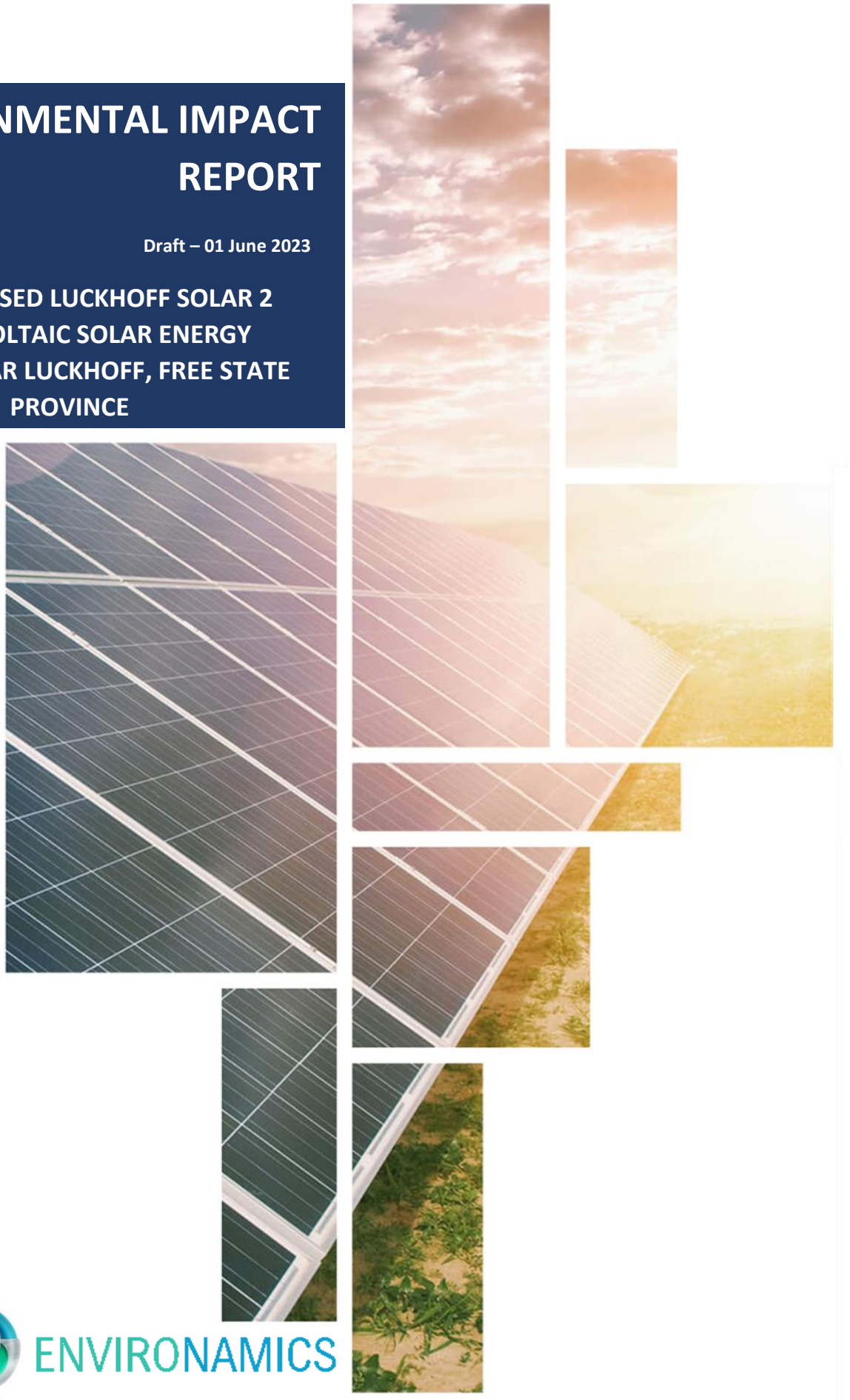
ENVIRONMENTAL IMPACT REPORT

Draft – 01 June 2023

THE PROPOSED LUCKHOFF SOLAR 2 PHOTOVOLTAIC SOLAR ENERGY FACILITY NEAR LUCKHOFF, FREE STATE PROVINCE



ENVIRONAMICS

PROJECT DETAIL

DFFE Reference No.	:	14/12/16/3/3/2/2285
Project Title	:	Proposed Luckhoff Solar 2 Photovoltaic Solar Energy Facility near Luckhoff , Free State Province
Authors	:	Mr. Austin Sharkey
Reviewed	:	Ms. Roschel Maharaj
Client	:	Luckhoff Solar 2 (Pty) Ltd
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GLOSSARY OF TERMS AND ACRONYMS

BA	Basic Assessment
BAR	Basic Assessment Report
CEA	Cumulative Effects Assessment
DFFE	Department of Forestry, Fisheries and the Environment
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
GNR	Government Notice Regulation
I&AP	Interested and affected party
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilo Volt
LM	Local Municipality
Mitigate	Activities designed to compensate for unavoidable environmental damage.
MW	Megawatt
NEMA	National Environmental Management Act No. 107 of 1998
NERSA	National Energy Regulator of South Africa
NWA	National Water Act No. 36 of 1998
OHPL	Overhead Powerline
PAOI	Project Area of Influence

PPP	Public Participation Process
PV	Photovoltaic
QDS	Quarter Degree Square
REIPPP	Renewable Energy IPP Procurement Process
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SEI	Site Ecological Importance
SPP	Solar Power Plant
VU	Vegetation Unit

CONTEXT FOR THE DEVELOPMENT

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

The primary rationale for the proposed solar photovoltaic (PV) facility is to add new generation capacity from renewable energy to the national electricity mix and to aid in achieving the goal of 42% share of all new installed generating capacity being derived from renewable energy forms, as targeted by DMRE (Integrated Resource Plan Update 2010-2030). The IRP also identifies the preferred generation technologies required to meet the expected demand growth up to 2030 and incorporates government objectives including affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources and localisation and regional development. In terms of the Integrated Resource Plan Update (2019 IRP Update, 2010-2030), over the short term (of the next two or three years), clear guidelines arose; namely to continue with the current renewable bid programme with additional annual rounds of 1000 MW PV, with approximately 8.4GW of the renewable energy capacity planned to be installed from PV technologies over the next twenty years.

The proposed project is intended to form part of the Department of Mineral Resources and Energy's (DMREs) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or any other programmes/opportunities to generate power in South Africa. The REIPPP Programme aims to secure 14 725 Megawatts (MW) of new generation capacity from renewable energy sources, while simultaneously diversifying South Africa's electricity mix. According to the 2021 State of the Nation Address, Government will soon be initiating the procurement of an additional 11 800 MW of power from renewable energy, natural gas, battery storage and coal in line with the Integrated Resource Plan 2019 and fulfilling their commitments under the United Nations Framework Convention on Climate Change and its Paris Agreement which include the reduction of greenhouse gas emissions. Eskom, our largest greenhouse gas emitter, has committed in principle to net zero emission by 2050 and to increase its renewable capacity.

During the 2022 State of the Nation Address it was indicated that during the past year the government had taken "firm steps" to bring additional generation capacity online as quickly as possible to close the shortfall in terms of electricity. As a result, it was confirmed that several new generation projects will be coming online over the next few years. During the recent 2023 State of the Nation Address, the government has embarked upon allowing private developers to generate electricity. There are now more than 100 projects, which are expected to provide over

9 000 MW of new capacity over time. A number of companies that have participated in the renewable energy programme will soon enter construction and deliver a total of 2 800 MW of new capacity. Through the Just Energy Transition Investment Plan, R1.5 trillion will be invested in our economy over the next five years in new frontiers such as renewable energy, green hydrogen and electric vehicles. A number of projects are already underway, including the development of a new facility by Sasol at Boegoebaai in the Northern Cape, the Prieska Power Reserve in the Free State, and the Hydrogen Valley initiative in Limpopo, Gauteng and KwaZulu-Natal.

In response to the above, Luckhoff Solar 2 (Pty) Ltd is proposing the development of a photovoltaic solar facility and associated infrastructure for the purpose of commercial electricity generation on an identified site located on Farm Mooidoorns No. 1224, Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577, Registration Division Fauresmith, Free State Province situated within the Letsemeng Local Municipality area of jurisdiction (refer to Figure A for the locality map). The project entails the generation of up to 240 MW electrical power through photovoltaic (PV) technology. The total development footprint of the project will be approximately be 416 hectares (including supporting infrastructure) within the 570 hectares identified and assessed as a part of the scoping process. A further 25 ha was assessed for the proposed 132 kV overhead powerline which will connect the on-site facility substation to an off-site collector substation ~2.5 km southeast of the facility (at Luckhoff Solar 1 – assessed separately). The Luckhoff Solar 2 PV facility forms a part of the Luckhoff cluster comprising a total of three (03) proposed PV facilities located adjacent to one another. Each solar PV facility is concurrently undergoing individual S&EIR processes. From a regional site selection perspective, this region is preferred for solar energy development due to its global horizontal irradiation value of around 2118 kwh/m^2.

EXECUTIVE SUMMARY

Like many other small and developing municipalities in the country, the Letsemeng Local Municipality faces a number of challenges in addressing the needs of sustainable growth and improved quality of life (IDP, 2021). The Letsemeng Local Municipality, IDP (2021/2022), has identified specific issues that require special attention including but not limited to waste collection and illegal dumping; sewer spillage and maintenance; unemployment; roads and infrastructure; public private partnership; growth and investment.

The Letsemeng Local Municipality does not regard the development of an IDP as the only requirement prevailing legislation. Therefore, there are specific reasons why the municipality should prepare the IDP. One of the main reasons is that developmental responsibilities have been prescribed by the Constitution, which is aimed at ensuring quality for the life of the municipality's residents. The responsibility does not only relate to the provision of basic services, but also include job creation as well as the promotion of accountability and eradication of poverty within the municipality (IDP, 2021/22). The IDP considers the economic structure and performance and how the municipality relies heavily on the agricultural sector and the general decline of the sector. It indicates that alternative sectors to the declining sectors of the area needs to be explored, which includes the renewable energy sector.

Luckhoff Solar 2 (Pty) Ltd intends to develop a 240 MW photovoltaic solar facility and associated infrastructure on Farm Mooidoorns No. 1224, Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577, Registration Division Fauresmith, Free State Province situated within the Letsemeng Local Municipality and Xhariep District Municipality area of jurisdiction. The town of Luckhoff is located approximately 5 km south of the proposed development (refer to Figure A and B for the locality and regional map). The total footprint of the project will approximately be 416 hectares (including supporting infrastructure on site). A further 25 ha was assessed for the proposed 132 kV overhead powerline which will connect the on-site facility substation to an off-site collector substation ~2.5 km southeast of the facility (at Luckhoff Solar 1 – assessed separately).. The site was identified as being highly desirable due to its suitable climatic conditions, topography (i.e., in terms of slope), environmental conditions (i.e., low agricultural potential, low ecological sensitivity and archaeology), proximity to a grid connection point (i.e., for the purpose of electricity evacuation), as well as site access via a main road (i.e., to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase).

In terms of the National Environmental Management Act (Act 107 of 1998), with specific reference to Sections 24 and 24D, as read with GNR 324-327, as amended (2017), Environmental Authorisation is required for the Luckhoff Solar 2 PV facility. The following listed activities have been identified with special reference to the proposed development and are listed in the EIA Regulations (as amended):

- Activity 11 (i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."*

- Activity 12 (ii)(a)(c) (GN.R. 327): "*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."*
- Activity 19 (GN.R. 327): *"The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."*
- Activity 24 (ii) (GN.R 327): *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters."*
- Activity 27 (GN.R. 327): *"The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation…"*
- Activity 28 (ii) (GN.R. 327): *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."*
- Activity 56 (ii) (GN.R 327): " *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"*
- Activity 1 (GN.R. 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more..."*
- Activity 15 (GN.R. 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation..."*
- Activity 4 (b)(i)(ee)(gg) (GN.R 324): "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."*
- Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

- Activity 12 (b)(ii)(iv) (GN.R 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (ii) within critical biodiversity areas identified in bioregional plans (iv) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.*

- Activity 14(ii)(a)(c)(b)(i)(ff)(hh) (GN.R 324): "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve."*

- Activity 18 (b)(i)(gg)(hh) (GN.R 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) Free State (i) outside urban areas, within (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

Activities required for the development of the solar facility which are listed under Listing Notice 1, 2 and 3 (GNR 327, 325 and 324) implies that the development could potentially have an impact on the environment that will require mitigation. Subsequently a 'thorough assessment process' is required as described in Regulations 21-24. Environamics has been appointed as the independent consultant to undertake the Scoping and Environmental Impact Reporting (S&EIR) process on behalf of Luckhoff Solar 2 (Pty) Ltd.

Regulation 21 of the EIA Regulations requires that an Environmental Impact Report (EIR) must contain the information set out in Appendix 3 of the Regulations or comply with a protocol or minimum information requirements relevant to the application as identified and gazetted by the Minister in a government notice. Appendix 3 of GN R.326 requires a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred site, the scope of the assessment, and the consultation process undertaken be set out in the EIR report.

It has been determined through the EIA process that the proposed development will have a net positive impact for the area and will subsequently ensure the optimal utilisation of resources and land, specifically where the affected landowner is experiencing challenges and limitations in terms of the current agricultural land use. All negative environmental impacts can be effectively mitigated through the recommended mitigation measures and no residual negative impacts are foreseen. The potentially most significant environmental impacts associated with the development are briefly summarised below:

Impacts during the construction phase:

During the construction phase minor negative impacts are foreseen over the short term. The latter refers to a period of 18-24 months. The potentially most significant impacts relate to habitat destruction caused by clearance of vegetation and socio-economic impacts such as the creation of direct and indirect employment opportunities, economic multiplier effects from the use of local goods and services and temporary increase in traffic disruptions and movement patterns.

Impacts during the operational phase:

During the operational phase the site will serve as a solar PV energy facility and the potential impacts will take place over a period of 20 – 25 years. The negative impacts are generally associated with habitat destruction caused by clearance of vegetation, displacement of priority avian species from important habitats, potential collision and electrocutions of avifauna and visual impact of sensitive visual receptors located within a 10 km radius of the proposed development and powerlines. The provision of sustainable services delivery also needs to be confirmed. The operational phase will have a direct positive impact through the creation of employment opportunities and skills development, development of non-polluting, renewable energy infrastructure and contribution to economic development and social upliftment.

Impacts during the decommissioning phase:

The negative impacts generally associated with the decommissioning phase include: habitat destruction caused by clearance of vegetation and the loss of permanent employment. However, skilled staff will be eminently employable and a number of temporary jobs will also be created in the process. It is not expected that the facility will be decommissioned, but rather that the technology used will be upgraded.

Cumulative impacts:

Cumulative impacts could arise as other similar projects are constructed in the area. According to the Department of Forestry, Fisheries and Environment database three (03) other solar facilities have been proposed in relatively close proximity to the proposed activity.

The potential for cumulative impacts may therefore exist. The Draft Scoping Report includes an assessment of the potential cumulative impacts associated with the proposed development. Potential cumulative impacts with a significance rating of negative medium during the construction phase relate to: habitat destruction and fragmentation, impact on the characteristics of the watercourse, displacement of priority avian species from important habitats, loss of important avian habitats, impacts of employment opportunities, business opportunities and skills development and impact associated with large-scale in-migration of people. Cumulative impacts during the operational phase relate to: habitat destruction and fragmentation, impacts on the characteristics of the watercourse and visual intrusion. The cumulative effect of the generation of waste was identified as being potentially significant during the decommissioning phase.

Regulation 23 of the EIA Regulations determine that an EIA report must be prepared and submitted for the proposed activity after the competent authority accepts the final Scoping Report, including the Plan of Study for the EIA phase. The EIA report will evaluate and rate each identified impact and identify mitigation measures that may be required. The EIA report will

contain information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Appendix 3 of the EIA Regulations. This is the Draft EIA Report submitted to the competent authority (Department of Forestry, Fisheries and the Environment (DFFE) for review and commenting on the Application for Environmental Authorisation.

1 INTRODUCTION

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

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

(i) the EAP who prepared the report; and

(ii) the expertise of the EAP, including a curriculum vitae.

1.1 LEGAL MANDATE AND PURPOSE OF THE REPORT

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

The activities triggered under Listing Notice 1, 2 and 3 (Regulation 327, 325 and 324) for the project implies that the development is considered as potentially having a significant impact on the environment. Subsequently a 'thorough assessment process' is required as described in Regulations 21-24. According to Appendix 3 of Regulation 326 the objective of the Environmental Impact Report (EIR) is to, through a consultative process:

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

- degree to which these impacts-
  - can be reversed;
  - may cause irreplaceable loss of resources, and
  - can be avoided, managed or mitigated;

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

This report is the Draft Environmental Impact Report (EIR) that has been submitted to the Department of Environment, Forestry and Fisheries for a 30-day review and comment period. According to Regulation 326 all registered I&APs and relevant State Departments must also be allowed the opportunity to review the report. The Draft EIR was made available to registered I&APs and all relevant State Departments for a 30-day review period from 01 June to 03 July 2023 These stakeholders and individuals were requested to provide written comments on the Draft EIR within the allocated timeframe. All issues identified during the review period will be documented and compiled into a Comments and Response Report as part of the Final EIR (**Appendix C7**). All comments received prior to and during the Scoping Phase of the project are available in the Comments and Response Report as referred to above, as well as Appendix C5 and C6 of this Draft EIR.

1.2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

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

Contact person:	Marélie Botha
EAPASA Registration:	2021/3834
Postal Address:	14 Kingfisher Street, Tuscany Ridge Estate, Potchefstroom, 2531
Telephone:	082 493 5166 (Cell)
Electronic Mail:	marelie@environamics.co.za

And/or

Contact person:	Roschel Maharaj
EAPASA Registration:	2019/824
Postal Address:	14 Kingfisher Street, Tuscany Ridge Estate, Potchefstroom, 2531

Telephone: 063 062 7725 (Cell)

Electronic Mail: roschel@environamics.co.za

And/or

Contact person: Austin Sharkey

Postal Address: 14 Kingfisher Street, Tuscany Ridge Estate, Potchefstroom, 2531

Telephone: 083 747 6717 (Cell)

Electronic Mail: austin@environamics.co.za

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

1.3 DETAILS OF SPECIALISTS

Table 1.1 provides information on the specialists that have been appointed as part of the S&EIR process. Regulation 13(1)(a) and (b) determines that an independent and suitably qualified, experienced and independent specialist should conduct the specialist study, in the event where the specialist is not independent, a specialist should be appointed to externally review the work of the specialist as contemplated in sub regulation (2), must comply with sub regulation 1. In terms of the independent status of the specialists, their declarations are attached as Appendix E to this report. The expertise of the specialists is also summarized in their respective reports.

Table 1.1: Details of specialists

Study	Prepared by	Contact Person	Postal Address	Tel	e-mail
Geotechnical Desktop Study	Delta Geotech	Mattew Jones	17 Clearview Place, Beacon Bay, East London, 5241	Tel: +27 81 586 7378	mattew@deltageotech.co.za
Avifauna Scoping Report	Pachnoda Consulting CC	Lukas Niemand	PO Box 72847, Potchefstroom 2522	Cell: 082 214 3738	adrian.haagner@agreencogroup.com
Ecological Scoping Report	Biodiversity Africa	Tarryn Martin	30 Chudleigh Road, Plumstead, 7800, Cape Town, Western Cape	Cell: 071 332 3994/ 078 340 6295	Tarryn@biodiversityafrica.com
Phase 1 Cultural Heritage Impact Assessment	J van Schalkwyk	J van Schalkwyk	62 Coetzer Avenue, Monument Park, 0181	Cell: 076 790 6777	jvschalkwyk@mweb.co.za
Paleontological Desktop Assessment	Banzai Environmental (Pty) Ltd	Elize Butler	-	Cell: 084 447 8759	info@banzai-group.com
Agricultural Compliance Statement	Johann Lanz Soil Scientist	Johann Lanz	1A Wolfe Street, Wynberg, 7800, Cape Town	Cell: 082 927 9018	johann@johannlanz.co.za
Visual Impact Assessment	Donaway Environmental Consultants	Johan Botha	30 Fouche Street, Steynsrus, 9515	Tel: 082 316 7749	johan@donaway.co.za
Social Impact Assessment	Donaway Environmental Consultants	Johan Botha	30 Fouche Street, Steynsrus, 9515	Cell: 082 493 5166	johan@donaway.co.za
Traffic Impact Assessment	iWink Consulting (Pty) Ltd	Iris Wink	Plattekloof Glen	Cell: 082 691 9096	iris@iwink.co.za
Aquatic Ecological Assessment	EnviroSci (Pty) Ltd	Dr Brian Colloty	1 Rossini Road, Pari Park, Gqeberha, 6070	Cell: 083 498 3299	brianc@envirosci.co.za

1.4 STATUS OF THE EIA PROCESS

The Scoping and Environmental Impact Reporting (S&EIR) process is conducted strictly in accordance with the stipulations set out in Regulations 21-24 of Regulation No. 326. Table 1.2 provides a summary of the S&EIR process and future steps to be taken. It can be confirmed that to date:

- A site visit was conducted by the EAP on 06 October 2022.
- Site notices were erected on site on 06 October 2022 informing the public of the commencement of the S&EIR process.
- A newspaper advertisement was placed in the Bloemnuus on 13 October 2022, informing the public of the S&EIR process and for the public to register as I&APs.
- The Background Information Document (BID) was circulated to all I&APs and surrounding landowners on 15 November 2022.
- A pre-application meeting request was submitted to DFFE on 17 November 2022.
- The DFFE indicated that a pre-application meeting is not required, in an email dated 21 November 2022.
- An Application for Environmental Authorisation and the draft Scoping Report was submitted to DFFE on 20 January 2023.
- The draft Scoping Report was made available for a 30-day review and comment period from 20 January 2023 to 20 February 2023.
- The final Scoping Report was submitted to the DFFE on 06 March 2023 for decision-making and approval of the Plan of Study for the EIA.
- The DFFE accepted the Final Scoping Report (FSR) on 19 April 2023
- The Draft EIR Report was submitted to the DFFE (and registered I&APs) on 01 June 2023 for the 30-day review and comment period which will be from 01 June to 03 July 2023

It is envisaged that the EIA process should be completed within approximately four months of submission of the Final EIR, i.e., by November 2023 – see Table 1.2.

Table 1.2: Estimated timeframe for completion of the 'scoping and EIA process'

Activity	Prescribed timeframe	Timeframe
Site visit		06 October 2022
Public participation (BID)	30 Days	15 November – 15 December 2022

Submit application form and DSR	-	20 January 2023
Public participation (DSR)	30 Days	20 January – 20 February 2023
Submit FSR	44 Days	06 March 2023
Department acknowledges receipt	10 Days	07 March 2023
Department approves/reject	43 Days	19 April 2023
Public participation (DEIR)	30 Days	01 June 2023 – 03 July 2023
Submission of FEIR & EMPr	-	July 2023
Department acknowledges receipt	10 Days	July 2023
Decision	107 Days	October 2023
Department notifies of decision	5 Days	October2023
Registered I&APs notified of decision	14 Days	October 2023
Appeal	20 Days	October/November 2023

Table 1.3 below provides more detail on timeframes as well as process flow for the S&EIR process.

Table 1.3: Estimated timeframe for completion of the 'S&EIR processes' for Luckhoff Solar 2 PV facility

Tasks to be performed	October				November				December				January				February				March				April				May				June				July				August				September			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
REGISTRATION PHASE																																																		
Pre-application meeting (DFFE doesn't require meeting)							X																																										
Site visits	X																																																
Public participation																																																	
– Press advertisement		X																																														
– On site advertisement	X																																															
– Distribution of notices	X																																															
– Complete PP report																				X																													
Specialist inputs and reports																																																
– Draft terms of reference	X									X																																						
– Receive specialist studies															X																																	
'Draft' Scoping Report																																																
- Information gathering															X																																	
- Report writing															X																																	
- Circulate 'Draft' Scoping Report																			X																													
SCOPING PHASE																																																
Complete and submit application form																																																
– Information gathering																																																
– Complete and submit application form															X																																	
Authority acknowledges receipt of application form															X																																	
Final Scoping Report																																																
– Information gathering																				X																													
– Report writing																				X																													
– Submission of Final Scoping Report																					X																											
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Specialist inputs and reports																																																
– Draft terms of reference																											X																					
– Receive specialist studies																											X					X															
Draft EIR Report																																																
- Circulate																																																
Final EIA Report & EMP																																																
- Submission																																															X	

The competent authority has 107 days for decision-making after the EIR has been submitted and an additional 5 days to notify the applicant in writing of their decision. The applicant must within 14 days of the date of the decision notify registered I&APs of the decision. Registered I&APs are then provided 20 days in which to lodge appeals. The appeal period expires 20 days after registered I&APs have been informed of the decision according to GNR326, Regulation 7.

1.5 SPECIALIST STUDIES IDENTIFIED IN THE DFFE SCREENING TOOL REPORT

In terms of GN R.960 (promulgated on 05 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the national web based environmental screening tool is compulsory for the submission of applications in terms of Regulations and 21 – 24 of the EIA Regulations.

The requirement for the submission of a Screening Report for the Luckhoff Solar 2 PV facility is applicable as it triggers Regulation 21 of the EIA Regulations, 2014 (as amended). The Screening Report has been appended to the amended application for EA as submitted to the DFFE on 01 June 2023 and as Appendix B to this Draft EIA Report.

The tables included below provides an indication of the specialist studies identified by the DFFE Screening Tool Report (Appendix B), an indication of whether the studies were undertaken or not and a motivation or confirmation of the studies being included or not.

Table 1.4: Specialist studies identified by the DFFE Screening Tool for the solar PV category and specialist studies completed

Study identified in the DFFE Screening Tool and sensitivity	Study included?	Appendix
Agricultural Impact Assessment Sensitivity: Medium Feature(s): Low to moderate land capability	Yes	An Agricultural Compliance Statement is included in Appendix E4.
Animal Species Assessment Sensitivity: Medium Feature(s): Presence of sensitive animal species i.e., Aves-*Neotis ludwigii*	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Aquatic Biodiversity Impact Assessment Sensitivity: Low	Yes	An Aquatic Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.

Archaeological and Cultural Heritage Impact Assessment Sensitivity: Low	Yes	A Heritage Impact Assessment is included in Appendix E5, as per the requirements of the National Heritage Resources Act.
Palaeontological Impact Assessment Sensitivity: High Feature(s): Potential of presence of features with a high paleontological sensitivity	Yes	A Palaeontological Impact Assessment is included in Appendix E6, as per the requirements of the National Heritage Resources Act.
Plant species Assessment Sensitivity: Medium Feature(s): Potential presence of Aves- *Tridentea virescens*	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Terrestrial Biodiversity Impact Assessment Sensitivity: Very High Feature(s): In close proximity to the Thanda Tula Nature Reserve as well as CBA 1 and 2 and ESA 1 and 2.	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Geotechnical Assessment Sensitivity: Not indicated	Yes	The detailed Geotechnical Assessment will be conducted before construction begins as part of the micro-siting of the facility layout. The consideration of geotechnical aspects is considered to be of a technical concern rather than an environmental concern. A Desktop Geotechnical Assessment is included in Appendix E9.

Socio-Economic Assessment Sensitivity: Not indicated	Yes	A Social Impact Assessment is included in Appendix E7.

Table 1.5: Specialists studies identified by the DFFE Screening Tool for the substation category and specialist studies completed

Study identified in the DFFE Screening Tool and sensitivity	Study included?	Appendix
Agricultural Impact Assessment Sensitivity: Medium Feature(s): Low to moderate land capability	Yes	An Agricultural Compliance Statement is included in Appendix E4 of the Scoping Report.
Animal Species Assessment Sensitivity: Medium Feature(s): Presence of sensitive animal species i.e., Aves-*Neotis ludwigii*	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Aquatic Biodiversity Impact Assessment Sensitivity: Low	Yes	An Aquatic Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Archaeological and Cultural Heritage Impact Assessment Sensitivity: Low	Yes	A Heritage Impact Assessment is included in Appendix E5, as per the requirements of the National Heritage Resources Act.
Civil Aviation Assessment Sensitivity: Low	No	The identification of the site as low sensitivity considering civil aviation is agreed to by the EAP.

		The Civil Aviation Authority has been consulted regarding the development of the project since the commencement of the S&EIR Process. No specific negative impacts or issues have been raised to date by the CAA regarding the project. The project is also not located within an area considered to be of a high sensitivity.
Defence Theme Sensitivity: Low	No	The sensitivity for the entire extent of the site is low and therefore no assessment has been included. No defence base has been found to be located in close proximity to the project site. The South African National Defence Force (SANDF) has been consulted regarding the development of the project since the commencement of the S&EIR Process. No specific negative impacts or issues have been raised to date regarding the project. The project is also not located within an area considered to be of a high sensitivity.
Palaeontological Impact Assessment Sensitivity: High Feature(s): The project may comprise of feature that have a High paleontological sensitivity	Yes	A Palaeontological Impact Assessment is included in Appendix E6, as per the requirements of the National Heritage Resources Act.
Plant species Assessment Sensitivity: Medium	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the

Feature(s): The project may comprise of *Tridentea virescens*		Protocols of GNR320 – refer to the content of the report.
Terrestrial Biodiversity Impact Assessment Sensitivity: Very High Feature(s): In close proximity to the Thanda Tula Nature Reserve as well as CBA 1 and 2 and ESA 1 and 2.	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.

Table 1.6: Specialists studies identified by the DFFE Screening Tool for the powerline category and specialist studies completed

Study identified in the DFFE Screening Tool and sensitivity	Study included?	Appendix
Agricultural Impact Assessment Sensitivity: Medium Feature(s): Low to moderate land capability	Yes	An Agricultural Compliance Statement is included in Appendix E4.
Animal Species Assessment Sensitivity: Medium Feature(s): Presence of sensitive animal species i.e., Aves-*Neotis ludwigii*	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Aquatic Biodiversity Impact Assessment Sensitivity: Low	Yes	An Aquatic Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Archaeological and Cultural Heritage Impact Assessment	Yes	A Heritage Impact Assessment is included in Appendix E5, as per the

Sensitivity: Low		requirements of the National Heritage Resources Act.
Civil Aviation Assessment Sensitivity: Low	No	The identification of the site as low sensitivity considering civil aviation is agreed to by the EAP. The Civil Aviation Authority has been consulted regarding the development of the project since the commencement of the S&EIR Process. No specific negative impacts or issues have been raised to date by the CAA regarding the project. The project is also not located within an area considered to be of a high sensitivity.
Defence Theme Sensitivity: Low	No	The sensitivity for the entire extent of the site is low and therefore no assessment has been included. No defence base has been found to be located in close proximity to the project site. The South African National Defence Force (SANDF) has been consulted regarding the development of the project since the commencement of the S&EIR Process. No specific negative impacts or issues have been raised to date regarding the project. The project is also not located within an area considered to be of a high sensitivity.
Palaeontological Impact Assessment Sensitivity: High	Yes	A Palaeontological Impact Assessment is included in Appendix E6, as per the requirements of the National Heritage Resources Act.

Feature(s): The project may comprise of feature that have a High paleontological sensitivity		
Plant species Assessment Sensitivity: Medium Feature(s): The project may comprise of *Tridentea virescens*	Yes	An Ecological Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Terrestrial Biodiversity Impact Assessment Sensitivity: Very High Feature(s): In close proximity to the Thanda Tula Nature Reserve as well ESA 1.	Yes	A Terrestrial Biodiversity Impact Assessment is included in Appendix E2. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.

1.6 STRUCTURE OF THE REPORT

This report is structured in accordance with the prescribed contents stipulated in Appendix 3 of Regulation No.326. It consists of seven sections demonstrating compliance to the specifications of the regulations as illustrated in Table 1.4., 1.5. and 1.6.

Table 1.7: Structure of the report

Requirements for the contents of an EIR as specified in the Regulations		Section in report
Appendix 3. (3) - An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-		
(a)	details of -	1
	(i) the EAP who prepared the report; and	
	ii) the expertise of the EAP, including a curriculum vitae.	
(b)	the location of the activity, including-	2
	(i) the 21-digit Surveyor General code of each cadastral land parcel;	
	(ii) where available, the physical address and farm name;	
	(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	

(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-	
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	
(d)	a description of the scope of the proposed activity, including-	
	(i) all listed and specified activities triggered and being applied for; and	
	(ii) a description of the associated structures and infrastructure related to the development.	
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	3
(f)	a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	4
(g)	A motivation for the preferred development footprint within the approved site.	
(h)	a full description of the process followed to reach the proposed development footprint within the approved site, including –	
	(i) details of all the development footprint alternatives considered;	
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	5
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	
	(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and	
	(x) a concluding statement indicating the preferred alternative development location within the approved site.	
	(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	6
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	

	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	
	(viii) the possible mitigation measures that could be applied and level of residual risk;	
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-	
	(i) a description of all environmental issues and risks that were identified during the EIA process; and	
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	
(j)	an assessment of each identified potentially significant impact and risk, including-	
	(i) cumulative impacts;	
	(ii) the nature, significance and consequences of the impact and risk;	
	(iii) the extent and duration of the impact and risk;	
	(iv) the probability of the impact and risk occurring;	
	(v) the degree to which the impact and risk can be reversed;	
	(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	
	(vii) the degree to which the impact and risk can be mitigated;	
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	6
(l)	an environmental impact statement which contains-	
	(i) a summary of the key findings of the environmental impact assessment:	
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	8
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Not applicable

(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Not applicable
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	8
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	8
(s)	an undertaking under oath or affirmation by the EAP in relation to-	Appendix A to the report
	(i) the correctness of the information provided in the report;	
	(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties (I&APs);	
	(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	
	(iv) any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs;	
(t)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Not applicable
(u)	an indication of any deviation from the approved scoping report, including the plan of study, including-	Not applicable
	(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	
	(ii) a motivation for the deviation;	
(v)	any specific information that may be required by the CA; and	Not applicable
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not applicable

2 ACTIVITY DESCRIPTION

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

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

(b) the location of the activity, including-

(i) the 21-digit Surveyor General code of each cadastral land parcel;

(ii) where available, the physical address and farm name;

(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;

(c) a plan which locates the proposed activity applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is- -

(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or

(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;

(d) a description of the scope of the proposed activity, including-

(i) all listed and specified activities triggered and being applied for;

(ii) a description of the associated structures and infrastructure related to the development.

