

A detailed field survey was carried out on the 29th and 30th of March 2022. A field survey aid in filling in any information gaps identified from pilot investigations and published data. Bird communities were surveyed on the proposed development area as suggested by Gazetted Avifauna Assessment Protocols using the point count and line transect surveying techniques. ArcGIS was used to create random points across the surveying area for the proposed Solar Park area and line transect for the proposed power line development.

The proposed site is classified as mixed grasslands with only a few roads running through the proposed area. The eastern part of the proposed site has various power lines running from north to south to the Eskom Watershed Substation. Habitat at the proposed site is dominated by grasslands resulting in low species richness.

The desktop analysis recorded a total of 236 species that have been recorded during SABAP2 in the 9 pentads surrounding the proposed Lichtenburg Solar Park.

Of these, 32 were confirmed during the point survey count or are very likely to occur within the study area, and a further 40 are likely to occur. Species whose presence was confirmed include grassland species (e.g. Ant-eating Chat, Zitting Cisticola, Cape Longclaw and Orange River Francolin). Avian diversity on the site is low, a characteristic of natural grasslands (Freeman et al. 2018). Furthermore, endemic or near-endemic species to South Africa, such as Cape Sparrow, Cape Longclaw and Eastern Clapper Lark, were also observed during the field survey.

During the field investigation, various flight paths were observed from non-priority species. Priority species such as White-backed and Cape Vultures were seen soaring over the proposed solar park and power lines. Furthermore, vultures continuously visited the supplementary feeding site and roosted on nearby power lines. However, there are no distinct flight paths across the site, making it difficult to mitigate.

In the Avifaunal Specialist Assessment, 12 threatened or near-threatened species have been recorded in the greater region during the desktop survey, and only two were confirmed during the field survey. However, the proposed solar park is unlikely to pose a significant threat to any of the following species, but the proposed powerline connecting the solar park and substation poses a significant threat regarding collisions and electrocution with the infrastructure.

The findings of this survey and the relevant impact assessment concluded that the development of the proposed Lichtenburg Solar Park would have a medium impact on the bird communities and will cause a slight impact on the ecological process of the overall bird community. The biggest concern is the threat the power lines within this area hold to threatened species such as the three vulture species present at the site. Therefore, careful considerations need to be taken in terms of the proposed power line as the impact can be catastrophic. Still, the competent authority must consider all prescribed mitigation measures and recommendations.

9.4.9 VISUAL

A Visual Impact Assessment (Annexure I) was conducted by Graham Young an independent visual specialist to determine visual impact of the proposed solar park. The visual impact assessment analyses and rates the impacts of the proposed project on the visual environment as well as the sense of place of the receiving landscape.

The assessment of likely effects on a landscape resource and visual amenity is complex since it is determined through quantitative and qualitative evaluations. When assessing visual impact, the worst-case scenario is considered. Landscape and visual assessments are separate, although linked, procedures. The landscape, its analysis, and the assessment of impacts on the landscape all contribute to the visual impact assessment studies baseline. The potential impact on the landscape is assessed as an impact on an environmental resource, *i.e.* the physical landscape. On the other hand, visual impacts are assessed as one of the interrelated effects on people (*i.e.* the viewers and the result of an introduced object into a view or scene).

PV solar projects typically include medium to large-scale infrastructure that can cause change to the fabric and character of an area and possible visual intrusion in sensitive landscapes due to their physical presence.

Within a 5,0km radius of the Project site, the study area comprises primarily slightly undulating plains that gently slope to the north and to the south across the study area from a low west to east ridge line near the southern boundary of the site. The ridge line represents the highest elevation in the general area at 1515m AMSL. The development footprint follows this slope to the north with no PV arrays proposed south of it.

The landscape character types in the study area are common within the sub-region and have been impacted by agricultural, industry and quarry activities (specifically the southern part of the study area immediately north of Lichtenburg town). However, for much of the northern and eastern sections of study area the overwhelming sense of place of the is characterised by the open grazing lands and cultivation (mostly central pivot systems), resulting in a pastoral sense of place. The southern section is of mixed character and does not exert a strong sense of place, due to the variety of land uses with no unity.

Visual impacts will be caused by activities and infrastructure in both Project phases, i.e. construction and operational. Activities associated with the Project will be visible to varying degrees from varying distances around the project site. During the construction phase, the project's visibility will be influenced due to the preparatory activities, primarily earthworks and building works. During the operational phase, the visibility of the project will be caused by the established solar PV arrays, associated infrastructure and the proposed new 132 kV powerline.

The primary visual envelope, where open, partially obstructed views of the development would occur, is contained to the immediate north, west, east of the site and sections of the R505 as illustrated in Figure 6. However, due to the flat nature of the landscape and the prevalence of medium to tall trees west and north of the site, most of these views would be completely blocked or partially screened by vegetation, buildings and other structures. The Project's solar arrays would be most visible from east of the site in the game reserve where the landscape is open and there are fewer trees. Due to the low ridgeline along the southern boundary of the Project site and the prevalence of medium to tall vegetation southwest of the site, views from the south and southwest are mostly blocked. The sensitive viewing areas in the far southwest of the study area, would therefore not be affected.

The study area's scenic quality has been rated *low* to *moderate* within the context of the sub-region, and the project site is in a moderate rated landscape type. Sensitive viewing areas and landscape types have been identified and mapped, indicating potential sensitivity to the Project, mainly for residences of farmsteads to the immediate west and north of the site and visitors of the Lichtenburg Vakansie Oord Game Park east of the Project site.

Impacts on views are the highest when viewers are sensitive to change in the landscape, and the view is focused on and dominated by the change. The Project's visual impact will cause changes in the landscape that are noticeable to people viewing the landscape from the R505 provincial road and adjacent farmsteads. People living in the residential areas in the far south of the study area will not be affected by the Project.

The visual specialist's opinion is that all aspects of the project should be approved from a potential visual impact perspective, if mitigation/management measures are effectively implemented, managed, and monitored in the long term.

9.4.10 SOCIO-ECONOMIC ENVIRONMENT

A report on the socio-economic considerations related to the proposed project was compiled and is attached in this Report in Annexure M. The following issues can be anticipated:

- The national and local economies will benefit from civil contractor work, labour and building materials that will be required on site.
- After approval, the project will take approximately **18 months** to be built and will have a lifetime of 30 years. Approximately **100 people** are expected to be employed during the construction period. During operational phase, the power plant will require a permanent staff of approximately **40 people**. That impact will be positive.
- The presence of permanent security personnel may be beneficial to the overall safety and security situation in the area.
- Approximately **50% of the operational costs** will have a local economic return (mostly for maintenance works by local sub-contractors), then the impact will also be positive during the operational phase (30 years).
- The most important economic benefit is the experience that will be gained with regard to solar electricity generation in North West and in South Africa, considering that this forms part of a national strategic plan. This experience will be essential for the roll-out of the strategy, for efficiency improvements and for the establishment of a local manufacturing supply chain for equipment requirements. The project will contribute towards reducing carbon emissions per unit of electricity generated, albeit very small to start with.
- Furthermore, the project will comply with the Economic Development Requirements, as requested by the REIPP Procurement Programme. This economic development programme identifies needs of the surrounding communities in order to have a positive socio-economic impact.
- The socio-economic impact of the proposed Lichtenburg Solar Project is considered positive and the application is supported, provided that all the mitigation measures proposed by specialist consultants are implemented.

9.4.11 AGRICULTURAL POTENTIAL

An Agricultural Agro-Ecosystem Assessment was done to assess the agricultural potential and value of the soil types on the site and the report is attached in Annexure F. A thorough investigation of the soil types of the proposed development site is necessary for an accurate classification of the soils. The main aim of the study is to identify the soil types on site and evaluate their specific characteristics to determine the agricultural potential of the soils.

The assessment of agricultural potential and land capability of the study area will be based on a combination of desktop studies to amass general information and then through site visit for status quo assessment, soil sampling and characterization, and also the validation of generated information from desktop studies:

- Definition of parameters of land as stipulated by Subdivision of Agricultural Land Act, No. 70 of 1970 and Amended Regulation of Conservation of Agricultural Resources Act No. 43 of 1983;
- Classification of high potential agricultural land in South Africa compiled by the Agricultural Research Council (Schoeman, 2004) for the National Department of Agriculture;
- Long-term climatic data record of the study area, obtained from Weather SA.
- Geophysical features of the site using Geographical Information System;
- Moisture availability class, determined through seasonal rainfall and fraction of the potential evapotranspiration (ARC, 2002);
- Field visit to the project site for general observation, survey of the farm in terms of vegetation, soils, water resources, terrain type and infrastructural profile;
- Previous and current land use of the farm and that of the neighbourhood;
- Other agro-ecological factors prevailing in the area;
- Agricultural potential of the property;
- Possible crop productivity or value of the farm for grazing purposes.

Shallow red-yellow apedal soils of the Mispah / Glenrosa soil forms

The shallow Mispah or Glenrosa soil forms occur on the flatter areas and has a shallow depth. The soil in this area has a sandy to sandy-loam structure forms a mosaic of Mispah and Glenrosa soils, although some areas also have exposed bedrock.

Agricultural Potential: Low potential soils, due to the climatic conditions and shallow gravelly nature of the soils, making these areas marginally suitable for crop cultivation under arable conditions.

Land capability: The grazing potential of these areas is low. The most suitable and optimal utilization of the area would be grazing by small livestock or game species.

Deep red apedal soils of the Hutton soil form

Very deep soils of the Hutton soil form. Hutton soils are identified based on the presence of an apedal (structureless) "red" B-horizon. The Hutton soils found on this section of the site are widespread and moderately deep, although it has a Moderate clay content.

Agricultural Potential: Moderate potential soils – soils deep and often sandy-loam structure that causes a medium water holding capacity, although the clay content of the soils is sufficient.

Under the climatic conditions these soils would not sustain arable crop production. The many old, cultivated fields in the larger area confirm that crop cultivation over the longer term is not a financially viable option under the prevailing climatic conditions.

Land capability: Livestock and / or game grazing are viable due to the slightly higher nutrient and organic content of the topsoil in woodland areas that support a mixture of palatable and unpalatable species.

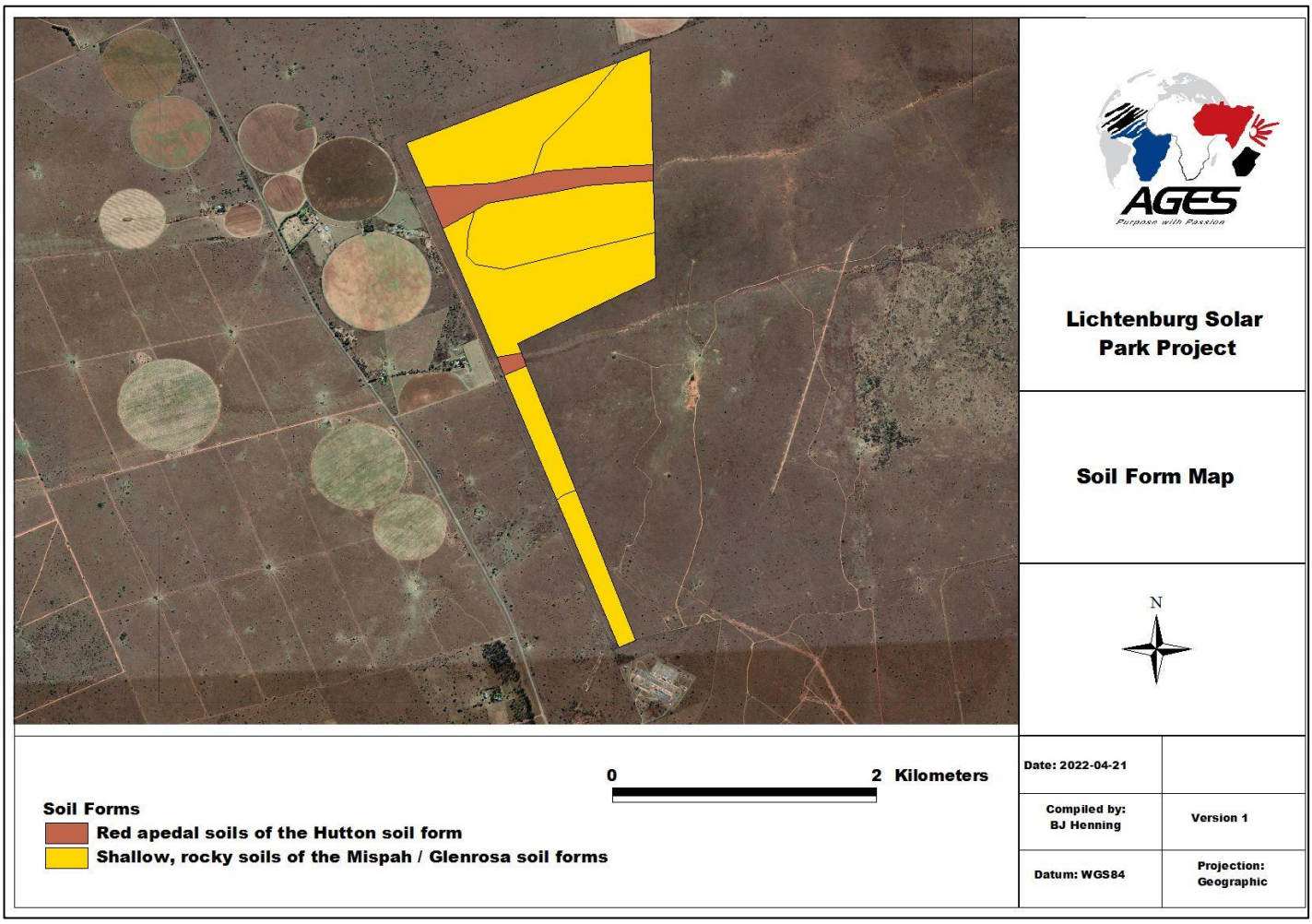


Figure 14. Soil Form Map

Arable Land (Crop Production)

The proposed development site is composed of sandy to sandy-loam soils. From the soil textural analysis, it can be concluded that the soil has a clay content varying between 4 and 10%. The soils are further predominantly red-yellow apedal soils with a loamy texture, with some section shallow and gravelly, although the central section of the site is located on shallow Mispah soils and exposed bedrock. The areas with shallow soils render these areas unfavourable for effective crop production which could result from high moisture demands by planted crops. The red apedal soils have a marginal potential for arable crop production.

The farm is expected to receive an annual total rainfall of ± 500 mm which is relatively low and highly variable. In addition, the farm is in an area which is marginal to dry for rain-fed arable crop production. Economically viable farming is restricted to irrigated cropping due to the high risk that could be associated with dry-land farming. At present no irrigation or centre pivots occur on the property. Furthermore, higher day temperatures and evaporation rates in summer months may hamper soil moisture storage for crop use.