2.1 THE LOCATION OF THE ACTIVITY AND PROPERTY DESCRIPTION

The project entails the development of a photovoltaic solar facility and associated infrastructure on the Farm Mooidoorns No. 1224, Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577, Registration Division Fauresmith, Free State Province situated within the Letsemeng Local Municipality area of jurisdiction. The proposed development is located in the Free State Province in the interior of South-Africa (refer to Figure B for the regional map). The town of Luckhoff is located approximately 5 km south of the proposed development (refer to Figure A for the locality map).

The project entails the generation of up to 240 MW electrical power through the installation and operation of photovoltaic (PV) panels. The total area assessed as part of this EIA Report (hereafter referred to as the "development area") is ~570 ha. The development footprint for Luckhoff Solar 2 is proposed to be up to 416 ha in extent. A further 25 ha was assessed for the proposed 132 kV overhead powerline which will connect the on-site facility substation and Luckhoff Solar 2 to an off-site collector substation ~2.5 km southeast of the facility (at Luckhoff Solar 1 – assessed separately). The full extent of the development area was considered during scoping with the aim

of confirming the suitability from an environmental and social perspective. Based on the outcome of the findings of the scoping phase, a development footprint has been defined. Refer to table 2.1 for general site information. The property on which the facility is to be constructed will be leased by Luckhoff Solar 2 (Pty) Ltd from the property owner for the life span of the project (minimum of 20 years).

Energy generated by the facility will be transmitted from the on-site facility substation/Eskom switching station to the Luckhoff Main Transmission Substation via a new 132 kV powerline. A separate Basic Assessment Application will be undertaken to assess the proposed grid connection infrastructure.

Table 2.1: General site information

Description of affected farm portion	Solar PV Facility: • Farm Mooidoorns No. 1224 Grid Corridor: • Farm Mooidoorns No. 1224 • Farm Rorich's Hulp No. 505 Access Road: • Farm Mooidoorns No. 1224 • Farm Rorich's Hulp No. 505 • Farm De Dorpsgronden Van Luckhoff No. 577
Province	Free State
District Municipality	Xhariep District Municipality
Local Municipality	Letsemeng Local Municipality
Ward numbers	1
Closest towns	The town of Luckhoff is located approximately 5 km south of the proposed development.
21 Digit Surveyor General codes	Solar PV Facility: • Farm Mooidoorns No. 1224 F01100000000122400000 Grid Corridor: • Farm Mooidoorns No. 1224

	F01100000000122400000 • Farm Rorich's Hulp No. 505 F01100000000050500000 <u>Access Road:</u> • Farm Mooidoorns No. 1224 F01100000000122400000 • Farm Rorich's Hulp No. 505 F01100000000050500000 • Farm De Dorpsgronden Van Luckhoff No. 577 F01100000000057700000
Title Deed	<u>Solar PV Facility:</u> • Farm Mooidoorns No. 1224 o T17814/1996 <u>Grid Corridor:</u> • Farm Mooidoorns No. 1224 o T17814/1996 • Farm Rorich's Hulp No. 505 o T35955/1889 <u>Access Road:</u> • Farm Mooidoorns No. 1224 o T17814/1996 • Farm Rorich's Hulp No. 505 o T35955/1889 • Farm De Dorpsgronden Van Luckhoff No. 577 o T56703/1899
Photographs of the site	Included in Plates as an appendix to the Report

Type of technology	Photovoltaic solar facility
Structure Height	• Panels ~6m, • Buildings ~ 9m, • Battery storage facility ~8m
Battery storage	Up to a 5 ha area within the development footprint
Surface area to be covered (development footprint)	Approximately 416 ha
Structure orientation	Monofacial or Bifacial PV panels will be utilised. The panels will either be fixed to a single-axis and/or double horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun.
Laydown area dimensions (area assessed as part of the EIA)	Temporary laydown area will occupy up to 5 hectares. Permanent laydown area will occupy up to 1 hectare. PV arrays will cover an area of up to 404 ha while 7 ha will be utilised for permanent hard stand area i.e., BESS, facility substation, and auxiliary buildings.
Generation capacity	Up to 240 MW
Expected production	N/A - this will be dependent on the chosen technology.

The site is located in a rural area and is bordered by agricultural land uses, as well as mining activities. The site survey revealed that the affected property currently consists of agricultural activities – refer to plates 1 – 9 for photographs of the affected property and proposed development footprint area.

2.2 ACTIVITY DESCRIPTION

The proposed development will trigger the following activities:

Table 2.2: Listed activities

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(i)	• *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* • Activity 11(i) is triggered as energy generated by the PV array will be transmitted via underground medium voltage cables (i.e., up to 33 kV) to the onsite Luckhoff Solar 2 substation (the onsite facility substation) where it will be stepped-up to 132 kV. Thereafter, the electricity will pass to an offsite facility collector substation (~2.5 km southeast of the facility) via a 132 kV overhead powerline.
GNR. 327 (as amended in 2017)	Activity 12(ii)(a)(c)	• "*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse (c) within 32 meters of a watercourse measured from the edge of a watercourse."* • Activity 12(ii)(a)(c) is triggered based on the presence of a small depression (wetland feature) located within the development area. The project comprises of PV arrays which will be located within 32 m from the identified wetland depression as well as a watercourse. The artificial watering point identified on site will be avoided and maintained. The main existing access road that leads to the farm traverses a watercourse and will be expanded to suit the project needs.
GNR. 327 (as amended in 2017)	Activity 19	• *"The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."* • Activity 19 is triggered as the project area requires an access road. The main existing access road that leads to the farm traverses a watercourse and will be expanded to suit the project needs. Construction of the main access road will

		require removal of more than 10 cubic metres of soil from a watercourse.
GNR. 327 (as amended in 2017)	Activity 24(ii)	• *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters."* • Activity 24(ii) is triggered as the proposed main access road to Luckhoff Solar 2 will be up to 8 m wide, but with the inclusion of side drains and gavel embankments, will exceed the threshold of this activity.
GNR. 327 (as amended in 2017)	Activity 27	• *"The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation…"* • A total of 12 ha of indigenous vegetation will be removed for the following: o Auxiliary buildings – Up to 1 ha o BESS – Up to 5 ha o On-site facility substation – Up to 1 ha o Temporary laydown area – Up to 5 ha
GNR. 327 (as amended in 2017)	Activity 28(ii)	• *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."* • Activity 28(ii) is triggered as the total area to be developed for the PV facility and associated infrastructure is greater than 1 ha and occurs outside an urban area in an area currently zoned for agriculture. The property will be re-zoned to "special" use. The development footprint of the solar PV facility is 416 ha.
GNR. 327 (as amended in 2017)	Activity 56(ii)	• *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* • Activity 56 (ii) is triggered since the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres.

GNR. 325 (as amended in 2017)	Activity 1	• *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."* • Activity 1 is triggered since the proposed photovoltaic solar energy facility will generate up to 240 megawatts of electricity through the use of a renewable resource.
GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • Activity 15 is triggered since portions of the site has not been lawfully disturbed during the preceding ten years; therefore, more than 20 hectares of indigenous vegetation will be removed. The development footprint of the solar PV facility will be approximately 416 ha in extent.
GNR. 324 (as amended in 2017)	Activity 4 (b)(i)(ee)(gg)	• "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."* • Activity 4 (b)(i)(ee)(gg) is triggered as internal and perimeter access roads with a width of between 6 and 10 meters will be constructed and the development footprint is located within an ESA 1. The Thanda Tula Nature Reserve is a protected area and is also located within 5 km of the proposed project area.
GNR. 324 (as amended in 2017)	Activity 10 (b)(i)(ee)(gg)(hh)	• *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from*

		any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland." • Activity 10(b)(i)(ee)(gg)(hh) is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel and/or oils) in containers with a capacity exceeding 30 but not exceeding 80 cubic metres. The project is located within the Free State Province and the development footprint is located within an ESA 1. The Thanda Tula Nature Reserve is a protected area and is also located within 5 km of the proposed project area. The development is located within 100 m from the watercourse identified. The project area comprises of artificial (livestock) watering points which will be avoided.
GNR. 324 (as amended in 2017)	Activity 12 (b)(ii)(iv)	• *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (ii) within critical biodiversity areas identified in bioregional plans (iv) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 12 (b)(ii)(iv) is triggered since the project is located within the Free State Province and the development footprint is located within an ESA 1. A small wetland depression was encountered and delineated by the wetland specialist which is located within the project site as well as a watercourse. The development is located within 100 m from the wetland depression.
GNR. 324 (as amended in 2017)	Activity 14(ii)(a)(c)(b)(i)(ff)(hh)	• "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified*

		in terms of NEMPAA or from the core area of a biosphere reserve." • Activity 14(ii)(a)(c)(b)(i)(ff)(hh) is triggered as the project is located within 100 m from a watercourse. The project area comprises of internal access roads and infrastructure which lies within 32 m from the identified depression wetlands. The main existing access road that leads to the farm traverses a watercourse and will be expanded to suit the project needs. According to the Ecological Impact Assessment, the project area is located within an ESA 1. The Thanda Tula Nature Reserve is a protected area and is also located within 5 km of the proposed project area.
GNR. 324 (as amended in 2017)	Activity 18 (b)(i)(gg)(hh)	• *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) Free State (i) outside urban areas, within (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 18 (b)(i)(gg)(hh) is triggered since the existing access road to the farm traverses a watercourse and will need to be widened by more than 4 metres. The project is located within the Free State Province and outside urban areas. The project area comprises of internal access roads and infrastructure which will lies within 32 m from the depression wetlands and watercourse. The Thanda Tula Nature Reserve is a protected area and is also located within 5 km of the proposed project area.

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

- Site clearing and preparation: Certain areas of the site and access road will need to be cleared of vegetation and some areas may need to be levelled.
- Civil works to be conducted:

- Terrain levelling if necessary – Levelling will be minimal as the potential site chosen is relatively flat.

- Laying foundation – The structures will be connected to the ground through cement pillars, cement slabs or metal screws. The exact method will depend on the detailed geotechnical analysis.
- Construction of access and inside roads/paths – The majority of the access road will follow existing, gravel farm roads that may require widening up to 10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road of up to 33 km, each with a width of up to 6 m, will be constructed to provide access to the various components of the PV development.
- Trenching – all Direct Current (DC) and Alternating Current (AC) wiring within the PV facility will be buried underground. Trenches will have a river sand base, space for pipes, backfill of sifted soil and soft sand and concrete layers where vehicles will pass.

2.3 PHOTOVOLTAIC TECHNOLOGY

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

The key components of the proposed project are described below:

- PV Panel Array - To produce up to 240 MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the yield.

Figure 2.1: Typical example of solar PV array

- Wiring to Central Inverters - Sections of the PV array will be wired to central inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Electrical reticulation network – Energy generated by the PV array will be transmitted via underground medium voltage cables (i.e., up to 33kV) to the onsite Luckhoff Solar 2 substation (the onsite facility substation) where it will be stepped-up to 132 kV. Thereafter, the electricity will pass to an offsite facility collector substation located ~2.5 km southeast of the facility (at Luckhoff Solar 1 – assessed separately) via a 132 kV overhead powerline.

- Supporting Infrastructure – The following auxiliary buildings including a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre will be required with basic services including water and electricity. The project requires the need for both temporary and permanent laydown areas.

- Battery Energy Storage System – The Battery Storage Facility will occupy an area of up to 5 hectares. The specifications and the exact capacity of the battery storage remains unspecified at this stage.

- Roads – The majority of the access road will follow existing, gravel farm roads that will require widening between 6 -10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed/lengthened, this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road of up to 33 km, each with a width of up to 6 m, will be constructed to provide access to the various components of the PV development. Access will be obtained via the S572 an existing gravel road located adjacent to the site, off the R48 Regional Road.

- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 3.5 m will be used.

2.4 LAYOUT DESCRIPTION

The layout plan provided within this draft EIA report will follow the limitations of the site and aspects such as environmentally sensitive areas, roads, fencing and servitudes on site will be considered – refer to Figure H to L. The total surface area proposed for the layout includes the PV panel arrays (spaced to avoid shadowing), access and maintenance roads and associated infrastructure (buildings, power inverters, battery energy storage system, on-site substation, powerine and perimeter fences). Limited features of environmental significance exist on site, with the main features of significance being the depression wetlands, watercourses as well as artificial watering points. These features have been avoided in the layout of the solar facility. The artificial watering point identified on site will be avoided and maintained. A final layout plan is included as Figure M and Table 2.3 below provides detailed information regarding the layout for the proposed facility as per DFFE specifications.

Table 2.3: Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	Up to 5.5 m
Area of PV Array	Up to 404 ha
Area occupied by inverter / transformer stations / substations / BESS	BESS: up to 5 ha Facility substation: up to 1 ha
Capacity of on-site substation	132kV
Capacity of the power line	132kV
Area occupied by both permanent and construction laydown areas	Temporary Laydown Area: up to 5 ha Permanent Laydown Area: ○ Auxiliary buildings – Up to 1 ha ○ BESS – Up to 5 ha ○ Facility substation – Up to 1 ha ○ PV array – Up to 404 ha
Area occupied by buildings	A 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre: Up to 1 ha
Battery storage facility	The Battery Storage Facility will occupy an area of up to 5 ha. Maximum height of the BESS is up to 8 m. The exact capacity of the battery storage remains unspecified at this stage.
Length of internal roads	Approximately 33 km

Width of internal roads	Approximately 6 meters *N.B: Only the main access roads may be widened up to 10 meters*
Grid connection corridor width	100 m
Grid connection corridor length	~2.5 km
Power line servitude width	Up to 36m
Height of fencing	~3.5 m

Table 2.4 provides the co-ordinate points for the proposed project site and associated infrastructure.

Table 2.4: Project co-ordinates

Coordinates			
Project Site	A	29°41'30.39"S	24°44'6.54"E
	B	29°40'58.43"S	24°44'28.66"E
	C	29°41'43.08"S	24°45'3.89"E
	D	29°41'32.50"S	24°45'6.41"E
	E	29°41'20.59"S	24°45'29.01"E
	F	29°42'9.76"S	24°46'8.88"E
	G	29°42'12.46"S	24°45'28.61"E
	H	29°43'9.81"S	24°44'11.05"E
	I	29°42'44.40"S	24°44'9.53"E
	J	29°42'34.49"S	24°44'29.46"E
PV Array	A	29°41'43.75"S	24°44'10.51"E
	B	29°41'14.82"S	24°44'37.00"E
	C	29°41'22.97"S	24°44'43.71"E
	D	29°41'26.97"S	24°44'47.23"E
	E	29°41'45.93"S	24°45'4.55"E
	F	29°41'29.73"S	24°45'11.04"E
	G	29°41'21.14"S	24°45'29.39"E
	H	29°41'57.71"S	24°46'0.50"E
	I	29°41'57.49"S	24°45'50.07"E

	J	29°42'9.95"S	24°45'49.77"E
	K	29°42'12.84"S	24°45'28.03"E
	L	29°42'30.96"S	24°45'2.77"E
	M	29°42'31.29"S	24°44'52.33"E
	N	29°42'13.51"S	24°44'41.10"E
	O	29°42'12.98"S	24°44'25.19"E
	P	29°42'7.08"S	24°44'29.28"E
	Q	29°42'4.06"S	24°44'16.83"E
Associated Infrastructure			
Laydown Area	A	29°41'57.17"S	24°45'50.27"E
	B	29°41'57.29"S	24°46'0.58"E
	C	29°42'1.22"S	24°46'1.99"E
	D	29°42'1.30"S	24°45'58.95"E
	E	29°42'2.87"S	24°45'58.84"E
	F	29°42'2.62"S	24°45'50.06"E
BESS	G	29°42'3.26"S	24°45'50.08"E
	H	29°42'3.45"S	24°45'58.84"E
	I	29°42'8.61"S	24°45'58.83"E
	J	29°42'9.37"S	24°45'49.93"E
Auxiliary Buildings	K	29°42'1.86"S	24°45'59.21"E
	L	29°42'1.73"S	24°46'1.85"E
	M	29°42'3.71"S	24°46'2.79"E
	N	29°42'4.72"S	24°46'2.71"E
	O	29°42'4.60"S	24°45'59.09"E
Facility Substation	P	29°42'5.32"S	24°45'59.13"E
	Q	29°42'5.24"S	24°46'2.67"E
	R	29°42'8.34"S	24°46'2.65"E
	S	29°42'8.22"S	24°45'59.00"E
132 kV 100 m Corridor			
Start	1	29°42'8.68"S	24°46'0.22"E

Bend Point	2	29°42'9.38"S	24°46'10.38"E
Middle Point	3	29°42'39.01"S	24°46'22.78"E
Bend Point	4	29°43'11.05"S	24°46'36.52"E
End	5	29°43'14.31"S	24°46'44.12"E
Access Road			
Start	A	29°42'5.09"S	24°46'3.24"E
Bend Point	B	29°42'4.86"S	24°46'6.28"E
Mid-Point	C	29°43'16.13"S	24°46'39.77"E
Bend Point	D	29°44'10.83"S	24°47'2.89"E
End	E	29°44'27.78"S	24°46'59.45"E

The figures below indicate the co-ordinate points as per Table 2.4. above.

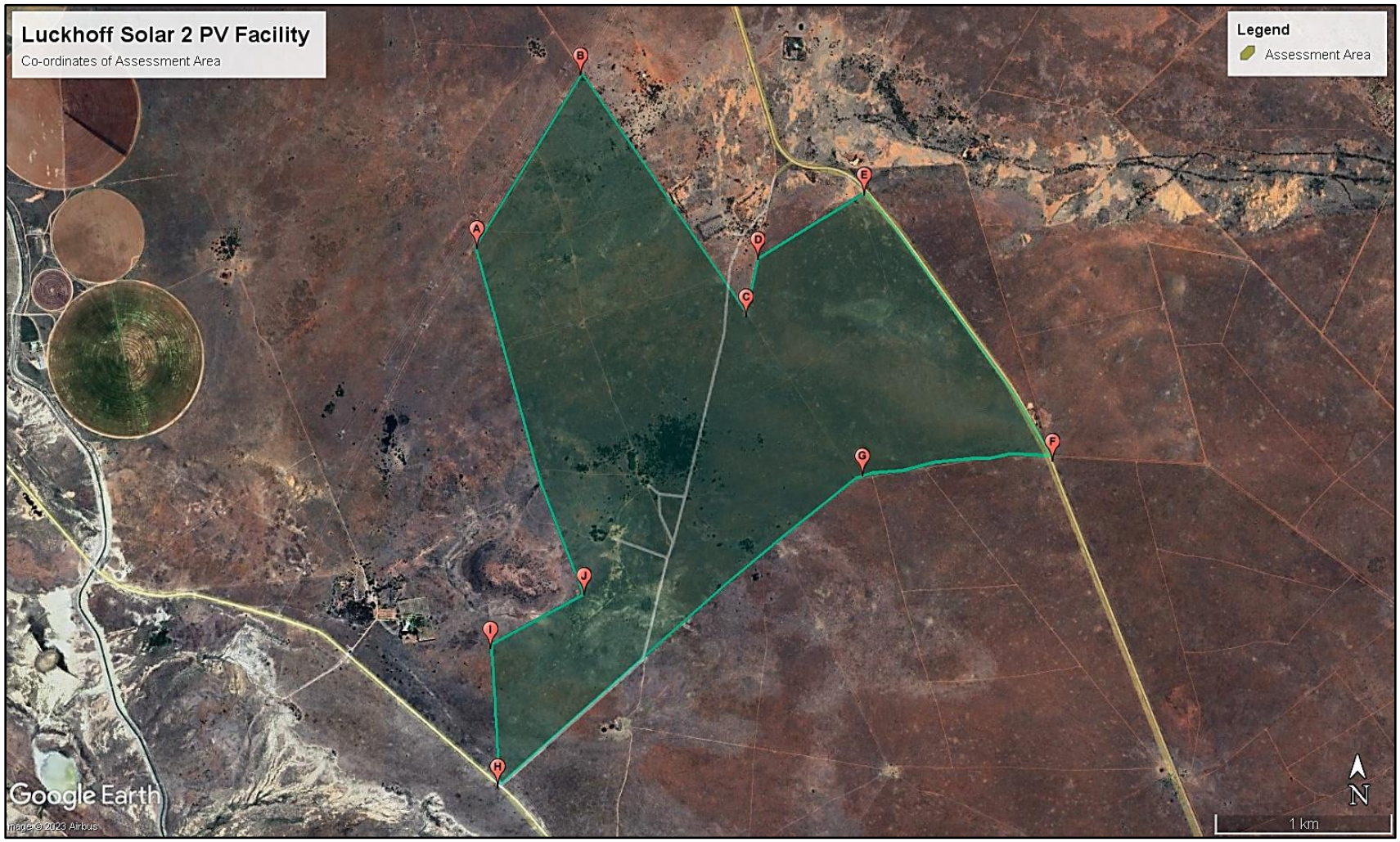


Figure 2.2: Co-ordinate points of the assessment area

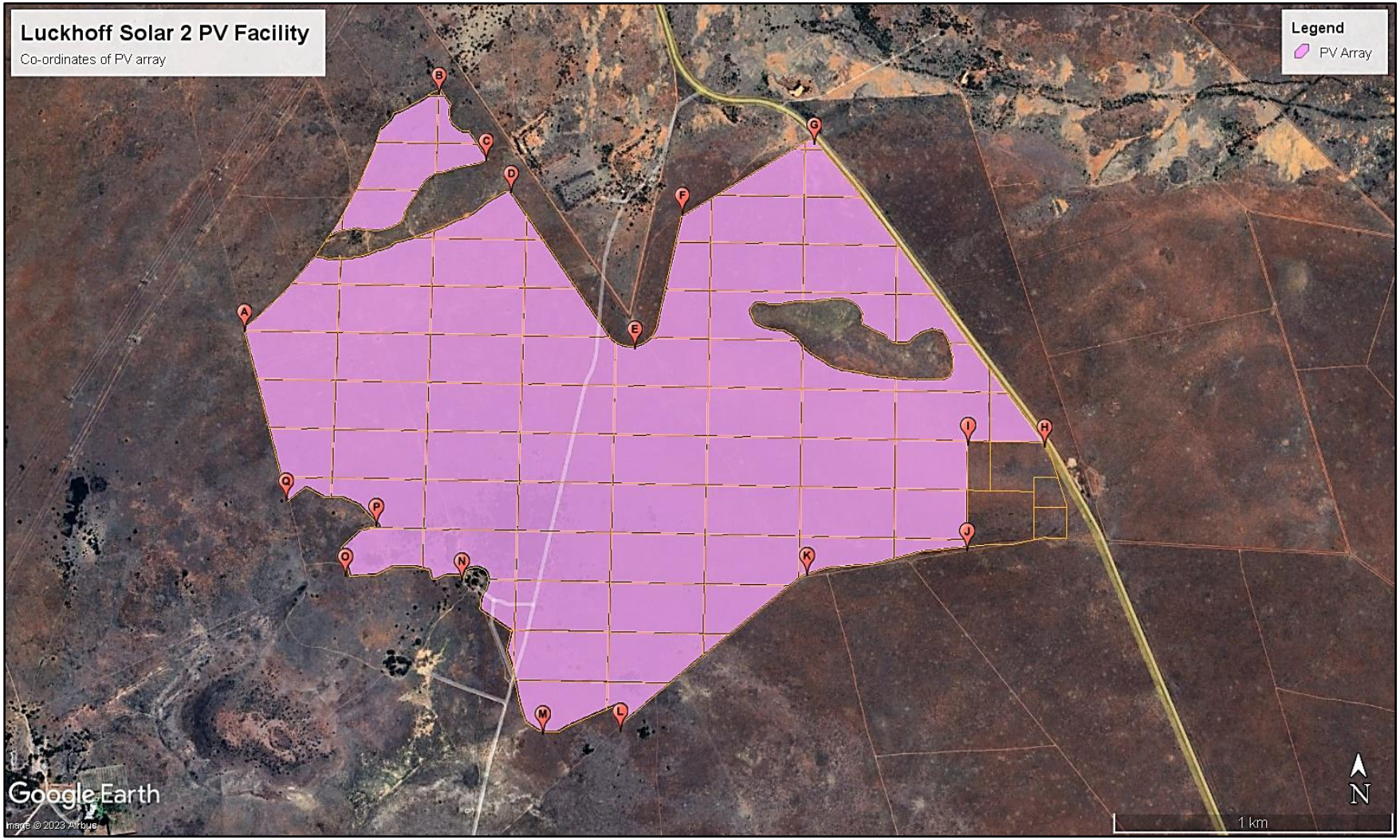


Figure 2.3: Co-ordinate points of the PV array

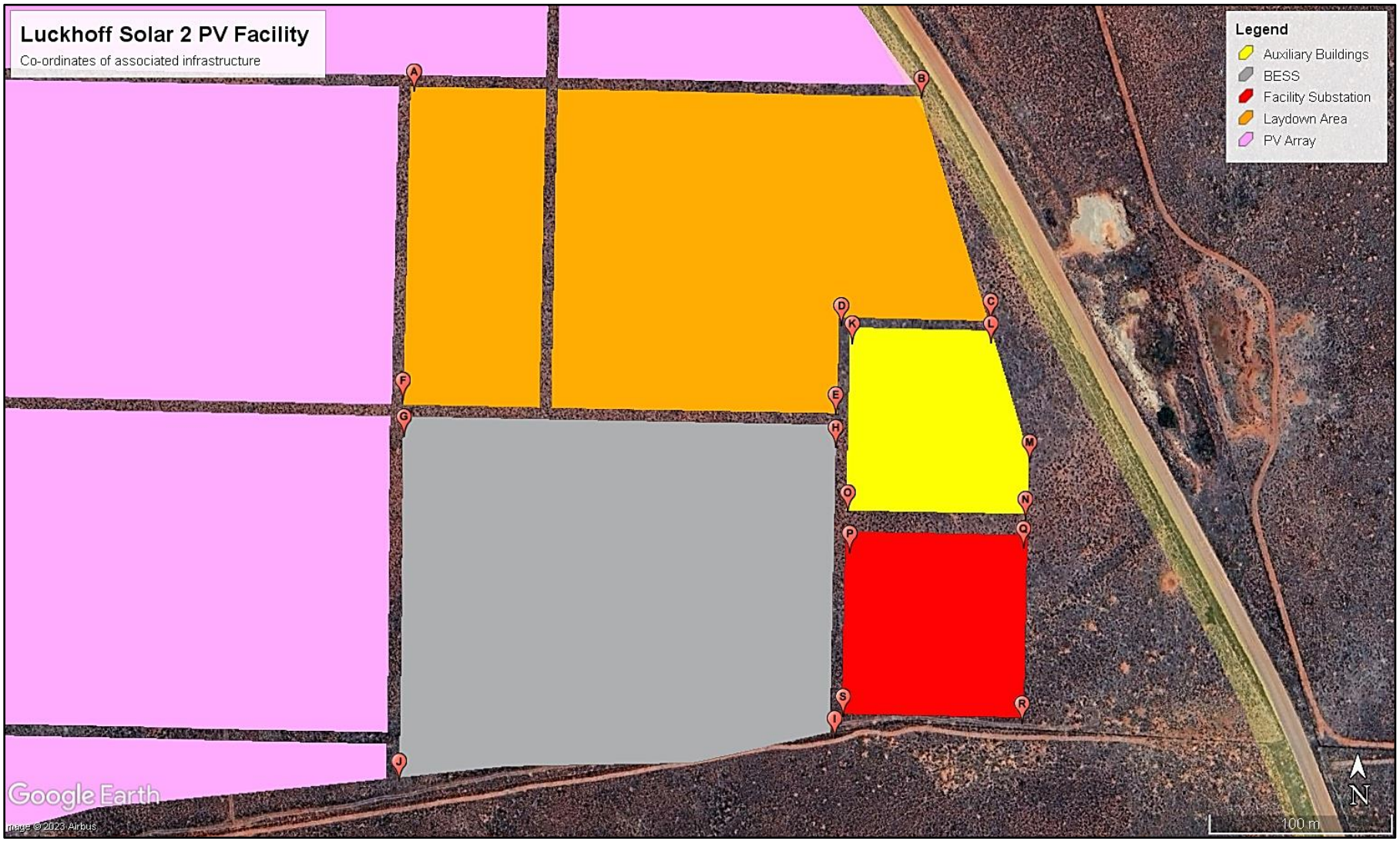


Figure 2.4: Co-ordinate points of associated infrastructure

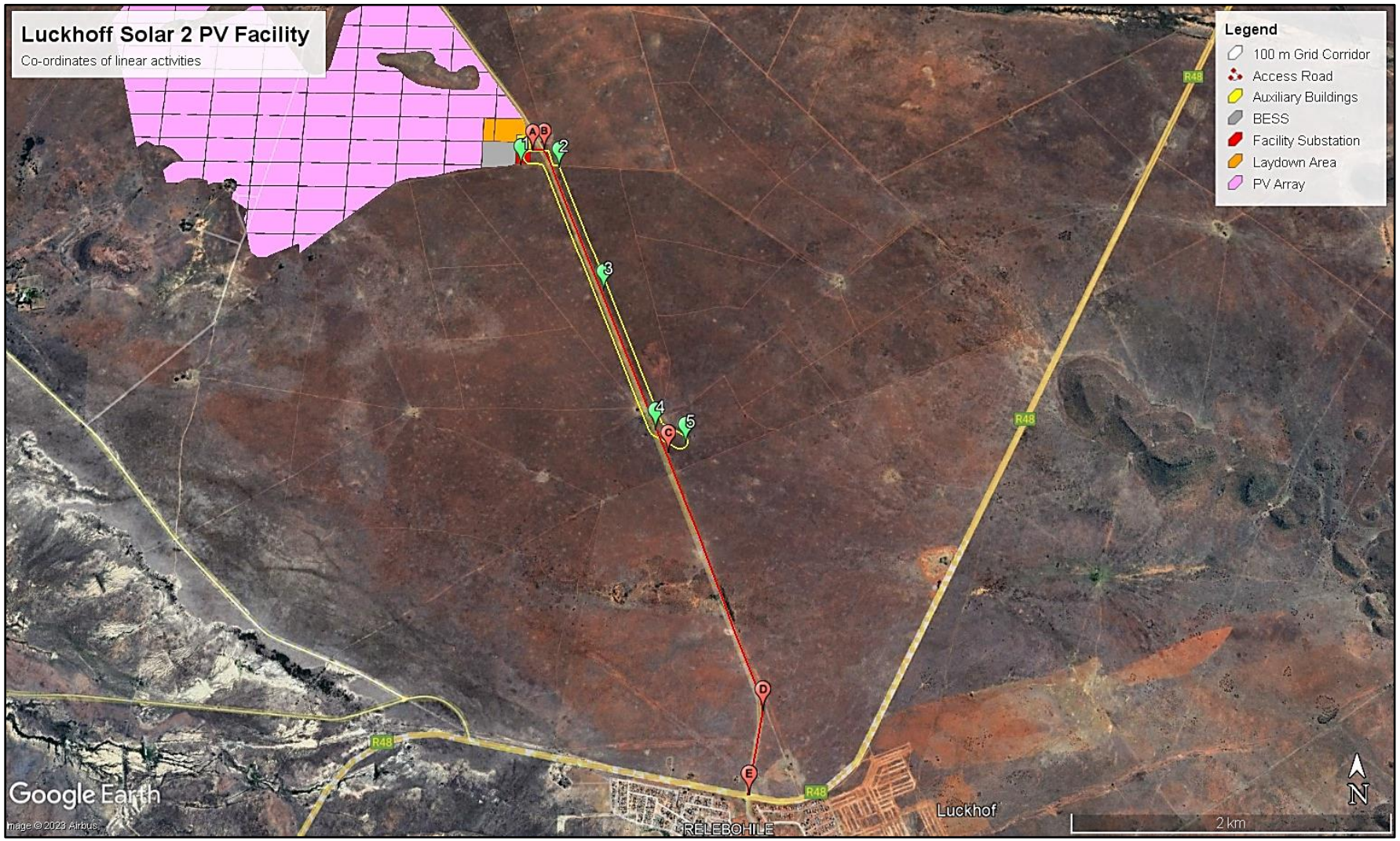


Figure 2.5: Co-ordinate points of access road and grid corridor

2.5 SERVICES PROVISION

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

2.5.1 Water

Adequate provision of water will be a prerequisite for the development. Four options will be considered, in order of priority by the Developer:

1. Supply from the Local Municipality (LM). The Developer will approach the Local Municipality to enquire whether they can provide all or part of the total water requirements of the Project. Specific arrangements will be agreed with the Local Municipality in a Service Level Agreement (SLA), following the appointment of preferred bidder during the financial close period.
2. Supply from a Private Contractor, which may include extraction from any bulk water supply lines nearby to the site.
3. An existing borehole on site, subject to NWA requirements[1].
4. A new borehole on site, subject to NWA requirements.

The estimated maximum amount of water required during construction is 34 100kl. The estimated maximum amount of water required during the operational phase is 9 547 kl per annum.

2.5.2 Stormwater

To avoid soil erosion, it is recommended that the clearing of vegetation be limited. It will also be good practice to design stormwater canals into which the water from the panels can be channelled. These canals should reduce the speed of the water and allow the water to drain slowly onto the land. Stormwater management and mitigation measures are included in the Environmental Management Programme (EMPr) – refer to Appendix F1.

2.5.3 Sanitation

During construction phase, portable chemical toilets will be utilised, that will be serviced privately or by the local municipality. Wastewater will be disposed of at a licensed landfill site. Should the contractor decide to install a conservancy tanks/s, this will be done in accordance with the NWA.

No effluent will be produced during operation of the facility, except for normal sewage from site and operations staff. This will be collected and treated as per normal standards using a septic or conservancy tank. In cases where the Local Municipality does not permit the use of sceptic tanks,

[1] The need for a NWA process is largely dependent on the Municipality's capacity to supply the project water demand at the time when construction commences. As such, the need for a NWA process will only be investigated and commissioned at this stage (if deemed necessary).

sewage will be stored in conservancy tank and collected by means of a honey-sucker and treated at an approved facility off site.

2.5.4 Solid Waste

During the construction phase, solid waste will mainly be in the form of construction material, excavated substrate and domestic solid waste. All waste will be disposed of in scavenger proof bins and temporarily placed in a central location for removal by an appointed contractor. Any other waste and excess material will be removed once construction is complete and disposed of at a registered waste facility. During the EIA, the applicant will request confirmation from the municipality that they have sufficient capacity at their registered landfills for the solid waste.

During the operational phase household waste will be removed to a licensed landfill site by a private contractor or by the local municipality.

2.5.5 Electricity

Electricity supply during construction will be provided by either diesel generators or arranged with the Local Municipality or Eskom Distribution, via an 11 kV or 22 kV feeder line.

During operation, the electricity will be supplied by the facility.

2.6 DECOMMISSIONING OF THE FACILITY

The operating period will be 20-25 years from the commencement date of the operation phase. It is anticipated that new PV technologies and equipment will be implemented, within the scope of the Environmental Authorisation, when influencing the profitability of the solar facility.

A likely extension of the facility's lifetime would involve putting new, more efficient, solar panels on the existing structures to improve the efficiency of the facility as the technology improves. The specifications of these new panels will be the same as the current panels under consideration, but the conversion efficiency of sunlight to energy will be greater (comparable to new computer chips, that are the same, but faster and more efficient). If, for whatever reason the facility halts operations, the Environmental Authorisation and contract with the landowner will be respected during the decommissioning phase.

The decommissioning process will consist of the following steps:

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

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

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

3 LEGISLATIVE AND POLICY CONTEXT

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

> **Appendix 3.** (3) An EIR (...) must include-
>
> (e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.

3.1 INTRODUCTION

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

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA]
- The National Energy Act, 2008 (Act 34 of 2008)
- National Water Act, 1998 (Act No. 36 of 1998)
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999)
- Conservation of Agricultural Resources Act, 1983 (Act No. 85 of 1983)
- The National Forests Act, 1998 (Act 84 of 1998)
- The White Paper on the Energy Policy of the Republic of South Africa (1998)
- The White Paper on Renewable Energy (2003)
- Integrated Resource Plan (IRP) for South Africa (2010-2030)
- National Development Plan of 2030
- National Infrastructure Plan of South Africa (2012)
- New Growth Path Framework (2010)

- Climate Change Bill (2018)
- Climate Change Bill (2021) – for public comment
- Strategic Integrated Projects (SIPs) (2010 – 2030)
- Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa (2014)
- Free State Provincial Spatial Development Framework (PSDF) (2012)
- Xhariep DM Reviewed Draft Integrated Development Plan (IDP) 2021 – 2021 (2021)
- Letsemeng Local Municipality Integrated Development Plan 2021/22 (2021)
- Letsemeng Spatial Development Framework 2019/2020 (SDF) (2018)

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

3.2 LEGISLATIVE CONTEXT

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

LEGISLATION	ADMINISTERING AUTHORITY	DATE	SUMMARY / IMPLICATIONS FOR PROPOSED DEVELOPMENT
The Constitution of South Africa **(Act No. 108 of 1996)**	National Government	1996	The Constitution is the supreme law of the Republic and all law and conduct must be consistent with the Constitution. The Chapter on the Bill of Rights contains a number of provisions, which are relevant to securing the protection of the environment. Section 24 states that "everyone has the right to (a) an environment that is not harmful to their health or well-being and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that – (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution therefore, compels government to give effect to the people's environmental right and places government under a legal duty to act as a responsible custodian of the country's environment. It compels government to pass legislation and use other measures to protect the environment, to prevent pollution and ecological degradation, promote conservation and secure sustainable development. The development of the Luckhoff Solar 2 PV facility and the aspects related thereto considers the creation of an environment which is not harmful or degraded through the implementation of appropriate mitigation measures.
The National Environmental Management Act **(Act No. 107 of 1998)**	National Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment) and the Free State	1998	NEMA provides for co-operative governance by establishing principles and procedures for decision-makers on matters affecting the environment. An important function of the Act is to serve as an enabling Act for the promulgation of legislation to effectively address integrated environmental management. Some of the principles in the Act are accountability; affordability; cradle to grave management; equity; integration; open information; polluter pays; subsidiary; waste avoidance and minimisation; co-operative governance; sustainable development; and environmental protection and justice.

	Province Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA)		The mandate for EIA lays with the National Environmental Management Act (107 of 1998) and the EIA Regulations No. 324, 325, 326, and 327 promulgated in terms of Section 24 of NEMA. The EIA Regulations determine that an Environmental Authorisation is required for certain listed activities, which might have a detrimental effect on the environment. The EIA process undertaken for the Luckhoff Solar 2 PV facility is in-line with the requirements of NEMA for the Application for Environmental Authorisation.
The National Energy Act **(Act No. 34 of 2008)**	Department of Mineral Resources and Energy	2008	One of the objectives of the National Energy Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar: "To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies…" (Preamble). Considering that the Luckhoff Solar 2 PV facility is proposed to make use of PV technology and the solar resource for the generation of electricity, the proposed project is in-line with the Act.
The National Water Act **(Act No. 36 of 1998)**	Department of Water Affairs (now known as Department of Water and Sanitation)	1998	Sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. The intention of the Act is to promote the equitable access to water and the sustainable use of water, redress past racial and gender discrimination, and facilitate economic and social development. The Act provides the rights of access to basic water supply and sanitation, and environmentally, it provides for the protection of aquatic and associated ecosystems, the reduction and prevention of pollution and degradation of water resources. As this Act is founded on the principle that National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, a person can only be entitled to use water if the use is permissible under the Act. Chapter 4 of the Act lays the basis for regulating water use. The study area is situated predominantly within the Northern Upper Karoo (NKu 3) vegetation unit, associated with the upper reaches of the Lemoenspruit River catchment (D33C), a small

			subquaternary catchment linked to the Orange / Gariep River. A small depression wetland has been found to be located within the project area and a watercourse which has been avoided by the proposed layout. In terms of Government Notice 509 of 2016 gazetted on 26 August 2016, any disturbance that takes place within the regulated area of a watercourse in terms of the Notice (in this case within 100 m of the edge of a watercourse OR within 500 m of a wetland) constitutes a water use that needs to be registered with the Department of Water and Sanitation. If the Risk Class of such a disturbance is found to be: • LOW, then the water user is required to comply with the provisions of Government Notice 509 and is exempt from applying for a WUL; or • MEDIUM or HIGH, then the water use is excluded from General Authorisation and the water user is required to comply with the conditions of a Water Use Authorisation Licence. Since infrastructure associated with the project will occur within 500 m of a wetland/depression (wetland feature), a WUA process will need to be followed. The applicant has initiated the WUA process on the Department's Electronic Water Use Licence Application and Authorisation System (e-WULAAS) which is running in parallel to the EIA process. The application is currently in the preapplication phase.
National Environmental Management: Waste Act **(Act No. 59 of 2008)**	National Department Environmental Affairs (DEA) (now known as the Department of Forestry, Fisheries and the Environment)	2008	NEMWA has been developed as part of the law reform process enacted through the White Paper on Integrated Pollution and Waste Management and the National Waste Management Strategy (NWMS). The objectives of the Act relate to the provision of measures to protect health, well-being and the environment, to ensure that people are aware of the impact of waste on their health, well-being and the environment, to provide for compliance with the measures, and to give effect to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being. Regulations No. R921 (of 2013) promulgated in terms of Section 19(1) of the National Environmental Management: Waste Act (59 of 2008) determines that no person may commence, undertake or conduct a waste management activity listed in this schedule unless a

			license is issued in respect of that activity. It is not envisaged that a waste permit will be required for the proposed development as no listed activities in terms of NEM:WA are expected to be triggered.
National Environment Management: Air Quality Act **(Act No. 39 of 2004)**	National Department Environmental Affairs (DEA) (now known as the Department of Forestry, Fisheries and the Environment)	2004	The object of this Act is to protect the environment by providing reasonable measures for the protection and enhancement of the quality of air in the Republic; the prevention of air pollution and ecological degradation; and securing ecologically sustainable development while promoting justifiable economic and social development. Regulations No. R248 (of 31 March 2010) promulgated in terms of Section 21(1)(a) of the National Environmental Management Act: Air Quality Act (39 of 2004) determine that an Atmospheric Emission License (AEL) is required for certain listed activities, which result in atmospheric emissions which have or may have a detrimental effect on the environment. The Regulation also sets out the minimum emission standards for the listed activities. It is not envisaged that an Atmospheric Emission License will be required for the proposed development.
The National Heritage Resources Act **(Act No. 25 of 1999)**	South African Heritage Resources Agency (SAHRA)	1999	The Act aims to introduce an integrated and interactive system for the management of heritage resources, to promote good governance at all levels, and empower civil society to nurture and conserve heritage resources so that they may be bequeathed to future generations and to lay down principles for governing heritage resources management throughout the Republic. It also aims to establish the South African Heritage Resources Agency together with its Council to co-ordinate and promote the management of heritage resources, to set norms and maintain essential national standards and to protect heritage resources, to provide for the protection and management of conservation-worthy places and areas by local authorities, and to provide for matters connected therewith. The Act protects and manages certain categories of heritage resources in South Africa. For the purposes of the Heritage Resources Act, a “heritage resource” includes any place or object of cultural significance. In this regard the Act makes provision for a person undertaking an activity listed in Section 28 of the Act to notify the resources authority. The resources authority may

			request that a heritage impact assessment be conducted if there is reason to believe that heritage resources will be affected. A case file has been opened on SAHRIS for the Luckhoff Solar 2 PV facility with case reference number 20140, and all relevant documents were submitted for their comments and approval. The Heritage Impact Assessment undertaken for the solar PV facility is included as Appendix E5, and the Palaeontological Impact Assessment is included as Appendix E6.
Conservation of Agricultural Resources Act **(Act No. 85 of 1983)**	National and Provincial Government	1983	The objective of the Act is to provide control over the utilisation of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith. Consent will be required from the Department of Agriculture, Forestry and Fisheries (now known as the Department of Forestry, Fisheries and the Environment) in order to confirm that the proposed development is not located on high potential agricultural land and to approve the long-term lease agreement. A Soils and Agricultural Compliance statement has been undertaken for the Luckhoff Solar 2 PV facility and is included as Appendix E4.
The National Forests Act, 1998 **(Act 84 of 1998)**	Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)	1998	The purposes of this Act are to: (a) promote the sustainable management and development of forests for the benefit of all; (b) create the conditions necessary to restructure forestry in State forests; (c) provide special measures for the protection of certain forests and trees: (d) promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes. (e) promote community forestry; (f) promote greater participation in all aspects of forestry and the forest products industry by persons disadvantaged by unfair discrimination. Section 12(1) read with s15(1) of the NFA stated that the Minister may declare a particular tree, group of trees, woodland; or trees belonging to a particular species, to be a protected tree,

	group of trees, woodland or species. A list of protected tree species was gazetted in GN 635 of 6 December 2019. The effect of the declaration is that no person may (a) cut, disturb, damage or destroy; or (b) possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except under a license granted by the Minister; or in terms of an exemption published by the Minister in the Gazette. An Ecological Impact Assessment has been undertaken for the Luckhoff Solar 2 PV facility and is included in Appendix E1.

3.3 POLICY CONTEXT

Table 3.2: Policy context for the construction of photovoltaic solar facilities

POLICY	ADMINISTERING AUTHORITY	DATE	SUMMARY / IMPLICATIONS FOR PROPOSED DEVELOPMENT
The White Paper on the Energy Policy of the Republic of South Africa	Department of Mineral Resources and Energy	1998	The White Paper on the Energy Policy of the Republic of South Africa establishes the international and national policy context for the energy sector, and identifies the following energy policy objectives: • Increasing access to affordable energy services • Improving energy governance • Stimulating economic development • Managing energy-related environmental and health impacts • Securing supply through diversity • Energy policy priorities The White Paper sets out the advantages of renewable energy and states that Government believes that renewables can in many cases provide the least cost energy service, particularly when social and environmental costs are included. The White Paper acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive, and many appropriate applications exist. The White Paper notes that renewable energy applications have specific characteristics that need to be considered. Advantages include: • Minimal environmental impacts in operation in comparison with traditional supply technologies; and • Generally lower running costs, and high labour intensities. Disadvantages include: • Higher capital costs in some cases; • Lower energy densities; and

			• Lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. The Luckhoff Solar 2 PV facility is in line with this policy as it proposes the generation of renewable energy from the solar resource.
The White Paper on Renewable Energy	Department of Mineral Resources and Energy	2003	This White Paper on Renewable Energy supplements the *White Paper on Energy Policy*, which recognises that the medium and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. The White Paper notes that while South Africa is well-endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. The medium-term (10-year) target set in the White Paper is: *10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1667 MW) of the projected electricity demand for 2013 (41539 MW)* (Executive Summary, ix). The Luckhoff Solar 2 PV facility is in line with this paper as it proposes the generation of renewable energy from the solar resource.
Integrated Resource Plan (IRP) for South Africa	Department of Mineral Resources and Energy	2010-2030	The Integrated Resource Plan for Electricity for South Africa of 2010–2030 (further referred to as the IRP) is a "living plan" which is expected to be revised and updated continuously as necessary due to changing circumstances. According to the Summary of the plan the current IRP for South Africa, which was originally initiated by the Department of Energy (DoE) in June 2010 (the Department is now known as Department of Mineral Resources and Energy), led to the Revised Balanced Scenarios (RBS) for the period 2010–2030. "*This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation".* In addition to all existing and committed power plants, the RBS included 11,4 GW of

renewables, which relates to the proposed Luckhoff Solar Power Plant. In 2010 several changes were made to the IRP model. The main changes in the IRP were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP), and wind options (RSA, 2011a).

The summary of the IRP further explains that traditional cost-optimal scenarios were developed based on the previously mentioned changes in the IRP. This resulted in the Policy-Adjusted IRP, which stated that:

"*The installation of renewables (solar PV, CSP and wind) have been brought forward in order to accelerate a local industry*; *To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW is included in the IRP; The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) is maintained; and Energy efficiency demand-side management (EEDSM) measures are maintained at the level of the RBS*" (RSA, 2011a:6).

"The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources" (RSA, 2011a:6).

The IRP highlights the commitments before the next IRP. The commitments pertaining to the purpose of the proposed project in renewable energy is: "*Solar PV programme 2012-2015: In order to facilitate the connection of the first solar PV units to the grid in 2012 a firm commitment to this capacity is necessary. Furthermore, to provide the security of investment to ramp up a sustainable local industry cluster, the first four years from 2012 to 2015 require firm commitment."*

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

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

comments until March of 2017. The new IRP of 2019 was formally published in October 2019. For the revision scenario, analysis was conducted. The results revealed that for the period ending 2030 that: *"The committed Renewable Energy Independent Power Producers Programme, including the 27 signed projects and Eskom capacity rollout ending with the last unit of Kusile in 2022, will provide more than sufficient capacity to cover the projected demand and decommissioning of plants up to approximately 2025"; "Imposing annual build limits on renewable energy will not affect the total cumulative capacity and the energy mix for the period up to 2030*"; and *"the scenario without renewable energy annual build limits provides the least-cost option by 2030*" (RSA, 2018:34).

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

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

The Luckhoff Solar 2 PV facility is in line with this plan as it proposes the generation of renewable energy from the solar resource and will contribute to the energy mix of the country as set out in this plan.

National Development Plan of 2030	The Presidency: National Planning Commission	-	The National Development Plan aims to "eliminate poverty and reduce inequality by 2030" (RSA, undated). In order to eliminate or reduce inequality, the economy of South Africa needs to grow faster in order to benefit all South Africans. In May 2010 a draft national development plan was drafted, which highlighted the nine (9) key challenges for South Africa. The highest priority areas according to the plan are considered to be the creation of employment opportunities and to improve the quality of national education. In this regard, the plan sets out three (3) priority areas, namely, to raise employment by a faster growing economy, improve the quality of education, and to build the capability of the state in order to play a more developmental and transformative role. One of the key challenges identified was that the economy is unsustainably resource intensive and the acceleration and expansion of renewable energy was identified as a key intervention strategy to address this challenge. The development of the Luckhoff Solar 2 PV facility will contribute to the intervention strategy as identified within the plan.
National Infrastructure Plan of South Africa	Presidential Infrastructure Coordinating Commission	2012	In the year 2012 the South African Government adopted a National Infrastructure Plan (hereafter referred to as the Plan). The aim of this Plan is to transform the economic landscape, while strengthening the delivery of basic services and creating new employment opportunities. This Plan also supports the integration of African communities, and also sets out the challenges and enablers that our country needs in order to respond to the planning and development of infrastructure with regards to fostering economic growth (RSA, 2012). The Plan has developed eighteen (18) strategic integrated projects (further referred to as SIPs). These SIPs stretch over all nine (9) provinces, covering social and economic infrastructure, and projects that enhances development and growth. Of the eighteen (18), five (5) are geographically focused, three (3) spatial, three (3) energy, three (3) social infrastructure, two (2) knowledge, one (1) regional integration, and one (1) water and sanitation focussed. The three (3) SIPs according to the Plan, which are energy focused and correlate to the proposed project are as follow: - SIP 8: Green energy in support of the South African economy; - SIP 9: Electricity generation to support socio-economic development; and - SIP 10: Electricity transmission and distribution for all. SIP 8 according to the Plan "*support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the IRP 2010 and support bio-fuel production facilities*". The purpose of SIP 9 according to the Plan is to "*accelerate the construction of new electricity*

		generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances". SIP 9 should also monitor the implementation of major projects such as new power stations like Medupi, Kusile and Ingula. Lastly, SIP 10 aims to "*expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development*" (RSA, 2012:20). The Luckhoff Solar 2 PV facility is in line with this plan as it proposes the generation of renewable energy from the solar resource which supports socio-economic development and will contribute to meeting the electricity demand of the country as set out in this plan.
New Growth Path Framework	Department of - Economic Development	The New Growth Path was developed after 16 years of South Africa's democracy, to respond to emerging opportunities and risks while building on policies. This framework provides a dynamic vision on how to collectively achieve a more developed, equitable and democratic society and economy. This framework mainly reflects the commitment of the South African Government to create employment opportunities for its people in all economic policies (RSA, 2011b). This framework sets out the markers for job creation and growth and also identify where there are viable changes in the character and structure of production, in order to create a more inclusive, greener economy in the long-term. It is stated in the framework that in order for this framework to reach its objectives, the Government is committed to: - Identify the possible areas of employment creation; and - Develop a policy to facilitate employment creation especially with regards to social equity, sustainable employment and growth in the creation of employment activities (RSA, 2011b). This framework also identifies investments in five key areas, one of which is energy. This framework also states that the green economy is a priority area, which includes the construction of and investment in renewable energy technologies like solar (RSA, 2011b). In this regard it will also assist creating employment opportunities over the medium- and long-term. Considering that the construction of and investment in renewable energy is a key area identified within the framework, the Luckhoff Solar 2 PV facility is considered to be in-line with the framework.

Climate Change Bill	National Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)	2018	On 08 June 2018 the Minister of Environmental Affairs published the Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. The following objectives are set within the Bill: • Provide for the coordinated and integrated response to climate change and its impacts by all spheres of government in accordance with the principles of cooperative governance; • Provide for the effective management of inevitable climate change impacts through enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic, and environmental resilience and an adequate national adaptation response in the context of the global climate change response; • Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe and in a manner that enables economic, employment, social and environmental development to proceed in a sustainable manner. The Luckhoff Solar 2 PV facility comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.
Climate Change Bill	National Department of Forestry, Fisheries and the Environment	2021	The Department of Forestry, Fisheries and the Environment has published a new Climate Change Bill for public comment. The bill notes that climate change represents an urgent threat to human societies and the planet, and requires an effective, progressive and incremental response from both government and citizens. It recognises that South Africa has a global responsibility to reduce greenhouse gasses and that the anticipated impacts arising as a result of climate change have the potential to undermine achieving of the country's developmental goals.

			The main objective of the bill is to enable the development of an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society, and to provide for matters connected therewith. The Luckhoff Solar 2 PV facility comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Committee	2010 - 2030	The Presidential Infrastructure Coordinating Committee (PICC) is integrating and phasing investment plans across 18 Strategic Infrastructure Projects (SIPs) which have five core functions: to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development and enabling regional integration. SIP 8 and 9 of the energy SIPs supports the development of the solar energy facility: • SIP 8: Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010 – 2030) and supports bio-fuel production facilities. • SIP 9: Electricity generation to support socio-economic development: The proposed Luckhoff Solar PV facility is a potential SIP 9 Project as electricity will be generated and social and economic upliftment, development and growth will take place within the surrounding communities. It would become a SIP 9 project if selected as a Preferred Bidder project by the Department of Mineral Resources and Energy. SIP 9 supports the acceleration of the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances. The Luckhoff Solar 2 PV facility could be registered as a SIP project once selected as a preferred bidder under the REIPPP Programme. The project would then contribute to the above-mentioned SIPs.

Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa	National Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)	2014	The then Department of Forestry, Fisheries and the Environment (DFFE) has committed to contribute to the implementation of the National Development Plan and National Infrastructure Plan by undertaking Strategic Environmental Assessments (SEAs) to identify adaptive processes that integrate the regulatory environmental requirements for Strategic Integrated Projects (SIPs) while safeguarding the environment. The wind and solar photovoltaic (PV) SEA was accordingly commissioned by DEA in support of SIP 8, which aims to facilitate the implementation of sustainable green energy initiatives. This SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs). The REDZs also provide priority areas for investment into the electricity grid. Currently one of the greatest challenges to renewable energy development in South Africa is the saturation of existing grid infrastructure and the difficulties in expanding the grid. Proactive investment in grid infrastructure is likely to be the most important factor determining the success of REDZs. Although it is intended for the SEA to facilitate proactive grid investment in REDZs, such investment should not be limited to these areas. Suitable wind and solar PV development should still be promoted across the country and any proposed development must be evaluated on its own merit. The Luckhoff Solar 2 PV facility is not located within a REDZ, but the development will contribute to the expansion of renewable energy facilities and infrastructure within the country, and provide the positive opportunities associated with it.
Free State Provincial Spatial Development Framework (PSDF)	Free State Provincial Government	2012	The Free State PSDF is a policy document that promotes a 'developmental state' in accordance with national and provincial legislation and directives. It aligns with the Free State Provincial Growth and Development Strategy which has committed the Free State to 'building a prosperous, sustainable and growing provincial economy which reduces poverty and improves social development'. The PSDF includes comprehensive plans and strategies that collectively indicate which type of land-use should be promoted in the Province, where such land-use should take place, and how it should be implemented and managed. In broad terms, the PSDF:

		• Indicates the spatial implications of the core development objectives of the Free State Provincial Growth and Development Strategy. • Serves as a spatial plan that facilitates local economic development. • Lays down strategies, proposals and guidelines as it relates to sustainable development. • Facilitates cross-boundary co-operation between municipalities, adjoining provinces, and bordering countries. • Serves as a manual for integration and standardisation of the planning frameworks of all spheres of government in the Province. The Free State Provincial Growth and Development Strategy states that sustainable economic development is the only effective means by which the most significant challenge of the Free State, namely poverty, can be addressed. The PSDF gives practical effect to sustainable development, which is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The PSDF is prepared in accordance with bioregional planning principles that were adapted to suit the site-specific requirements of the Free State. It incorporates and complies with the relevant protocols, conventions, agreements, legislation and policy at all applicable levels of planning, ranging from the international to the local. The PSDF builds upon achievements and learns from mistakes of the past, reacts to the challenges of our time, incorporates the traditional knowledge of the people of the Free State, and builds upon international best-practice and technology. The development of the Luckhoff Solar 2 PV facility is in-line with the framework based on the contributions and opportunities presented by a development of this nature.
Xhariep District Municipality Integrated Development Plan (IDP)	Xhariep District Municipality 2021	The long-term vision of the Xhariep DM is to be: *"A community-oriented municipality, with a* sustainable environment for business and economic opportunities". The key words and phrases in the vision must be interpreted as follows:

			○ Municipality: A municipality consists of the political structures, the administration and the community. ○ Community: A social group of any size whose members reside in a specific locality, share government, and often have a common cultural and historical heritage. ○ Sustainable: That "meets the needs of the present without compromising the ability of future generations to meet their own needs". It rests on three "pillars" i.e., economic development, social development and environmental protection. Opportunities: To make possible or easy. Enabling environments are those where participants feel safe enough to develop relationships and to share experiences. In order to support the vision statement, the Municipality has identified a mission statement. The Mission statement of the municipality is therefore: ○ *"To facilitate and support local municipalities, by promoting a healthy and conducive environment in our communities by ensuring that we deliver on our core functions.* ○ *To promote an inclusive society through social/cultural events.* ○ *To promote local economic development, by creating sustainable markets for local producers.* ○ *To ensure a sound Political and Administrative Leadership".* The development of the Luckhoff Solar 2 PV facility will contribute to the goals of the area, albeit to a limited extent.
Letsemeng Local Municipality Integrated Development Plan (IDP)	Letsemeng Local Municipality	2021/ 22	As per the IDP *"Our approach shall continue to be informed by the commitment of the Municipality to the five Pillars of Back to Basics strategies namely;* - *Putting people and their concerns first;* - *Creating conditions for decent living;* - *Demonstrating good governance;* - *Ensuring sound financial management; and* - *Building and maintaining sound institutional and administrative capabilities;"*

			The development of the Luckhoff Solar 2 PV facility will contribute to the goals of the area, albeit to a limited extent.
Letsemeng Spatial Development Framework 2019/2020 (SDF) (2018)	Letsemeng SDF	2019/ 2020	Spatial Development Frameworks and policies at all spheres of government must address the inclusion of persons and areas that were previously excluded, with an emphasis on informal settlements, former homeland areas and areas characterised by widespread poverty and deprivation. The Spatial Development Framework (SDF) supports the Letsemeng Vision as indicated in the IDP document and is intended to promote an urban form that will deliver the long-term vision for Letsemeng. The main purpose of the current SDF is to create a town that is sustainable, accessible and efficient. The following objective will ensure that the municipality succeeds in their main purpose. o Objective 1: To create sustainable human settlement with quality physical, economic and social environments; o Objective 2: To encourage land reform towards more intensive land uses; o Objective 3: To encourage urban and regional integration and rectification of past imbalances; o Objective 4: To create a sustainable local land use management system; o Objective 5: Support Local Economic Development Opportunities; o Objective 6: Manage Informal settlements; o Objective 7: Manage development to ensure environmental sustainability; o Objective 8: Promote regional connectivity. The Spatial Development Framework needs to be indicative and therefore there is a need to adopt a set of structuring elements that can give future structure to the urban and rural form of the municipal area. Six (6) spatial structuring elements have been identified; with the main purpose of these structuring elements being: o To ensure that the SDF achieves the desired urban form; o To link spatial objectives with clear implementation strategies; o To ensure that infrastructure is carefully planned; o Policy and institutional instruments are in place;

- Growth is appropriately managed;
- To ensure that all relevant sectors are aligned to the plan;

The above can be achieved by implementing an effective growth management approach, which steers development to achieve the desired spatial and developmental outcomes. Growth management is a multi-sectoral concept that should be reflected in an integrated management system which relies on the contributions of all service providers in the area.

The development of the Luckhoff Solar 2 PV facility will contribute to the goals of the area, albeit to a limited extent.

3.4 OTHER LEGISLATION

Other legislation mainly refers to the following:

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

3.5 RELEVANT GUIDANCE

The following guidance was considered in conducting the EIA:

- The Equator principles III (2013)[2]
- World Bank Group Environmental, Health and Safety General Guidelines (EHS Guidelines) (2007)
- Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (2007)
- International Finance Corporation's Policy on Environmental and Social Sustainability (2012)
- DEA. (2013). Draft National Renewable Energy Guideline. Department of Environmental Affairs, Pretoria, South Africa
- DEA, (2012), Guideline 5 – Final companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010
- DEA, (2012), Guideline 7 – Public participation in the Environmental Impact Assessment process
- DEA, (2012), Guideline 9 – Need and desirability
- DEA, (2006), Guideline 3 – General guide to the Environmental Impact Assessment Regulations
- DEAT, (2006), Guideline 4 – Public participation in support of the Environmental Impact Assessment Regulations
- DEAT, (2006), Guideline 5 – Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations
- BirdLife, (2017). Best Practise Guidelines Birds & Solar Energy: Guidelines for assessing and monitoring the impact of solar power generating facilities on bird in southern Africa.

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

3.6 CONCLUSION

The S&EIR process was undertaken in accordance with the EIA Regulations, 2014 (as amended) published in GNR 326, in terms of Section 24(5) and 44 of the NEMA as amended as well as all relevant National legislation, policy documents, national guidelines, the World Bank EHS Guidelines, the IFC Performance Standards, and the Equator Principles.

The legislative and policy context plays an important role in identifying and assessing the potential social impacts associated with the proposed development, as well as an indication of the need and desirability of the proposed development from a national, provincial and local level. For this reason, the proposed development project will be assessed in terms of its fit with the key legislative, policy and planning documents discussed above.

The main findings of the review of the policy documents on all spheres of Government indicated that strong support was given towards renewable energy, specifically PV solar energy and therefore it is concluded that there is support for the development of the Luckhoff Solar 2 PV facility. The White Paper on the Energy Policy of the Republic of South Africa of 1998 stated that due to the fact that renewable energy resources operate from an unlimited resource base, i.e., the sun, renewable energy can increasingly contribute towards a long-term sustainable energy supply for future generations. This policy further highlights that due to the unlimited resources base of renewable energy in South Africa, renewable energy applications, like PV solar energy and associated infrastructure, are more sustainable in terms of social and environmental costs. The Integrated Resource Planning for Electricity for South Africa of 2010–2030, the National Infrastructure Plan of South Africa and the New Growth Path Framework all support the development of the renewable energy sector. In particular, the IRP also indicated that 43% of the energy generation in South Africa is allocated to renewable energy applications. On a District and Local level limited attention is given explicitly to renewable sources like PV solar energy, however the documents reviewed do make provision for such developments and efficiency in improving the quality of lives in terms of efficient physical infrastructure as well as socio-economic growth. At Provincial, District and Local level the policy documents support the applications of renewables.

The review of the relevant policies and documents related to the energy sector therefore indicate that renewables, like solar energy and the establishment of solar energy facilities and associated infrastructure, are supported on all spheres of Government. The proposed Luckhoff Solar 2 PV facility is therefore supported by the related policy and planning documents reviewed in this section of the report.

4 THE NEED AND DESIRABILITY

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

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

(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;

4.1 THE NEED FOR THE PROPOSED ACTIVITY

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

Over 90% of South Africa's electricity generation is coal based, the World bank estimates that this results in an annual, per capita carbon emission of ~8.9 tons per person. Based on 2008 fossil-fuel CO_2 emissions statistics released by the Carbon Dioxide Information Analysis Centre, South Africa is the 13th largest carbon dioxide emitting country in the world and the largest emitter in Africa (Boden, et al. 2011). In August 2021 an article confirmed that South Africa is the 12th highest greenhouse gas emitter in the world (source: https://www.news24.com/fin24/economy/eskom-will-only-able-to-meet-global-air-quality-standards-by-2050-owing-to-financial-woes-20210818).

The proposed project is intended to form part of the Department of Mineral Resources and Energy's (DMREs) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme[3] or any other appropriate energy generation programmes / opportunities. The REIPPP Programme aims to secure 14 725 Megawatts (MW) of new generation capacity from renewable energy sources, while simultaneously diversifying South Africa's electricity mix. According to the 2021 State of the Nation Address, Government will soon be initiating the procurement of an additional 11 800 MW of power from renewable energy, natural gas, battery storage and coal in line with the Integrated Resource Plan 2019 and fulfilling their commitments under the United Nations Framework Convention on Climate Change and its Paris Agreement which include the reduction of greenhouse gas emissions. Eskom, the largest greenhouse gas emitter of South Africa, has committed in principle to net zero emission by 2050 and to increase its renewable capacity.

During the 2022 State of the Nation Address it was indicated that during the past year the government had taken "firm steps" to bring additional generation capacity online as quickly as possible to close the shortfall in terms of electricity. As a result, it was confirmed that

[3] The project will also participate in other programs/opportunities to generate power in South Africa.

several new generation projects will be coming online over the next few years. During the recent 2023 State of the Nation Address, the government has embarked upon allowing private developers to generate electricity. There are now more than 100 projects, which are expected to provide over 9 000 MW of new capacity over time. A number of companies that have participated in the renewable energy programme will soon enter construction and deliver a total of 2 800 MW of new capacity. Through the Just Energy Transition Investment Plan, R1.5 trillion will be invested in our economy over the next five years in new frontiers such as renewable energy, green hydrogen and electric vehicles. A number of projects are already underway, including the development of a new facility by Sasol at Boegoebaai in the Northern Cape, the Prieska Power Reserve in the Free State, and the Hydrogen Valley initiative in Limpopo, Gauteng and KwaZulu-Natal.