Grazing Land (Livestock Production)

The current vegetation at the proposed site of development consists mainly of areas of native woody perennial species and unpalatable grasses (low quality grazing grass species) on the shallow, to gravelly soils. Mixed quality grazing (highly palatable and unpalatable grasses) occurs in the central section of the site and these areas can support limited grazing by livestock and game species. The nature of the vegetation and size of the properties make the area marginal for extensive livestock production. Using planted pasture to supplement livestock production is also not an option considering the limited water availability for extensive irrigation.

The nature of the vegetation at the farm is therefore marginal for extensive livestock production.

Impacts on the agricultural capability

The impacts associated with the proposed development on the agro-ecosystem capability will depend on the specific area where the development will take place. If the activities take place along the slightly undulating terrain the impacts will be lower with only marginal erosion risks that can be managed though proper mitigation measures. The mitigation of the overall impacts on soils (compaction, erosion) will be easier on these flatter areas.

The following list of impacts is anticipated with the proposed developments on the soils and land capability in the area during the construction phase:

- Disturbance of soils (Soil compaction, erosion and crusting);
- Sterilisation of soil (soil stripping);
- Soil contamination due to leaching of soluble chemical pollutants;
- Loss of current and potential agricultural land.

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. Furthermore, the proposed layout plan of the PV plant should be consistent with the agro-ecosystem maps and recommendations stipulated in this report, and the impact on the sensitive soil forms on site should be kept to a minimum. According to the soil specialist who conducted the Agricultural Potential Impact Assessment, provided that the proposed development and layout plans is consistent with the agro-ecosystem sensitivity map and take all the mitigation measures into consideration stipulated in this report, the planned development can be supported.

9.4.12 CULTURAL AND HERITAGE RESOURCES

An Archaeological Impact Assessment (Annexure G) was conducted by Beyond Heritage (Mr J van der Walt) to ascertain whether there are any remains of significance in the area that will be affected by the proposed development.

Published Stone Age and Iron Age archaeological sites are absent from the immediate study area. Stone Age lithic scatters occur near watercourses, and some were exposed due to diamond mining in the wider area, suggesting that the landscape was used since the Early Stone Age (ESA). However, currently, published references only include Later Stone Age sites 200 km south-east of Lichtenburg, as well as rock art occurring to the south at Ottosdal.

Early Iron Age farmers settled at Broederstroom *ca*. 500 CE (Mason 1981), the oldest Iron Age site in the North West Province. Agropastoral communities preferred open woodland areas with readily available access to water and cultivatable soils and farmers did not occupy the central highveld area of Lichtenburg. During the Late Iron Age when climatic conditions became more favourable people started to occupy areas previously considered unsuitable (Maggs 1994; Huffman 2007). The earliest Iron Age farmers who moved into the North-West Province were Tswana-speakers such as the BaRolong. During the early 1820s Methodist missionaries had contact with BaRolong communities as they fled from the chaos caused by the ongoing Mfecane, settling near Maquassi hills in modern-day Potchefstroom. Peace was short-lived and communities decided in 1833 to move towards Thaba Nchu under the protection of king Moshoshoe. The region was also a focal point for *Voortrekkers* such as Hendrik Potgieter and Sarel Cilliers, as they moved further towards the interior violent battles took place between local Sotho-Tswana, Ndebele and Zulu chiefdoms.

The surrounding area of Lichtenburg was only occupied from the 1850s as resources were few and the town was established in 1873. During the South African War 1899-1902, several skirmishes took place in the larger region. The area included concentration camps and the famous battle of Mafikeng took place close-by. Lichtenburg is also home to the infamous General Koos de la Rey. The town was the seat of the local Senator, and he died in 1914 on his way home from a meeting in parliament about South Africa's participation in World War I. During the 1920s the town experienced a diamond rush that lasted 10 years. Today Lichtenburg is known for cattle and crop farming. The project area was utilised for grazing or agricultural fields since the 1900s.

A previous HIA conducted for the study area (Hutten 2012) recorded no heritage resources of significance and the current assessment similarly recorded no sites of significance although isolated MSA flakes were noted. These were found occasionally scattered through the study area in direct contrast to high density sites to the west (van der Walt 2014, Van der Walt 2022a). Historical topographic maps and areal imagery also showed no structures or stonewalled settlements within the project area.

No heritage sites of significance occur within the impact area and no adverse impact to heritage resources is expected. Any additional effects to subsurface heritage resources can be successfully mitigated by implementing a chance find procedure. Mitigation measures as recommended in this report should be implemented during all phases of the project. Impacts of the project on heritage resources is expected to be low during all phases of the development. No adverse impact on heritage resources is expected by the project and it is recommended that the project can commence on the condition that the following recommendations (Section 10) are implemented as part of the EMPr and based on approval from SAHRA.

Recommendations for condition of authorisation:

- Implementation of a chance find procedure for the project.

9.4.13 PALAEONTOLOGICAL RESOURCES

A Palaeontological Impact Assessment (Annexure H) was conducted by Prof Bamford. The proposed site lies on the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) and in particular on the Oaktree and Monte Christo Formations that could preserve oolitic chert and stromatolites. The site visit walk-down confirmed that there are NO FOSSILS in the project footprint. It is unknown whether there are fossils below the ground surface, therefore, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor, developer, environmental officer or other designated responsible person once excavation activities have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

Recommendations of the Palaeontological Specialist

Based on the fossil record but confirmed by the site visit and walk through there are NO FOSSILS or trace fossils visible even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the dolomites of the Oaktree and Monte Christo Formation (Malmani Subgroup, Chuniespoort Group, Pretoria Supergroup) and may be disturbed, so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the contractor, environmental officer, or other responsible person once excavations and drilling have commenced, then they should be rescued, and a palaeontologist called to assess and collect a representative sample. Since the impact on the fossil heritage is low, as far as the palaeontology is concerned, the project should be authorised.

9.4.14 TRAFFIC IMPACT ASSESSMENT

A Traffic Impact Assessment Report was obtained after a Traffic Impact Assessment was conducted by Siyazi Limpopo Consulting Services (Pty) Ltd. The specialist report is attached in Annexure J.

The purpose of the study was to assess the implications of the vehicular traffic that could potentially be generated due to the proposed development in terms of:

a. The traffic impact that the change in land use would have on the road and transport-related infrastructure.
b. Whether it is possible to accommodate the proposed development within acceptable norms from a traffic-engineering point of view.
c. The mitigating measures required to accommodate the proposed development within acceptable traffic-engineering norms.

FINDINGS OF THE TRAFFIC ASSESSMENT

- Access to the proposed development will be via the provincial R505.
- The Access position from and to Road R505 for the proposed development was not finalised at the time of conducting this study, and therefore basic investigations were conducted to identify tentative access points which would be suitable from a traffic engineering and road safety perspective, for which two tentative proposed points were identified (Points A and B).

RECOMMENDATIONS AND TERMS OF REFERENCE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT

The following recommendations are made from a traffic engineering point of view:

- As part of the construction phase, a dedicated loading and off-loading area on site should be established where workers can safely be loaded and off-loaded by public or arranged transport.
- From a road safety perspective, dust suppression on the proposed access road (relevant for gaining access via Point A or Point B) should be conducted when required to avoid road visibility issues caused by dust from vehicles making use of the road, which could lead to vehicle accidents.

REASONED OPINION FOR AUTHORISATION OF THE PROPOSED DEVELOPMENT

In conclusion of the findings as part of the investigations, Siyazi Limpopo Consulting Services (Pty) Ltd is of the opinion that the Proposed Development would have a manageable impact on the relevant road network during all phases, as long as the mitigation measures are implemented as recommended in the Traffic Report. In this case, it is therefore recommended that authorisation be granted.

9.4.15 RADIO FREQUENCY INTERFERENCE

The following findings are made with respect to the RFI sensitivity of this project (see Annexure K for more detail):

- This assessment is applicable to the proposed development footprint as it is shown in this document. The power line corridors identified here is part of the solar park and has been evaluated as one.
- After evaluation and consideration of all activities identified, it is still considered to be classified as low sensitivity to RFI and the power line corridor classified as medium is only so because it ends up in a potential RFI active area (The Watershed power sub-station).
- For the proposed development referred to in this report, there should be no unacceptable impact on existing and potential, future installations if all equipment to be used permanently or temporarily has acceptable EMI/RFI levels that have been subjected to the ICASA requirements.
- No Cumulative RFI effects are expected at any of the adjacent sites and whether there is a single solar park or combined with the power line corridor the outcome will be the same.

Glint and Glare

The South African Civil Aviation Authority (SACAA) obstacle notice 3/2020[1] Additional Requirements for Solar Project Applications states that a Glint and Glare Assessment would not be required if the solar PV facility is not within a 3km radius of the aerodrome (Part 139.01.30 (3). Therefore, a full Glint and Glare Assessment is not required.

The effect of glint (a sharp focus of light) is not generally associated with PV arrays; however, glare could occur with certain climatic and orientation conditions, for limited periods of the day in the early morning or late afternoon for areas west and east of the Project site. The nature of the visibility of the project and the limited number of people that could be affected, suggests that glint and glare is not a significant issue associated with the project.

9.4.16 AVIATION IMPACT ASSESSMENT

The development of solar developments throughout South Africa means that new renewable energy plants and overhead transmission lines are sometimes developed near existing civil and military airbases. The aviation assessment is done to determine if a proposed renewable energy generation project will interfere with the Obstacle Limitation Surfaces of airports in the vicinity of the project.

Although a "low" sensitivity has been identified, Tappas Aviation Consultant undertook a safeguarding assessment for the proposed new solar park and new transmission line in the North West Province in the vicinity of Lichtenburg Airport (FALI). The Aviation Assessment is attached in Annexure L.

[1] Obstacle Notice 3/2020 (Replacement for 17/11/2017): Additional Requirements for Solar Project Applications:
Kindly note that with immediate effect, A Glint & Glare Assessment will be required as soon as the proposed site is located on the extended runway centreline within the ICAO Annex 14 Approach Surface, Take-Off Climb Surface & Departure Surface, and within 3km radius around an Aerodrome/helistop as pe Part 139.01.30 (3).

FALI is the ICAO (International Civil Aviation Organization) code for the Lichtenburg Airport. There are no Military installations and also no promulgated Danger, Restricted and Prohibited areas according to the SACAA list in the vicinity of the Lichtenburg Solar Park.

It was decided to assess the development using the methodology of the assessment of the Obstacle Limited Surfaces as well as the Approach/Departure Surfaces of Lichtenburg Airport. This will be done in accordance with the ICAO and SACAA safeguarding rules and regulations. According to the SACAA Lichtenburg Airport is not a certified airport under Instrument Flight Rules. The possibility exist that the Lichtenburg Airport could become an Instrument Flight Rules airport in the future, therefore both the Obstacle Limited Surfaces as well as the Approach/Departure Surfaces will be assessed.

The proposed Lichtenburg Solar Park's location is outside the flight paths of runway 06/24 and runway 18 and will therefore not interfere with the standard departures and arrivals flight paths on these runways. It will not be necessary to investigate the Obstacle Identification Surfaces of these runways.

Evidence from the assessment and the technical drawings show clearly that the Lichtenburg Solar Park will not interfere with the safeguarding of the Obstacle Limit Surfaces and the Approach/Departure Surfaces of Lichtenburg Airport (FALI).

9.4.17 STORMWATER MANAGEMENT PLAN CONCEPT REPORT

Matukane and Associates (Pty) Ltd was appointed by AGES Limpopo (Pty) Ltd to conduct a desktop study, and to compile a report on the Storm Water Management Plan for the proposed Lichtenburg Solar Park for client. The proposed development is envisaged for the farm Portion 10 of Farm number 27 IP Registration Division in the Ditsobotla Local Municipal area, in the Ngaka Modiri Molema District Municipality in the Northwest Province.

The purpose of this report is to provide an oversight of the hydrological setting of the project, and to provide the scope of work for further hydrological assessment and the development of the Storm Water Management Plan (Annexure O) for the proposed development site.

Aspects of importance are:

- Water quality.
- Mitigating the hydrologic impact of the solar farm development.
- Flood-lines where relevant.

Topography

The Lichtenburg site is situated in the bigger quaternary catchment C31A. The site is characterized by an east-west watershed in the bottom half of the southern side, and an east-west drainage line in the northern half. The site is flat, with a slope of approximately 0.6% (very low).

Soils

Soils were classified into broad classes according to dominant soil form and family as follows:

- Shallow red-yellow apedal soils of the Mispah / Glenrosa soil forms.
- Deep, red apedal soils of the Hutton soil form.

The geological formations and vegetation patterns showed a strong correlation to the major soil units identified in the study area.

Erosion

A Rehabilitation and Revegetation Plan was compiled by Dr. Henning, which is included in the During the construction phase, clearing of the site will leave soil exposed and can cause erosion. The following list provides a guide to preventing erosion on construction sites:

1. Programming: Install erosion control measures before construction commences. Schedule construction activities to minimize land disturbance.
2. Land clearing: minimize the extent and duration of land clearing.
3. Stormwater and run-off systems: install temporary drains and minimize concentrated water flows. Control stormwater velocity where necessary with temporary energy dissipater structures. Divert run-off around trench excavations or disturbed areas.
4. Rehabilitation: revegetate or stabilize all disturbed areas as soon as possible. Indigenous trees can be planted in the buffer zone of the proposed development to enhance the aesthetic value of the site and stabilize soil conditions.
5. Services: coordinate the provision of site services to minimize disturbance.
6. Stockpiles: locate stockpiles away from concentrated flows and divert run-off around them.

Climate

The mean annual precipitation for the Carletonville Dolomite Grassland vegetation type being the main vegetation type of the area is 593mm, while the mean annual temperature is 16.1˚C. The monthly distribution of average daily maximum temperatures for Lichtenburg ranges from 17.7°C in June to 30°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night.

Hydrological Characteristics

The site is situated in the C31A quaternary catchment area. This area represents a plateau that drains in all directions.

The area presents an average rainfall of 596 mm per year. The average monthly rainfall is less than Y mm per month (3.2.4). With an average infiltration rate of Z mm/hour (3.2.3.1), “to Interpret” downflow occurs.

The high evaporation rate will rapidly dry out the moisture holding layer of the soil, "resetting" the capacity to absorb rainwater. (To present interpretation).

The drainage channels are generally defined weekly, and wide and shallow.

HYDROLOGICAL CONSIDERATIONS

Drainage through the defined drainage channel from higher ground in the catchment area:

If present, this requires the establishment of flood-lines and the exclusion of the area included in the 1:100-year flood-lines. There are no draining lines impacting on this site requiring this. No formal flood-line provisions apply.

Surface flow and channels with limited impact reaching the site from higher ground:

Not applicable in this case as it is on a plateau.

Surface flow generated on site:

Due to direct rainfall on site, sheet flow will occur, leading to the smallest of flow channels, interlinking to bigger until it leads onto drainage lines of a magnitude that must be managed.

Flow speed of down flowing water:

- A definite relationship exists between the flow speed of water and erosion. In general terms, the capacity of water to transport solid particles (thus to erode) is exponential to the flow-speed. A slight increase in flow speed thus gives rise to a proportionally bigger erosion risk.
- The flow speed of surface flood water is of importance because of:
  - the potential ~~of~~ damage to the development.
  - the potential downstream impact due to altering the natural flow pattern.
- The flow speed of flood water is a function of:
  - Climate, and specifically precipitation and the intensity of it.
  - Slope of the flow path of water: Through the correct design of discharge channels on site, the flow speed of water can be manipulated. A longer flow path with a more gradual slope may slow down downflow. Care must be taken not to slow down the water to the point that suspended solids may in turn be deposited in the channels. This will cause blockages that will require additional maintenance to clean and to dispose of the material.
  - Vegetation on site: Vegetation forms a physical obstacle that dissipates energy from flowing water and have a slowing effect.

A Site specific stormwater management plan is included in Annexure O.

Construction Phase Storm Water Management

- It is recommended that access and service roads, as well as stormwater systems are constructed at the commencement of the construction phase to ensure that suitable stormwater management measures are in place at the least additional cost.
- These permanent routes must also be used for construction purposes. In order to preserve the natural state of the surface and vegetation as far as practically possible, off-road driving should be restricted to the absolute essential.
- Space for lay-down areas for construction material and for construction facilities is restricted on site. It is not possible to give clear directions in terms of its positioning. The flowing should however be considered:
    - High resolution site survey data must be used to design stormwater ditches to direct surface flood water past any stockpiles.
- Site clearing should be limited to the essential.
- Construction waste, including possible broken and damaged panels must be collected and stored safely for disposal in accordance with the relevant waste regulations, protocols, and product specifications. Care must be taken not to leave any waste on site that can lead to future contamination of the site or the downstream area.
- Training with regards to stormwater management of construction personnel must be undertaken as part of their induction.

Operational Phase Storm Water Management

- Training with regards to stormwater management of site personnel must be undertaken as part of their induction. Refreshment training must be undertaken periodically.
- Regular conditional inspections of all storm water infrastructure are required.
- Any item that may be found to be out of order, for instance accumulation of settled sand in a trench, or erosion, must be addressed and corrected without delay to keep the storm water system in a good and fully functional condition.
- Specific attention must be given to inspection during and after any rain and/or flood event to kerb any damage that may occur.
- For any structures in the 1:100-year flood line zone, a Water Use Licence is compulsory.

Way Forward

Prior to the detailed design stage and implementation, a physical survey needs to be conducted. Based on this:

- The flood line determination should be reviewed.
- The site drainage needs to be designed on an elevation basis, with full consideration of:
    - Final infrastructural layout on site. The final infrastructural layout and drainage design mutually impact on each other and will therefore be an iterative process.
    - Final flood line alignment that may require either or both of limited infrastructural re-arrangement of ground work to mitigate any exceedance of infrastructural development in the 1:100-year flood zones.

9.5 IMPACTS AND RISKS IDENTIFIED

The environmental impacts of the construction, operation, maintenance and management of the proposed project were identified and the . significance of the impacts was assessed. Each impact was assessed and rated. The assessment of the data, whereas possible was based on broadly accepted scientific principles and techniques. As previously described, construction activities for the establishment of the proposed PV power plant include:

- land clearing activities necessary for preparation of the site and access routes;
- excavation and filling activities;
- transportation of various materials;
- construction of the storage structures;
- installation of the PV modules and construction of associated structures and infrastructure; and
- construction of the on-site high-voltage substation.

EXTENT

The extent of most of the construction activities is localized and impacts will only occur at the development site. Some activities will extend to adjacent landowners as access roads will be used which will lead to an increase in the traffic in the area. mitigations measures are included in this EIA report.

DURATION

The impact of construction activities will only be for the duration of the construction phase, after which it will cease completely. (Construction period planned to last between a minimum of 6 months and a maximum 15 months).

PROBABILITY

The probability of impacts occurring during the construction is phase very high as there will be impacts on the vegetation as most will be removed to make way for the proposed development. The evaluation of environmental impacts as a result of the proposed development is discussed in this EIA report. Environmental impacts associated with the operational phase of a solar energy facility include visual and other impacts.

The decommissioning activities of the PV plant mainly include the removal of the project infrastructure and the restoring of the site *status quo ante*.

The identification of impacts is based on:

- legal and administrative requirements;
- the nature of the proposed activity;
- the nature of the receiving environment;
- specialist studies and
- issues raised during the public participation process.

Environmental impacts associated with the operational phase of a solar energy facility may include visual and other impacts.
The decommissioning activities of the PV plant mainly include the removal of the project infrastructure and the restoring of the site *status quo ante*.

The identification of impacts will be based on:

- legal and administrative requirements;
- the nature of the proposed activity;
- the nature of the receiving environment;
- amended specialist studies; and
- issues raised during the public participation process.

Potential impacts include:

- Impacts on soils & agricultural potential;
- Impacts on ground water;
- Impacts on the road system and traffic;
- Impacts on air quality and potential emissions;
- Geological, soil and erosion impacts;
- Impacts on avifauna;
- Impacts on vegetation;
- Impacts on heritage resources;
- Noise impacts;
- Impacts on tourism;
- Social impacts; and
- Visual impacts.

Potential impacts identified include:

- Impacts on soils & agricultural potential:
    - Extent:Locally at the proposed site
    - Duration: Life of the project (approx. 30 years)
    - Probability: Low
    - Significance: Low
- Impacts on ground water:
    - Extent:Surrounding and adjacent land
    - Duration: Life of the project (approx. 30 years)
    - Probability: Medium
    - Significance: Low
- Impacts on the road system and traffic:
    - Extent:Surrounding and adjacent land
    - Duration: Life of the project (approx. 30 years)
    - Probability: Low
    - Significance: Low

- Impacts on air quality and potential emissions:
  - Extent:Regional
  - Duration: Life of the project (approx. 30 years)
  - Probability: Very Low
  - Significance: Very Low
- Geological, soil and erosion impacts:
  - Extent:Locally at the proposed site
  - Duration: Life of the project (approx. 30 years)
  - Probability: Low
  - Significance: Low
- Impacts on avifauna:
  - Extent:Locally at the proposed site
  - Duration: Life of the project (approx. 30 years)
  - Probability: Low
  - Significance: Low
- Impacts on vegetation:
  - Extent:Locally at the proposed site
  - Duration: Life of the project (approx. 30 years)
  - Probability: High
  - Significance: Medium
- Impacts on heritage resources:
  - Extent:Locally at the proposed site
  - Duration: Life of the project (approx. 30 years)
  - Probability: Low
  - Significance: Low
- Noise impacts:
  - Extent:Locally at the proposed site
  - Duration: Life of the project (approx. 30 years)
  - Probability: Low
  - Significance: Very Low
- Impacts on tourism:
  - Extent:Regional
  - Duration: Life of the project (approx. 30 years)
  - Probability: Unknown
  - Significance: Unknown
- Social impacts:
  - Extent:Regional & Locally
  - Duration: Life of the project (approx. 30 years)
  - Probability: High
  - Significance: High - Positive

- Visual impacts:
    - Extent:Locally at the proposed site
    - Duration: Life of the project (approx. 30 years)
    - Probability: Definite
    - Significance: Medium

The significance of the potential impacts was determined as all the specialist studies have been obtained.

9.5.1 DEGREE TO WHICH THE IMPACTS CAN BE REVERSED

- The visual impact is resident for a long time (25-30 years). It can be reversed during decommissioning and rehabilitation of the area.
- Biodiversity impacts can be reversed at the decommissioning stage of the development. Plants can be replanted, and animals will return to the project area.
- Impacts on soil (erosion) can be reversed by careful handling of storm water on site.
- Impacts on water quality and quantity can be reversed at the decommissioning stage.
- Agricultural resources will again become available after decommissioning of the facility.
- Impacts on heritage resources could be permanent without mitigation.
- The potential impacts on river systems, drainage channels and wetlands will be minimal. Impacts on these resources can be reversed successfully.
- Socio-economic impacts can be reversed at the decommissioning phase, though this will have a nett negative effect on the area.

9.5.2 DEGREE TO WHICH IMPACTS MAY CAUSE IRREPLACEBLE LOSS OF RESOURCES

The only impact which can cause an irreplaceable loss of resources is an impact on the heritage resources where heritage sources are destroyed. This should not happen as the heritage resources are well surveyed and protected from development impacts.

9.5.3 DEGREE TO WHICH IMPACTS CAN BE AVOIDED, MANAGED OR MITIGATED

It is not possible to completely avoid the impacts of the development on the environment. By following the mitigation and management measures detailed in the impact section in this report, most of the impacts and the effects it can have on the environment can be successfully lowered to a lower degree of significance to the environment. This can be done to a point where the impacts are acceptable and where the benefits of the development are greater than the detriment to the environment.

9.6 HIGH LEVEL RISK ASSESSMENT FOR BESS TECHNOLOGY

Batteries store electrical energy in chemical form. The range of electrochemical technologies include:
a) batteries with solid electrolyte, as Lithium-ion battery;
b) batteries with liquid electrolyte, as Na–S battery, Lead–Acid (PbA) battery, nickel - cadmium (Ni–Cd) battery or other types of liquid metal battery

A Li-ion battery cell is a sealed article, with a typical voltage of 3.6V DC per cell and it is an article with no intended release of its substances.

The preferred technology for the Battery Energy Storage System ("BESS") is **Lithium-ion battery cells**, which will be pre-assembled at the supplier factory and installed in the containers prior to delivery to the site. Lithium-ion cells technology offers the highest energy density (compared to the other cell technologies), does not suffer from memory effect and is low maintenance. Typical lithium-ion cells used for BESS hold a solid rechargeable electrolyte (the energy accumulator), therefore they don't hold any liquid or gas. The main benefit of solid ceramic electrolytes is that there is no risk of leaks, which is a serious safety issue for batteries with liquid electrolytes.

A BESS does not emit any gas to the atmosphere during construction and/or normal operation. The containers of the batteries are equipped with a firefighting system conceived to effectively detect smoke and high temperatures and automatically activate the extinguishers to prevent fire. Furthermore, the external metallic surface of the cells is conceived to resist to fire.

The preferred technology is therefore Lithium-ion battery cells with solid rechargeable electrolyte.

Under normal conditions of use, the battery does not release its content as it is sealed. In case of accidental release of the batteries components, please refer to the emergency response guidance below)
In case of large electrical serial assembly, modules and full battery may offer high Voltage hazard (> 36 Volts).
The presence of the High Voltage warning sign requires dedicated intervention equipment:

The primary focus is on the fire hazards associated with Li-ion batteries and potential for a condition known as "thermal runaway". Thermal runaway results from **internal shorts** inside a battery cell which occur due to a variety of reasons and **can ultimately lead to the battery catching fire**.

The following measures will reduce the fire risk to an acceptable level:

- The Battery Management System should include an approved device to preclude, detect, and control thermal runaway.
- The BESS should incorporate appropriately certified inverters/inverter systems and must comply with all safety standards which address risk assessment and controls.
- The BESS must be located well away from critical buildings or equipment and located in a non-combustible enclosure. Sufficient clearance should be maintained around the installation to provide for fire service access.
- Clear signage should be visible to include warnings of a possible fire hazard.
- An approved, monitored, automatic smoke detection system must be installed at the BESS. A fire suppression system must be designed and installed at the BESS.
- Regular inspections must be undertaken to ensure battery systems do not overheat.
- Portable fire extinguishers must be provided at the BESS.
- Installations should have emergency power disconnects to ensure manual, remote, and local disconnect is possible adjacent to the BESS.
- BESS must have an online condition monitoring system. System should be fitted with temperature monitoring incorporating a high temperature alarm for battery room and container. Temperatures should be monitored at a constantly attended location.

Additional general recommendations to prevent and manage potential contamination of water resources in the BESS area:

- Compilation and adherence to a procedure for the safe handling of battery cells;
- Lithium-ion batteries must have battery management systems (containment, automatic alarms and shut-off systems) to monitor and protect cells from overcharging or damaging conditions, such as temperature extremes;
- Compilation of an Emergency Response Plan for implementation in the event of a spill of electrolyte from the batteries;
- Provision of spill kits on-site for clean-up of spills and leaks;
- Immediate clean-up of spills and disposal of contaminated absorbents and materials or soil at a licensed hazardous waste disposal facility;
- Recording and reporting of all significant electrolyte spills so that appropriate clean-up measures can be implemented. A copy of these records must be made available to authorities on request throughout the project lifecycle;
- Frequent and appropriate disposal of any hazardous waste to prevent pollution of soil and groundwater;
- On-site battery maintenance should only be undertaken on impermeable surfaces with secondary containment measures. Any resulting hazardous substances must be disposed of appropriately; and

- Provision of emergency and safety signage on-site, and demarcation of areas which may pose a safety risk (hazardous substances). Emergency numbers for local police, fire department, Eskom and Local Municipality must be placed in clearly visible areas.
- Dispose of waste batteries in accordance with national legislation. When collected waste batteries must undergo recycling to comply with national regulations. Batteries should not be disposed of into the environment.

Safe handling advice

- When handling the batteries (cells), use personal protective equipment (non-conductive gloves), specifically to avoid short-circuits between the battery poles.

Technical measures/precautions

- Follow the instructions reported in the user's manual prepared by the manufacturer.
- Do not short (+) or (-) battery terminals with conductors, do not allow battery terminals to contact each other.
- Do not use unadapted charging systems.
- Do not reverse the polarity,
- Do not mix different types of batteries or mix new and old ones together e.g. in a power pack,
- Do not open the battery system or modules,
- Do not use the unit without its electronic management system,
- Do not submit to static electricity risks to avoid damages to the protecting electronic circuit,
- Do not submit to excessive mechanical stress,
- Do not expose the battery to water or humidity (avoid water condensation),
- Do not expose to heat, or throw into fire. Such unsuitable use can cause leakage or evacuate through a safety valve gaseous electrolyte fume that may cause fire,
- Immediately disconnect the batteries and isolate in a safe place if, during operation, they emit an unusual smell, develop heat, change shape/geometry, or behave abnormally. Contact the manufacturer if any of these problems are observed.

Storage

- Keep in a dry, cool and well-ventilated place, check recommended storage temperature specified in the user's manual as per the manufacturer, (e.g. 35°C),
- Keep away from heat sources (max 60°C) and sources of ignition. Protect from direct exposure to sunlight.
- Keep away from water and condensation.
- Store in closed container and packaging, in such a way to prevent short circuits and damages during storage or transportation. Packaging qualified for transport is generally suitable for storage.