Besides capacity additions, several assumptions have changed since the promulgation of IRP 2010–2030. Key assumptions that changed include the electricity demand projection, Eskom's existing plant performance, as well as new technology costs. These changes necessitated the review and update of the IRP which resulted in the draft IRP 2018 as per table 4.1 below:

Table 4.1: Published Draft IRP 2018 (Approved by Cabinet for Consultation)

	Coal	Nuclear	Hydro	Storage (Pumped Storage)	PV	Wind	CSP	Gas / Diesel	Other (CoGen, Biomass, Landfill)	Embedded Generation
2018	39 126	1 860	2 196	2 912	1 474	1 980	300	3 830	499	Unknown
2019	2 155					244	300			200
2020	1 433				114	300				200
2021	1 433				300	818				200
2022	711				400					200
2023	500									200
2024	500									200
2025					670	200				200
2026					1 000	1 500		2 250		200
2027					1 000	1 600		1 200		200
2028					1 000	1 600		1 800		200
2029					1 000	1 600		2 850		200
2030			2 500		1 000	1 600				200
TOTAL INSTALLED	33 847	1 860	4 696	2 912	7 958	11 442	600	11 930	499	2600
Installed Capacity Mix (%)	44.6	2.5	6.2	3.8	10.5	15.1	0.9	15.7	0.7	

Installed Capacity
Committed / Already Contracted Capacity
New Additional Capacity (IRP Update)

According to the South African Energy Sector Overview (2021), there is currently 1 723 MW of installed PV capacity, while an additional 2 600 MW and 860 MW from wind and solar has been rewarded as part of Bid window 5 and 6, respectively (latter announced in 2022).

4.2 THE DESIRABILITY OF THE PROPOSED ACTIVITY

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

- Lesser dependence on fossil fuel generated power - The deployment of the facility will have a positive macro-economic impact by reducing South Africa's dependence on fossil fuel generated power and assisting the country in meeting its growing electricity demand.
- Increased surety of supply - By diversifying the sources of power in the country, the surety of supply will increase. The power demands of South Africa are ever increasing and by adding solar power this demand can be met, even exceeded without increasing pollution in relation to the use of fossil fuels. The project has the potential of "securing" economic activity by assisting in removing supply constraints if Eskom generation activities result in a supply shortfall. When supply is constrained, it represents a limitation to economic growth. When a supply reserve is available, it represents an opportunity for economic growth.
- Local economic growth - The proposed project will contribute to local economic growth by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Free State Province. The project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally. The development of the photovoltaic solar facility will in turn lead to growth in tax revenues for local municipalities and sales of carbon credits, resulting in increased foreign direct investment. The location of the proposed development within the Xhariep District Municipality is desirable since 41,9% of households within the Municipality live within the poverty level with an income of less than R30 000 or less per annum (Xhariep SDF, 2010-2011).
- Lower costs of alternative energy - An increase in the number of solar facilities commissioned will eventually reduce the cost of the power generated through solar facilities. This will contribute to the country's objective of utilising more renewable energy and less fossil fuel-based power sources. It will assist in achieving the goal to generate 14 725 MW of electricity from renewable energy as per the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme of the Department of Mineral Resources and Energy. The Government will be initiating the procurement of an additional 11 800 MW of renewable energy as stated during the 2021 State of the Nation Address.
- Reduction in greenhouse gas emissions - The additional power supplied through solar energy will reduce the reliance on the combustion of fossil fuels to produce power. The South African electricity grid is predominantly coal-fired and therefore GHG emissions intensive (coal accounts for more than 92% of the fuel used in South Africa's electricity generation). The reduction of GHG emissions as a result of the project implementation will be achieved due to reduction of CO_2 emissions from combustion

of fossil fuel at the existing grid-connected power plants and plants which would likely be built in the absence of the project activity.

- CDM Project - A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e., a financial mechanism developed to encourage the development of renewable technologies).
- Climate change mitigation - On a global scale, the project makes a contribution to greenhouse gas emission reduction and therefore contributes toward climate change mitigation.
- Reduced environmental impacts - The reduction in non-renewable electricity consumed from the grid will not only result in a reduction in greenhouse gas emissions, but also the prevention of negative impacts associated with coal mining. For example, coal power requires high volumes of water, in areas of South Africa where water supply is already over-stretched and water availability is highly variable. Photovoltaic solar energy technology also does not produce the sulphur emissions, ash or coal mining concerns associated with conventional coal fired electricity generation technologies resulting in a relatively low level of environmental impacts. It is a clean technology which contributes toward a better-quality environment for employees and nearby communities.
- Social benefits - The project activity is likely to have significant long-term, indirect positive social impacts that may extend to a regional and even national scale. The larger scale impacts are to be derived in the utilization of solar power and the experience gained through the construction and operation of the PV facility. In future, this experience can be employed at other similar solar installations in South Africa.
- Provision of job opportunities - The main benefit of the proposed development operating in the area is that local companies or contractors will be hired for the duration of the construction period. The operational phase will provide permanent job opportunities to the local communities from the surrounding area since security guards and general labourers will be required on a full-time basis. Approximately 500 employment opportunities will be created during the construction and operational phases.
- Indirect socio-economic benefits - The increase in the demand for services such as accommodation, transportation, security, general maintenance and catering will generate additional indirect socio-economic benefits for the local community members.
- Effective use of resources - Because of predominantly the climate and soil limitations, the site is totally unsuitable for cultivated crops, and the viable agricultural land use is limited to grazing only. The proposed development in this specific area will generate alternative land use income through rental for the proposed energy facility, which will have a positive impact on agriculture. It will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve the financial sustainability of agricultural activities.

- Increased access to electricity: According to the Letsemeng LM IDP, the national electricity crises of 2010 and the resultant effects on South African residents and the economy has highlighted how highly reliant we are on electricity as a source of energy. Government has committed to developing measures to promote energy saving, reduce energy costs to the economy, and reduce the negative impact of energy use on the environment.

- Cumulative impacts of low to medium significance – No cumulative impacts with a high residual risk have been identified. In terms of the desirability of the development of sources of renewable energy therefore, it may be preferable to incur a higher cumulative loss in such a region as this one, than to lose land with a higher environmental value elsewhere in the country. This draft EIR includes a detailed assessment of the potential cumulative impacts associated with the proposed development – refer to Section 7 of the report. Considering the cumulative impacts associated with the development and the significance ratings thereof being medium to low, the project can be described as desirable for development.

5 DESCRIPTION OF ENVIRONMENTAL ISSUES

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

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

(g) A motivation for the preferred development footprint within the approved site (i) details of all the alternatives considered;

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

(i) details of all the development footprint alternatives considered;

(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;

(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;

(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and

(xi) a concluding statement indicating the preferred alternative development location within the approved site

5.1 CONSIDERATION OF ALTERNATIVES

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

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

5.1.1 No-go Alternative

This alternative considers the option of 'do nothing' and maintaining the status quo of the affected environment. The description provided in section 5.3 of this report could be considered the baseline conditions (*status quo*) to persist should the no-go alternative be preferred. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used

for the current land uses present. The area associated with the development footprint has limited agricultural potential and is unsuitable for cultivation, with grazing considered to be the only agricultural option. The potential opportunity costs in terms of alternative land use income through rental for the energy facility and the supporting social and economic development in the area would be lost if the *status quo* persists.

5.1.2 Location Alternatives

This alternative asks the question, if there is not, from an environmental perspective, a more suitable location for the proposed activity. No other properties have at this stage been secured by Luckhoff Solar 2 (Pty) Ltd in the Luckhoff area to potentially establish the Luckhoff Solar 2 PV facility. From a local perspective Farm Mooidoorns No. 1224; Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577, is preferred due to its suitable climatic conditions, topography (i.e., in terms of slope), environmental conditions (i.e., low agricultural potential and archaeology), proximity to a grid connection point (i.e., for the purpose of electricity evacuation), as well as site access (i.e., to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase).

Provision will be made in this Draft EIA Report to consider the results of the specialist studies to exclude the sensitive areas presented, which includes any no-go buffer areas recommended by the specialists i.e., the small depression wetland, the watercourse and the artificial watering point. The sensitive areas and associated buffers have been considered by the developer for the facility layout design to optimise the layout for avoidance of the environmental sensitivities identified. As part of the specialist studies undertaken, areas that will need to be avoided has been identified and includes a small depression (wetland feature) and a watercourse that were encountered and delineated in the aquatic ecological assessment. The avifauna study has identified an artificial watering point which has been avoided by the development layout and will be maintained. The development footprint is however large enough to ensure the avoidance of the sensitive features and the associated buffers by the facility layout and still provide an opportunity for the successful development and operation of the proposed PV facility from a technical perspective. Therefore, a single preferred location alternative was assessed – refer to Figure 5.1.

Based on the above site-specific attributes, the study area is considered to be highly preferred in terms of the development of a solar PV facility.

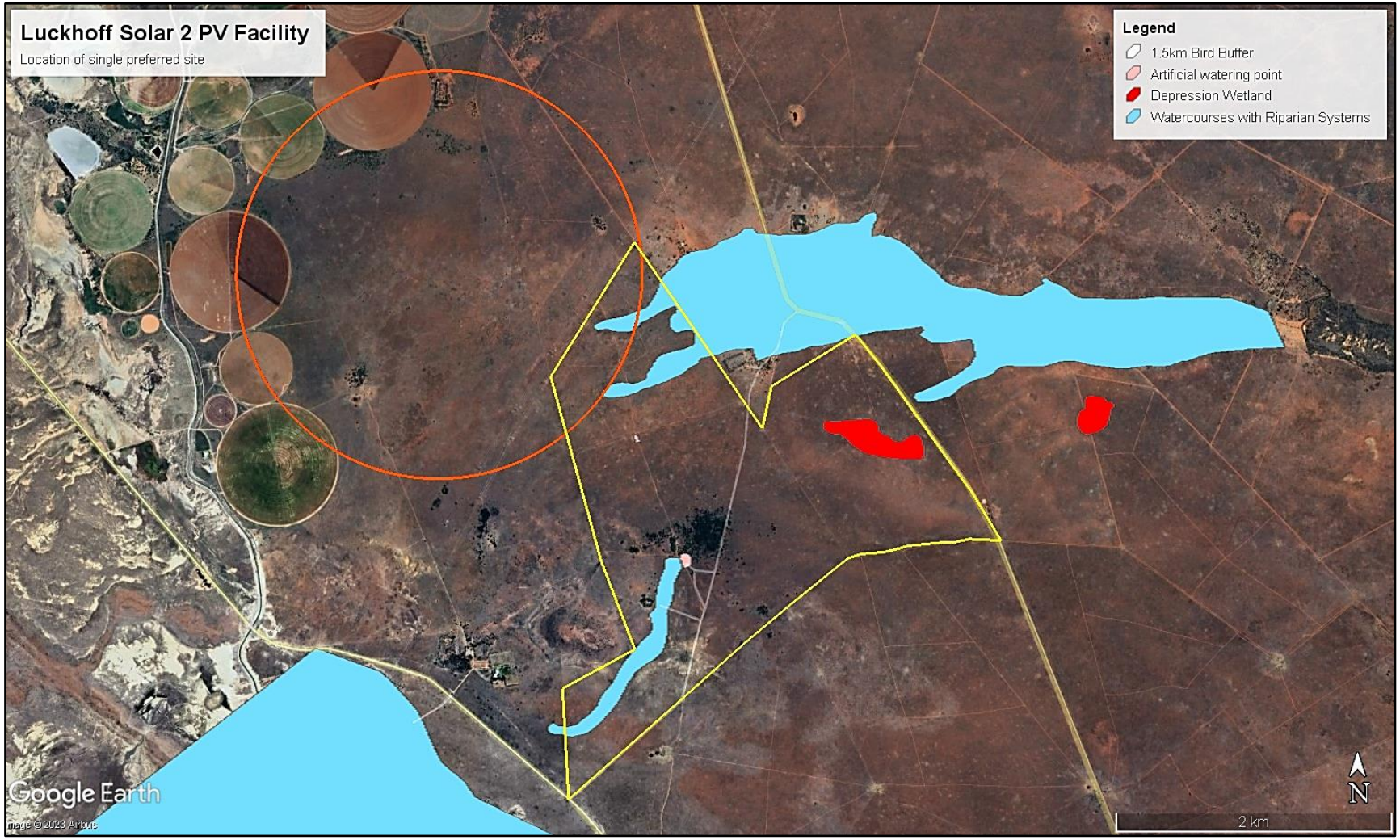


Figure 5.1: Location of the single preferred property alternative. Development footprint located within the assessment area.

5.1.3 Activity Alternatives

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

- Photovoltaic (PV) solar facility – Luckhoff Solar 2 (Pty) Ltd is part of a portfolio of solar PV projects throughout South Africa. Luckhoff Solar 2 (Pty) Ltd is of the opinion that solar PV technology is perfectly suited to the site, given the high irradiation values for of the Luckhoff area – refer to Figure 5.2. The technology furthermore entails low visual impacts, have relatively low water requirements, is a simple and reliable type of technology and all the components can be recycled.

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

- Concentrated solar power (CSP) technology - CSP technology requires large volumes of water, and this is a major constraint for this type of technology considering the water challenges and limitation experienced not only in the country but also within the local area. While the irradiation values are high enough to generate sufficient solar power, the water constraints render this alternative not feasible. It must also be noted that the IRP no longer includes the use of CSP as part of the energy mix of the county. Therefore, this alternative will not be considered further in this report.

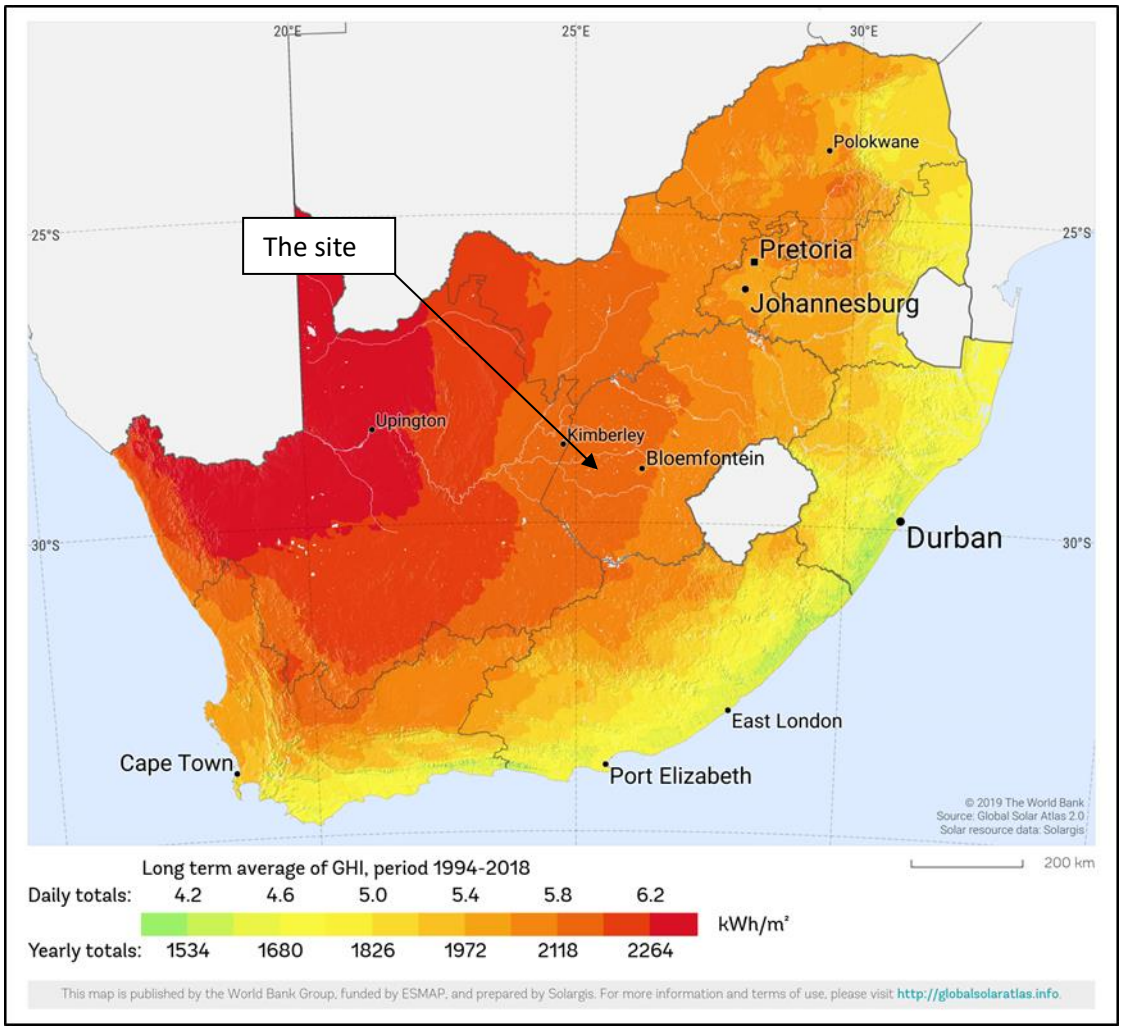


Figure 5.2: Global horizontal irradiation values for South Africa (Solar GIS, 2021) and the Luckhoff Solar 2 PV facility development footprint

5.1.4 Design and Layout Alternatives

Design alternatives were considered throughout the planning and design phase (i.e., what would be the best design option for the development?). In this regard discussions on the design were held between the EAP and the developer, which also included the consideration of sensitive environmental areas and features present as identified by the independent specialists that needs to be avoided by the placement of infrastructure. A final layout plan is included as Figure C and M.

The layout follows the limitations of the site and aspects such as environmental sensitive areas (supported by specialist input), areas under cultivation, roads, fencing and servitudes are considered. The developer has considered the environmental sensitivities as identified during the scoping phase and have accordingly optimised the layout of the PV facility to ensure avoidance of the sensitive areas (Figure L). This optimised layout is considered to be the final layout plan as assessed within this draft EIR.

The total surface area proposed for layout options include the PV panel arrays spaced to avoid shadowing, access and maintenance roads and associated infrastructure (buildings, power

inverters, power lines, BESS and perimeter fences). With regards to the structure orientation, the panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun.

An initial site and site verification was conducted on Farm Mooidoorns No. 1224; Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577; and the farms were found favorable due to its close proximity to grid connections, solar radiation, ecology and relatively flat terrain. Where specific features of environmental sensitivity were identified by the independent specialists as part of the Scoping Phase, these areas and the associated required buffers have been considered by the developer to ensure that the facility layout is appropriate considering the sensitive features present. The site selection also took the site geology, land capability, water availability and land use into consideration before deciding on the specific site within the affected property. Access roads are required during both the construction and operational phases of the development. Access points considered by the Developer are highlighted in the Traffic Impact Assessment Report attached as Appendix E.

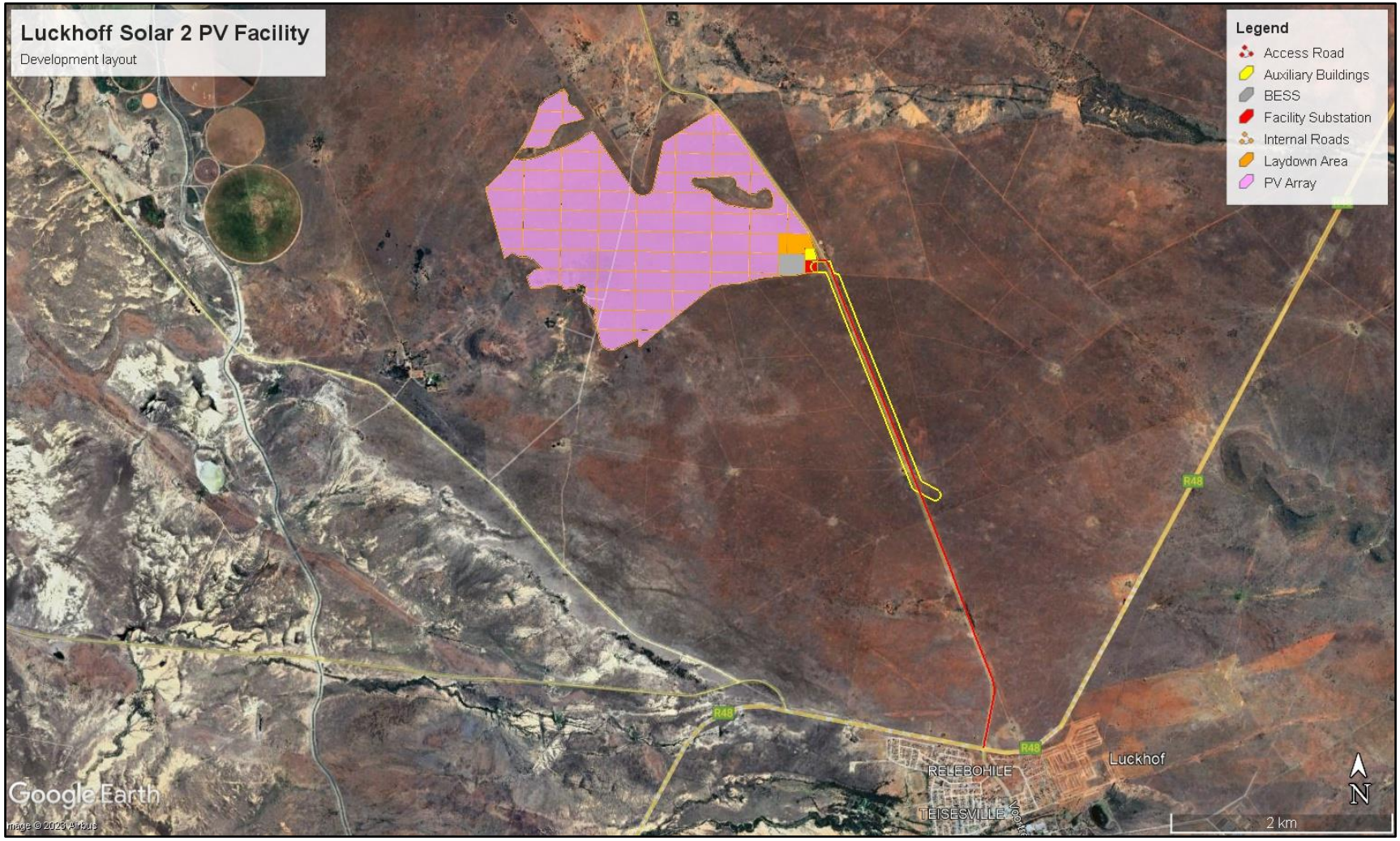


Figure 5.3: Final layout plan for the Luckhoff Solar 2 PV facility and associated infrastructure

Note: It is customary to develop the final/detailed construction layout of the solar PV facility only once an Independent Power Producer (IPP) is awarded a successful bid under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or an alternative programme, after which major contracts are negotiated and final equipment suppliers identified.

For the purpose of the Environmental Impact Assessment (EIA), site layout alternatives will not be comparatively assessed, but rather a single layout will be refined as additional information becomes available throughout the EIA process (e.g., specialist input, additional site surveys, ongoing stakeholder engagement).

The development area presented in the Scoping Report and draft EIR has been selected as a practicable option for the facility, considering technical preference and constraints, as well as initial No-Go layers informed by specialist site surveys.

5.1.5 Technology Alternatives

Powerline:

A 132 kV overhead powerline is required and will connect the on-site facility substation at Luckhoff Solar 2 to an off-site collector substation ~2.5 km southeast of the facility (at Luckhoff Solar 1 – assessed separately). 132 kV overhead distribution line is the only preferred alternative for the applicant due to the following reasons:

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

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

  Furthermore, overhead power lines also provide an opportunity for the avoidance of sensitive environmental features as the overhead lines can span on-ground environmental features to ensure conservation, therefore providing more flexibility in terms of mitigation of the associated on-ground disturbance.

The following alternatives may be considered for the overhead powerline:

- Single Circuit Overhead Powerline - The use of single circuit overhead power lines to distribute electricity is considered the most appropriate technology and has been designed over many years for the existing environmental conditions and terrain. Based on all current technologies available, single circuit overhead power lines are considered the most environmentally practicable technology available for the distribution of power. This option is considered appropriate for the following reasons:

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

- Double Circuit Overhead Power Line - Where sensitive environmental features are identified, the use of double circuit (placing 2 power lines on either side of the same tower structure) to minimise impacts will be considered. However, the use of double-circuiting has a number of technical disadvantages, which includes faults or problems on one powerline may mean that the other powerline is also disabled during maintenance, and this will affect the quality of supply to an area. Larger and taller towers as well as more towers are required for double-circuit power lines.

  The double-circuit overhead powerline proves more feasible since the single circuit may not have the capacity to transmit the large amount of electricity generated from the plant and during maintenance the entire plant would not have to be offline as one of the double circuit lines would still be able to supply electricity. However, due to the rapid requirement changes, this will only be determined before construction.

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

Powerline pylon structure:

The choice of pylon structure to be used for the power line will be determined to ensure that is does not significantly affect the environmental impacts of the proposed development as provision has already been made for the visual, ecological and heritage impacts of erecting a power line. The structure to be utilised for the power line towers will also be informed by the local geotechnical and topographical conditions. The following alternatives are considered with regards to the proposed structures:

- Steel lattice towers - The steel lattice towers provide the following advantages over the other tower types available:
  - Enables multipath earthing which enhances the overall electrical performance of the powerline.
  - Is visually less obtrusive than the mono-pole options.
  - Is more practicable that other options i.e., more cost effective and more practical to construct and maintain.
  - Is safer to work on than the monopole and wood pole structures.
  - Is more durable than the wood pole structures.

- Steel monopoles - The steel monopole is considered less suitable than the steel lattice towers for the following reasons:
  - Is visually more intrusive than the lattice towers.
  - Is more expensive than the lattice towers.
  - Requires more steel than the lattice towers.

- Is more difficult to erect.
- Is not as safe to work on as the lattice towers.

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

Battery Energy Storage Facility (BESS)

As technological advances within battery energy storage systems (BESS) are frequent, two BESS technology alternatives are considered:

- Solid state battery electrolytes; and
- Redox-flow technology.

Solid state battery electrolytes, such as lithium-ion (Li-ion), zinc hybrid cathode, sodium ion, flow (e.g., zinc iron or zinc bromine), sodium sulphur (NaS), zinc air and lead acid batteries, can be used for grid applications. Compared to other battery options, Li-ion batteries are highly efficient, have a high energy density and are lightweight. As a result of the declining costs, Li-ion technology now accounts for more than 90% of battery storage additions globally (IRENA, 2019).

Flow batteries use solid electrodes and liquid electrolytes. The most used flow battery is the Vanadium Redox Flow Battery (VRFB), which is a type of rechargeable flow battery that employs vanadium ions in different oxidative states to store chemical potential energy. Considering the nature of the project, only a solid-state technology type would be envisaged for implementation.

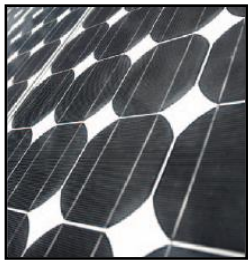
PV Panels:

With regards to the structure orientation, the panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun.

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

- Crystalline (high efficiency technology at higher cost):

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



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

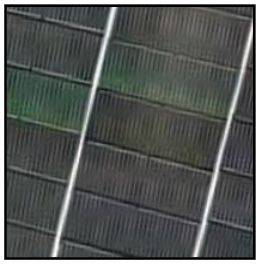
- Poly-crystalline Silicon – poly-crystalline panels use solar cells that are cut from multifaceted silicon crystals. They are less uniform in appearance than mono-crystalline cells, resembling pieces of shattered glass. These are the most common solar panels on the market, being less expensive than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

- <u>Thin film (low-cost technology with lower efficiency):</u>

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

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

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



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

- Bifacial panels:

As the name suggests, bifacial solar panels have two faces, or rather, they can absorb light from both sides of the panel. A lot of potential energy transfer is lost in traditional solar cells when the light hits the back of a solar panel. Most bifacial solar panels use monocrystalline cells, whereas traditional cells use polycrystalline materials. The monocrystalline materials, alongside the clear light pathway on both sides of the panel, enable the light to be absorbed from either side of the cell, and it is thought that the overall efficiency of these cells can be up to 30% greater in commercial applications. Although, the exact amount is variable depending on the surface that they are installed on. The front side of the solar panel still absorbs most of the solar light, but the back side of the solar panel can absorb between 5-90% of the light absorbed by the front of the solar panel. Refer to Figure 5.4.

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

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

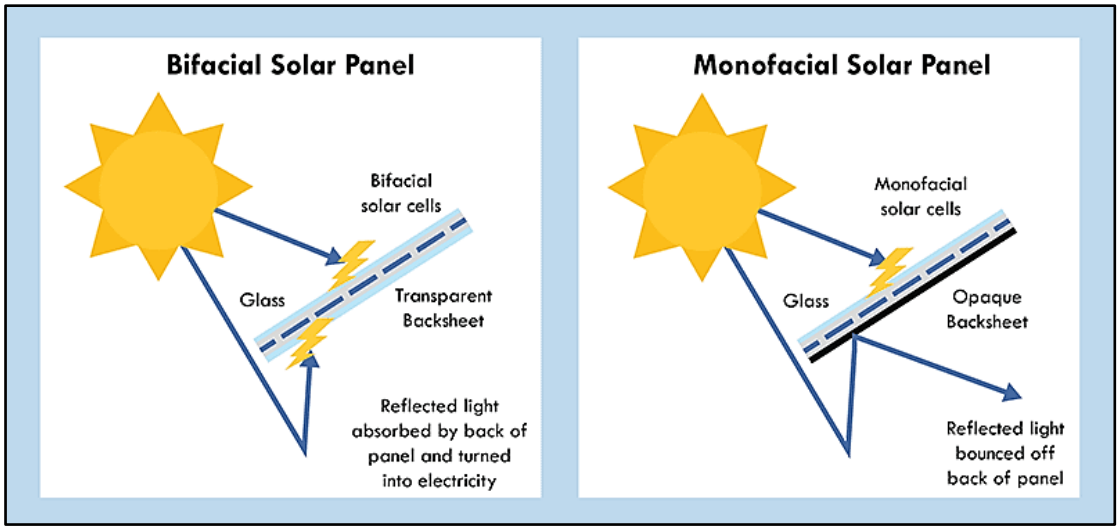


Figure 5.4: Bifacial vs Monoficial Solar Panel absorption

5.2 PUBLIC PARTICIPATION PROCESS

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

5.2.1 General

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

- The scale of anticipated impacts;
- The sensitivity of the affected environment and the degree of controversy of the project; and
- The characteristics of the potentially affected parties.

Since the scale of impact is low, the general land use of the area is related to mining and agriculture, the limited environmental sensitivity of the site and the fact that no conflict was foreseen between potentially affected parties, no additional public participation mechanisms are considered at this stage of the process. The following actions have already been undertaken:

- Site notices
  Site notices (size 60cm x 42cm) were erected on site on 06 October 2022 informing the public of the commencement of the S&EIR process Photographic evidence of the site notices are included in Appendix C3.

- Newspaper advertisement
  An advertisement was placed in the Bloemnuus on 13 October 2022 (see Appendix C2) notifying the public of the S&EIR process and the (then) proposed application for Environmental Authorisation. The advertisement invited Interested and Affected Parties (I&APs) to register on the project I&AP database and submit any comments to Environamics Environmental Consultants. I&APs were given the opportunity to raise comments within 30 days of the advertisement. Since the proposed development is unlikely to result in any impacts that extend beyond the municipal area where it is located, it was deemed sufficient to advertise in a local newspaper.

- Background Information Document (BID)
  The release of a BID providing information on the proposed development, the Scoping process and inviting Interested and Affected Parties (I&APs) to register on the project's I&AP database was sent to the identified I&APs, including the adjacent landowners, key stakeholders and relevant organs of state on 15 November 2022.

- Direct notification of identified I&APs
  Identified I&APs, including key stakeholders representing various sectors, have been directly informed of the S&EIR process via registered post, telephone calls, WhatsApp's and emails (as relevant). The BID was distributed with the notification on 15 November 2022. For a complete list of I&APs with their contact details see Appendix C4 of this report.

It was expected from I&APs to provide their inputs and comments by 15 December 2022. To date comments have been received from various parties that have an interest in the development (Appendix C5 – C7).

- Direct notification of surrounding landowners and occupiers

  Written notices were also provided via registered post, WhatsApp or email (as relevant) to all surrounding landowners and occupiers on 15 November 2022. Refer to Figure 5.5 for the location of the surrounding landowners. The surrounding landowners were given the opportunity to raise comments within 30 days. For a list of surrounding landowners see Appendix C4. The surrounding landowners were given the opportunity to raise comments by 15 December 2022. To date comments have been received from various parties that have an interest in the development (Appendix C5 – C7).

- Circulation of Draft Scoping Report

  Copies of the draft Scoping report have been provided to all I&APs via courier, Dropbox and/or email (as relevant). Hard copies of the report were made available on request and where an I&AP did not have the resources to view the report on an online platform. I&AP's and organs of state were requested to provide their comments on the report from 20 January 2023 until 20 February 2023. All issues identified during the 30-day review and comment period were recorded and documented and compiled into a Comments and Response Report included as part of the Final Scoping Report for decision-making (Appendix C5 – C7).

- Circulation of the Draft Environmental Impact Assessment Report

  All registered I&APs and State Department have been informed of the availability of the Draft EIR on 01 June 2023 and requested to provide their comments within 30 days (refer to Appendix C). The 30-day review and comment period is from 01 June 2023 up to and including 03 July 2023. All comments received during this period will be included in the final EIR. All comments received prior to the release of the Draft EIR have been included in Appendix C. The Comments and Responses report are included as Appendix C7 of this draft EIR.

- Circulation of decision and submission of appeals:

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

5.2.2 Consultation Process

Regulation 41 requires that the landowner, surrounding landowners, municipality, relevant ward councillor, any organ of state having jurisdiction in respect of any aspect of the activity should be given written notice of the activity. A complete list of all the consultees who received written notice as well as proof of correspondence is attached as Appendices C4 and C5.