- In case of risk of thermal runaway during storage or transport, it is necessary to use strong outer packaging as recommended by the UN Special Provision 376 in order to restrict the potential ejection of cells constituents and battery parts during fire.
- In case of mixed storage of goods and articles, organize separate storage area for lithium-ion batteries. *E.g.* by maintaining a distance of 2.5 meters between the Lithium-ion batteries storage area and other goods.
- Store in limited quantities and in isolated area under external surveillance, unless specifically designed storage building (detectors and/or sprinklers protection systems).
- Infra-Red cameras may be used to detect any excessive temperature raise in stored quantities, *e.g.* > 85°C

The potential hazard offered by damaged lithium batteries *in absence of fire* is mainly the release of an electrolyte containing a corrosive salt. Measures should also be taken to protect operators from inhalation of volatile organic substances. Reaction of the electrolyte with water/humidity may generate hydrofluoric acid and irritate the eyes, nose, throat and skin.

Personal precautions

- Use personal protective equipment.
- Avoid contact with skin and eyes.
- Ventilate the area.
- Position yourself in the wind direction.

Environmental precautions

- Eliminate all possible sources of heat or ignition.
- Prevent further leakage or spillage if safe to do so (use absorbent cloth or other inert absorbent non-conductive mineral such as sand, sodium bicarbonate, alumina or vermiculite).
- Dry clothes can also be used as a absorbent material in absence of fire.
- Do not allow material to contaminate ground water system.

The information below refers to exposure to the substances contained in the battery.

Call for emergency services. Consider and decide about the adapted intervention plan (ACTIVE/PASSIVE Response, proximity or distance response).

In active response, (with Fire)

- Large flow of water can be used to **reduce the temperature of the batteries** and stop the fire reactions inside the batteries. Specific care should be taken for large and compact batteries, where cooling may require more time.
- Foam and specialized products can be used to reduce access of oxygen to the fire and stop flames, but are generally less efficient than cooling down the batteries. Be aware of the risk of re-ignition until the batteries have been cooled down below 100°C.

In passive response, control extension of fire to neighbours materials and buildings

- Use abundant flow of water to cool down cells or batteries adjacent to the ones that have caught fire (maintain low temperature) whatever the type of batteries at the origin of the fire.
- The first responders need to be informed that in case of fire there is a risk of ejection of projectiles from the battery.

Suitable extinguishing media

- Water (see below)
- Specialized products, liquid foam, carbon dioxide (CO2), sand, vermiculite.

Warning/risk for the use of water

- If water is used on active batteries, caution should be taken to avoid the electrical hazard that may be present (in case of high voltage battery, > 36 Volts).
- The decision to use large amount of water is depending on the local circumstances (water retentions systems, environment risks.).
- In case of fire including large Lithium metal or Lithium metal polymer batteries, the use of water may increase the energy /heat release.
- In such case, stop the use of water and allow the energetic fire of the battery for 15 minutes.
- Protect or cool with water the surroundings to avoid propagation of the fire.

Treatment of Wastewater

- Confine the effluent or the contaminated material and collect it further as hazardous waste (water) for appropriate treatment.
- Pick up and transfer to properly labelled containers.
- Dispose of in accordance with local waste management legislation and emissions regulations.

9.7 METHODOLOGY USED IN RANKING THE NATURE, SIGNIFICANCE, CONSEQUENCES, EXTENT, DURATION AND PROBABILITY OF POTENTIAL IMPACTS AND RISKS ASSOCIATED WITH ALTERNATIVES

To assess the impacts on the environment, the process will be divided into two main phases namely the Construction phase and the Operational phase. The activities, products and services present in these two phases will be studied to identify and predict all possible impacts. In any process of identifying and recognising impacts, one must recognise that the determination of impact significance is inherently an anthropocentric concept. Duinker and Beanlands, (1986) in DEAT 2002. Thompson (1988), (1990) in DEAT 2002 stated that the significance of an impact is an expression of the cost or value of an impact to society.

However, the tendency is always towards a system of quantifying the significance of the impacts so that it is a true representation of the existing situation on site. This will be done by using where possible, legal and scientific standards which are applicable

The significance of the aspects/impacts of the process will be rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrixes use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

The consequence matrix uses parameters like severity, duration and extent of impact as well as compliance to standards. Values of 1-5 are assigned to the parameters that are added and averaged to determine overall consequence. The same process is followed with the likelihood that consists of two parameters namely frequency and probability. The overall consequence and the overall likelihood are then multiplied to give values ranging from 1 to 25. These values as shown in the following table are then used to rank the significance.
It must be said however that in the end, a subjective judging of an impact can still be done, but the reasons for doing so must be qualified.

Significance ratings (Plomp 2004)

Significance	Low -	Low-Medium -	Medium -	Medium-High -	High -
Overall Consequence X Overall Likelihood	1-4.9	5-9.9	10-14.9	15-19.9	20-25

Significance	Low +	Low-Medium +	Medium +	Medium-High +	High +
Overall Consequence X Overall Likelihood	1-4.9	5-9.9	10-14.9	15-19.9	20-25

Description of the parameters used in the matrixes

Severity:

Low	Low cost/high potential to mitigate. Impacts easily reversible, non-harmful insignificant change/deterioration or disturbance to natural environments.
Low-medium	Low cost to mitigate Small/ potentially harmful Moderate change/deterioration or disturbance to natural environment.
Medium	Substantial cost to mitigate. Potential to mitigate and potential to reverse impact. Harmful Significant change/ deterioration or disturbance to natural environment
Medium-high	High cost to mitigate. Possible to mitigate Great/Very Harmful Very significant change/deterioration or disturbance to natural environment.
High	Prohibitive cost to mitigate. Little or no mechanism to mitigate. Irreversible. Extremely Harmful Disastrous change/deterioration or disturbance to natural environment.

Duration:

Low	Up to one month
Low-medium	One month to three months
Medium	Three months to one year
Medium-high	One to ten years
High	Beyond ten years

Extent:

Low	Within footprint area
Low-medium	Whole of site
Medium	Adjacent properties
Medium-high	Communities around site area
High	Ditsobotla Municipality area

Frequency:

Low	Once/more a year or once/more during operation
Low-medium	Once/more in 6 months
Medium	Once/more a month
Medium-high	Once/more a week
High	Daily

Probability:

Low	Almost never/almost impossible
Low-medium	Very seldom/highly unlikely
Medium	Infrequent/unlikely/seldom
Medium-high	Often/Regularly/Likely/Possible
High	Daily/Highly likely/definitely

Compliance:

Low	Best Practise
Low-medium	Compliance
Medium	Non-compliance/conformance to policies etc. - internal
Medium-high	Non-compliance/conformance to legislation etc. - external
High	Directive, prosecution of closure or potential for non-renewal of licences or rights

9.8 ASSESSMENT CRITERIA

The terms of reference for the EIA study will include criteria for the description and assessment of environmental impacts. These criteria are drawn from the *Integrated Environmental Management Guidelines Series, Guideline 5*: *Assessment of Alternatives and Impacts*, published by the DFFE in terms of the Environmental Impact Assessment.

These criteria include:

Table 14. Impact Assessment Criteria

Nature of impact This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. The description should include what is being affected, and how.		
Extent The physical and spatial size of the impact.	**Site**	The impact could affect the whole, or a measurable portion of the above-mentioned properties.
	Local	The impacted area extends only as far as the activity, e.g. a footprint.
	Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
Duration The lifetime of the impact; this is measured in the context of the lifetime of the proposed base.	**Short term**	The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than any of the phases.
	Medium term	The impact will last up to the end of the phases, where after it will be entirely negated.
	Long term	The impact 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.
	Permanent	The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Intensity	**Low**	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
	Medium	The affected environment is altered, but function and process continue, albeit in a modified way.
	High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Probability This describes likelihood of impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time.	**Improbable**	The possibility of the impact occurring is very low, due either to the circumstances, design or experience.
	Probable	There is a possibility that the impact will occur to the extent that provisions must be made therefore.
	Highly probable	It is most likely that the impacts will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity.
	Definite	The impact will take place regardless of any prevention plans, and there can only be relied on mitigation actions or contingency plans to contain the effect.
Determination of 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.	**No significance**	The impact is not substantial and does not require any mitigation action.
	Low	The impact is of little importance but may require limited mitigation.
	Medium	The impact is of importance and therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
	High	The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

9.9 CUMULATIVE IMPACTS

Cumulative impacts were assessed in relation to other renewable energy developments in the proximity from the proposed Lichtenburg Solar Park. Mitigation measures are proposed, in order to mitigate the impacts that may result from the establishment of the Lichtenburg Solar Park to an acceptable level.

The general approach to this study has been guided by the principles of Integrated Environmental Management (IEM). In accordance with the IEM Guidelines issued by the previously called DEA, an open approach, which encourages accountable decision-making, was adopted.

The principles of the IEM require:

- informed decision-making.
- accountability for information on which decisions are made;
- a broad interpretation of the term "environment";
- an open participatory approach in the planning of proposals.
- consultation with I&APs;
- due consideration of alternatives;
- an attempt to mitigate negative impacts and enhance positive impacts of proposals;
- an attempt to ensure social costs of developments are outweighed by social benefits;
- democratic regard for individual rights and obligations;
- compliance with these principles during all stages of the planning, implementation and decommissioning of proposals; and
- the opportunity for public and specialist input in the decision-making process.

The combined, incremental effects of human activity, referred to as cumulative impacts, may pose a serious threat to the environment. While they may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of important resources.

Method and process used for assessment of cumulative impacts at Lichtenburg Solar Park:

Step 1: Initiate the process by identifying possible cumulative impacts of the proposed project on the surrounding environment at the project location. The possible cumulative impacts can be selected based on information related to current or anticipated future conditions, the occurrence of protected species or habitats, and the presence or anticipated presence of other human activities that would (adversely) affect the same environment. Once the possible cumulative impacts have been selected, they should be subject to each of the following five steps.

Identified possible cumulative impacts:

- Visual impact
- Loss of Agricultural Resources
- Loss of Biodiversity
- Increase in Traffic Impact
- Increased positive Socio-economic Impact

Step 2: Identify other past, present, and reasonably foreseeable future actions within the space and time boundaries that have been, are, or could contribute to cumulative effects in the area. Based on this knowledge, identify appropriate spatial and temporal study boundaries.

- Visual impact
- Loss of Agricultural Resources
- Loss of Biodiversity
- Increase in Traffic Impact
- Increased positive Socio-economic Impact

Step 3: For the identified cumulative impacts, assemble appropriate information and describe and assess the historical to current conditions of the area. The historical information should coincide with the selected past temporal boundary (or historical reference point). Further, and depending upon the availability of information, any identified trends in the conditions of the area should be identified.

Step 4: Numerous types of tools could be used to establish either descriptive or quantitative connections. Predictions related to future cumulative impacts, resulting from multiple actions may be problematic due to the absence of detailed information; however, identification of changes in the environment and their indicators can be useful. Finally, emphasis should be given to the anticipated cumulative impacts.

Step 5: Assess the significance of the cumulative effects. Such significance determinations should begin with the incremental effects (the direct and indirect effects) of the proposed development on the directly surrounding areas. The concept of environmental sustainability (including social and economic sustainability) could be considered both in relation to incremental effects and cumulative effects.

Step 6: For negative incremental impacts from the proposed project and for which the cumulative effects are significant, develop appropriate action-specific mitigation measures for such impacts. Further, if significant cumulative effects are anticipated consideration should be given to multi-stakeholder collaboration to develop joint cumulative effects management measures, either locally or regionally, or both. Finally, multi-stakeholder collaboration in follow-up activities can be both cost-efficient and an aid in local and regional planning.

Environmental Assessment Framework and Cumulative Effects Assessment (A tool to be used as referred to in Step 4):

1. Scoping.
2. Analysis.
3. Mitigation.
4. Significance.
5. Follow-up.

9.10 POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY

- The positive impact that the development will have on the environment and community is a Socio-economic impact. It will create *temporary jobs* during the construction phase.
- The PV Solar Park will help to reduce the pressure on the Eskom grid in the country with far less negative impacts on the natural resources of the area than in the case of power generation using other sources like coal, gas, water and nuclear energy.
- During the operational phase the PV Solar Park might have a negative impact on the *visual environment)* in the area of the PV Facility.

9.11 POSSIBLE MITIGATION MEASURES AND RESIDUAL RISK

- To mitigate the visual impact, screening of the facility can be done with vegetation.
- Panels must be washed with methods that can save on water use. Employees living/sleeping at the site must be educated on the saving of water.
- Water used for domestic purposes (sanitation) must be treated before release to comply with standards for effluent release.
- The storm water must be managed so that erosion is not caused on the site.
- Domestic waste must be removed from the site on a regular basis not to impact on the soils or water bodies in the area.

9.12 CONCLUDING STATEMENT INDICATING THE PREFERRED ALTERNATIVE AND LOCATION OF ACTIVITY

The preferred alternative was selected based on the fact that it will have the smallest impact on the environment having been located on the least sensitive area, avoiding potentially sensitive heritage sites and will be in line with Eskom requirements.

The negative impacts including the *cumulative* impacts can be effectively mitigated and managed to reduce the negative effect the impacts would have on the environment, so that the development with the positive effect of the socio-economic impact and the positive impact of renewable energy generation will have a positive effect on the environment that would offset the negative effects of the development.

10 DESCRIPTION OF THE PROPOSED PROCESS TO IDENTIFY AND RANK ENVIRONMENTAL IMPACTS THAT THE ACTIVITY, ASSOCIATED STRUCTURES AND INFRASTRUCTURE WILL IMPOSE ON THE PREFERRED LOCATION THROUGH THE LIFE OF THE ACITIVITY

An environmental impact is defined as a change in the environment, be it the physical/chemical, biological, cultural and or socio-economic environment. Any impact can be related to certain aspects of human activities in this environment and this impact can be either positive or negative. It could also affect the environment directly or indirectly and the effect of it can be cumulative.

10.1 DESCRIPTION OF ENVIRONMENTAL ISSUES AND RISKS IDENTIFIED DURING THE EIA PROCESS

The potential aspects to assess during the EIA process may include:

- Soils & agricultural potential;
- Avifauna aspects;
- Vegetation aspects;
- Heritage resources aspects;
- Noise aspects;
- Socio-economic aspects; and
- Visual aspects.

The **decommissioning activities** of the PV plant mainly include the removal of the project infrastructure and the restoring of the site *status quo ante*.

The identification of impacts will be based on:

- legal and administrative requirements;
- the nature of the proposed activity;
- the nature of the receiving environment;
- specialist studies; and
- issues raised during the public participation process.

Potential impacts may include:

- Impacts on soils & agricultural potential;
- Impacts on avifauna;
- Impacts on vegetation;
- Impacts on heritage resources;
- Social impacts; and
- Visual impacts.

The following possible Key environmental impacts were identified:

ENVIRONMENTAL ISSUES	POSSIBLE CAUSE	POTENTIAL IMPACTS
Air Pollution and noise		
Dust	• Construction machines and vehicles during clearing and construction of the PV Solar facility	• Health problems • Air pollution • Public nuisance
Emissions	• During operation of construction equipment. • Spraying of insecticides and herbicides during operation • During veld fires	
Noise	• Construction noise	
Water quality		
Pollution of water sources Pollution by *E.coli*	• Spillages of fuel & oil from vehicles during construction • Pollution from solid general waste if not removed regularly • By using insecticides and herbicides • Poorly planned and managed sanitation facilities	• Pollution of surface and groundwater • Health risk • Lower water quality • Soil degradation
Water quantity		
Impact on amount of water resources available Over-use of water	• Use of water during construction of the PV solar facility • Water use during operation	• Loss of a scarce resource • Increased pressure on water supply sources
Land/Soil degradation		
Soil contamination and degradation	• Spillages of oil, chemicals from machinery and vehicles during construction • Site clearing during construction • Use of Pesticides and Fertilizers • Loss of Agricultural potential of soil • Erosion if storm water is not correctly managed	• Pollution of soil • Soil degradation • Loss of topsoil • Effect soil characteristics, ecology & groundwater • Loss of topsoil
Biodiversity		
Decline in fauna and flora diversity	• Clearing of site for construction • Loss of habitat due to construction of panels • Power lines to Eskom power lines	• Loss of biodiversity • Loss of habitat • Negative impact on biodiversity • Negative impact on rare / endangered/ endemic species and habitats • Animal deaths.

ENVIRONMENTAL ISSUES	POSSIBLE CAUSE	POTENTIAL IMPACTS
Cultural/Heritage		
Possible loss of heritage sites Damage to palaeontological resources	• Damage during construction or operation	• Possible loss of cultural heritage sites paleo-resources
Visual impact		
Change in the visual characteristics of the site	• Clearing of vegetation for panels • Presence of Solar facility	• Visual intrusion
Socio-economic impacts		
Job creation	• Increase in temporary and permanent work opportunities during the construction and operational phases. • Loss of land available for farming without fair compensation.	• Socio- economic benefit

10.2 IMPACTS & MITIGATION MEASURES OF CONSTRUCTION PHASE

All the possible impacts that can be predicted in both the construction and operational (limited) phase of the PV Solar Park are addressed. Specific mitigation measures are proposed, and the significance of these impacts is described with and without the mitigation measures. Furthermore, considering that all or part of the construction infrastructure may be owned and/or operated by Eskom, the mitigation measures described in the following paragraphs and in particular in the attached Environmental Management Programme (EMPr) can be the responsibility of Eskom or of the developer.

10.2.1 ATMOSPHERIC POLLUTION AND NOISE

Listed Activity:

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Construction Phase

During this phase there will be a concentration of earthmoving equipment and construction vehicles that will level the area, clear vegetation for construction purposes and in the process, will create dust and exhaust smoke that will impact on air quality. There will also be more noise created by the vehicles during this phase. Burning of waste and fires at construction sites may also create smoke.

Operational Phase

The increased traffic volumes and people will lead to increased levels of air pollution and noise. Smoke from burning of waste can cause air pollution.

Project Phase	Impact Atmospheric Pollution and noise								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and Vegetation clearance	Air pollution Dust	Low-medium	Medium-high	Medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Air pollution: Smoke	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low	Low-Medium
	Vehicle movement	Air pollution: Dust	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low	Low-Medium
	Vehicle movement	Noise pollution	Low-medium	Medium-high	Low-medium	Medium-high	Medium	Low	Low-Medium
	Burning of cleared vegetation, solid waste & veld fires	Air pollution by excessive smoke	Low-medium	Medium-high	Medium	Low-Medium	Low	Low	Low-Medium
	Cooking fires of workers	Air pollution: Smoke	Low	Medium-high	Low-medium	Low-Medium	Medium	Low	Low-Medium
Operation	Vehicle movement	Noise pollution	Low	High	Low-medium	Low-Medium	Low-Medium	Low	Low-Medium
	Fire places and veldt fires	Air pollution caused by smoke	Low-medium	High	Low-medium	Low-medium	Low-medium	Low	Low-Medium
	Burning of vegetation refuse and solid waste	Air pollution by excessive smoke	Low-medium	High	Low-medium	Low-Medium	Low-medium	Low	Low-Medium
Cumulative impacts	Dust formation & Noise during construction phase	Increase in release of dust and increase in noise levels	Low	High	Low-medium	Medium	Medium	Low	Low-Medium

Mitigation measures – Construction Phase

- Vehicles must be well serviced to prevent excessive smoke and noise.
- Speed of construction vehicles should be kept as low as possible(20-30km/h) to reduce generation of dust and noise.
- Construction areas must be dampened/treated to prevent excessive dust formation. This would lower the cumulative impact of dust formation
- The clearing of the site should be done in phases as the construction progresses.
- Construction should only take place during the hours between sunrise and sunset on weekdays and Saturdays.
- Contractors must comply with Provincial noise regulations. The construction machinery must be fitted with noise mufflers and be maintained properly. This would lower the cumulative impact of noise during this phase.

- Solid waste generated by the construction teams may not be burned on site or the surrounding areas but be regularly removed to the municipal waste disposal site.
- Fire belts must be made around the development according to the regulations of the Veld and Forest Fire Act.
- The cleared vegetation must be stock-piled and should be removed at regular intervals and be distributed amongst the local community members. The cleared vegetation may not be burned on site.
- Cooking at construction site may not be done on open fires. Gas stoves can be used.

Mitigation Measures – Operational Phase

- Speed of vehicles on roads should be controlled *e.g.* speed bumps and speed restrictions (20-30km/h), with visible signage.
- All roads should preferably be sealed to eliminate dust formation caused by strong winds and vehicle movement.
- Solid waste may not be burned on the project area.
- Fire belts around the development must be made according to the regulations of the Veld and Forest Fire Act.
- Vegetation underneath the panels must be kept short
- Vegetation refuse should be composted if possible and re-used.

During operation the cumulative impact of dust generation and noise is low. Comparatively, agricultural activities would create more dust and noise.

10.2.2 LAND AND SOILS

Listed Activity:

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Construction Phase

During construction, the vehicles used have the potential to spill diesel and lubricants that can pollute the soil. The storage of solid waste before it can be disposed of has the potential to pollute the soil and becomes a nuisance.
The cumulative impact of possible soil erosion is increased with the development.

Operational Phase

Solid waste can be a nuisance and has the potential to pollute the soil if not managed correctly. The use of conventional fertilizers, herbicides and insecticides should be limited as far as possible. Wastewater from activities can pollute the soil.

Project Phase	Impact: Land and soils								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spilling of oil/diesel by construction machines or tanks	Contaminate soil	Low-medium	Medium-high	Low	Medium	Medium-high	Low	Low-Medium
	Spilling of chemicals/se-wage	Contaminate soil	Low-medium	Medium-high	Low	Medium	Medium-high	Low	Low-Medium
	Solid waste disposal	Soil pollution & nuisance	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low	Low-Medium
	Storm water over roads and cleared areas	Erosion	Low-medium	Medium-high	Low-medium	Low-Medium	Medium-high	Low	Low-Medium
	Trenches for electric cables and water and sewerage pipes	Erosion	Low-Medium	Medium-high	Low	Low-Medium	Medium	Low	Low-Medium
	Moving of equipment over soils	Compaction of soils	Low-Medium	Medium-high	Low-Medium	High	Medium-high	Low-Medium	Medium
	Using land for solar facility	Sterilising of Agricultural land	Low	Medium-high	Low-Medium	High	Medium	Low	Low-Medium
Operation	Solid waste	Soil pollution + nuisance	Low	High	Low-Medium	Low-Medium	Medium	Low	Low-Medium
	Storm water from paved areas and solar panels	Erosion	Low-medium	High	Low-medium	Low-Medium	Medium	Low	Low-Medium
	Storm water over roads and cleared areas	Erosion	Medium	Medium-high	Low-medium	Low-Medium	Medium-high	Low	Low-Medium
	Use of fertilizers, insecticides and herbicides	Pollution	Low-Medium	High	Medium	Low-Medium	Medium	Low	Low-Medium
Cumulative impacts	Increased potential for negative impacts on soil resource	Increased potential for erosion and soil pollution	Medium	High	Low-medium	Low-Medium	Medium-high	Low	Medium
	Increased potential for negative impacts on soil resource	Sterilise agricultural land	Low	High	Low-Medium	High	High	Low	Medium

Mitigation measures – Construction Phase

- Clearance of vegetation should be restricted to the footprint area and access road.
- Construction activities should be restricted to the proposed development footprint.
- Construction vehicles must be well maintained and serviced to minimise leaks and spills.
- Spill trays must be used during refuelling of vehicles on site.
- Temporary diesel storage must not exceed 30 000 litres at construction camp. Diesel tanks and other harmful chemicals and oils must be within a bunded area and water from this bunding must be channelled through an oil/water separator.

- Solid waste and building rubble must be kept in containers and disposed of regularly at the municipal dumping site.
- Trenches that are dug for the supply of services and electrical cables must be filled up and compacted well and slightly higher than the areas around it.
- The clearing of the site should be done in phases as the construction progresses.
- Slopes produced by removing soil must be kept to a minimum to reduce the chances of erosion damage to the area.
- Soil should be handled when dry, to reduce compaction risk.
- During construction, sensitive soils with high risk of compaction (e.g. clayey soils) must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts
- Institute a storm water management plan including temporary and permanent erosion control plans.
- Minimise bare areas-revegetate as soon as possible to prevent soil erosion and mitigate the cumulative effect of erosion.

Mitigation measures – Operational Phase

- Solid waste must be kept in adequate waste bins and removed on a weekly basis to the waste disposal site.
- The surface drainage system should be monitored after storms and storm water damage should be repaired. The maintenance of the roads must be kept up to standard to prevent and reduce the incident of erosion next to the roads.
- The use of eco-friendly products e.g., organic compost, herbicides and insecticides should be promoted and should only be used according to the specifications
- Revegetate bare areas to minimise soil erosion and mitigate this cumulative impact in the area.

10.2.3 GROUNDWATER AND SURFACE WATER POLLUTION

Listed Activity:

Listing Notice 1, Activity 12 (xii) (c) - The development of infrastructure or structures with a physical footprint of 100m² or more; within 32m of a watercourse, measured from the edge of a watercourse.

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.
Listing Notice 2, Activity 15 - The clearance of an area of 20 ha or more of indigenous vegetation.

Construction Phase

- Lack of sanitation facilities could result in ground water pollution and associated health risks.
- Construction vehicles will be refuelled at the construction camp.
- Spillage of fuel and lubricants from construction vehicles could occur. Storm water contamination by solid waste could lead to groundwater and surface water pollution.
- Soil cover and vegetation is removed and storm water in the area can cause erosion. Road construction will increase a possibility of erosion, because of increased storm water run-off.

Operational Phase

- Pollution by sanitation system leakages, solid waste and erosion may lead to water pollution. Storm water run-off over open areas can cause erosion.
- Storm water flowing over polluted areas could lead to water pollution.
- Fertilizers, pesticides and herbicides used at the project during operation can create pollution if not handled and applied correctly.
- Cumulative impacts could be a concentration of water runoff during rain events when the panels are in a relatively flat position.

Project Phase	Impact: Groundwater and Surface water Pollution								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spillage of fuel and lubricants from construction vehicles	Groundwater Pollution	Low-Medium	Medium-high	Medium	Medium	Medium-high	Low	Medium
	Spillage of fuel and fuel tanks	Groundwater Pollution	Low-Medium	Medium-high	Medium	Medium	Medium-high	Low	Medium
	Clearing of vegetation	Erosion & siltation of streams	Medium	Medium-high	Medium	Low-Medium	Medium-high	Low-medium	Medium
	Solid waste disposal water resources	Pollution of freshwater resources	Low	Medium-high	Medium	Medium	Medium	Low-medium	Low-Medium
	Sanitation seepage from chemical toilets and/or from the temporary sanitation system	Groundwater Pollution	Medium	Medium-high	Low-medium	Low-medium	Medium	Low	Low-Medium
Operation	Spillage of fuel and lubricants from vehicles	Groundwater Pollution	Low-Medium	High	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Solid waste disposal-freshwater resources	Groundwater Pollution	Low	High	Low-medium	Low-Medium	Low-medium	Low	Low-Medium
	Leakage from the permanent Sanitation system	Groundwater Pollution	Medium-high	High	Low-Medium	Low	Low-Medium	Low-medium	Medium
	Use of fertilizers, insecticides and herbicides	Pollution of streams & rivers	Low-Medium	High	Medium	Low	Medium	Low	Low-Medium
	Storm water runoff	Erosion & siltation of streams	Low-medium	High	Medium	Low-medium	Medium-high	Low	Medium
	Cooling water for fire/thermal runaway at BESS	Pollution of surface and Groundwater	High	Low	Low	Low	Medium-high	Low	Medium
Cumulative impacts	Water pollution and increased water run-off	Increased potential for water pollution and increased water run-off	Low-Medium	High	Medium	Low-Medium	Medium	Low	Low-Medium

Mitigation measures – Construction Phase

The following precautionary measures are recommended to prevent any surface or groundwater pollution:

- Clearance of vegetation and construction activities must be restricted to the footprint area and access road.
- Cleared areas should be rehabilitated by reintroducing a grass layer to limit soil erosion.
- Berms to limit water flow over cleared areas, to limit erosion.
- Drip pans should be used during re-fuelling and servicing of construction vehicles. Used parts like filters should be contained and disposed of at a site licensed for dumping of these waste products.
- Oil traps must be installed in the vehicle wash bay to prevent pollution. Oil traps must be serviced on a regular basis by an approved service agent.
- Diesel storage must not exceed 30 000 litres at construction camps. Diesel tanks and other harmful chemicals and oils must be within a bunded area. Any water from out of this bunding must flow through an oil/water skimmer.
- Vehicle maintenance yard and construction storage area should have bund walls and lined with impermeable material to prevent ground and surface water pollution.
- Chemical/temporary sanitation facilities at construction site must be regularly serviced to ensure no spills or leaks to surface and/or groundwater.
- Solid waste must be kept in adequate waste bins. Building/construction waste and various waste products must be removed regularly to the municipal landfill site.

Mitigation measures – Operational Phase

- Solid waste must be kept in adequate waste bins and removed on a weekly basis to the municipal landfill site.
- The use of eco-friendly products *e.g.* Organic Compost, herbicides and insecticides should be promoted.
- A permanent closed, sewage treatment system to treat effluent to the required standards of the DWS must be installed at the solar facility.
- The permanent sanitation system should be regularly inspected to ensure that no spills or leaks from sanitation system to groundwater take place.
- Storm water run-off from the site must be managed in such a way that erosion of the area is not caused by water accumulated on the site.
- Water used for extinguishing a fire or thermal runaway at BESS must be contained and disposed of or treated at a Hazardous waste facility.