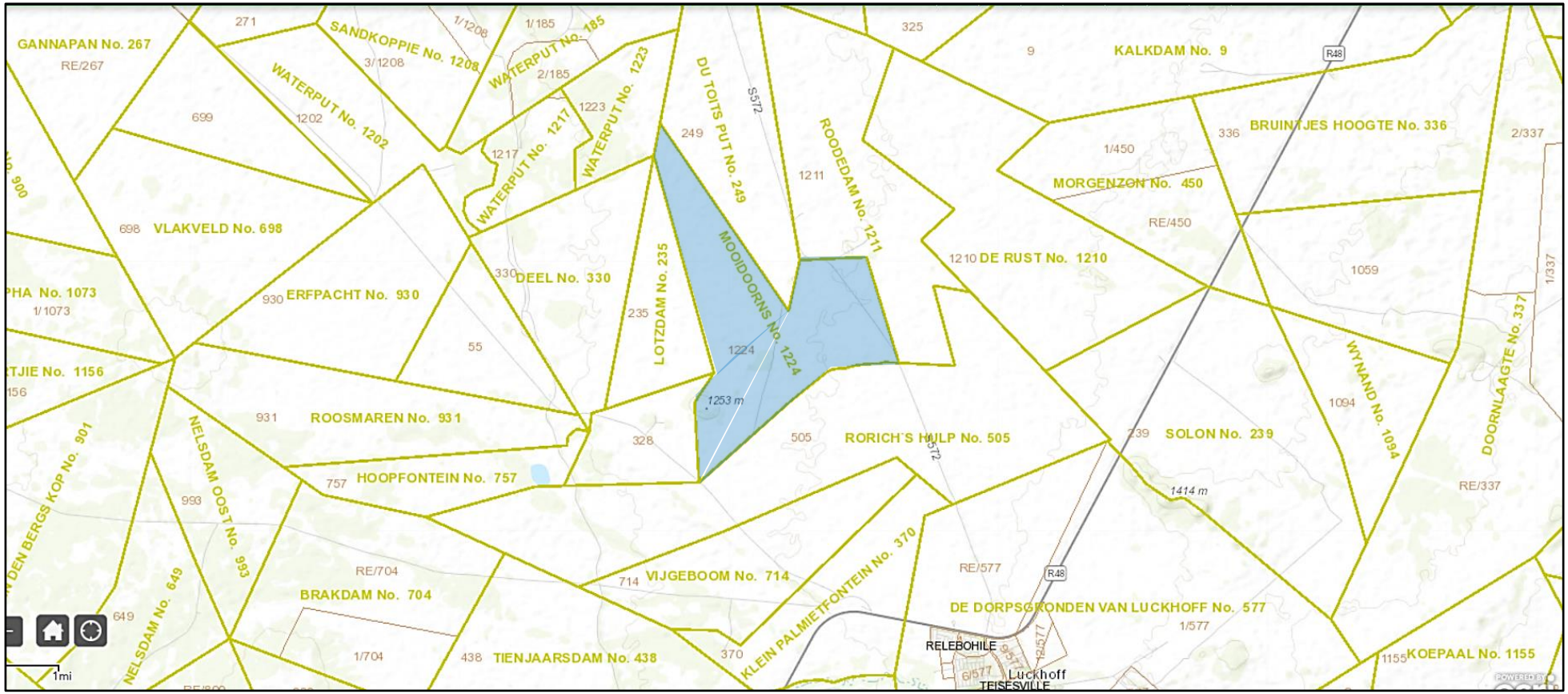


Figure 5.5: Affected properties (Blue) in relation to surrounding properties

5.2.3 Registered I&APs

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

This report is the Draft Environmental Impact Report which has been made available to all potential and/or registered I&APs and State Departments. They were provided with a copy of the Draft EIR and were requested to provide written comments on the report within 30 days. All issues identified during the review period, and previous review periods (i.e., Scoping Phase) will be documented and compiled into a Comments and Response Report and included as part of the Final EIR (Appendix C7).

All comments received during the Scoping Phase, and prior to the release of the Draft EIR for the 30-day review and comment period have also been included in this Draft report as Appendix C which provided I&APs an opportunity to confirm that their comments raised during the Scoping Phase have been included and considered as part of the EIA Phase

5.2.4 Issues Raised by I&APs and Consultation Bodies

Several comments were received from I&APs and stakeholders including DFFE, DFFE Biodiversity and Conservation Unit, and individual surrounding landowners. All comments received during the circulation of the Draft EIR will be addressed accordingly in the Final EIR. The full wording and original correspondence are included in Appendix C5 and Appendix C6 of the Draft EIR.

5.3 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PREFERRED ALTERNATIVE

The following sections provide general information on the biophysical and socio-economic attributes associated with the preferred alternative (i.e., the location of the development footprint within the affected property).

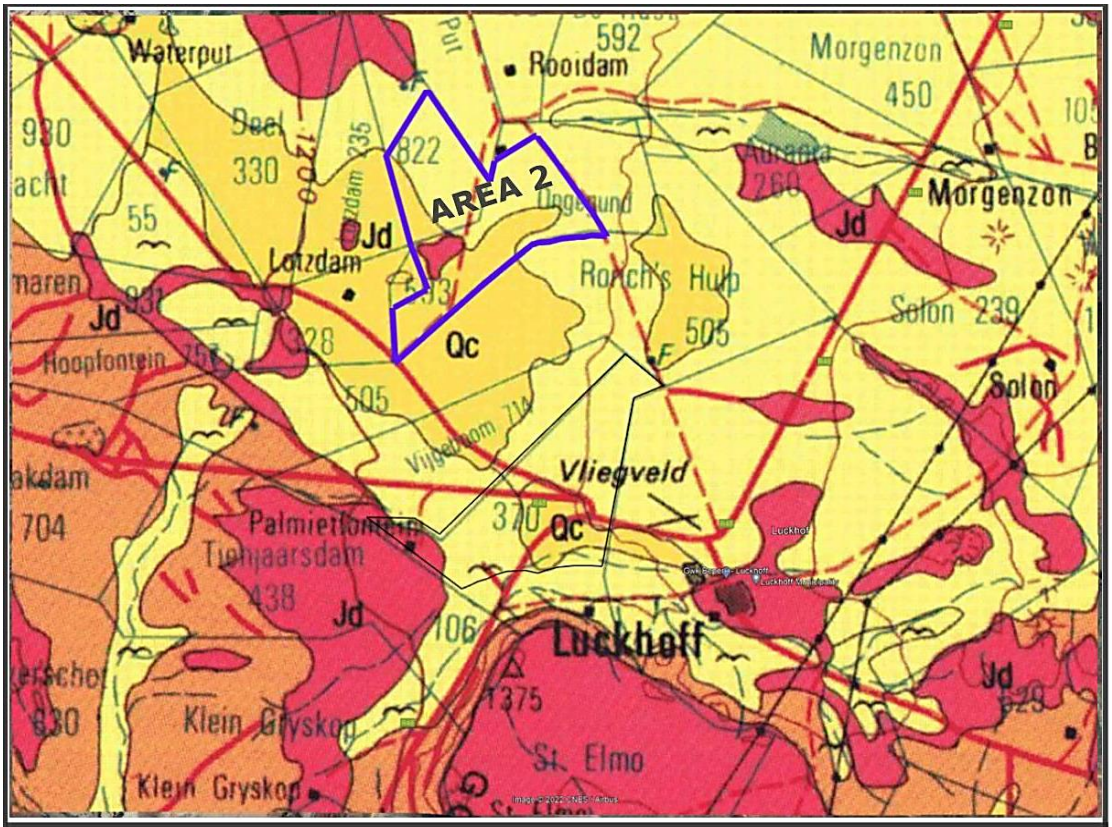
5.3.1 Biophysical Environment

The biophysical environment is described with specific reference to geology, soils, agricultural potential, vegetation and landscape features, climate, biodiversity, heritage features (in terms of archaeology and palaeontology), the visual landscape and the social environment to be affected. A number of specialists were consulted to assist with the compilation of this chapter of the report – refer to the Table 1.1.

However, due to the fact that the area proposed for development (i.e., the development area) exclusively consists of land used for grazing and excludes the areas under cultivation, limited sensitive areas from an ecological, heritage or conservation point have been identified. These include the two (02) watercourses that occur within the study area, and one of two (02) small depression that were encountered and delineated within the development footprint. These features are described in more detail below.

5.3.1.1 Geology, Soils and Agricultural Potential

According to the Geotechnical desktop study (Appendix E9), the general geology of the area comprises relatively young quaternary deposits with large areas of the region underlain by calcrete and wind-blown sands (aeolian) as well as more localised alluvial deposits adjacent to river courses or more widespread alluvial variants as sheet-wash deposits. In lower lying areas these soils are underlain by Permian aged Tierberg Formation blue-grey to dark grey shale with carbonate concretions and subordinate sandstone in the upper parts of the formation which form part of the Ecca Group, Karoo Supergroup. These Karoo sediments are intensely intruded by Jurassic hypabyssal igneous dolerite dykes and sills which outcrop and are generally associated with the surrounding high ground koppies and hills, refer to Figure 5.6.



Geological Legend

Supergroup	Group	Formation	Description
QUATERNARY			Aeolian sand — Qs
			Calcrete — Qc
JURASSIC			Dolerite — Jd
Karoo Supergroup	PERMIAN ECCA	Tierberg	Blue-grey to dark-grey shale with carbonate concretions; subordinate sandstone and siltstone in upper part — Pt

Figure 5.6: Geological plan indicating regional geology and approximate site boundary

According to the Agriculture Compliance Statement (attached in Appendix E4), the purpose of including an agricultural component in the environmental assessment process is to ensure that South Africa balances the need for development against the need to ensure the conservation of the natural agricultural resources, including land, required for agricultural production and national food security. The different categories of agricultural sensitivity, used in the national web-based environmental screening tool, indicate the priority by which land should be conserved as agricultural production land.

The screening tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is used for cropland or not. All cropland is

classified as at least high sensitivity, based on the logic that if it is under crop production, it is indeed suitable for it, irrespective of its land capability rating.

The screening tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. The data is generated by GIS modelling. Land capability is defined as the combination of soil, climate, and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land, based on its soil, climate, and terrain. The higher land capability values (≥8 to 15) are likely to be suitable as arable land for crop production, while lower values are only likely to be suitable as non-arable grazing land. A map of the proposed development area overlaid on the screening tool sensitivity is given in Figure 5.7.

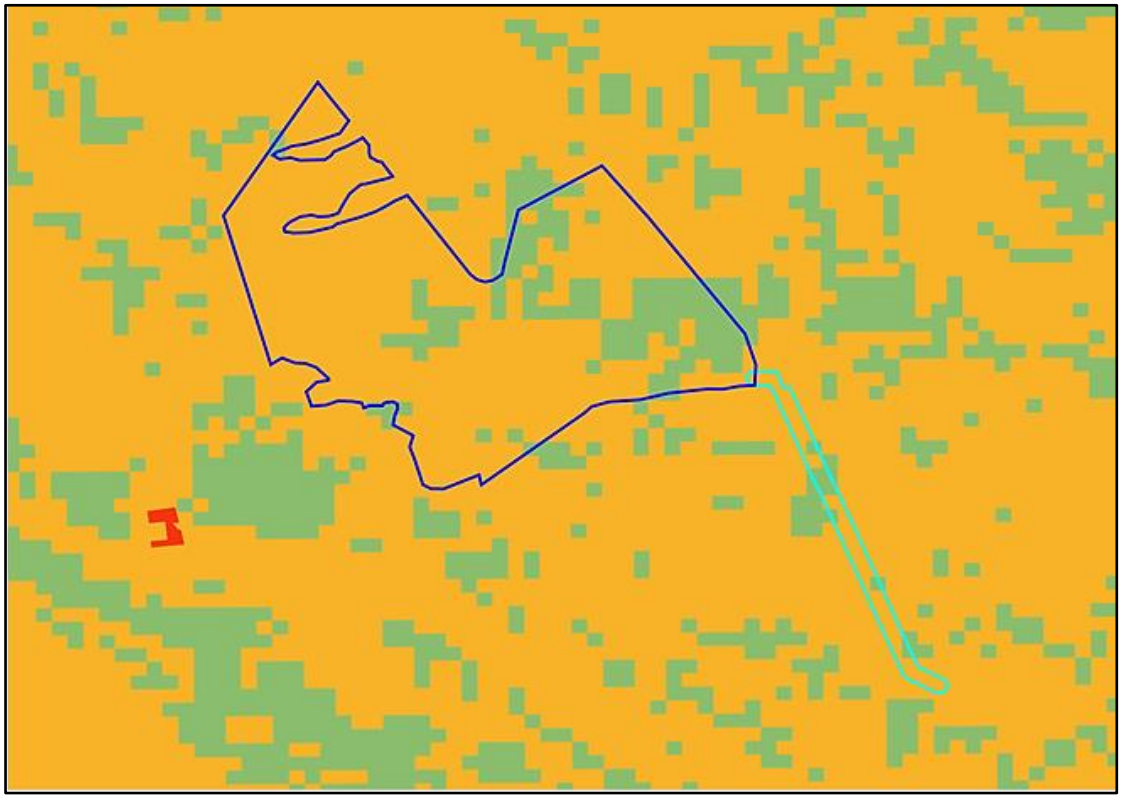


Figure 5.7: Agricultural sensitivity of the development footprint as per the results of the DFFE Screening Tool (Appendix B)

None of the land is classified as cropland and agricultural sensitivity is therefore purely a function of land capability. The classified land capability of the sites is predominantly 6, but ranges from 4 to 7. The small-scale differences in the modelled land capability across the project area are not very accurate or significant at this scale and are more a function of how the data is generated by modelling, than actual meaningful differences in agricultural potential on the ground. Values of 1 to 5 translate to a low agricultural sensitivity and values of 6 to 8 translate to a medium agricultural sensitivity, although there is little real difference between low and medium agricultural sensitivity on the ground.

The low to medium agricultural sensitivity of the site, as identified by the screening tool, is confirmed by this assessment. The motivation for confirming the sensitivity is predominantly

that the climate data (low rainfall of approximately 344 mm per annum and high evaporation of approximately 1,510 mm per annum) proves the area to be arid and therefore of limited land capability. Moisture availability is completely insufficient for viable rain-fed crop production. In addition, the land type data shows a high proportion of shallow soils on underlying rock and hardpan carbonate. A low to medium agricultural sensitivity is entirely appropriate for the site, which is of insufficient land capability for crop production.

This site sensitivity verification verifies the entire site as being of low to medium agricultural sensitivity, with a land capability of predominantly 6. The required level of agricultural assessment is therefore confirmed as an Agricultural Compliance Statement. From an agricultural impact point of view, it is recommended that the development be approved.

5.3.1.2 Vegetation, Topography and Landscape Features

The project site is located within the Nama-Karoo Biome which is situated on the central plateau of the western half of South Africa extending into south-eastern Namibia (Mucina *et al.,* 2011). This region is characterised by an arid climate with most rainfall occurring over the summer months (December to April). Mean Annual Rainfall (MAR) increases from 70mm in the north-west (near the desert biome) to 500mm in the south-east with rainfall quantity and reliability increasing eastwards. The project site is located in the eastern portion of the biome and receives a MAR of 286mm per annum (metoeblue.com, Accessed: 21-12-22) with mean annual highs reaching 32 ^{o}C and mean annual lows of 1^{o}C.

The Nama-Karoo is underlain by a succession of sedimentary rocks that includes the Cape Supergroup followed by Dwyka tillites and then other fossil rich sediments of the Karoo Supergroup (Mucina *et al.,* 2011). Volcanic activity in the area has resulted in intrusions of igneous rock resulting in the formation of ridges, hills and mountains. Igneous rock is more resistant to weathering than sedimentary rock resulting in the formation of mesas, buttes and plateaus within the biome. These features are often characterised by a higher species diversity than the low-lying flat areas. The topography of the project site is a combination of relatively flat open grassland plains interspersed with high lying rocky ridges, hills and slopes.

Soils that have arisen from the sedimentary and igneous rock are typically weakly structured and skeletal (Mucina *et al*., 2011). The project area is characterised by moderately deep, calcareous, sandy-clay loams which contain calcrete and calcareous horizons in the flat areas and shallow soils on the slopes and plateaus of the hilly areas.

The climatic variation, geology and soils associated within this biome have given rise to plains dominated by dwarf succulent shrubs interspersed with grasses, geophytes and annual herbs (Mucina *et al.,* 2011). Variation in the timing of the rainfall and the amount received between years has resulted in variation in the structure, cover and productivity of the vegetation present as well as a diversity of plant forms that range from ephemerals, annuals, geophytes, C_3 and C_4 grasses, succulents, deciduous and evergreen perennial shrubs and trees.

Other factors that have influenced the structure and composition of the vegetation within the biome, and which are therefore ecological drivers, include grazing of domestic livestock and wildlife, fires and rainfall. Increased grazing pressure or fire events, followed by heavy rainfall makes this biome prone to erosion.

Vegetation Units:

Vegetation types and distributions specific to the project site are described based on the National Vegetation Map (Figure 5.8 below) and data gathered during the field survey. According to the National Vegetation Map, the entire site occurs within the vegetation type Northern Upper Karoo.

The Northern Upper Karoo occurs in the Northern Cape and Free State Provinces and is described as a shrubland dominated by dwarf karoo shrubs, grasses and Senegalia mellifera subsp. detinens (Mucina et al., 2011). It is associated with typically flat to gently sloping topography with isolated hills of Upper Karoo Hardeveld.

The Upper Karoo Hardeveld recorded on site is a matrix of grassland and karoo shrubland dominated by grass species such as Eragrostis lehmanniana, Themeda triandra, Aristida adscensionis, Chloris virgata and Digitaria eriantha and shrubs and herbs such as Hertia pallens, Eriocephalus ericoides, Aptosimum marlothii, Senecio burchelli, Wahlenbergia albens and Zygophyllum lichtensteinianum. There was one patch of shrubs/small trees within the site comprised of Vachellia karoo, Ziziphus mucronata, Searsia burchelli, Searsia pyroides, Searsia lancea and Schinus mole. The vegetation has been grazed and is of low diversity and is thus considered near-intact.

This vegetation type is listed as Least Concern with a conservation target of 21%. Although listed as not protected, current data indicates that 94% of this vegetation type remains intact (RLE, 2021).

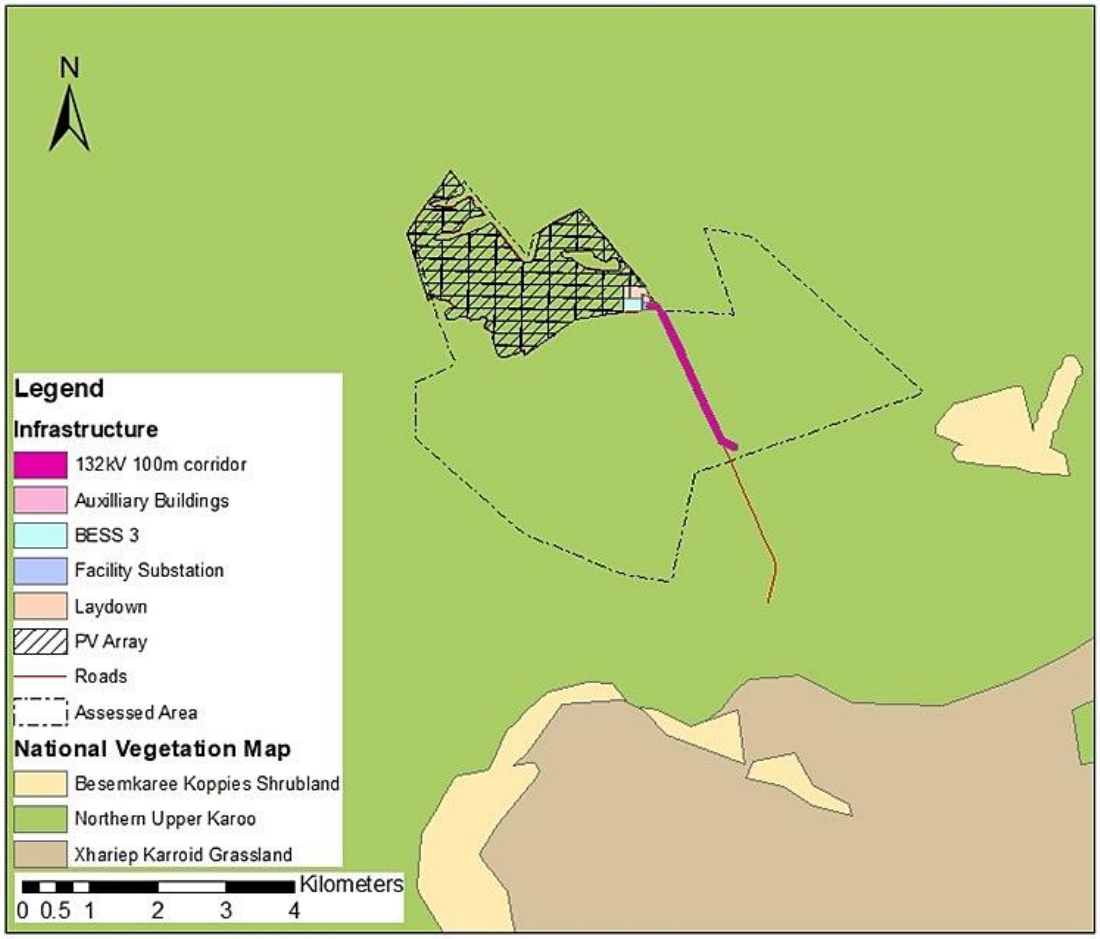


Figure 5.8: National vegetation map for the project site

Site Sensitivity

The Species Environmental Assessment guideline (SANBI, 2021) was applied to assess the Site Ecological Importance (SEI) of the project area. The habitats and the species of conservation concern in the project area were assessed based on their conservation importance, functional integrity and receptor resilience (Table 5.1). The Northern Upper Karoo was determined to have a low SEI. Although the vegetation present is near-intact with good ecological corridors and habitat connectivity, there is a low likelihood of occurrence of SCC and habitat is likely to recover easily to its current state. This vegetation type is also listed as Least Concern with 94% of the remaining extent intact.

Table 5.1: Sensitivity assessment for each vegetation type within the project site

Habitat / Species	Conservation Importance (CI)	Functional Integrity (FI)	BI	Receptor Resilience	SEI
Northern Upper Karoo	Low	High	Medium	High	**Low**
	No confirmed or highly likely populations of Species of	Large area of intact vegetation with good habitat connectivity		Habitat can recover relatively quickly (5-10 years) to restore more than 70% of the original species composition and functionality of the site.	

Habitat / Species	Conservation Importance (CI)	Functional Integrity (FI)	BI	Receptor Resilience	SEI
	Conservation Concern	and functional ecological corridors.			

Floristics

A total of 41 species from 18 families were recorded within the project site (Table 5.2 below) (a full species list has been included in Appendix 1 of the Ecological specialist report). The Poaceae family had the highest number of species (eight species) followed by the Asteraceae family (six species), Scrophulariaceae family (five species), Anacardiaceae family (4 species). All other families had either one or two species present. Of the 41 recorded species, 38 species are listed as least concern and three as Not Evaluated.

Table 5.2: Number of families and species recorded within the project site

Family	No. of Species	Family	No. of Species
POACEAE	8	AMARANTHACEAE	1
ASTERACEAE	6	AMARYLLIDACEAE	1
SCROPHULARIACEAE	5	CAMPANULACEAE	1
ANACARDIACEAE	4	CONVOLVULACEAE	1
ASPARAGACEAE	2	CYPERACEAE	1
ASPHODELACEAE	2	PAPAVERACEAE	1
FABACEAE	2	RHAMNACEAE	1
MALVACEAE	2	SOLANACEAE	1
AIZOACEAE	1	ZYGOPHYLLACEAE	1

The ecological desktop assessment identified two species of conservation concern that could occur within the project site and the likelihood of occurrence for each of these species assessed:

- *Tridentia virescens*
- *Lithops salicola*

Both species were found to have a low likelihood of occurrence due to their habitat not occurring within the project site. No Species of Conservation Concern (SCC) were recorded on site.

Protected Areas, Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)

The proposed site falls within the Free State Province and as such their bioregional plan is applicable. It is our understanding that this plan is based on terrestrial data and that the aquatic data has not yet been added to the spatial planning tool data set. Critical Biodiversity Areas (CBAs) are areas that are required to meet the regions biodiversity targets and there are no, or very few, other options available in the landscape to meet these targets. Such sites therefore need to remain in a largely natural state and land management objectives require that these areas are managed for no further degradation and that degraded areas are rehabilitated. A small portion of the southern section of the project area occurs within a CBA

1 and CBA 2. The biodiversity features driving this are the vegetation type Northern Upper Karoo and the species, *Lithops salicola*. The field survey found that there was no suitable habitat within this area to support this species and as such is unlikely to negatively affect the functioning of this feature.

Ecological Support Areas (ESAs) are important for maintaining ecological processes on which CBAs depend and are important in delivering ecosystem services. These areas should remain in a largely functional state and land management objectives should support ecological processes. The project site occurs within an ESA 1. The biodiversity feature driving the ESA is the vegetation type Northern Upper Karoo. Since 94% of this vegetation type remains intact, the development is unlikely to negatively affect the functioning of this feature. Refer to Figure 5.9.

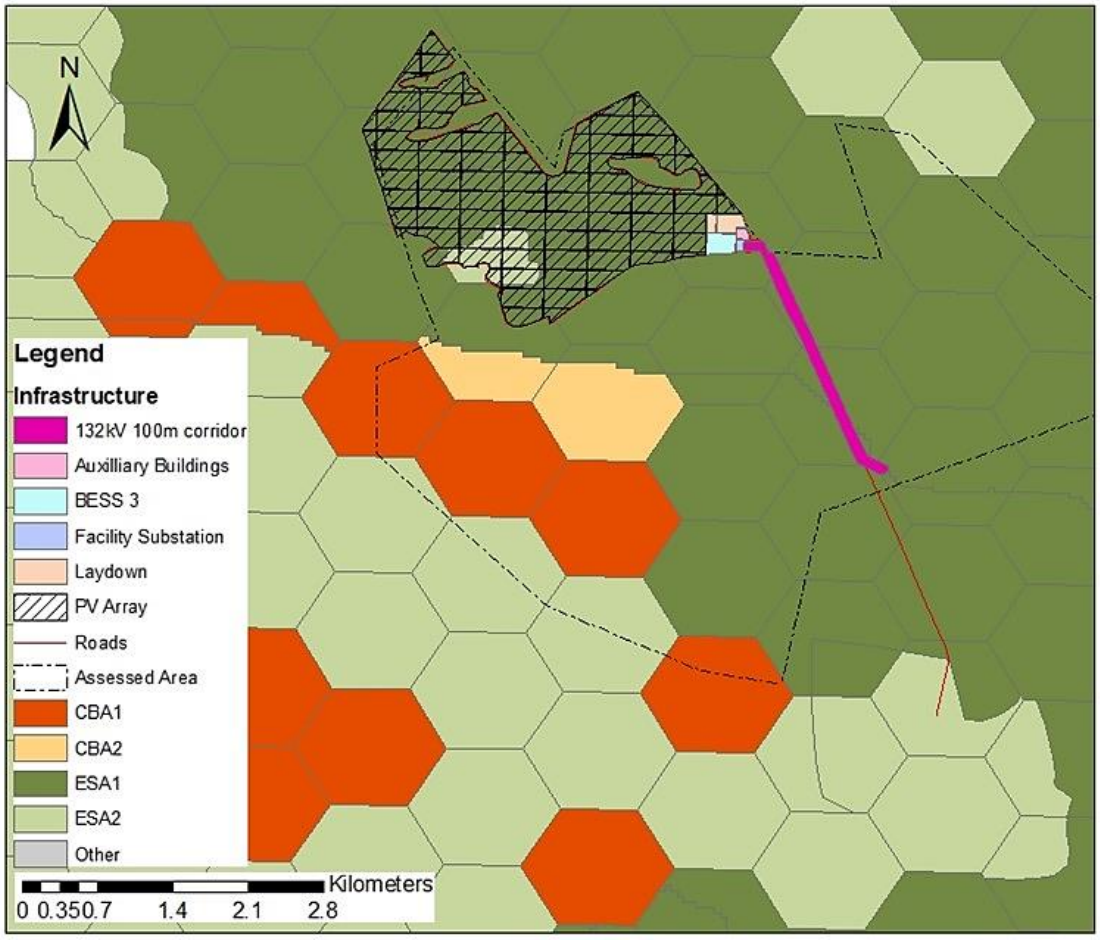


Figure 5.9: Map illustrating the project site in relation to CBAs and ESAs. The site falls within an ESA 1.

The project site does not occur within a formally protected area. However, Thanda Tula Private Reserve is situated directly north of the project boundary. Project infrastructure may cause a barrier for species moving south of the reserve. However, since the town of Luckhoff and a number of access roads are situated south of the proposed project, there is already a barrier for species moving south and the impact of this development on the movement of species, is likely to be negligible. Species are still able to move east, west and north which is what they are likely doing as they avoid the town of Luckhoff. Refer to Figure 5.10.

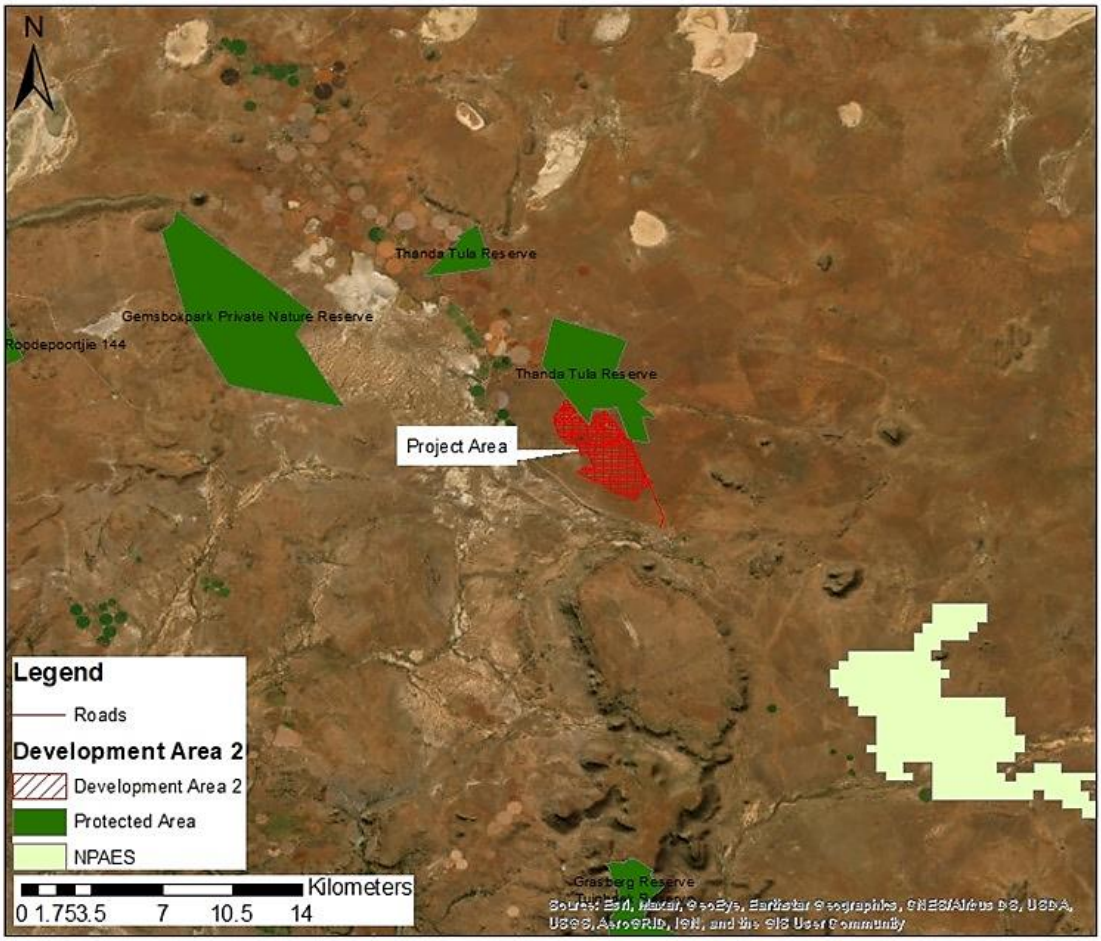


Figure 5.10: Map illustrating the project site in relation to protected areas

Protected Plants in terms of the Free State Nature Conservation Ordinance

Plant species are also protected in the Free State Province according to the Free State Nature Conservation Ordinance. According to this ordinance, no person may pick, import, export, transport, possess, cultivate, or trade in a specimen of a specially protected or protected plant species. Communication with Provincial authorities indicates that a permit is required for all these species if they are expected to be affected by the proposed project.

Although no SCC were recorded, two species (*Aloe broomii* and *Boophone disticha*) are listed as Schedule 6 species on the Free State Nature Conservation Ordinance (No. 8 of 1969). These species will require permits for their removal/destruction if impacted by project infrastructure.

Declared Invasive Alien Species

The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of the National Environmental Management: Biodiversity Act (10/2004). The regulation listed a total of 559 alien species as invasive and further 560 species are listed as prohibited and may not be introduced into South Africa. Below is a brief explanation of the four categories of Invasive Alien Plants as per the regulation.

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

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

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

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

Three exotic species (*Schinus molle, Argemone ochroleuca* and *Cymbopogon pospischilii*) were recorded within the project site. *Argemone ochroleuca* is listed as a Category 1b species and must be removed from the project site. It is recommended that an alien invasive management plan is included within the EMPr to manage the spread of exotic and alien invasive species.

Impacts on the terrestrial plant species can be reduced to acceptable levels through the implementation of mitigation measures. The specialist is therefore of the opinion that the development can proceed, provided the recommendations contained in this report are implemented.

5.3.1.3 Wetlands and Riparian Features

The study area is dominated by three major types of natural aquatic features and a small number of artificial barriers associated with catchments and rivers, characterised as follows:

- Ephemeral watercourses with riparian vegetation that included, *Vachellia karroo*, *Searsia lancea*, *Euclea undulata* and *Gymonsporia buxifolia*;
- Depressions, dominated by grass species and
- Dams and weirs / berms with no wetland or aquatic features.

The study area is situated predominantly within the Northern Upper Karoo (NKu 3) vegetation unit, associated with the upper reaches of the Lemoenspruit River catchment (D33C), a small subquaternary catchment linked to the Orange / Gariep River, refer to Figure 5.11. This is located within the Orange River Water Management Area (Kimberley), in the Nama Karoo Eco-region.

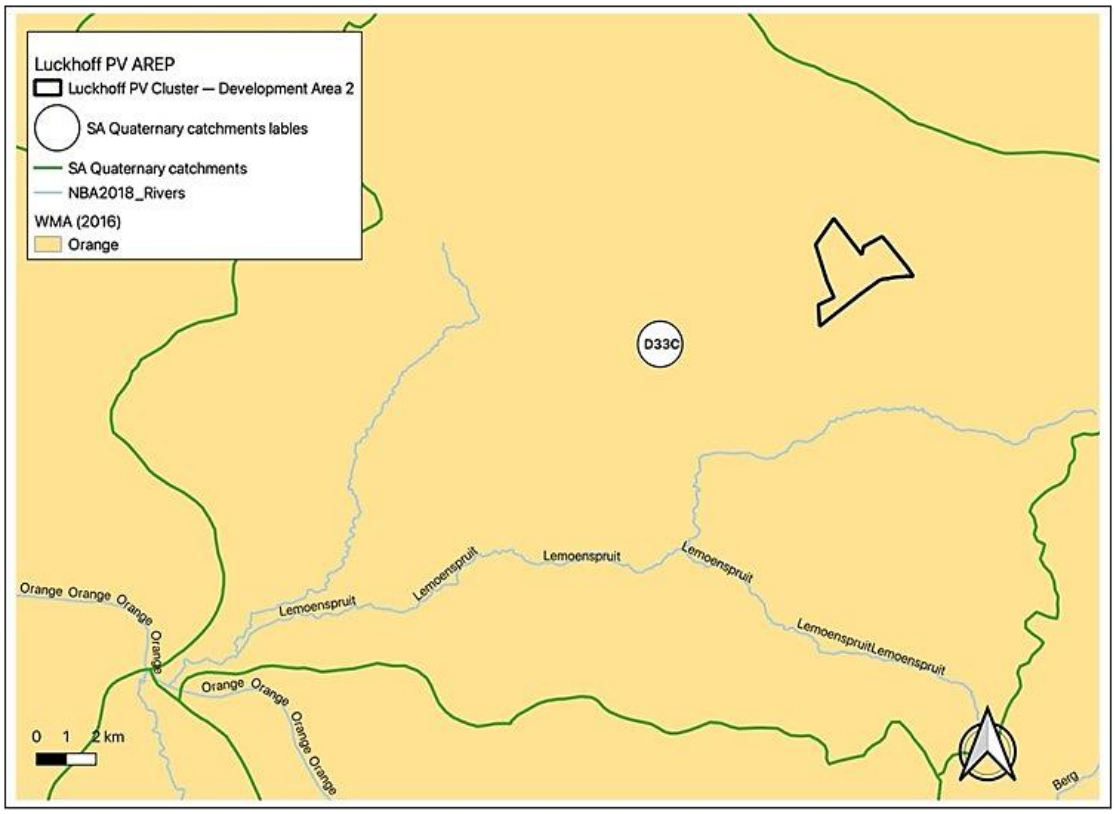


Figure 5.11: Locality map indicating the various quaternary catchments and mainstream rivers within the proposed project's boundaries

The area is characterised by low lying areas surrounded by inselbergs (koppies). Two watercourses occur within the study area, and only two small depression was encountered and delineated in this aquatic ecological assessment. One of these is located within the proposed PV area and will need to be avoided in the final design process. This pan can also not be used for any stormwater management purposes as this will alter the hydrological function of the system, which would then in turn create permanent wetland aquatic habitat and would then in turn attract birds and animals into the area. Refer to Figure 5.12 and 5.13.

Figure 5.12: A small depression (red circle) dominated by grass species, that only accumulates water for very short periods

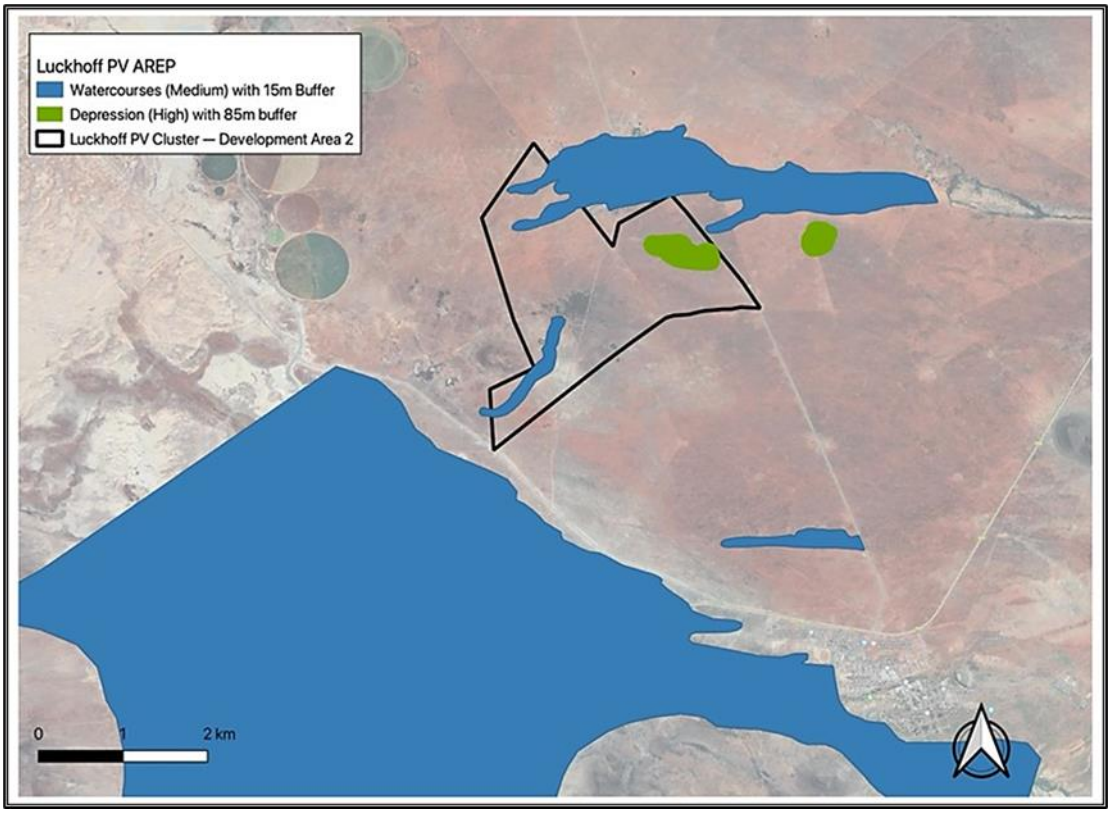


Figure 5.13: Waterbodies delineated in this assessment based on ground-truthing information collected by the aquatic specialist

The Present Ecological State (PES) of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES and functional importance of the Depression wetlands (collectively referred to as "HGM1 – DEPRESSION) were assessed together as both wetlands share similar ecological characteristics and have been subjected to the same anthropogenic impacts. The Wet-Health2 assessment determined that the wetlands fall within the 'B' ecological category for present condition. The vegetation component scored particularly poorly due to transformation of natural habitat via grazing. Refer to Table 5.3.

Table 5.3: Outcomes of WET-Health Version 2 assessment for HGM 1-Depression

	Wetland PES Summary			
Wetland name	**Unnamed**			
Assessment Unit	**HGM1 - DEPRESSION**			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	6.2	1.4	1.2	4
PES Score (%)	45%	88%	90%	60%
Ecological Category	**D**	**A**	**A**	**D**
Combined Impact Score	2.4			
Combined PES Score (%)	70%			
Combined Ecological Category	**B**			
Confidence	High: Field-based 'Level 2' assessment area			

The trajectory of change for both wetlands is negative. The continuation of the current activities within the catchment, without improved management, will result in a slow decline in aquatic habitat integrity. The recommended management objective is to improve the wetland present ecological state.

Site Sensitivity

Table 5.4 below provides an overview of the sensitivity of features (with buffer distances included) as it relates to the main project component types for the project. The features are shown spatially in Figure 5.14.

The sensitivity ratings of High (No-Go) to Low were determined through an assessment of the habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e., existing road crossings within systems are considered acceptable since these areas have already been impacted).

In summary, structures such as PV Panel Areas, buildings, substations and Battery Energy Storage System (BESS), should be placed outside of the High Sensitivity habitats, while remaining structures (roads and transmission lines) could cross or span the Moderate/Low Sensitivity areas. Noting that Low Sensitivity can also = Moderate areas but with existing impacts e.g., current roads, farm tracks of previously disturbed areas but these must be confirmed during the remainder of the assessment phases for areas such as roads or grid access.

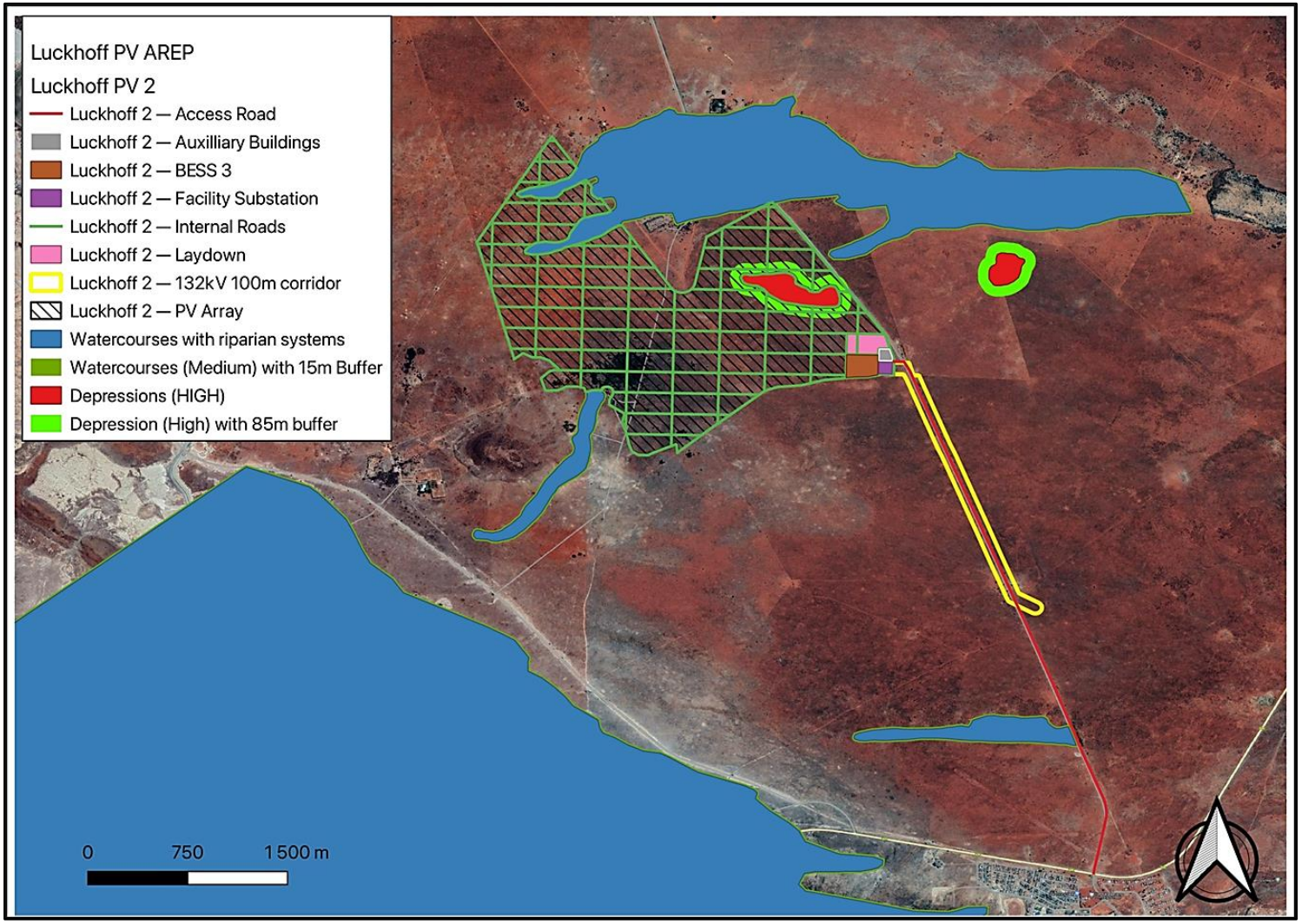


Figure 5.14: The delineated habitats inclusive of the respective buffers and overall sensitivity ratings

Table 5.4: Results of the sensitivity rating/constraints assessment

Map Key	Sensitivity Rationale	Buffer	Development Constraints and override exceptions
High = No Go	"No go" areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile Therefore areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations	85m	No buildings or structures (e.g., PV Panel Areas, Substations, O/M Buildings or temporary laydown areas should be placed within these zones.
Medium	Areas that are deemed to be of medium sensitivity but should still be avoided as this would minimise impacts and or the need for additional Water Use Authorisation in the case of any aquatic features	15m to aid delineation accuracy and prevent bank instability	No buildings or structures (e.g., PV Panel Areas, Substations, O/M Buildings or temporary laydown areas should be placed within these zones. Access roads and grid connection can span these areas, but preferably where existing impacts already occur

Low	Areas of low sensitivity or constraints such as artificial systems with little to no biological value or would not result in any future licensing requirements e.g. dry earth wall farm dams. While from a terrestrial perspective the vegetation or habitat is ubiquitous within the greater region or has seem some form of disturbance.	N/A	N/A
Neutral	Unconstrained areas (left blank in mapping) from aquatic perspective	N/A	N/A

The specialist has no objection to the authorisation of the proposed activities assuming that all mitigations especially within the buffer zones are implemented.

The significant impacts are associated with the access road crossings river systems. These systems are generally in a less modified state and still provide some habitat and important ecological functions. Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the implementation of mitigation measures, the project has potential to cause a Moderate cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Low impact upon aquatic biodiversity.

5.3.1.4 Climate

The project site is located within the Nama-Karoo Biome which is situated on the central plateau of the western half of South Africa extending into south-eastern Namibia (Mucina *et al.,* 2011). This region is characterised by an arid climate with most rainfall occurring over the summer months (December to April). Mean Annual Rainfall (MAR) increases from 70mm in the north-west (near the desert biome) to 500mm in the south-east with rainfall quantity and reliability increasing eastwards. The project site is located in the eastern portion of the biome and receives a MAR of 286 mm per annum (metoeblue.com, Accessed: 21-12-22) with mean annual highs reaching 32 ^{o}C and mean annual lows of 1^{o}C.

5.3.1.5 Biodiversity

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

Avifauna

According to the Avifaunal Impact Assessment (Appendix E2), approximately 169 bird species are expected to occur in the study area and immediate surroundings (refer to the Avifauna report under Appendix E2). The expected richness was inferred from the South African Bird Atlas Project (SABAP1 & SABAP2) (Harrison et al., 1997; www.sabap2.birdmap.africa) and the presence of suitable habitat in the study area. The expected richness is also strongly correlated with favourable environmental conditions (e.g., during good rains) and seasonality (e.g., when migratory species are present). This equates to 17 % of the approximate 991 species listed for the southern African subregion (and approximately 19 % of the 873 species recorded within South Africa). However, the mean species richness obtained from the pentad mapping units (c. 2940_2445 and 2940_2440) corresponding to the study area is significantly lower than the expected number of species with an average of 48.2 species recorded for each full protocol card submitted (for observations of two hours or more; range = 32 - 59 species). The lower richness is explained due to the spatial scale of the mapping units and general access to the area (being of private land the area is inaccessible to the general public and citizen scientists).

According to field observations (February and May, 2023), the total number of species observed on the study area is *ca*. 144 species. It shows that the surveys on the study area produced a higher tally when compared to the average richness recorded for the

corresponding pentad grids and that the number of species observed during the surveys were regarded as sufficient (when compared to the expected number of species). In addition, the 2023 surveys detected 18 bird species that are novel (new) species, which were observed for the first time within pentad grids 2940_2445 and 2940_2440. These species were previously overlooked and included three threatened and/or near threatened species and eight waterbird species (50% of the newly recorded species). These include:

- African Palm Swift (*Cypsiurus parvus*) – birds foraging overhead, often in company with other swift species;
- African Spoonbill (*Platalea alba*) – observed from a nearby artificial dam (focal point survey);
- Booted Eagle (*Hieraaetus pennatus*) – two adult birds, one roosting in a *Eucalyptus* tree approximately 1km southwest of the study site and another hunting bird at an artificial watering point approximately 1.4km west of the study site;
- Common Sandpiper (*Actitis hypoleucos*) - observed from a nearby artificial dam (focal point survey);
- Dusky Sunbird (*Cinnyris fuscus*) – relatively common and associated with *Vachellia karoo* and *V. tortilis* bush clumps at artificial watering points;
- European Nightjar (*Caprimulgus europaeus*) – associated with *Eucalyptus* groves where it was observed roosting on branches, approximately 2km west of the study site;
- Green-winged Pytilia (*Pytilia melba*) – relatively common and associated with *Vachellia karoo* and *V. tortilis* bush clumps at artificial watering points;
- Glossy Ibis (*Plegadis falcinellus*) – observed from a nearby artificial dam (focal point survey);
- Karoo Korhaan (*Eupodotis vigorsii* – regionally Near Threatened) – a sedentary pair was observed from nearby Farms Brakvlakte 328 and Lotzdam 235, approximately 950m southwest of the study site;
- Kittlitz's Plover (Charadrius pecuarius) - observed from a nearby artificial dam (focal point survey);
- Lanner Falcon (*Falco biarmicus* – regionally Vulnerable) – a single adult bird observed perching approximately 2.5km east of the study site;
- Marsh Sandpiper (*Tringa stagnatilis*) – observed from a nearby artificial dam (focal point survey);
- Marsh Warbler (*Acrocephalus palustris*) – uncommon and birds on passage observed within dense *Vachellia – Searsia* - dominated bush clumps;
- Ruff (*Calidris pugnax*) – observed from a nearby artificial dam (focal point survey);
- Temminck's Courser (*Cursorius temminckii*) – an uncommon nomadic species to the study area;
- Verreaux's Eagle (*Aquila verreauxii* – regionally Vulnerable) – an adult bird was observed soaring approximately 4.7km southeast of the study site;
- White-backed Duck (*Thalassornis leuconotus*) – observed from a nearby artificial dam (focal point survey);

- White-breasted Cormorant (*Phalacrocorax lucidus*) – observed from a nearby artificial dam (focal point survey); and
- White-faced Whistling Duck (*Dendrocygna viduata*) – observed from a nearby artificial dam (focal point survey).

According to Table 5.5, the study area is poorly represented by biome-restricted[4] (see Table 5.6) and local endemic bird species. However, regional endemic and near-endemic bird species are well represented with up to 48% of the regional near-endemic species expected to be present. Approximately nine threatened or near threatened species are known to be present in the wider study area, of which seven of these species were recorded in the wider study area, which included the Endangered Secretarybird (*Sagittarius serpentarius*) and the Endangered Ludwig's Bustard (*Neotis ludwigii*). Furthermore, a high number of regional endemic bird species are present, with 19 southern African endemics and 26 near-endemic species confirmed on the study site and the immediate surroundings. Dominant endemic and near-endemic species included the Rufous-eared Warbler (*Malcorus pectoralis*), Cape Sparrow (*Passer melanurus*), Ant-eating Chat (*Myrmecocichla formicivora*) along with other noteworthy endemics such as Lark-like Bunting (*Emberiza impetuani*), Grey-backed Cisticola (*Cisticola subruficapilla*), Kalahari Scrub Robin (*Cercotrichas paena*), Sickle-winged Chat (*Emarginata sinuata* – during the austral dry season), Layard's Warbler (*Curruca layardi* - uncommon) and Chestnut-vented Warbler (*C. subcoerulea*).).

Table 5.5: A summary table of the total number of species, Red listed species (according to Taylor et al., 2015 and the IUCN, 2023), endemics and biome-restricted species (Marnewick et al., 2015) expected (sensu SABAP1 and SABAP2) to occur in the study site and immediate surroundings.

Description	Expected Richness Value (study area and surroundings) ***	Observed Richness Value (study area) ****
Total number of species*	169 (19 %)	144 (85 %)
Number of Red Listed species**	9 (6 %)	7 (78 %)
Number of biome-restricted species – Zambezian, Namib-Karoo and Kalahari-Highveld Biomes*	8 (24 %)	7 (88 %)
Number of local endemics (BirdLife SA, 2022a)*	2 (5 %)	2 (100 %)
Number of local near-endemics (BirdLife SA, 2022a)*	8 (27 %)	7 (88 %)
Number of regional endemics (Hockey *et al.,* 2005)**	22 (21 %)	19 (86 %)
Number of regional near-endemics (Hockey *et al.,* 2005)**	29 (48 %)	26 (90 %)

[4] A species with a breeding distribution confined to one biome. Many biome-restricted species are also endemic to southern Africa.

Table 5.6: Expected and observed biome-restricted species (Marnewick et al, 2015) likely to occur on the study site and immediate surroundings.

Species	Kalahari-Highveld	Zambezian	Namib-Karoo	Frequency of occurrence
Kalahari Scrub Robin (*Cercotrichas paena)*	X			Common (confirmed)
White-bellied Sunbird (*Cinnyris talatala*)		X		Uncommon to rare
Karoo Korhaan (*Eupodotis vigorsii*)			X	Uncommon (confirmed)
Namaqua Warbler (*Phragmacia substriata*)*			X	Common in suitable habitat (confirmed)
Ludwig's Bustard (*Neotis ludwigii)*			X	Uncommon (confirmed)
Layard's Warbler (*Curruca layardi*)			X	Uncommon (confirmed)
Pale-winged Starling (*Onychognathus nabouroup)*			X	Uncommon, common in the town of Luckhoff (confirmed)
Sickle-winged Chat (*Emarginata sinuata*)			X	Fairly common during the dry season (confirmed)

Table 5.7 provides an overview of bird species of conservation concern that could occur on the study area and immediate surroundings based on their historical distribution ranges and the presence of suitable habitat. According to Table 5.7, a total of nine species could occur on the study area, of which seven were confirmed from the study area. These include six globally threatened species, two regionally threatened species and one regionally near threatened species. The species confirmed from the study area include the globally Critically Endangered White-backed Vulture (*Gyps africanus*), the globally Endangered Ludwig's Bustard (*Neotis ludwigii*), the globally Endangered Secretarybird (*Sagittarius serpentarius*), the globally Vulnerable Blue Crane (*Grus paradisea*), the regionally Vulnerable Lanner Falcon (*Falco biarmicus*), the regionally Vulnerable Verreaux's Eagle (*Aquila verreauxii*) and the regionally near threatened Karoo Korhaan (*Eupodotis vigorsii*). In addition, three of these species were new records for the area (ca. Lanner Falcon *Falco biarmicus,* Karoo Korhaan *Eupodotis vigorsii* and Verreaux's Eagle *Aquila verreauxii*).

The majority of the observed species were recorded on the western and southern extent of the wider study area, especially on the nearby Farms Brakvlakte 328 and Lotzdam 235, and the western section of Farm Rorich's Hulp 505 where open Upper Northern Karoo Srubland was suitable for the occurrence for large terrestrial species such as the Ludwig's Bustard and the Secretarybird, while the irrigation pivots and nearby agricultural land attract large numbers of Blue Cranes during the dry season. The open Upper Northern Karoo Shrubland unit on Luckhoff Solar 2 site provides suitable foraging opportunities for some of these species (e.g. Ludwig's Bustard, Karoo Korhaan and Secretarybirds), while most of the dominant habitat (northern Upper Karoo Shrubland) was moribund or densely vegetated by karroid shrubs and *Stipagrostis* graminoid species which will deter these species from foraging on the site (e.g. large terrestrial birds will find it difficult to move through the moribund vegetation). However, general veld management practice can alter the floristic structure on the study site to benefit these species and promote foraging area for large terrestrial species. The structural open habitat afforded by the artificial watering holes and cattle kraal areas often acts as focal congregation areas for Blue Cranes, which could utilise these azonal habitat units, especially during the austral dry season. In addition, a pair of Secretarybirds (*Sagittarius serpentarius*) occur on the nearby Farm Lotzdam 235 (approximately 1 km to the north-west of the study site) and were engaged in nestbuilding activities.

Three bird of prey species were observed and are wide-ranging species with opportunistic foraging behaviour pending the availability of prey (e.g., carcasses for vultures and small mammals or gamebird prey for the Verreaux's Eagle. Therefore, these species utilise the entire study area pending the availability of prey or carcasses. In addition, a single adult Lanner Falcon was observed perched on a dead *Vachellia* tree at the eastern boundary of the proposed Luckhoff Solar 1 site.

The remaining species as listed by Table 5.7 are regarded as highly irregular foraging visitors due to the absence of suitable habitat on the physical study site.

Please note that the Scoping Phase has identified the nearby "koppies" and outcrops as suitable habitat for the globally near threatened African Rock Pipit (Anthus crenatus). However, this species was absent on the proposed development footprint site due to the absence of suitable habitat.

Table 5.7: Bird species of conservation concern that could utilise the study area and immediate surroundings based on their historical distribution range and the presence of suitable habitat. Red list categories according to the IUCN (2023)* and Taylor et al. (2015)**

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
Anthropoides paradiseus (Blue Crane)	Vulnerable	Near threatened	15.00 (based on a three records from the 2023 surveys)	Prefers open grasslands. Also forages in wetlands, pastures and	Regarded as a regular foraging visitor to the study area, especially to artificial watering

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
				agricultural land.	points. At least two pairs were observed from the immediate surrounding area (c. Farm Boschjespan 105 and Farm Brakvlakte 328 during February 2023, while large numbers (~55-60 individuals) were observed on the pivots and along the canal on recently inundated land corresponding to nearby Farms Deel 330 and Palmietfontein 55.
Oxyura maccoa (Maccoa Duck)	Endangered	Vulnerable	5.00 (based on a single record)	Large saline pans and shallow impoundments.	Probably absent on the physical study site due to the absence of suitable habitat. It was last recorded during 04 November 2010 in the wider study region (sensu SABAP2). The two artificial dams south and south-east of the Luckhoff MTS provide ephemeral foraging habitat when inundated.
Gyps coprotheres (Cape Vulture)	Vulnerable	Endangered	3.85 (based on a single	Mainly confined to mountain	An irregular foraging/scavenging visitor to the study

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
			ad hoc record)	ranges, especially near breeding site. Ventures far afield in search of food.	area pending the presence of food. It was last observed during 2019 on the study area
Gyps africanus (White-backed Vulture)	Critically Endangered	Critically Endangered	5.00 (based on a single full protocol and ad hoc record)	Breeds on tall, flat-topped trees. Mainly restricted to large rural or game farming areas.	An irregular foraging/scavenging visitor to the study area pending the presence of food. A pair was observed soaring to the south-east of the study area near the corners of Farm Koepaal 1155, Brakleegte 654, Bergrivier 1132.
Neotis ludwigii (Ludwig's Bustard)	Endangered	Endangered	5.00 (based on one full protocol and three ad hoc records)	Open savannoid and arid grassland and open karroid to semi-desert plains.	A fairly common foraging visitor to the open Northern Upper Karoo Shrubland unit. Uncommon on the remainder of the site owing to moribund and densification of karroid shrubs. At least three pairs were observed from the study area and immediate surroundings
Falco biarmicus (Lanner Falcon)	-	Vulnerable	New record for the study area	Varied, but prefers to breed in	An uncommon to fairly common foraging visitor to the physical study

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
				mountainous areas.	site. A single adult bird was observed perched at the eastern boundary of the proposed Luckhoff Solar 1 facility. It probably breeds in the nearby escarpment south of the town of Luckhoff.
Eupodotis vigorsii (Karoo Korhaan)	-	Near threatened	New record for the study area	Mainly open gravel semi-desert plains or sparse karroid plains.	Probably a breeding resident on western parts of the study area, although an uncommon foraging visitor to the physical study site but could occur on the open Northern Upper Karoo Shrubland. A pair was observed on the nearby Farms Brakvlakte 328 and Lotzdam 235.
Aquila verreauxii (Verreaux's Eagle)	-	Vulnerable	New record for the study area	Breeds in mountainous rugged habitat and isolated hills and "koppies in the Karoo.	Considered to be a fairly common foraging visitor to the study area. A single adult was observed soaring immediately north of the town of Luckhoff (between the study site and the town of Luckhoff. It probably breeds in the nearby

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
					escarpment south of the town of Luckhoff.
Sagittarius serpentarius (Secretarybird)	Endangered	Endangered	10.00 (known from two full protocol cards and two ad hoc observations)	Prefers open grassland or lightly wooded habitat.	An uncommon to fairly common foraging visitor to the physical study site. A single adult bird was observed from the immediate surroundings on the western section Farm Rorich's Hulp 505, while a nesting pair was observed approximately 1 km to the west on the nearby Farm Lotzdam 235.

A sensitivity map was compiled, illustrating habitat units comprising of potential sensitive elements based on the following:

- Areas of high sensitivity - Areas of high sensitivity include the artificial watering points and the induced Secretarybird buffer area. The artificial livestock watering points attract large numbers of granivore passerine and non-passerine bird species, of which many need to drink water on a daily basis (e.g., sandgrouse). Due to the congregation of passerine species at these features, they could invariably attract small to medium sized bird of prey species (members of the genera *Falco, Micronisus* and *Accipiter*) and are often focal congregation areas for displaying Blue Cranes (*Grus paradisea*). The placement of electrical and PV infrastructure near these areas could increase potential avian collisions with the infrastructure. These areas are of artificial origin and could be relocated to other areas and/or removed.

  The high sensitivity area in the north of the study site corresponds to part of a 1.5 km buffer area, which was allocated due to the occurrence of a pair of Secretarybirds engaged in nest building behaviour.

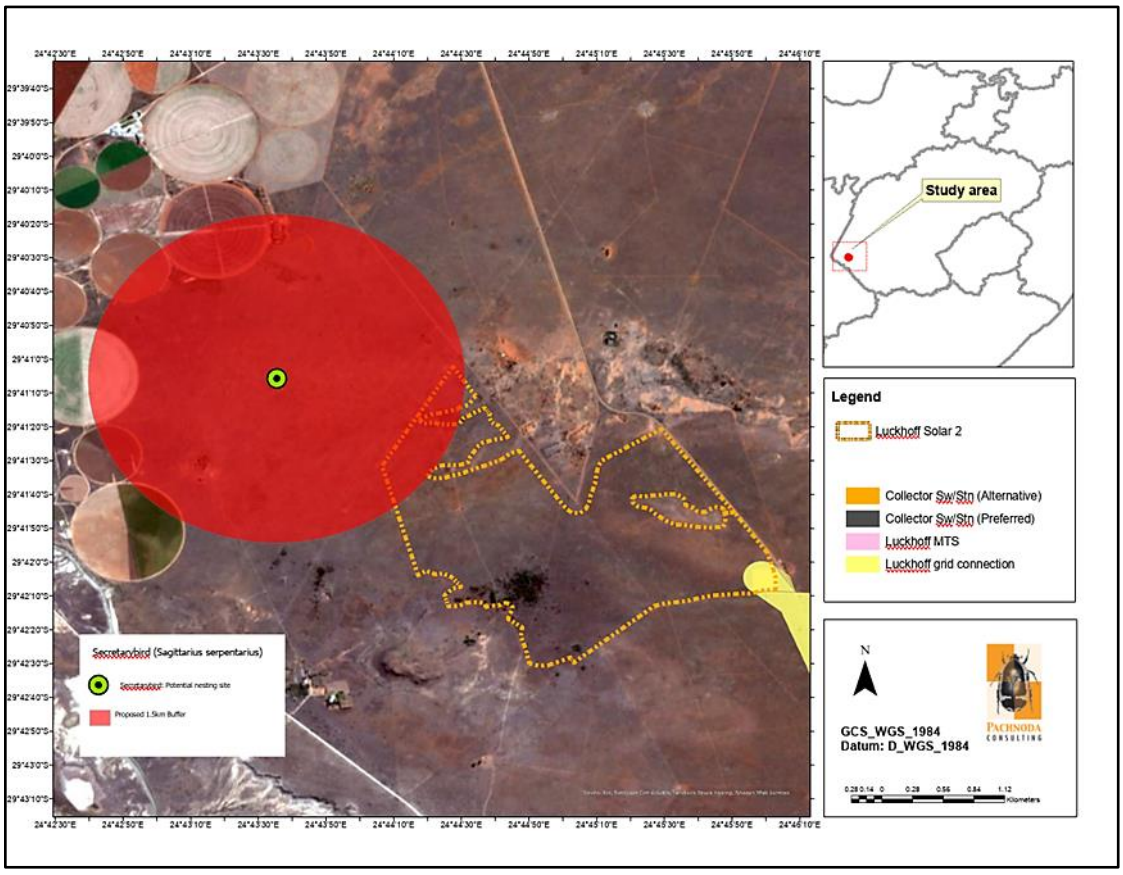


Figure 5.15: A map illustrating the occurrence of a pair of Secretarybirds (*Sagittarius serpentarius*) in close proximity to the study site. The map also displays the locality of a nest/roost site.