10.2.4 WATER USE / WATER QUANTITY

Listed Activity:

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Construction phase

During this phase, water consumption will be the highest because it will be utilized for gravel roads and building construction. The water needed for the construction activities will be provided from the Municipal water pipelines.

Operational phase

Water use will be limited except for short periods when the PV modules are cleaned. The water needed for the operational phase will be provided from the Municipal water pipelines.

Project Phase	Impact: Water use								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction process	Water consumption	Low-medium	Low	Medium	Medium	High	Low-Medium	Medium
	Dampening of cleared areas to prevent dust pollution	Water consumption	Low-medium	Low	Medium	Medium	High	Low-Medium	Medium
Operational	Water use & cleaning of panels	Water consumption	Low	High	Medium-High	Low-medium	High	Low-Medium	Medium
Cumulative impacts	Water use	Increased pressure on local water resources	Medium	High	Medium-high	Low-Medium	Medium	Low-Medium	Medium

Mitigation measures – Construction Phase

- Water should be used sparingly, and it should be ensured that no water is wasted.
- Roads must be treated with chemicals to lower water use for dust suppression.
- Washing of construction vehicles should be limited to once or twice a month and must be done with high-pressure sprayers to reduce water consumption.
- Water use in construction must be managed in such a way that there is no wastage of water as a resource

Mitigation measures – Operational Phase

- Cleaning of panels should be done only when necessary to limit the impact on water resources.
- Roads should be treated with chemicals to lower the use of water for dust suppression.
- Washing of vehicles should be limited to once a week and must be done with high-pressure sprayers to reduce water consumption.
- Care must be taken not to waste any water. In the offices, half-flush systems in the toilets as well as water aerators in all taps must be installed to reduce water consumption.
- Workers must be educated on the value of water and how to use it sparingly.

10.2.5 ARCHAEOLOGICAL, CULTURAL AND SOCIAL FEATURES

Listed Activity:

Listing Notice 1, Activity 11 (i) - 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.

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.
Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Construction phase

The clearing of the site may have a negative impact on the archaeological features of the site. Care must be taken in the excavations and moving of soil to observe any other archaeological, previously undetected, features of importance, which must be left and reported to the archaeological consultant for comments and actions.

Operational phase

The operational phase will not have any negative impact on the archaeological features of the site if the recommendations of the Heritage Impact Assessment and Palaeontological assessment are strictly adhered to.

Project Phase	Impact: Loss of Archaeological, Cultural and social features								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earth moving and soil clearance	Destroy archaeological evidence and heritage.	Low-medium	Medium-high	Low	Low	Low-medium	Low	Medium
	Earth moving and soil clearance	Impact of Palaeontological resources	Medium	Medium	Low	Low	Low	Low	Medium
Operation	Operational activities of development	Destroy archaeological evidence and heritage and graves	Low-medium	High	Low	Low	Low-medium	Low	Low
Cumulative impacts	Activities on site during construction and operation	Increase in potential to unearth archaeological evidence and graves	Low-medium	High	Low	Low	Low-medium	Low	Medium

Mitigation measures – Construction and Operational Phase

- The heritage sites identified and indicated on the site lay out plan must be cordoned off and be preserved. There must be no development in these areas and there should be no access to this site, either.
- It is not feasible for a specialist monitor to be continuously present at the earth works and therefore, personnel must be involved in mitigation by watching for fossils.
- Follow the steps outlined in the Chance Find Protocol in the Paleontological report if any fossilised remains are found.
- The ECO must contact the palaeontologist or archaeologist contracted to be on standby in the case of finds. The latter will liaise with SAHRA on the nature of the find and suitable consequent actions, must be taken, such as an immediate site inspection and/or application for a palaeontological collection permit.
- Care must be taken during the construction process that anything else of archaeological value that is unearthed must be recorded. Please refer to the Archaeological Impact Assessment (Annexure G). The archaeologist or SAHRA must be notified whenever anything of importance is discovered.

10.2.6 IMPACT OF THE DEVELOPMENT ON ECOLOGY (FAUNA & FLORA) OF THE AREA

Listed Activity:

Listing Notice 1, Activity 11 (i) - 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.

Listing Notice 1, Activity 12 (xii) (c) - The development of infrastructure or structures with a physical footprint of 100m² or more; within 32m of a watercourse, measured from the edge of a watercourse.

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Planning and construction phase

The removal of natural vegetation and destruction of habitat will have a negative effect on the biodiversity and is part of a cumulative effect together with other renewable energy development projects in the area. It is though partly on agricultural lands areas which has a LOW -MODERATE agricultural potential. The specific mitigation measures included in the Ecological and Avifauna Impact Assessment (Annexures C, D & E) should be adhered to.

Operational phase

Operation of the development can have a negative impact on biodiversity if not managed correctly. Exotic invasive plant species can have negative impacts on indigenous vegetation.

Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and vegetation clearance at construction site	Loss of indigenous plant species & disturbance to sensitive habitat	Medium	High	Low-Medium	Medium	High	Low-medium	Medium
	Vegetation clearance and movement of people on the site at different development areas	The spreading of exotic invasive plant species Loss of indigenous plant species	Medium	Medium	Medium	Medium	Medium-High	Low	Medium
	Topsoil & subsoil stripping, exposure of soils to wind and rain during construction causing erosion and sedimentation	Soil erosion	High	Medium	Low-Medium	Medium	High	Medium	Medium-high
	Soil sterilisation-Land not available for agriculture	Less land available for agricultural development	Medium	High	Low	High	High	Medium	Medium-high
	Exposure of soils to rainfall and wind during construction	Erosion and Dust pollution	Medium	Medium	Low-medium	Medium	High	Low	Medium
	Heavy machinery and vehicle movement on site	Spillages of harmful substances	Medium	High	Medium	Medium	Medium-High	Low	Medium

Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
	Heavy machinery and vehicle movement on site	Soil compaction	Low	High	Low	High	High	Low-medium	Medium
	Littering (e.g. cans and plastics) along access road and at construction site	Public nuisance and loss/death of indigenous fauna	Low-Medium	Medium	Medium	Medium-High	Medium	Low	Medium
	Control of animals on site Heavy machinery and vehicle movement on site	Disturbance to and loss of indigenous fauna to the area	Medium	Medium	Medium	Medium	Medium-High	Low	Medium
	The occurrence of veldt fires	The loss of indigenous fauna and flora	Medium-High	Medium	Medium	Low-Medium	Medium-High	Low	Medium
Operation	Rehabilitation of cleared areas	Spreading of exotic invasive plant species Loss of habitat and indigenous flora	Medium	High	Medium	Low-Medium	Medium	Low-Medium	Medium
	The occurrence of veldt fires	The loss of indigenous fauna and flora	Medium-High	Medium	Medium	Low-Medium	Medium-High	Low	Medium
	Disposal and storage of solid waste and littering	The death/loss of indigenous fauna e.g. raptors, mammals and reptiles	Medium-High	High	Medium-High	Medium-High	Medium	Low	Low-Medium
	The control of pests and vermin	Killing and poisoning of fauna feeding on poisoned vermin / pest	Low-Medium	High	Low-Medium	Medium-High	Medium	Low	Medium
	The feeding of fauna e.g. birds &small mammals	Disturbance to bio-diversity and natural movement of animals through the site The death/loss of indigenous fauna	Low-Medium	High	Low-Medium	Medium-High	Low-Medium	Low	Medium
	Catching of wild animals e.g. reptiles, bids and small mammals as pets	Disturbance to bio-diversity and decline in indigenous faunal numbers	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	Birds colliding with power line and panels	Electrocution of birds	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	The erection of fences and the construction of roads with a kerb	The fragmentation of available habitat and the restriction of movement of small mammals, reptiles and amphibians	Low-Medium	High	Low-Medium	High	Medium	Low	Medium
Cumulative Impacts	Increased potential negative impacts on ecology of the area	Increase in natural vegetation to be removed.	Medium-High	High	Medium	Medium	Medium	Low	Medium
	Loss of agricultural land	Less land available for agricultural development	Medium	High	Low	High	High	Medium	Medium-high

Mitigation measures – Construction Phase

- Clearance of vegetation should be restricted to footprint area and access roads.
- Construction activities should be restricted to the proposed development footprint.
  -Do not use more agricultural cropland areas than planned for.
- Construction must preferably take place after the bird breeding season.
- Speed limit of 30 km/h must be enforced on the roads.

- No unnecessary clearance of vegetation must be allowed. Where possible, natural vegetation must be retained to limit this impact.
- Bird nests found in this phase must be reported to the ECO.
- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project. Small animals like sheep could also graze beneath the panels.
- Herbicides used to control invasive plant species must be chosen in consultation with an ecologist. Some agents are detrimental to surrounding fauna and flora.
- Poisons for control of problem animals must be avoided. The wrong use thereof can have disastrous consequences for raptors occurring in the area. Use of poisons for control of 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 all applications.
- Construct a single fence if possible.
- Report all incidences of collisions of birds with panels.
- Speed limit of 30km/h on site to avoid collisions with night birds and twilight active birds.
- Panels should be tilted towards the vertical when not in use.
- All probable and high-risk perching surfaces should be fitted with bird guards and perch guards as deterrents.
- Where possible the installation of artificial bird space perches or platforms at a safe distance from energised components.
- Only power lines structures that are considered safe for birds should be erected to avoid the electrocution of birds (particularly large raptors) perching or attempting to perch.
- Overhead transmission cables should be marked with bird diverters to make the lines as visible as possible to collision-susceptible species.
- No Fires should be allowed within the construction camp and extra care should be taken to prevent veldt fires of occurring.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).
- Cleared areas should be rehabilitated by reintroducing a vegetation layer as soon as possible to limit the occurrence of erosion.
- The cleared vegetation may not be burned on site. The cleared vegetation should be stockpiled and distributed to the local communities.
- Solid waste must be kept in adequate animal proof waste bins at the construction camp and construction sites. Building rubble and various wastes should be removed on a regular basis to the closest available municipal landfill site.
- Regular clean-up programs must be in place along the access road and throughout the premises to limit the impact of littering caused by construction activities.

- The stockpiled topsoil and construction material should be managed in such a way that the material is not transported by wind or rain. This can be done by restricting the height of the stockpiles, sandbagging and avoiding steep slopes.
- No animals may be killed, captured or hunted on site by construction workers. Do not feed any wild animals on site.
- Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and trapped and/or injured. This can be prevented by constant excavating and backfilling of trenches during construction process.
- Cumulative impacts on the ecology of the area can be significant. However, with the mitigation measures in place, the potential is low for significant negative impacts on the ecology of the area.
- The EMPr will have to be adhered to during the construction phase and regular monitoring should be done to ensure that there is sound environmental practice at the Lichtenburg Solar Park.

Mitigation measures – Operational Phase

- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project to limit open soils which is prone to erosion.
- An ecologist must be consulted on the use of herbicides/eco-friendly products to control exotic tree and shrub species.
- Poisons for the control of problem animals must be avoided since the wrong use can have disastrous consequences for the raptors in the area. The use of poisons for the control of rats, mice or 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 all applications.
- High-risk sections of the power line from the Solar Park should be marked with a suitable anti-collision marking device on the earth wire as per Eskom guidelines.
- Report all incidences of collisions of birds with panels.
- Speed limit of 30 km/h on site to avoid collisions with night birds and twilight active birds.
- Panels should be tilted towards the vertical when not in use
- Regular monitoring of powerlines should be undertaken to detect bird carcasses, to enable identification of areas of high impact to be marked with bird diverters.
- Solid waste must be kept in animal proof waste bins.
- A monitoring program should be compiled and implemented to ensure that the sewage treatment system is functioning properly and that the treated wastewater conforms to the standards set by the Department of Water Affairs.
- Staff members should be discouraged from attempting to catch or kill any wildlife for use as food, pets or to feed any wild animals.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998.

- Lighting at night should be kept to a minimum. Use downward directed lights.
- The impact on the flying invertebrates will be minimized through the use of sodium vapour (yellow) lights as outside lighting.
- The use of eco-friendly products e.g. Organic Compost and/or Effective Microorganisms (EM), which reduces the frequency of application of conventional fertilizers, herbicides and insecticides, should be promoted.

10.2.7 VISUAL IMPACTS

Listed Activity:

Listing Notice 1, Activity 11 (i) - 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.

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Construction phase

The natural aesthetic character of the site will change. However, the local communities will be informed of the development stages and impacts on them during the construction phase.

Operational phase

Buildings and the solar modules have a visual impact to surrounding properties and to the sensitive viewers around the project site and lights at night can be a nuisance.

Project Phase	Impact: Visual disturbance								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Buildings& panels	Visual	Low	High	Low-Medium	High	High	Medium	Medium
	Lights	Visual	Low	Medium	Low-medium	Medium-high	High	Medium	Medium
Operation	Buildings and panels	Visual	Medium	High	Medium	High	High	Medium	Medium
	Lights	Nuisance	Low	High	Low-medium	Medium-High	High	Medium	Medium
	Electrical lines	Visual	Low	High	Low	High	High	Medium	Medium
Cumulative Impacts	Increased visibility of another solar park in the area	Increased visual intrusion and nuisance	Medium-High	Medium	Medium	Low-Medium	High	Medium	Medium

Mitigation measures – Construction and Operational Phase

- Only the footprint and a small "construction buffer zone" around proposed components are exposed and natural occurring vegetation, should be retained.
- Revegetate bare areas with vegetation occurring naturally in the area .
- Ensuring that cut to fill areas (if any) are revegetated with indigenous species that relate to the original vegetation types, as soon as possible after the establishment of terraces/roads/parking areas.
- Structures should be painted to mimic the hues of existing vegetation, specifically warehouses, workshops and control buildings associated with substation.
- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond immediate surrounds of project site and aimed away from public roads and areas around the site. Minimise lighting to security lighting.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.
- Ensure perimeter fence is see through and that its colour blends with environment.
- Minimise number of light fixtures to the bare minimum and connecting these lights to motion sensors in order to limit light pollution.
- A video-surveillance system using infrared or microwave video cameras, which do not need a switched-on lighting system, is recommended.
- Construction camp areas should either be screened or positioned in areas where they would be less visible from human settlements and main roads.
- Cumulative impacts will be medium-low as other solar facilities in the 30 km radius have not been constructed so far.

10.2.8 SAFETY, HEALTH, SECURITY AND FIRE HAZARDS

Listed Activity:

Listing Notice 1, Activity 11 (i) - 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.

Listing Notice 1, Activity 12 (xii) (c) - The development of infrastructure or structures with a physical footprint of 100m² or more; within 32m of a watercourse, measured from the edge of a watercourse.

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 ha or more indigenous vegetation.

Construction phase

Construction activities such as excavating of foundations and trenches, movement of construction vehicles, the use of equipment and the congregation of workers and staff on site increases the risk of injury. The activities of construction personnel on site may contribute to an increase in the level of crime in the area and may also contribute to an increased fire risk.

Operational phase

Fires and criminal activities pose a significant risk during the operation of the development.

Project phase	Impact: Safety, , Health, Security and Fire hazards								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction activities – excavation of foundations, trenches etc.	Loss or injury to human life	Medium	Medium-high	Low	High	Medium	Low	Medium
	Health issues	Risk of increase in Covid 19 infections	Medium-high	Medium-high	Low	High	Medium	Low	Medium
	Security	Crime	Medium	Medium-high	Low-medium	Medium	Medium-high	Low - medium	Medium
	Fire hazards	Loss of human life and construction equipment etc.	High	Medium-high	Medium	Low	Low-Medium	Low-Medium	Medium
Operation	Security	Crime	Medium	High	Medium	Medium	Medium-high	Low-Medium	Medium
	Fire hazards at panels and BESS	Loss of human life, biodiversity, buildings, infrastructure etc.	High	High	Medium -High	Low	Low	Low	Medium
Cumulative Impacts	Higher number of people in the area increases safety risks	Potential for an increase in criminal activity	High	Medium	Medium -High	Low	Low	Low	Medium

Mitigation measures – Construction and Operational Phase

- The Contractor shall conform to the Occupational Health and Safety act (Act 85 of 1993) and regulations applicable. The Act requires the designation of a Health and Safety representative when more than 20 employees are employed.
- Mitigation measures is required in the form of equipment design and on-site security. To ensure the panels and equipment are well protected.
- Contractors must ensure that employees are vaccinated against Covid 19 and that all the health protocols of the time are followed.
- Open trenches or excavations must be marked with danger tape or safety netting and must be filled and compacted as soon as possible.
- Number of construction workers to stay on site should be limited to the minimum.
- Proper access control (I.D. cards) should be enforced to ensure that no authorised persons enter the site.
- No solid waste or vegetation may be burnt on the premises or surrounding areas.

- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to prepare and maintain firebreaks).
- Fire extinguishers and fire-fighting equipment must be available.
- Fire extinguishers and fire-fighting equipment must be available especially to be able to combat fires at the BESS.
- Personal protective equipment must be issued to personnel working at the BESS to protect them against, shock, inhalation of vapours and contact with chemical substances especially when there is a fire hazard.
- A security fence should be constructed along the boundary of the development.
- Cumulative impacts of impact can be successfully mitigated if managed properly.

10.2.9 TRAFFIC AND ROAD SAFETY

Listed Activity:

Listing Notice 1, Activity 11 (i) - 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.

Listing Notice 1, Activity 12 (xii) (c) - The development of infrastructure or structures with a physical footprint of 100m^2 or more; within 32m of a watercourse, measured from the edge of a watercourse.

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Construction phase

Trip generation during the construction phase will be much higher than during operational phase. It is assumed that construction will take 15 months. If 10% of the trips occur in the peak hour approximately 4 trucks will arrive and leave in the peak hour. Private vehicles will also be used by construction supervision and admin staff to access the site as well as the construction workers who will arrive via bus or taxi.

Operational phase

During the operational phase, the facility will be managed by staff supported by admin and maintenance personnel. These are low traffic volumes (<20vph) that will have an insignificant impact on the road network surrounding the proposed development. Dedicated turn lanes will improve road safety at the intersection.

Project phase	Impact: Traffic and Road Safety								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction & Operation	Construction activities – Increase in traffic	High volume of vehicle trips with specific reference to heavy vehicles could contribute to a higher rate of deterioration of road surfaces	Low	High	Low-Medium	Low	Low	Low	Low
	Road Safety Issues	Spacing of intersections impacts significantly on the operation, level of service and capacity of a roadway.	Low	High	Low-medium	Low	Low	Low	Low
	Road Safety Issues Sight distance	The vertical and horizontal road alignment could influence road safety in terms of intersection and stopping sight distances.	Medium	High	Low-Medium	High	High	Low	Medium-High
	Road Safety Issues Speed Limits	High vehicle speeds at access intersections could result in vehicle accidents which could be caused by several factors.	Low	High	Low-Medium	Low	Low	Low	Low
	Road Safety Issues Intersections	Without dedicated turning lanes, especially dedicated right-turn lanes, could result in vehicle accidents for instance vehicles waiting to turn right and a vehicle that is travelling straight crashing into the back of the vehicle waiting to turn.	Medium	High	Low-Medium	High	High	Low	Medium-High
	Road Safety Issues Pedestrians	The conflict between vehicles and pedestrians could lead to fatalities.	Low	High	Low-Medium	Low	Low	Low	Low
	Road Safety Issues Public transport	Loading and off-loading of visitors and workers by public transport/ arranged shuttle transport could lead to the unsafe manoeuvres by vehicles at intersections it could lead to fatal vehicle accidents.	Medium	High	Low-Medium	High	High	Low	Medium-High
Cumulative Impacts	Construction activities – Increase in traffic	High volume of vehicle trips with specific reference to heavy vehicles could contribute to a higher rate of deterioration of road surfaces	Low	High	Low-Medium	Low	Low	Low	Low
	Road safety issues	Accidents, and injuries or fatalities to road users	Medium	High	Low-Medium	High	High	Low	Medium-High

Mitigation measures – Construction and Operational Phase

- Intersection sight distances for access intersection need to be complied with. This should be determined as part of the detail design phase.
- Monitor vehicle volumes along Road R505. Once volumes become high with high vehicle speeds, gaps in traffic flow could become problematic for vehicles to enter traffic flow from proposed development.
- Provide 60 metres dedicated right turn lane on the southern approach of Road R505.
- Provide 60 metres acceleration taper towards the south of Road 505.
- Provide reflective road studs as part of the proposed intersection to improve visibility of the intersection geometry when it is dark.
- Provide a dedicated loading and off-loading area on site and ensure that contractors make use of it and not stop within Road R505, road reserve at the proposed access intersection to load and off-load workers.

10.2.10 SOCIO-ECONOMIC IMPACT

Listed Activity:

Listing Notice 1, Activity 11 (i) - 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.

Listing Notice 1, Activity 12 (xii) (c) - The development of infrastructure or structures with a physical footprint of 100m² or more; within 32m of a watercourse, measured from the edge of a watercourse.

Listing Notice 1, Activity 24 (ii) - The development of a road with a reserve wider than 13,5m or where no reserve exists where the road is wider than 8m.

Listing Notice 2, Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more.

Listing Notice 2, Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

Construction phase

The construction and operation phases of the development will have a positive impact on the socio-economic environment of beneficiary communities through employment opportunities and training and skills development.

Operational phase

A number of permanent jobs will be created for local people during this phase.
The local communities were identified for the purpose of entering into a partnership for the project, as required by the rules of the REIPP Procurement programme.

Project phase	Impact: Job creation								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Job creation	Job Creation(100 jobs)	High +	High +	Medium-high +	High +	High +	N/A	High +
	Solar energy value chain	Boost local business for solar components		Medium-High	High	High	High+	N/A	High+
	Crime	Possible rise in crime levels in area	Low	Medium High	Low	Low	Low	Low	Low
Operation	Local Community /businesses development	Local Community development	High +	High +	high +	High +	High +	N/A	High +
	Contribute power to the National Grid	Reduce load shedding periods		High	High		High	N/A	High +
	Investment of R2bn.	Foreign investment in country and province		High	Medium		High	N/A	High +
	CO2 Emissions	Reduce CO2 Emissions opposed to coal power stations		High	High	High	High	N/A	High +
	Permanent Job Creation	40 new permanent jobs created		High	Low	High	High	N/A	High +
	Vandalism	Possible theft of solar panels	Low	High	Low	Low	Low	Low	Low
Cumulative impacts	Increased potential for job creation.	Increased potential for local Community development	High +	High +	high +	High +	High +	N/A	High +

Mitigation measures – Construction and Operational Phase

- During the construction and operational phases, jobs must be created for unemployed local people and skills must be transferred to them.
- Security: Mitigation measures will be required in the form of equipment design and on-site security for protection of assets.
- Where viable, the work must be executed in a labour-intensive manner to create as many jobs as possible.
- The cumulative impact of this impact can just be positive. As one of the larger provinces in South Africa, the North-West Province is definitely in need of more job opportunities.

10.3 ASSESSMENT OF POTENTIALLY SIGNIFICANT IMPACTS AND RISKS

Impacts with a rating of Medium-high or High are impacts which are regarded as potentially significant, rated without any mitigation measures. In this impact assessment, the following impacts were regarded as potentially significant impacts:

i. Soil erosion
ii. Loss of Agricultural land.
iii. Job creation (Positive impact)
iv. Road safety

These impacts will now briefly be discussed.

10.3.1 CUMULATIVE IMPACTS

i. The area does not have a good cover of vegetation and erosion by wind and water can lead to cumulative losses of soil in the area.
ii. The cropland loss is adding to the other losses in the area, although in this region it is still small losses.
iii. Job creation will be cumulative once the project is implemented.
iv. This is cumulative as the impact is added to the current road safety.

10.3.2 NATURE OF IMPACT

i. Impact could result in a **loss** of a natural resource (soils).
ii. Impact could result in a loss of natural resources.
iii. Local communities will **benefit** in various ways, including job opportunities, skills development and other projects.
iv. The impact could result in loss of life or injuries.

10.3.3 EXTENT AND DURATION OF IMPACT

i. The extent is local, and the duration is permanent.
ii. The extent is local. The impact can be reversed.
iii. Extent is local and regional, and the duration is for the life of the development.
iv. The impact is local and for the duration of the development.

10.3.4 PROBABILITY OF OCCURRENCE

i. The probability is possible.
ii. The probability is high.
iii. The probability of occurrence is high.
iv. The probability is high.

10.3.5 DEGREE TO WHICH IMPACT CAN BE REVERSED

i. Impact is non-reversible.
ii. The impacts is reversible.
iii. Impact should not be reversed although reversible.
iv. The impact is reversible should the development be decommissioned.

10.3.6 DEGREE TO WHICH IMPACT CAN CAUSE IRREPLACEABLE LOSS OF RESOURCE

i. If this impact is not mitigated, it can lead to an irreplaceable loss of a resource.
ii. The impact will not lead to an irreplaceable loss of resources.
iii. This impact will not lead to an irreplaceable loss of any resources.
iv. The impact could lead to loss of life.

10.3.7 DEGREE TO WHICH IMPACT CAN BE MITIGATED

i. Successful mitigation is possible.
ii. Mitigation is possible.
iii. This impact will not lead to an irreplaceable loss of any resources.
iv. The impact can be mitigated successfully.

11 SUMMARY AND FINDINGS AND RECOMMENDATIONS OF SPECIALIST REPORTS AND HOW FINDINGS HAVE BEEN INCLUDED IN THE ASSESSMENT REPORT

The main issues identified as a result of the specialist studies include the following:

- Visual impacts
- Soil erosion (Wind and water)
- Impact on biodiversity (bird collisions)
- Agricultural land availability
- Archaeological sites
- Paleontological finds
- Impacts on traffic safety

SPECIALIST	FINDINGS	RECOMMENDATIONS
Landscape Architect: Visual Impacts	The existing visual condition of the landscape that may be affected by the proposed Lichtenburg PV Solar Power Project has been described. The study area's scenic quality has been rated *low* to *moderate* within the context of the sub-region, and the project site is in a moderate rated landscape type. Sensitive viewing areas and landscape types have been identified and mapped, indicating potential sensitivity to the Project, mainly for residences of farmsteads to the immediate west and north of the site and visitors of the Lichtenburg Vakansie Oord Game Park east of the Project site. Impacts on views are the highest when viewers are sensitive to change in the landscape, and the view is focused on and dominated by the change. The Project's visual impact will cause changes in the landscape that are noticeable to people viewing the landscape from the R505 provincial road and adjacent farmsteads. People living in the residential areas in the far south of the study area will not be affected by the Project.	1. With the preparation of the land within the full extent of the Project site onto which activities will take place, the minimum amount of existing vegetation and topsoil should be removed. 2. Specifications with regards to the placement of construction camps (if required), as well as a site plan of the construction camp, indicating waste areas, storage areas and placement of ablution facilities, should be included in the EMPr. These areas should either be screened or positioned in areas where they would be less visible from nearby farmsteads and the R505 main road. 3. Construction activities should be limited to between 08:00 and 17:00 or in conjunction with the ECO. 4. Adopt responsible construction practices that strictly contain the construction/establishment activities to demarcated areas. 5. Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas. 6. Existing vegetation should be retained where possible. 7. All cut and fill slopes (if any) and areas affected by construction work should be progressively top soiled and re-vegetated as soon as possible. 8. Disturbed soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation. 9. Lighting should be kept to a minimum. 10. Lighting should be carefully directed and only used where necessary. 11. Paint all structures (structural support for the arrays) with colours that reflect and compliment the colours of the surrounding landscape.
Soil Specialist: Soil Potential assessment	The shallow and often sandy nature of the soil makes the potential to cultivate crops under arable conditions basically impossible, especially considering that the shallow soils would not allow ploughing of the topsoils. Therefore, the site should be classified as not suitable for arable agriculture due to its physical characteristics. Although the soil texture and depth are suitable for arable agriculture, the climatic conditions render the soils unsuitable for arable agriculture.	1. Unnecessary soil compaction must be avoided. 2. Minimize the area of land disturbance 3. Erosion and dust control measures to be implemented. 4. Storm water management plan to be implemented. 5. Exposed, bare soil must be minimized. 6. Topsoil to be conserved and maintained where possible. 7. Store chemicals on impervious area. 8. Soil pollution to be avoided and prevented. 9. Treat spillages according to correct procedures. 10. Stockpile topsoil separately from subsoil. 11. Restrict development to specific areas.