A resident/breeding pair of Secretarybirds occurs in close proximity to the study site, where it occupies an open grassy area approximately 1km northwest of the study site. It was observed during the austral dry season survey, whereby a pair of birds was engaged in the construction of a nest located on the crest of a small Senegalia mellifera tree. To minimise impacts associated with the construction and operation of the PV facility which may displace Secretarybirds from the area, it is recommended that a 1.5 km buffer be allocated around the nest site. The 1.5 km buffer is recommended to reduce disturbance and displacement impacts on breeding pairs during the construction phase. During the breeding season, construction activities should be minimised within 1.5 - 2 km of active nests (pers comm., Dr Melissa Whitecross, BirdLife South Africa). To reduce the risk of fatalities due to collision and/or electrocution with overhead powerlines, all powerlines should not be placed within 2 km of the nest locality (BirdLife South Africa, 2022b). The buffer area was derived from the dispersal dynamics of juvenile Secretarybirds (Whitecross et al., 2019), which showed that juvenile Secretarybirds have a mean home range size of 1.21 ± 0.34 km^2 and spend at least an average of 91.30 ± 8.80 days at their natal nesting grounds, although this distance increases exponentially as they mature. More importantly, High natal philopatry occurs in Secretarybirds, with most of the individuals when reaching maturity return to their natal

grounds (Whitecross et al., 2019). It emphasises the importance of preserving nesting sites along with suitable foraging habitat.

- Areas of medium sensitivity - Areas of medium sensitivity represent habitat units of natural and open Northern Upper Karoo vegetation and grassland mosaics and the mixed microphyllous bush clumps. The natural and open Northern Upper Karoo vegetation and grassland mosaics provide foraging habitat for certain threatened bird species (e.g., Secretarybird and Ludwig's Bustard), as well as terrestrial bird species (e.g., Northern Black Korhaan) with the potential to interact (e.g., collide) with the proposed electrical infrastructure. However, these species appeared to be relatively irregular on the study site owing to the moribund condition of the dominant vegetation. In addition, reporting rates for threatened bird species was relatively low, thereby suggesting a medium sensitivity rating instead of a high sensitivity even though the majority of the habitat units is natural. The mixed microphyllous bush clumps sustained high bird richness values, but the majority of this composition is widespread in the region.
- Areas of low sensitivity - Areas of low sensitivity include habitat units represented by transformed habitat, thereby contributing little towards local biodiversity.

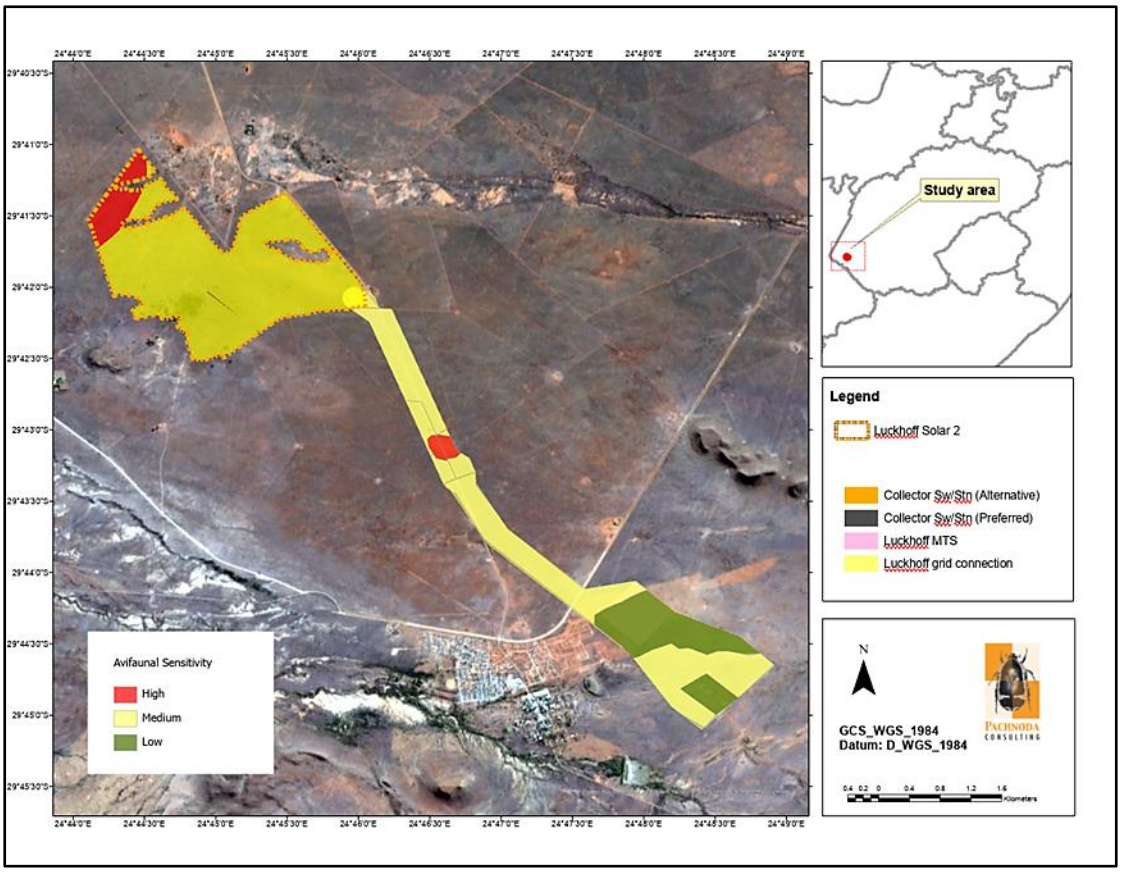


Figure 5.16: A map illustrating the avifaunal sensitivity of the study site based on habitat types supporting bird taxa of conservation concern and important ecological function.

In conclusion, it was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project.

Fauna

Based on the sensitivity feature in the DFFE Screening Report, a site visit by the faunal specialist was not required and the faunal component was therefore done at a desktop level.

All species have a unique geographic range which describes the spatial area where a species is found. This is a species distribution. Some species have a range which covers most of the earth, this is known as a cosmopolitan distribution and others a very limited geographic area known as an endemic distribution. However, just because an area may be within a species distribution the species may no longer inhabit the area or may not inhabit it permanently. For example, large carnivores such as Rhino have a distribution which include the project area, but these animals no longer occur outside of reserves and private game farms. Further, a species may occur in the broader area (QDS/Pentad) where habitat is available and if its preferred habitat is not present onsite it is unlikely to occur. Therefore, the number of species that could occur in the PAOI and in the project area is often far fewer than species distributions.

Amphibians

- Of the 12 amphibian species with a distribution that includes the project area, 7 species have been confirmed within the same QDS as the study area.
- Microhabitats important to amphibian species include terrestrial and aquatic habitats i.e., not all amphibians require permanent access to water, some species only require access to water for breeding and egg/tadpole development and some species do not require any water and are fully terrestrial.
- The majority of the species confirmed within the same QDS as the study area are unlikely to permanently occur within the project area. Species that do not require permanent water may occur e.g., Tremelo Sand Frog (*Tomopterna cryptotis*) is likely to occur and increase during the wet season.

Reptiles

- Of the 46 reptile species with a distribution that includes the project area, 21 species have been confirmed within the same QDS as the study area.

Mammals

- Of the 72 mammal species with a distribution that includes the project area, 33 species have been confirmed within the same QDS as the study area.
- Mammal species likely to occur in the project area include rodents such as the Mice, Gerbils (*Gerbilliscus sp.*), Ground Squirrel (*Xerus inauris*) and Cape Porcupine (*Hystrix africaeaustralis*), small carnivores such as Yellow Mongoose (*Cynictis penicillata*), Meerkat (*Suricata suricatta*) and Aardwolf (*Proteles cristata*), Hares (*Scrub and Spring*) and small antelope such as Steenbok.

- Springbok and Black-backed Jackal (*Canis mesomela*) are often viewed as a pest by farmers as the springbok damage fences used to enclose livestock and other game and the Jackal preys on livestock, mainly lambs.
- No rocky habitat was recorded on site thus no mammals related to this habitat are expected e.g., Rock Sengi (*Elephantulus sp.*) and Rock Hyrax (*Procavia capensis*).

Species of Conservation Concern

Species of conservation concern (SCC) are those species that are either nationally threatened and listed as critically endangered, endangered, vulnerable or near-threatened and/or endemic and/or range restricted. It refers to a species that may require conservation of what individuals remain to ensure the longevity of the species.

Amphibians

- None of the amphibian species that have a distribution which includes the project area are of conservation concern. However, all amphibian species are protected under the Lists of Threatened and Protected Species issued in Terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004.

Reptiles

- None of the reptile species that have a distribution which includes the project area are of conservation concern.

Mammals

- The study area intersects the distribution of 12 mammal species of conservation concern, six threatened and six near-threatened species.
    - Threatened species includes the Black Rhino (*Diceros bicornis*) (CR), Mountain Reedbuck (*Redunca fulvorufula*) listed as endangered and the vulnerable listed Black-footed Cat (*Felis nigripes*), Cheetah (*Acinonyx jubatus*), Leopard (*Panthera pardus*) and Spotted-necked Otter (*Hydrictis maculicollis*).
    - Near-threatened species includes the White Rhino (*Certotherium simum*), Brown Hyaena (*Parahyaena brunnea*), Cape Clawless Otter (*Aonyx capensis*), Vlei Rat (*Otomys auratus*), Serval (*Leptailurus serval*) and African Striped Weasel (*Poecilogale albinucha*).
- The large mammal species would not occur in the project area unless stocked and therefore have not been assessed further. This includes the Black Rhino, Cheetah, Leopard and White Rhino.
- The likelihood of occurrence for the remaining species has been assessed in the table below. Six species have a low likelihood of occurrence within the study area due to lack of available habitat. One species, the Black-footed Cat, has a moderate likelihood of occurrence in the study area and the African Striped Weasel (*Poecilogale albinucha*) has a high likelihood of occurrence in the study area.

Table 5.8: Mammal Species of Conservation Concern likelihood of occurrence within the study area

Name	Threat Status			Habitat	Likelihood of Occurrence
	Global (IUCN)	National (SA red list, 2016)	TOPS		
Southern Mountain Reedbuck *Redunca fulvorufula*	*EN	EN		Mountain Reedbuck are typically found in high altitude grasslands and rocky ridges and hillsides from 1,500 – 5,000m above sea level (IUCN, 2017 and Taylor *et al.*, 2016). They are predominantly grazers and occur in drier hilly areas (such as the Nama Karoo) utilising steep slopes and bases of hills that have a higher moisture content and therefore greener, softer grasses. They avoid open areas with no cover. The availability of drinking water is crucial to their survival and therefore existence. In 1999 this species was estimated to have a population of approximately 33,000 individuals but in 2016 was reported to have unexpectedly declined by 73% (IUCN, 2017; Taylor *et al.*, 2016).	**Low** No suitable habitat is present within the site.
Black-footed Cat *Felis nigripes*	*VU	VU	Protected	The Black-footed cat is typically a solitary, ground dweller that is crepuscular and nocturnal (Sliwa *et al.'* 2016). During the day it makes use of dens, preferring hollowed termite mounds when available but also making use of burrows dug by other animals (e.g., Springhares, Ground Squirrels and Aardvark). It hunts small rodents and ground-dwelling birds found in short, open grasslands and is found in dry, open grasslands, savannah and karoo semi-desert. The estimated EOO is 930,000 km^2 and individual home ranges for males have been recorded to be approximately 16-20km^2 and for females were 9-10km^2.	**Moderate** Suitable habitat present within the site. The nearest record is 60km north (iNat, July 2022)
Spotted-necked Otter (*Hydrictis maculicollis*)	NT	VU		0-2500m asl Habitat requirements include streams, rivers, lakes (natural & manmade) and open waters which are unpolluted and are not silted. Shelters along water edges with cover provided by boulders, reeds, long grass, dense bushes and overhanging trees. Feed predominantly on fish and occasionally crabs, frogs, insects (esp. dragonfly larvae) and birds.	**Low** No suitable habitat is present within the site.

Brown Hyaena *Parahyaena brunnea*	NT	NT		Inhabits desert areas (<100 mm MAR), semi-desert, open scrub and open woodland savannah (<700 mm). Avoids developed areas but can survive close to them. It is estimated that there are 800–2,200 individuals in SA.	**Low** Suitable habitat is present within the site (i.e., grasslands and karoo scrub) but this species is sparely distributed and considered uncommon.
African Clawless Otter *Aonyx capensis*	NT	NT		This species is the most widely distributed otter species in Africa, with a range stretching from Senegal and Mali throughout most of West Africa to Sudan and Ethiopia, and then southwards throughout East Africa to the Western Cape of South Africa (Jacques *et al., 2021).* Provided freshwater (0.5–1.5 m deep) is available this species can occur in a variety of habitats. Permanent habitation is dependent on the availability of prey and shelter and females may exhibit territoriality in these areas (Okes, et al., 2016). Although this species can tolerate high levels of pollution, eutrophication, and disturbance (traffic, dogs, etc) in developed areas this is only in moderation (Okes, et al., 2016).	**Low** No suitable habitat is present within the site.
Vlei Rat *Otomys auratus*	NT	NT		Inhabits mesic Highveld Grassland and associated with sedges and grasses adapted to densely vegetated wetlands with wet soils (Taylor, Baxter & Child, 2016).	**Low** No suitable habitat is present within the site.

Serval *Leptailurus serval*	LC	NT		This species depends on vegetation boarding water sources such as wetlands, marshland, rank grass and vleis as well as well-watered savannah with long-grass (Ramesh, *et al*., 2016). Servals prey on small mammals, birds, reptiles, fish, and rarely invertebrates. Their main diet consists of Vlei Rats (*Otomys sp.*) and Striped Mice (*Rhabdomys pumilio*).	**Low** No suitable habitat is present within the site (i.e., grasslands along water courses)
African Striped Weasel *Poecilogale albinucha*	LC	NT		0-2300m asl Wide habitat tolerance including fynbos, lowland rainforest, semi-desert grassland, pine plantations and agricultural fields but mainly found in savanna.	**High** Given its high habitat tolerance this species could occur on site.

Faunal SCC Sensitivity

The Species Environmental Assessment guideline (SANBI, 2021) was applied to assess the Site Ecological Importance (SEI) of the project area. The habitats and the species of conservation concern in the project area were assessed based on their conservation importance, functional integrity and receptor resilience (Table 5.9).

Table 5.9: Sensitivity of faunal SCC

Habitat / Species	Conservation Importance (CI)	Functional Integrity (FI)	BI	Receptor Resilience	SEI
Faunal SCC	Medium	High	Medium	High	**Low**
	The NT African Striped Weasel (*Poecilogale albinucha*) has a high likelihood of occurrence	Large area with good habitat connectivity.		Species is highly likely to return to site once the impact has been removed.	

There is a low likelihood of occurrence of SCC. Impacts on the terrestrial faunal habitats can be reduced to acceptable levels through the implementation of mitigation measures. The specialist is therefore of the opinion that the development can proceed, provided the recommendations contained in the ecological report are implemented.

5.3.1.6 Visual Landscape

Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks and conservation areas, highways and travel routes, and important cultural features and historic sites.

Visual Receptors

Visual Receptors can be defined as “Individuals, groups or communities who are subject to the visual influence of a particular project”.

Possible visual receptors identified within the 10 km radius landscape which due to use could be sensitive to landscape change. They include:

- Area Receptors which include:
  - Luckhoff.
  - One game/hunting farm.
- Linear Receptors which include:
  - R48 regional road.
  - S572 secondary road.
  - Unnamed secondary road.
- Point Receptors which include:

- Homesteads on farms.
- Lodging facilities.

Zone of Theoretical Visibility Model

A Zone of Theoretical Visibility (ZTV) is a Geographic Information System (GIS)-generated tool to identify the likely (or theoretical) extent of visibility of a development. The tool used in this model does not take existing screening into account but only the above mean sea level of the landscape.

Table 5.10: ZTV Assumptions

Radius	Impact Magnitude
0-1km	Very High
1-3km	High
3-5km	Medium
5-10km	Low

Table 5.11 below reflects the visibility rating in terms of proximity on sensitive receptors of the SEF.

Table 5.11: ZTV rating in terms of proximity to the SEF

Radius	Visual Receptors	Visibility rating in terms of proximity
0-1km	- Two homesteads on farms. - S572 secondary road. - One unnamed secondary road. - One game/hunting farm. **Coverage: 61%**	Very High
1-3km	- One homestead on a farm. - S572 secondary road. - One unnamed secondary road. **Coverage: 27%**	High
3-5km	- Four homesteads on farms. - S572 secondary road. - R48 regional road. - One unnamed secondary road. - Teisesville. **Coverage: 25%**	Medium
5-10km	- Eight homesteads on farms. - S572 secondary road. - R48 regional road. - One unnamed secondary road. - Luckhoff.	Low

	Coverage: 14%	

Figures 5.17 and 5.18 reflects the theoretical visibility. The distances were calculated according to experience, assumptions and opinion. The ZTV maps below will give a clearer understanding of areas susceptible to line of sight of the SEF.

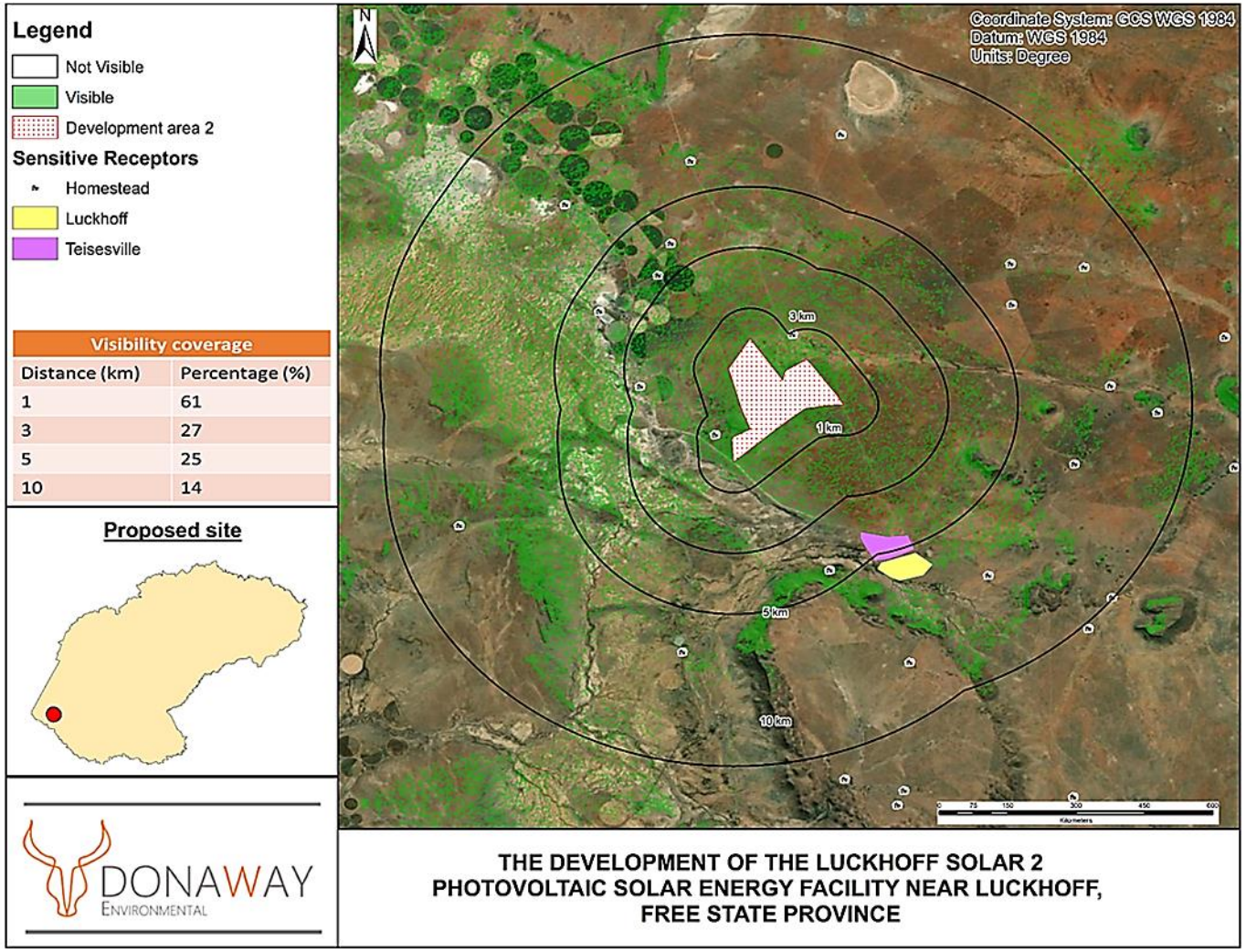


Figure 5.17: ZTV for the SEF, satellite view

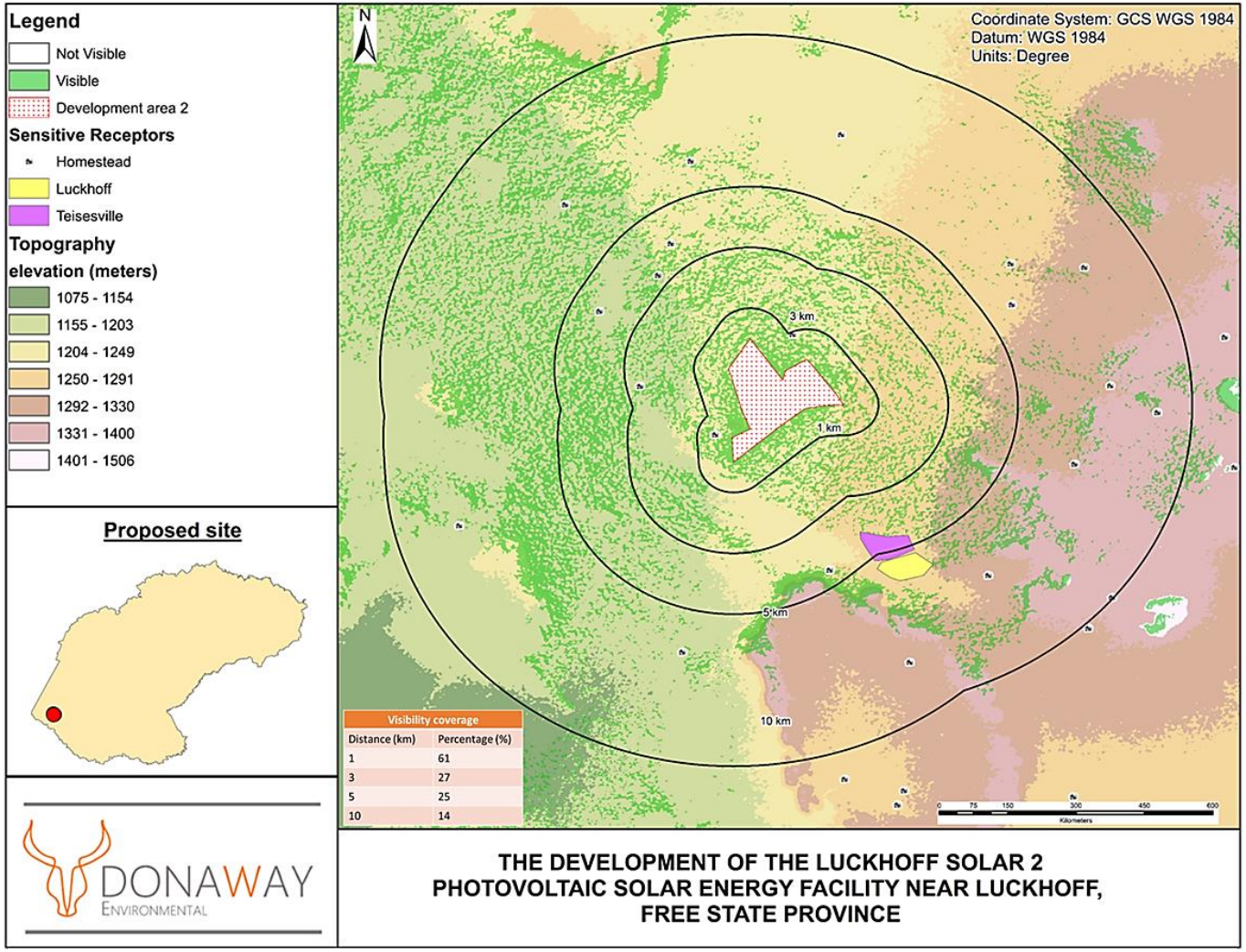


Figure 5.18: ZTV for the SEF, topography view

Referring to the assessment score of this VIA report review, the significance of the visual impact will be a "Negative Low Impact". Sensitive receptors likely to be impacted by the proposed development are the nearby property owners, including a game, hunting and ecotourism farm, people travelling on the S572 secondary road and an unnamed secondary road located to the west. A large part of the visual landscape is reflecting a farming landscape with a better visual appearance.

Following receipt of the final development layout, the visual specialist states *"Changes to the layout were made by the project proponent, Luckhoff Solar 2 (Pty) Ltd, including the application of a 100 m buffer between the development footprint and the adjacent property to the north-east, the Farm Du Toits Put No. 249, and other additional changes to address other sensitivities on the site not related to visual impacts. The project proponent decided to apply the buffer after the landowner, Mr Grobbelaar, of the Farm Du Toits Put No. 249 raised his concerns during the public participation process. His main concerns were the visual impacts that such a big project will have on the tourists on his game farm as well as the dangers of hunting on the project."*

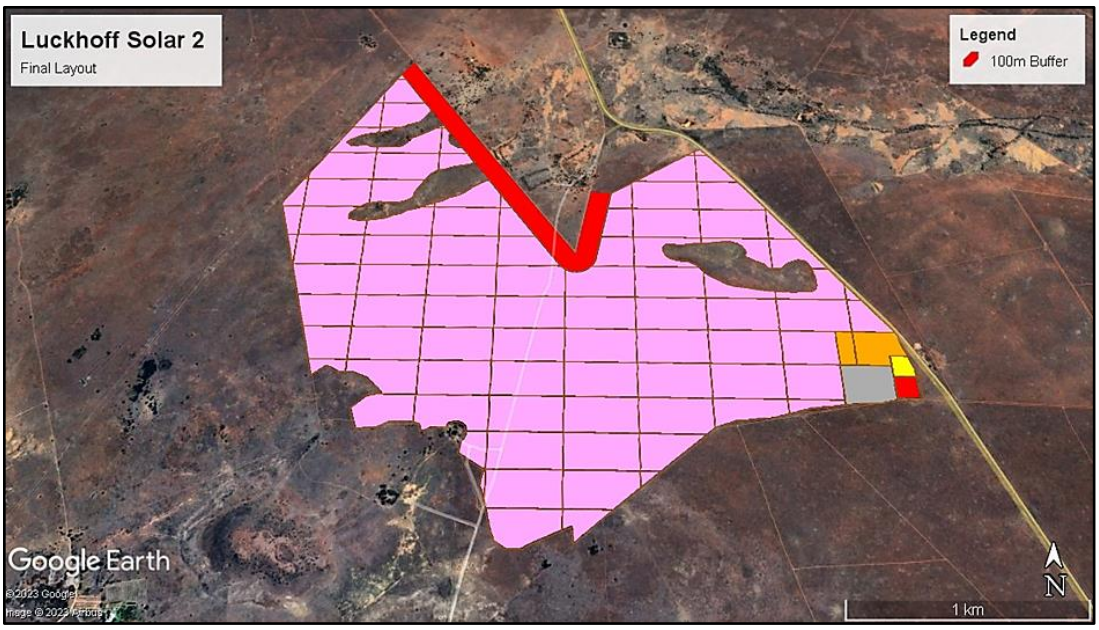


Figure 5.19: Luckhoff Solar 2 final layout indicating the applied 100 m visual buffer

The final layout footprint for the Luckhoff Solar 2 Photovoltaic Solar Energy Facility was reduced, thus the visual impacts will be reduced. Donaway Environmental does not foresee any additional negative impacts, making the final layout acceptable.

5.3.1.7 Traffic Consideration

According to the Traffic Impact Study (Appendix E8), suitable accessibility to the site from the external road network is assessed in line with access spacing requirements, required sight lines and road safety considerations. For Luckhoff Solar 2, it is recommended to gain access to the site via the intersection of S572 and the R48 at Luckhoff and then travel on S572 northwards towards the site approximately 2.2 km. Refer to Figure 5.20.

Figure 5.20: Aerial view of the recommended access towards Luckhoff Solar 2

The S572 is an approximately 8 m wide gravel road intersecting with the R48. The road opposite the S572 is surfaced and leading into Luckhoff. The R48 and the road leading into Luckhoff show road surface failure, with potholes, cracking, edge breaking and bleeding, which can have a negative effect on construction vehicles traveling on the R48. It is therefore recommended to upgrade the intersection at the turn-off towards the side.

Sight distances from the S572 turning into the R48 are good in a western direction and limited in an eastern direction due to a horizontal curve. However, due to little vegetation, the sight

lines are currently acceptable. It is advised that the sight lines in an eastern direction from S572 are kept clear of any vegetation or signage. Additionally, temporary road signage needs to be provided along the R48 approaching the Luckhoff intersection, alerting drivers of larger construction vehicles using the access route (S572) ahead and turning slowly.

As construction vehicles will drive past developed land on their last section on the R48 before turning off towards the site (for approximately 900 m arriving from a western direction and approximately 500 m arriving from an eastern direction), road safety measures need to be in place (i.e., temporary signage alerting pedestrians and vehicles driving from Luckhoff towards the R48 of construction vehicle traffic ahead).

As this access route is recommended for Luckhoff Solar 1 and Luckhoff Solar 3 as well, it is advised to provide a secondary access point during the construction period to limit congestion. The access location shown in Figure 5.20 above is suitable from a sight distance point of view and located at an existing farm path.

Internal Roads

The geometric design and layout for the internal roads from the recommended access points need to be established at detailed design stage. Existing structures and services, such as drainage structures, signage and pipelines will need to be evaluated if impacting on the roads. It needs to be ensured that the gravel sections remain in good condition and will need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed.

The geometric design constraints encountered due to the terrain should be taken into consideration by the geometric designer. Preferably, the internal roads need to be designed with smooth, relatively flat gradients (recommended to be no more than 8%) to allow a larger transport load vehicle to ascend to the respective laydown areas.

From a transport engineering perspective, the proposed development alternatives (i.e., electrical infrastructure compound location alternatives and the technology options for the BESS) are acceptable as they do not have any relevant impact on the traffic on the surrounding road network and the proposed development is supported to be approved.

5.3.2 Description of the Socio-Economic Environment

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

5.3.2.1 Socio-Economic Conditions

Free State Province is the landlocked core of the country. It is centrally placed, with good transport corridors to the north and the coast. It is the third biggest of South Africa's nine provinces in terms of size, and primary agriculture is a key economic sector. Mining is also important but has been declining steadily since 2008.

The Free State is situated in the heart of the country, between the Vaal River in the north and the Orange River in the south, bordered by the Northern Cape, Eastern Cape, North West, Mpumalanga, KwaZulu-Natal and Gauteng provinces, as well as Lesotho. The Free State is a

rural province of farmland, mountains, goldfields, and widely dispersed towns. This province is an open, flat grassland with plenty of agriculture that is central to the country's economy. Mining is its largest employer.

Bloemfontein is the capital and is home to the Supreme Court of Appeal, as well as the University of Free State and the Central University of Technology. The province also has 12 gold mines, producing 30 percent of South Africa's output.

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

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

Other mineral resources – gold, diamonds, and low-grade coal – are also important to the province; mining contributed 9% to the local economy and employed some 33 000 people in 2010. Other commodities include clay, gypsum, salt, and uranium.

Manufacturing also features in the provincial economic profile. This sector makes up 14% of the provincial output, with petro-chemicals (via Sasol) taking account of more than 85% of the output.

Free State is strategically placed to take advantage of the national transport infrastructure. Two corridors are of particular importance: the Harrismith node on the N3 corridor between Gauteng and KwaZulu-Natal and the N8. The N1 joins Gauteng to the Western Cape. Bloemfontein International Airport handles about 250 000 passengers and about 221 000 tons of cargo a year.

Important towns include Welkom, the heart of the goldfields; Odendaalsrus, another gold-mining town; Sasolburg; Kroonstad; Parys; and Phuthaditjhaba. The Free State is also home to the Vredefort Dome, the largest visible meteor-impact site in the world, which was formed two billion years ago when a meteorite 10 kilometres wide slammed into Earth. The Vredefort Dome is one of South Africa's seven UNESCO World Heritage sites.

In the north-eastern Free State is the Golden Gate Highlands National Park, which is the province's prime tourist attraction.

Xhariep District Municipality

The Xhariep District Municipality is a Category C municipality situated in the southern part of the Free State. It is bordered by the Mangaung Metro to the north, Eastern Cape to the south, Lesotho to the east, and Northern Cape to the west.

It is the largest district in the province, making up just more than a third of its geographical area. It is comprised of three local municipalities: Letsemeng, Kopanong and Mohokare, which include 21 towns. Its administrative headquarters are in Trompsburg, which lies 125km south of Bloemfontein.

The towns in this district boast abundant natural resources such as water and agricultural land. The largest dam in South Africa is situated at the southern tip of the district. Three national roads (N1 – Gauteng to Cape Town, N6 – Eastern Cape to Bloemfontein and N8 – Bloemfontein to Kimberley) pass through this area.

The municipality consists of the following towns: Bethulie, Edenburg, Fauresmith, Gariep Dam, Jacobsdal, Jagersfontein, Koffiefontein, Luckhoff, Oppermansgronde, Petrusburg, Philippolis, Reddersburg, Rouxville, Smithfield, Springfontein, Trompsburg, Waterkloof, Zastron.

The main economic sectors include: Agriculture, construction, mining, transport and communication.

In 2016 the Municipality had a population of 125 884. By 2016 only 34.7% of dwellings had piped water inside their dwellings and 6.8% of household still did not have electricity in their dwellings.

Letsemeng Local Municipality

The Letsemeng Local Municipality is a Category B municipality situated in the south-western Free State Province within the Xhariep District. It is bordered in the north by the Lejweleputswa District, in the south by Kopanong, in the east by the Mangaung Metro, and in the west by the Northern Cape Province. It is one of three municipalities in the district, making up almost a third of its geographical area. Koffiefontein is the municipal head office.