SPECIALIST	FINDINGS	RECOMMENDATIONS
Archaeologist: Archaeology and graves	The Project area is a Greenfields site mainly used for game farming and breeding without any major focal points like pans or hills that would have attracted human occupation in antiquity. A previous HIA conducted for the study area (Hutten 2012) recorded no heritage resources of significance and the current assessment similarly recorded no sites of significance although isolated MSA flakes were noted. These were found occasionally scattered through the study area in direct contrast to high density MSA scatters to the west of the Project area. Examination of historical topographic maps and aerial images also showed no structures or stone walled settlements in the study area and the impact footprint is considered to be of low archaeological potential.	1. Regular examination of trenches and excavations in order to detect and preserve previously undocumented heritage receptors – in particular human graves. 2. Regular examination of trenches and excavations in this area in order to avoid the destruction of previously undetected burials or heritage remains. 3. Implementation of a chance find procedure for the project.
Paleontological specialist	According to the SAHRA Paleontological sensitivity map the study area is of very high paleontological significance, and this was addressed in an independent study by Bamford (2022). The study conclude that it is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the dolomites of the Oaktree and Monte Christo Formation (Malmani Subgroup, Chuniespoort Group, Pretoria Supergroup) and may be disturbed.	1. It's extremely unlikely that the proposed development will have any effect on palaeontological heritage. However, if fossils are exposed in possible Quaternary alluvial deposits, which are not indicated on the geological map, it will create a unique opportunity to explore the area for fossils. 2. It is thus recommended that, in the unlikely event that fossils are exposed as a result of the PV development, a qualified palaeontologist must be contacted to assess the exposure for fossils before further activities takes place so that the necessary rescue operations are implemented following the attached Chance Find Protocol (CFP). 3. Depending on the nature of fossils discovered this could entail excavation and removal to a registered palaeontological museum collection.
Avifauna specialist: Impact on biodiversity (bird collisions)	Assessment of impacts identified by Birdlife SA as significant for PV developments has revealed that majority of the impacts fall within the "high" risk category due to the proximity to a supplementary feeding site. The risk should reduce to "moderate" risk levels after mitigation and provided recommended bird conservation protocols are employed. The majority of threats to birds and wildlife posed by PV facilities are poorly understood, Lichtenburg Solar Park, have the potential to provide an ideal platform for monitoring the impact of Solar Parks on avifauna communities in mixed grasslands.	1. Put bird diverters on power lines. 2. Put bird guards and perch guards as deterrents on infrastructure. 3. The installation of artificial bird space perches or platforms at a safe distance from energised components 4. Use bird-friendly powerline designs. 5. Keep activities inside development area. 6. Strict environmental control measures to be implemented. 7. Bird nests found must be reported 8. Limit speeds on site. 9. Keep lighting to the minimum at night 10. Report collisions with panels 11. Train ECO and workforce well

SPECIALIST	FINDINGS	RECOMMENDATIONS
	Institutions could possibly conduct valuable and relevant research into threats posed to avifauna by PV facilities and how to avoid these threats, especially to high priority species. The findings of this report and the relevant impact assessment concluded that the development of the proposed Lichtenburg Solar Park would have a medium impact on the bird communities and will cause a slight impact on the ecological process of the overall bird community. The biggest concern is the threat the power lines within this area hold to threatened species such as the three vulture species present at the site. Therefore, careful considerations need to be taken in terms of the proposed power line as the impact can be catastrophic. Still, the issuing authority must consider all prescribed mitigation measures and recommendations.	
Ecological specialist	All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. The proposed development activities will modify the vegetation and faunal habitats of the development site to a certain extent varying according to the habitats on the site, although in general the vegetation on site where the development footprint is planned are classified as pristine to slightly degraded. **Most sensitive sections**: It is evident from the distribution of biodiversity, presence of threatened species and sites of scientific interest, that the proposed development has the potential for negative impact on the flora and faunal of the study area. This is particularly true of the sensitive vegetation associated with the natural grasslands in the project area. **Most sensitive habitats**: Many threatened species are grassland specialists, linked to these habitats either for breeding, feeding or shelter. Major impacts on sensitive grassland areas should be avoided wherever possible during construction. Where unavoidable impacts will occur on grassland, strict mitigation measures and legislation should be implemented (DAFF licence for eradication of protected trees etc.).	1. A permit must be obtained from authorities before any protected plants are eradicated. These plants should form part of a rescue and relocation programme should the development activities impact on populations. 2. Natural vegetation removal should be kept to a minimum during any future construction activities and only vegetation on the footprint areas should be removed. The unnecessary impact on the surrounding vegetation types should be avoided as far as possible. Considering the footprint area to form part of an area that is degraded, the impact on the vegetation of the larger area would be low. 3. A detailed species rescue, relocation and re-introduction plan should be developed and implemented by a qualified person before any excavations or disturbance commence. 4. Mitigation measures and monitoring should be implemented should the development be approved. 5. Where trenches pose a safety risk, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. 6. No animals may be poached during the construction of the solar park. 7. Do not feed any wild animals on site; 8. Waste bins and foodstuffs should be made scavenger proof; 9. Roads in the area should be designed without pavements to allow for the movement of small mammals;

SPECIALIST	FINDINGS	RECOMMENDATIONS
	Monitoring of threatened species: Many endemic and protected species have been recorded in region. The EMP for the development should highlight the conservation status of these species and note that steps must be undertaken in conjunction with conservation authorities to protect or translocate any populations encountered during project actions. Ecological monitoring is recommended for the construction phase of the development considering the presence of protected trees and potential red data fauna on areas surrounding the site.	10. Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum during the construction and operational phases.
Stormwater management plan	A storm water management plan is to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the implementing of appropriate design measures that will allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	**CONSTRUCTION** 1. It is recommended that access and service roads, as well as storm water systems are constructed at the commencement of the construction phase to ensure that suitable storm water management measures are in place at the least additional cost. 2. Permanent routes must be used for construction purposes. In order to preserve the natural state of the surface and vegetation as far as practically possible, off-road driving should be restricted to the absolute essential. 3. Temporary or permanent soil stockpiles should be placed in such a way to minimize the impact on surface flow. 4. Site clearing should be limited to the essential. 5. Construction waste, including possible broken and damaged panels must be collected and stored safely for disposal in accordance with the relevant waste regulations, protocols, and product specifications. Care must be taken not to leave any waste on site that can lead to future contamination of the site or the downstream area. 6. Training with regards to stormwater management of construction personnel must be undertaken as part of their induction. **OPERATION** 7. Training regarding stormwater management of site personnel must be undertaken as part of induction. Training must be undertaken periodically. 8. Regular inspections of all storm water infrastructure are required. 9. Any item that may be found to be out of order, for instance accumulation of settled sand in a trench, or erosion, must be addressed and corrected without delay to keep the storm water system in a good and fully functional condition.

SPECIALIST	FINDINGS	RECOMMENDATIONS
		10. Specific attention must be given to inspection during and after any rain and/or flood event to kerb any damage that may occur. 11. If any structures have to be erected in the 1:100-year flood line zones, Water Use Licencing is compulsory (in terms of section 21(c)) of the National Water Act. **WAY FORWARD** 12. Prior to the detailed design stage and implementation, a physical survey needs to be conducted. Based on this: 13. The flood line determination should be reviewed. 14. The site drainage needs to be designed on this elevation basis, with the full consideration of: o Final infrastructural layout on site. The final infrastructural layout and drainage design mutually impact on each other and will therefore be an iterative process. o Final flood line alignment that may require either or both of limited infrastructural re-arrangement of ground work to mitigate any exceedance of infrastructural development in 1:100-year flood zones.
Traffic Impact study	Vehicle access to and from the proposed development is proposed to be gained from and to Road R505. The exact location of the access point had not yet been determined at the time of conducting this study and therefore further investigations were conducted to provide information on tentative access points to be used as input as part of the detailed design phase during which the relevant access point will be finalised. Two feasible points central to the locality of the proposed development were identified by means of a visual inspection during a site visit and deemed suitable for access points from and to Road R505 based on intersection stopping and decision sight distance requirements guided by the *Committee of Transport Official TMH 16 Volume 2 South African Traffic Impact and Site Traffic Assessment Standards and Requirements Guideline version 1.01 February 2014*, as well as from a road geometry perspective.	1. The identified tentative proposed access points from and to the proposed development from Road R505 are both existing intersections with sufficient intersection spacing between existing intersections and a low volume of vehicles along Road R505. Therefore, there are no mitigating measures required without the proposed development. 2. As part of the construction phase, a dedicated loading and off-loading area on site should be established where workers can safely be loaded and off-loaded by public transport or arranged transport. 3. From a road safety perspective, dust suppression on the proposed access road (relevant for gaining access via Point A or Point B) should be conducted when required to avoid road visibility issues caused by dust from vehicles making use of the road, which could lead to vehicle accidents. 4. Approval for the position and geometric layout for the proposed access intersection from and to Road R505 should be obtained from the South African National Roads Agency SOC Ltd.

12 ENVIRONMENTAL IMPACT STATEMENT

12.1 SUMMARY KEY FINDINGS OF THE EIA

It can be concluded that there will be environmental impacts including cumulative impacts as a result of the proposed development of the Lichtenburg PV Solar facility. However, all the impacts can be mitigated to an extent which would make the development possible. Most of the impacts can be avoided and potential impacted areas such as the heritage site will be demarcated as no-go areas, therefore limiting the possible negative environmental impacts to an acceptable level.

13 FINAL PROPOSED ALTERNATIVES RESPONDING TO IMPACT MANAGEMENT MEASURES, AVOIDANCE AND MITIGATION MEASURES IDENTIFIED IN ASSESSMENT

The preferred alternative was identified after all possible negative impacts were mapped and demarcated as no-go zones.

In order to minimize negative environmental impacts, there are areas that are not available for future developments of any kind. In order to mitigate for most of the negative impacts, avoidance seemed to be the best option in terms of the main issues, including:

- Visual impacts
- Bird collisions - limit occurrences
- Impacts on soils
- Impacts on biodiversity
- Degradation of archaeological sites/paleontology.
- Impacts on Traffic

14 ASPECTS WHICH WERE CONDITIONAL TO THE FINDINGS OF THE ASSESSMENT BY THE EAP OR SPECIALISTS WHICH ARE TO BE INCLUDED AS CONDITIONS OF AUTHORISATION

- Archaeological discoveries:
  - If anything of archaeological/paleontological significance is found, the archaeologist as well as SAHRA must be notified immediately.
  - Strict monitoring should be done during the construction phase.
- Eskom-approved; bird friendly devices must be attached to the powerlines to avoid bird collisions.
- Protected plants on site – permit applications and avoidance

  An ecologist should be appointed to assist with permit applications as well as assistance on site before construction commences during ground truthing.

- Inform staff of the need to watch for potential fossil occurrences.
- Inform staff of the procedures to be followed in the event of fossil occurrences.
- Monitor for presence of fossils, especially fossil bones
- Obtain permit from SAHRA for collection of fossil finds.
- Traffic Impact:
    - Transport for workers should be by means of arranged or contracted transport. A dedicated public transport loading and off-loading area should be provided on site where workers and visitors can be loaded and off-loaded within a safe and dedicated area.
    - With the provision of the required sight distances at the final proposed access intersection position which would be determined (mitigated) as part of the detail design phase, the impact from a road safety perspective in terms of intersection sight distances would have a low significance.
    - With the provision of a dedicated loading and off-loading area on site as part of the Proposed Development and ensuring that contractors make use of the dedicated area, the impact from a road safety perspective in terms of loading and off-loading workers would have a low significance.

15 ASSUMPTIONS UNCERTAINTIES AND GAPS IN KNOWLEDGE

Uncertainties could be limited by implementing a thorough ground-truthing process before construction commences.

It is assumed that the developer will always act responsibly towards the environment during the development and will comply with the conditions of the environmental authorization at all times.

16 REASONED OPINION FOR AUTHORISATION OF ACTIVITY AND CONDITIONS IN RESPECT OF THAT AUTHORISATION

It is the opinion of the EAP that the environmental impacts associated with the proposed development were identified and that the mitigation measures proposed to mitigate the negative impacts will decrease the environmental negative impacts to acceptable levels.

The EAP respectfully request comments from the competent authority to enable AGES to compile the Final Impact Assessment Report.

Conditions to be included in the environmental authorization

- Appoint an environmental control officer on site during construction of the development to monitor the development for compliance with the conditions of the environmental authorization.
- Permits are needed if any protected plants will be affected by the development and consequently have to be removed from the construction area.
- Invader plants must be controlled though removal and destroying the plants.
- Only vegetation inside the development footprint may be removed for construction.
- Preconstruction walk-through of the approved development footprint must be undertaken to ensure that sensitive habitats and species are avoided where possible.
- Permits from relevant authorities must be obtained for the removal or disturbance of any TOPs, Red Data listed or Nationally protected species.
- Rehabilitation Plan that guides planting and seeding with indigenous perennial shrubs and succulents from the local area must be developed to avoid erosion and alien invasion.
- Sensitive habitats in close proximity to the development footprint must be avoided or demarcated as No-Go area (i.e. SWSA)
- Suitable bird repelling structures and bird diverters must be considered to avoid collision of birds with the PV facility.
- Pre and Post construction monitoring must be conducted under the guidance of an avifaunal specialist to assess collision rates.
- The development must stay clear of the identified heritage features found on the proposed site.
- Should any previously undetected surface of subsurface paleontological or archaeological material be exposed during development activities, all activities should be suspended, and the archaeological specialist should be notified immediately.

17 PERIOD OF ENVIRONMENTAL AUTHORISATION AND DATE OF CONCLUSION OF ACTIVITY

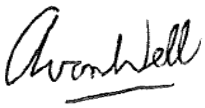
The period for which the EA is required is for 10 Years from date of Environmental Authorisation.

The date on which the activity will be concluded is in 10 years from date of Environmental Authorisation. Post construction monitoring must be done for at least 2 Years after finalisation of construction.

18 UNDERTAKING UNDER OATH OR AFFIRMATION BY THE EAP

I, Anton von Well, appointed EAP for the proposed Lichtenburg Solar Park application for Environmental Authorization, hereby confirm:

- Correctness of the information provided in this report
- All comments and inputs and responses from stakeholders and I&APs are included here.
- All inputs and recommendations from the specialist reports where relevant, are included.
- Any information provided by the EAP to interested and affected parties and responses by the EAP to comments or inputs made by Interested and affected parties will form part of the Final report.



Signed …….. Date…13/10/2022…….

19 BIBLIOGRAPHY

DEAT, 1998. *Guideline Document on the EIA Regulations implementation of sections 21, 22 and 26 of the Environment Act*, Government Printer, Pretoria.

DEAT, 1999. *Environmental Management Framework for the Northern Province.* University of Pretoria, Pretoria.

DEAT, 2002. *Impact Significance, Integrated Environmental Management, Information Series 5, Department of Environmental Affairs and Tourism,* Pretoria

DUINKER, P.N. and BEANLANDS, G.E. 1986. The significance of environmental impacts: and exploration of the concept, *Journal of Environmental Management*, 10(1), 1-10 in DEAT, (2002).

MIDGLEY, D.C. PITMAN, W.V. AND MIDDLETON, B.J.1994. First Edition *Surface water resources of South Africa 1990, Volume VI, Drainage regions U,V,W,X, Eastern Escarpment.* WRC Report No 298/6.2/94, Pretoria.

PLOMP, H. 2004. *A process for assessing and evaluating environmental management risk and significance in a gold mining company.* Conference Papers-Annual National Conference of the International Association for Impact Assessment: South African Affiliate.

THOMPSON, M.A., 1988. *The determination of Impact Significance in Environmental Impact Assessment*, Unpublished Master of Science Thesis, University of Manchester, UK.

THOMPSON, M.A., 1990. Determining Impact significance in EIA: a review of 24 methodologies, *Journal of Environmental Management*, 30, 235-250.