The socio-economic growth of the municipality is centred on agriculture. The municipal area also has mining activities, with diamond minerals being the major natural resource that helps with employment creation.

The municipality covers an area of 9 826km² and consists of the following towns: Jacobsdal, Koffiefontein, Luckhoff, Oppermansgronde and Petrusburg.

The main economic sectors in the municipality are Farming and Mining.

Following receipt of the final development layout, the social specialist states *"Changes to the layout were made by the project proponent, Luckhoff Solar 2 (Pty) Ltd, including the application of a 100 m buffer between the development footprint and the adjacent property to the north-east, the Farm Du Toits Put No. 249, and other additional changes to address other sensitivities on the site not related to visual impacts. The project proponent decided to apply the buffer after the landowner, Mr Grobbelaar, of the Farm Du Toits Put No. 249 raised his concerns during the public participation process. His main concerns were the visual impacts that such a big project will have on the tourists on his game farm as well as the dangers of hunting on the project."*

Donaway Environmental does not foresee any additional negative impacts, making the final layout acceptable.

5.3.2.2 Cultural and Heritage Aspects

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a very limited pre-colonial Stone Age and Iron Age occupation. The second and much later component is a colonial farmer one, with a very limited urban component consisting of a number of smaller towns, most of which developed during the last 120 to 150 years.

Stone Age

The Orange River and some of its tributaries are well known for its river gravels, in some places containing large numbers of Early Stone Age tools (Acheullian) (Sampson 1972). The larger region also produced what was to become the Fauresmith industry, first identified by Van Riet Lowe. The Fauresmith is regarded to represent a transitional phase between the ESA and MSA, and have some technological and typological elements of the latter. There is a tendency towards smaller tools and small hand-axes in particular seem to a characteristic feature of the Fauresmith. Assemblages include refined hand-axes, long blades, convergent flakes/points, scrapers and prepared cores used in the manufacture of these tool types. This combination of Modes 2 and 3 makes it a likely transitional industry (Barham & Mitchell 2008:229).

Although reports indicate that sites containing Later Stone Age lithics are few and far between, a number of rock engraving sites dating to the Later Stone Age as well as the historic period are known to exist in the larger region, especially in the region on the eastern side of the Riet River. In the latter case, people riding horses are depicted. Many of these engravings from different sites have been removed and are “exhibited” in the town of Koffiefontein.

Most of the archaeological remains recorded in the larger region of the project area consist of a background scatter of weathered and patinated, typologically mixed Middle Stone Age (MSA) artefacts, with a few isolated samples dating to the Fauresmith period. These artefacts occur dispersed within the surface gravels, rather than as discrete concentrations. The fact that there appears to be no stratigraphic context and no organic remains are preserved would suggest that most of the proposed Luckhoff 2 development area is of low archaeological heritage sensitivity.

As yet, no sites dating to the Early Iron Age have been reported from the region and most sites date to the Late Iron Age. A number of stone walled settlement sites, classified by Maggs (1976) as type R ruins, occur north and south of the study area. These sites represent a transitional phase between Khoi herders settling permanently and Iron Age Tswana-speaking people entering the area. These settlements were first described by William Burchell during the first two decades of the 19th century. A large number of graves, located in close vicinity to the Riet River, have been archaeologically investigated (Humphreys 1973).

The town of Luckhoff was established in 1892 and named after the Reverend H.J. Luckhoff (1842 – 1943). Like Fauresmith, sheep farming is the backbone of the town economy. The Van der Kloof Dam, originally named the P.K. le Roux Dam, was completed 1977, is located approximately 30km south of the study region.

Site Specific Review

From a review of the available old maps and aerial photographs it can be seen that the project area has always been open space, with the main activity being grazing, for which limited infrastructure such as watering points, were developed.

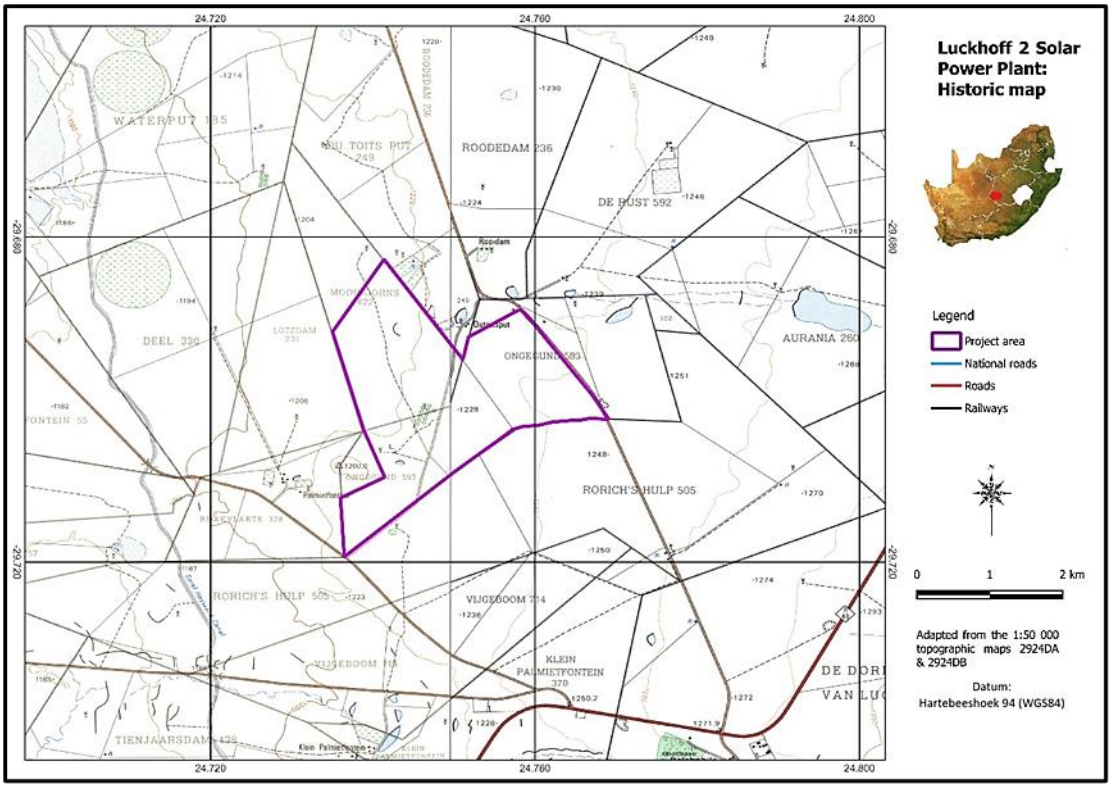


Figure 5.21: The project area on the 1971 version of the 1:50 000 topographic map

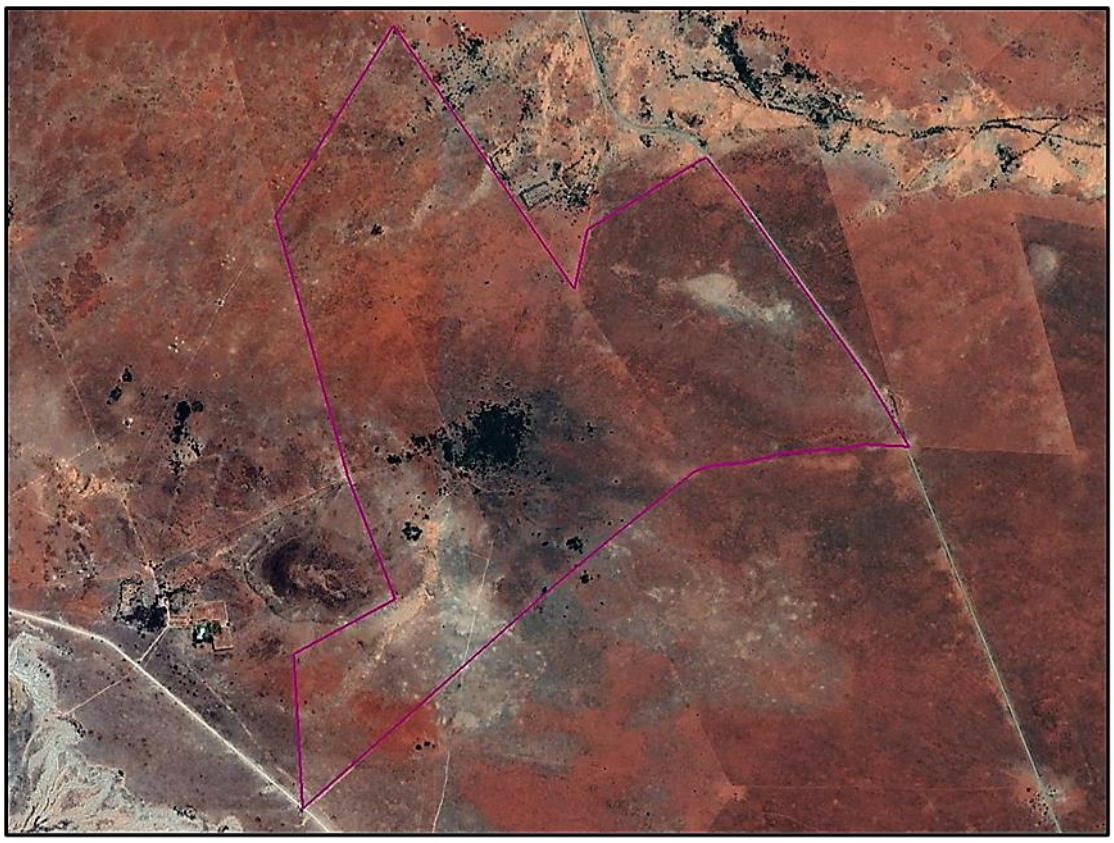


Figure 5.22: Aerial view of the project area dating to 2022

During the survey, the following sites, features and objects of cultural significance were identified in the project area.

Stone Age

- No sites, features or objects of cultural significance dating to the Stone Age were identified in the project area.

Iron Age

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

Historic Period

- No sites, features or objects of cultural significance dating to the historic period were identified in the project area.

Palaeontology

The Palaeontological Impact Assessment (refer to Appendix E6), found that the proposed development is underlain by Quaternary aeolian sand, calcrete with a small portion underlain by Jurassic Dolerite of the Karoo Igneous Province. The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the calcretes is High, Quaternary sands has a Moderate Palaeontological Sensitivity while that of the Jurassic dolerite of the Karoo Igneous Province is Zero as it is igneous in origin (Almond and Pether, 2009; Almond et al., 2013). Update geology (Council for

Geosciences, Pretoria) indicates that the proposed Luckhoff 2 PV facility is underlain by calcrete, surface limestones and Hardpan as well as alluvium, colluvium, eluvium, gravel, scree, sand, soil and debris.

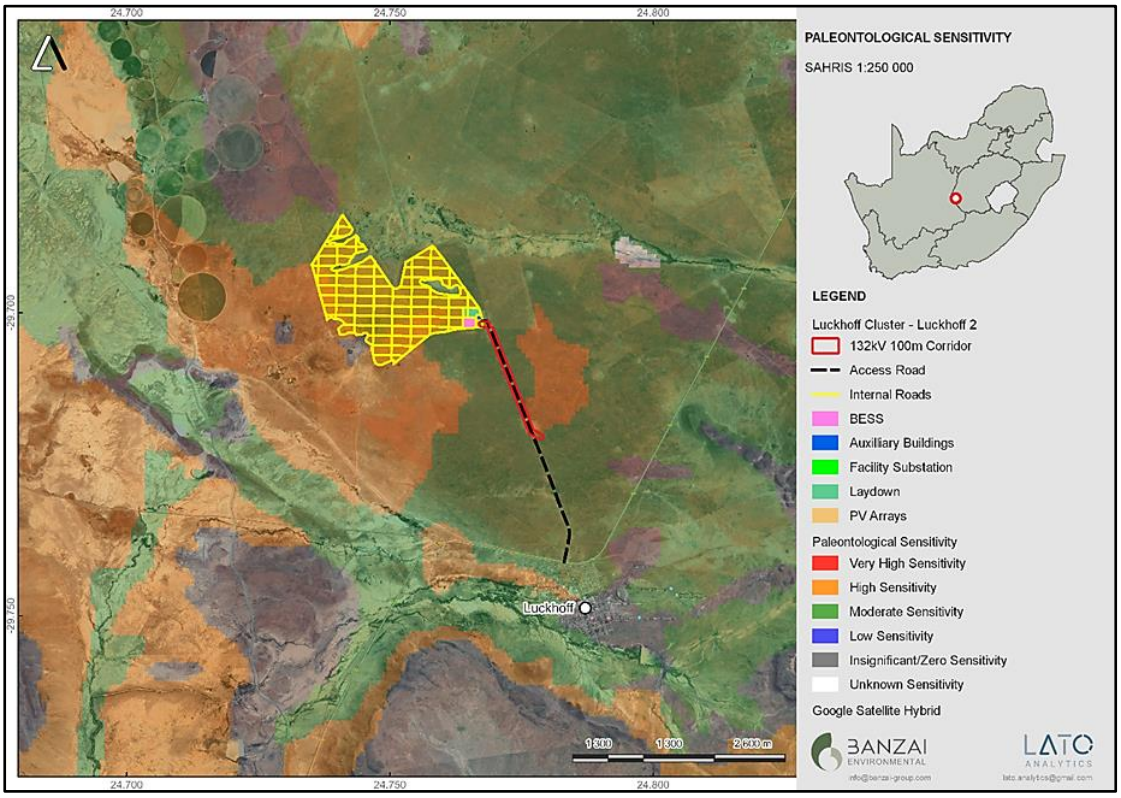


Figure 5.23: Palaeontological sensitivity according to the SAHRIS PalaeoMap

It is considered that the proposed Luckhoff 2 Solar Energy Facility in the Free State will not lead to detrimental impacts on the palaeontological resources of the area. The construction of the development may therefore be authorised as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are discovered during any phase of construction, either on the surface or uncovered by excavations, the ECO/site manager in charge of these developments must be notified immediately. These discoveries must be secured and the ECO/site manager must alert SAHRA so that appropriate mitigation (documented and collection) can be undertaken by a professional paleontologist. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports must meet the minimum standards for paleontological impact studies developed by SAHRA.

5.4 SITE SELECTION MATRIX

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

The receptiveness of the site to PV development includes the presence of optimal conditions for the sitting of a solar energy facility due to high irradiation values and optimum grid connection opportunities (i.e., the grid connection points are located within the affected property which minimizes the length of power line development and consolidates the overall impacts and disturbance of the project within the affected property). Farm Mooidoorns No. 1224, Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577, where the project is proposed to be located is considered favorable and suitable from a technical perspective due to the following characteristics:

- Climatic conditions: Climatic conditions determine if the project will be viable from an economic perspective as the solar PV facility is directly dependent on the annual direct solar irradiation values of a particular area. The Free State receives high averages of direct normal and global horizontal irradiation, daily. This is an indication that the regional location of the project includes a low number of rainy days and a high number of daylight hours experienced in the region. Global Horizontal Radiation of ~2118 kWh/m^2/year is relevant in the area.

- Topographic conditions: The surface area on which the proposed facility will be located has a favourable level topography, which facilitates work involved with construction and maintenance of the facility and ensures that shadowing on the panels do not occur. The topographic conditions, which are favourable, minimizes the significance of the impact that will occur during the clearing and leveling of the site for the construction activities.

- Extent of the site: A significant portion of land is required to evacuate the prescribed 240 MW and space is a constraining factor in PV facility installations. Provision was made to assess a larger area than is required for the facility to make provision for any other environmental or technical constraints that may arise and avoiding those areas. Larger farms are sought after to make provision for any constraints imposed by the Department of Agriculture on the extent of land that may be used for such facilities per farm, as well as the opportunities presented for the avoidance of sensitive environmental features present. Farm Mooidoorns No. 1224, Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577, and the development footprint assessed therein is considered to provide an opportunity for the successful construction and operation of a solar PV facility with a capacity of 240 MW, as well as opportunities for the avoidance and mitigation of impacts on the affected environment and sensitive environmental features.

- Site availability and access: The land is available for lease by the developer. Reluctant farm owners or farmers over capitalizing hamper efforts to find suitable farms. Access

will be obtained via the intersection of S572 and the R48 at Luckhoff and then travel on S572 northwards towards the site approximately 2.2 km.

- Grid connection: In order for the PV facility to connect to the national grid the facility will have to construct an on-site substation, Eskom switching station and a power line from the project site to connect to the Eskom grid. Available grid connections are becoming scarce and play a huge role when selecting a viable site.

- Environmental sensitivities: From an environmental perspective the proposed site is considered highly desirable due to limited environmental sensitivities in terms of geology, and soils, agricultural potential, vegetation and landscape features, climate, biodiversity and the visual landscape – refer to Section 5.3.1 of this report. The area proposed for development exclusively consists of land used for agriculture, but a wetland feature (small depression) is located on the development footprint. Although two (02) SCC where identified to potentially occur with the habitat, the ecological study found that the likelihood of occurrence of this species is low and no SCC where recorded. Sensitivities identified are considered by the developer for the placement of the facility infrastructure within the development footprint.

It is evident from the discussion above that Farm Mooidoorns No. 1224; Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577, are considered favourable and suitable in terms of the site and environmental characteristics. As mentioned previously, no alternative areas on the property have been considered for the placement of the development footprint as the assessed development footprint avoids areas that are under cultivation within the affected property. The development footprint of this project will cover a significant portion of the farm; however, provision has been made to exclude any sensitive areas from the facility layout to be developed within the development footprint.

5.5 CONCLUDING STATEMENT ON ALTERNATIVES

When considering the information provided by the specialists with regards to the site selection criteria, the site is identified as preferred due to the fact that the opportunities presented on the site to develop the project in such a way which avoids the areas and features (including the associated buffers) of environmental sensitivity. Therefore, development of the 240 MW Luckhoff Solar 2 PV facility on Farm Mooidoorn No. 1224l Farm Rorich's Hulp No. 505 and Farm De Dorpsgronden Van Luckhoff No. 577 is the preferred option.

No other possible sites were identified for the Luckhoff Solar 2 PV facility. This site is referred to as the preferred site. Additional land (if any) will be acquired to generate additional capacity in the future. The existing Eskom Luckhoff substation is located approximately 10 km from the preferred site. Connection to the grid plays a vital role in the site location for renewable energy facilities as there is a shortage of grid connection space. The location of the preferred site shortens the length of the required grid connection in order to evacuate energy into the national grid. There are sensitive features that occur on the site. However, the site is still viable. The size of the site makes provision for the exclusion of any sensitive environmental features that may arise through the EIA process and will ensure that potential impacts are adequately mitigated.

Considering the environmental sensitive features present within the development footprint, the Applicant has proposed a development facility layout which considers these features, and thereby aim to avoid any direct impact on these features. The final layout is included as part of this Draft EIR (refer to Figure C and M). It may be concluded that this is the only location that will be assessed in further detail within sections 6 and 7.

6 DESCRIPTION OF THE IMPACTS AND RISKS

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

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

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

(v) the impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;

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

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

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

(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-

(i) a description of all environmental issues and risks that were identified during the EIA process; and

(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.

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

(i) cumulative impacts;

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

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

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

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

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

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

(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;

6.1 SCOPING METHODOLOGY

The contents and methodology of the Environmental Impact Report aimed to provide, as far as possible, a user-friendly analysis of information to allow for easy interpretation.

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

6.1.1 Checklist Analysis

The independent consultant conducted a site visit on 06 October 2022. The site visit was conducted to ensure a proper analysis of the site-specific characteristics of the study area. Table 6.1 provides a checklist, which is designed to stimulate thought regarding possible consequences of specific actions and so assist scoping of key issues. It consists of a list of structured questions related to the environmental parameters and specific human actions. They assist in ordering thinking, data collection, presentation and alert against the omission of possible impacts. The table highlights certain issues, which are further analysed in matrix format in section 6.2.

Table 6.1: Environmental checklist

QUESTION	YES	NO	Un-sure	Description
1. Are any of the following located on the site earmarked for the development?				
I. A river, stream, dam or wetland	✕			Two (02) watercourses occur within the study area, and only two (02) small depressions were encountered and delineated as a part of the aquatic ecological assessment, one (01) of which falls within the project area and must be avoided during the final design process.

II. A conservation or open space area		×		A small portion of the southern section of the project area occurs within a CBA 1 and CBA 2. Most of the proposed development footprint represents Ecological Support Areas (ESA), the project site occurs within an ESA 1. Thanda Tula Nature Reserve is located within 5 km of the site.
III. An area that is of cultural importance		×		No sites, features or objects of cultural significance were identified
IV. Site of geological significance		×		None.
V. Areas of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.
VII. Floodplain		×		None.
VIII. Indigenous Forest		×		None.
IX. Grass land	×			The topography of the project site is a combination of relatively flat open grassland plains interspersed with high lying rocky ridges, hills and slopes
X. Bird nesting sites	×			The Avifauna Impact Assessment (refer to Appendix E2) states that the high sensitivity area in the north of the study site corresponds to part of a 1.5 km buffer area, which was allocated due to the occurrence of a pair of Secretarybirds engaged in nest building behaviour.
XI. Red data species		×		The Avifauna Impact Assessment (refer to Appendix E2) did not record any Red Data Species on site but indicated that some species of conservation concern may occur on site.
XII. Tourist resort		×		None.
2. Will the project potentially result in potential?				
I. Removal of people		×		None.

II. Visual Impacts	×			The significance of the visual impact will be a "Negative Low Impact". Sensitive receptors likely to be impacted by the proposed development are the nearby property owners, including a game, hunting and ecotourism farm, the town of Luckhoff and people travelling on the R48 regional road, S572 secondary road and an unnamed secondary road located to the west.
III. Noise pollution	×			Construction activities will result in the generation of noise over a period of 12-18 months. The noise impact is unlikely to be significant.
IV. Construction of an access road	×			It is recommended to access the site turning off the R48 onto the S572 towards the site.
V. Risk to human or valuable ecosystems due to explosion/fire/ discharge of waste into water or air.		×		None.
VI. Accumulation of large workforce (>50 manual workers) into the site.	×			Approximately 500 employment opportunities will be created during the construction phase and 50 employment opportunities during the operation phase of the SPP project.
VII. Utilisation of significant volumes of local raw materials such as water, wood etc.	×			The estimated maximum amount of water required during the facility's 20 years of production is approximately 9547kl per annum.
VIII. Job creation	×			Approximately 500 employment opportunities will be created during the construction phase and 50 employment opportunities during the operation phase of the SPP project.

IX. Traffic generation	×			It is estimated that 242 trips will occur at the peak of construction distributed over a 9-hour day. Daily site trips account for solar panel component delivery; staff transport; and material delivery.
X. Soil erosion	×			The site will need to be cleared or graded to a limited extent, which may potentially result in a degree of dust being created, increased runoff and potentially soil erosion. The time that these areas are left bare will be limited to the construction phase, since vegetation will be allowed to grow back after construction.
XI. Installation of additional bulk telecommunication transmission lines or facilities		×		None.
3. Is the proposed project located near the following?				
I. A river, stream, dam or wetland	×			Two (02) watercourses occur within the study area, and only two (02) small depressions were encountered and delineated as a part of the aquatic ecological assessment, one (01) of which falls within the project area and must be avoided during the final design process.
II. A conservation or open space area		×		A small portion of the southern section of the project area occurs within a CBA 1 and CBA 2. Most of the proposed development footprint represents Ecological Support Areas (ESA), the project site occurs within an ESA 1. Thanda Tula Nature Reserve is located within 5 km of the site.
III. An area that is of cultural importance		×		None.
IV. A site of geological significance		×		None.
V. An area of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.

VII. A tourist resort	×			Thanda Tula Nature Reserve- and lodge is located within 5 km of the site.
VIII. A formal or informal settlement	×			The town of Luckhoff is located approximately 5 km south of the proposed development.

6.1.2 Matrix Analysis

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

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

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

Detailed impact assessments have been undertaken by each of the respective specialists which has informed the matrix analysis as included in Table 6.2 below, as well as the key issues identified as included in sections 6.2.1-6.2.3. The table included on the overleaf includes reference to the sections in the respective specialist studies where the details of the in-depth assessment of potential environmental impacts can be obtained.

Table 6.2: Matrix analysis

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

Low significance	Medium significance	High significance	Positive impact

LISTED ACTIVITY (The Stressor)	ASPECTS OF THE DEVELOPMENT /ACTIVITY	POTENTIAL IMPACTS		SIGNIFICANCE AND MAGNITUDE OF POTENTIAL IMPACTS							MITIGATION OF POTENTIAL IMPACTS			SPECIALIST STUDIES / INFORMATION
		Receptors	Impact description / consequence	Minor	Major	Extent	Duration	Probability	Reversibility	Irreplaceable loss of resources	Possible Mitigation	Possible mitigation measures	Level of residual risk	
CONSTRUCTION PHASE														
Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* Activity 12(ii)(a)(c) (GN.R. 327): *"The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."* Activity 19 (GN.R. 327): *"The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than*	Site clearing and preparation Certain areas of the site will need to be cleared of vegetation and some areas may need to be levelled. Civil works The main civil works are: • Terrain levelling if necessary– Levelling will be minimal as the potential site chosen is relatively flat. • Laying foundation- The structures will be connected to the ground through cement pillars, cement slabs or metal screws. The exact method will depend on the detailed geotechnical analysis. • Construction of access and inside roads/paths – existing paths will be used were reasonably possible. Additionally, the turning	BIOPHYSICAL ENVIRONMENT	Flora	• Loss of Northern Upper Karoo Vegetation • The clearing of vegetation for the construction of the SEF and associated infrastructure will result in the permanent loss of approximately 480ha of Northern Upper Karoo. • The extent of vegetation that will be impacted equates to 1.2% of the remaining extent of this vegetation unit. • The loss of this vegetation type, which is listed as Least Concern, will have an overall impact of low significance. • This impact is difficult to mitigate as the loss of vegetation is definite and permanent and as such the impact will remain of low significance even after mitigation measures have been implemented.	-		S	LT	Pr	BR	ML	No	- See Table 6.3	L	Ecological Impact Assessment (Appendix E1)

10 cubic metres from a watercourse." Activity 24 (ii) (GN.R 327): *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters."* Activity 27 (GN.R. 327): *"The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation…"* Activity 28(ii) (GN.R. 327): *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."* Activity 56 (ii) (GN.R 327): "*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* Activity 1 (GN.R. 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more..."* Activity 15 (GN.R. 325): *"The clearance of an area of 20*	circle for trucks will also be taken into consideration. Transportation and installation of PV panels into an Array The panels are assembled at the supplier's premises and will be transported from the factory to the site on trucks. The panels will be mounted on metal structures which are fixed into the ground either through a concrete foundation or a deep-seated screw. Wiring to the Central Inverters Sections of the PV array will be wired to central inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.		Flora	• Loss of Plant Species of Conservation Concern • No restricted range species or CR, EN or VU species were recorded within the site during the field survey. • Additionally, the desktop assessment did not identify any SCC with a high likelihood of occurrence within the site. • The impact is therefore negligible.	Negligible		Not Applicable as impact is negligible						N/A	L	Ecological Impact Assessment (Appendix E1)
			Fauna and Flora	• Fragmentation is one of the most important impacts on vegetation as it creates breaks in previously continuous vegetation, causing a reduction in the gene pool and a decrease in species richness and diversity. • This impact occurs when more and more areas are cleared, resulting in the isolation of functional ecosystems, which results in reduced biodiversity and reduced movement due to the absence of ecological corridors. • The infrastructure associated with the Photovoltaic Solar Facility, particularly the roads, will increase habitat fragmentation by creating breaks in the environment. However, the movement of species (fauna and seeds) will not be entirely prohibited due to the nature of the infrastructure and the ecological	-		L	L	Pr	PR	ML	Yes	- See Table 6.3	L	Ecological Impact Assessment (Appendix E1)

hectares or more of indigenous vegetation..." Activity 4 (b)(i)(ee)(gg) (GN.R 324): *"The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."* Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans*				functioning of the site can still be maintained.										
			Fauna	• Loss of faunal habitat • The clearing of vegetation for the construction of project infrastructure will result in the permanent loss of approximately 480ha of faunal habitat. • This impact is difficult to mitigate as the loss of habitat is definite and permanent and as such the impact will remain even after mitigation measures have been implemented.	-		L	LT	D	BR	ML	No	- See Table 6.3	L	Ecological Impact Assessment (Appendix E1)
			Fauna	• Disturbance to Faunal Species • Construction activities may generate noise, dust, vibrations and light pollution. • This disturbance may cause faunal species to leave the area or disrupt foraging and/or breeding behaviour of those that remain.	-		L	LT	Pr	BR	ML	No	- See Table 6.3	L	Ecological Impact Assessment (Appendix E1)

adopted by the competent authority or in bioregional plans (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland." <u>Activity 12 (b)(ii)(iv) (GN.R 324):</u> *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (ii) within critical biodiversity areas identified in bioregional plans (iv) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* <u>Activity 14(ii)(a)(c)(b)(i)(ff)(hh) (GN.R 324):</u> *"The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional*			Fauna	• Mortality of faunal species • Construction activities may inadvertently kill terrestrial vertebrate fauna during vegetation clearing, earth works and driving across the site. • Fauna perceived as dangerous may be persecuted out of fear.	-		L	P	Po	IR	ML	Yes	- See Table 6.3	M	Ecological Impact Assessment (Appendix E1)
			Fauna	• Loss of faunal species of conservation concern	-		L	LT	Po	IR	SL	Yes	- See Table 6.3	L	Ecological Impact Assessment (Appendix E1)
			Air	• Air pollution due to the increase of traffic of construction vehicles and the undertaking of construction activities.	-		S	S	D	CR	NL	Yes	- Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	L	-
			Geology	• Collapsible soil. • Seepage. • Active soil (high soil heave). • Erodible soil. • Hard/compact geology. If the bedrock occurs close to surface it may present problems when driving solar panel columns.	-	-	S	S	Pr	CR	NL	Yes	- The most effective mitigation will be the minimisation of the project footprint by using the existing roads in the area and not create new roads to prevent other	L	-

plans (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve." <u>Activity 18 (b)(i)(gg)(hh) (GN.R 324):</u> *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) Free State (i) outside urban areas, within (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*				• The presence of undermined ground. • Instability due to soluble rock. • Steep slopes or areas of unstable natural slopes. • Areas subject to seismic activity.									areas also getting compacted. - Retention of vegetation where possible to avoid soil erosion.		
			Existing services infrastructure	• Generation of waste that need to be accommodated at a licensed landfill site. • Generation of sewage that need to be accommodated by the local sewage plant. • Increase in construction vehicles on existing roads.	-		L	S	D	PR	ML	Yes	-	L	Confirmation from the Local Municipality
			Groundwater	• Pollution due to construction vehicles and the storage and handling of dangerous goods.	-		S	S	Pr	CR	ML	Yes	- A groundwater monitoring programme (quality and groundwater levels) should be designed and installed for the site. - Monitoring boreholes should be securely capped, and must be fitted with a suitable sanitary seal to prevent surface water flowing down the outside of the casing. - Full construction details of monitoring boreholes must be recorded when they are drilled. - Sampling of monitoring boreholes should be done according to recognised standards.	L	-

			Aquatic Ecology	• Loss of habitat containing protected species or Species of Special Concern • Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones. • Loss can also include a functional loss, through change in vegetation type via alien encroachment, reducing aquatic biodiversity.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)
			Aquatic Ecology	• Loss of CBAs or potential areas with conservation potential • Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones and have been included in any Critical Biodiversity Areas	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)
			Aquatic Ecology	• Potential spread of alien vegetation • During construction, complete clearing of the PV panel areas, as well any ancillary structures (offices and substations) will be required. This disturbance then allows for the alien species to colonise the soils, if left unmanaged.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)

			Aquatic Ecology	• Loss of riparian and or wetland habitat • During construction, complete clearing of the PV panel areas, as well any ancillary structures (offices and substations) will be required, which may impact the aquatic function or any corridors or connections between aquatic systems. However, these areas can be avoided by the proposed layout.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)
			Aquatic Ecology	• Changes to the hydrological regime and increase potential for erosion • Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones and have been included in any Critical Biodiversity Areas	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)
			Aquatic Ecology	• Changes to surface water quality characteristics • During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)

				• Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. • This can result in possible deterioration in aquatic ecosystem integrity and species diversity.										
			General Environment (risks associated with BESS)	• Mechanical breakdown / Exposure to high temperatures • Fires, electrocutions and spillage of toxic substances into the surrounding environment. • Spillage of hazardous substances into the surrounding environment. • Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas. • Water Pollution – spillages into surrounding watercourses as well as groundwater. • Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e., rivers, streams, etc) as a primary source of water. • Generation of hazardous waste	-	S	M	Pr	PR	ML	Yes	- Operators are trained and competent to operate the BESS. Training should include the discussion of the following: - Potential impact of electrolyte spills on groundwater; - Suitable disposal of waste and effluent; - Key measures in the EMPr relevant to worker's activities; - How incidents and suggestions for improvement can be reported. - Training records should be kept on file and be made available during audits. - Battery supplier user manuals safety specifications and Material Safety Data Sheets (MSDS) are filed on site at all times.	L	-

													- Compile method statements for approval by the Technical/SHEQ Manager for the operation and management and replacement of the battery units / electrolyte for the duration of the project life cycle. Method statements should be kept on site at all times. - Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock. Signage should also specify how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. the inhalation of toxic fumes, etc.). - Firefighting equipment should readily be available at the BESS area and within the site. - Maintain strict access control to the BESS area. - Ensure all maintenance contractors / staff are familiar with the		

														supplier's specifications. - Undertake daily risk assessment prior to the commencement of daily tasks at the BESS. This should consider any aspects which could result in fire or spillage, and appropriate actions should be taken to prevent these. - Standard Operating Procedures (SOPs) should be made available by the Supplier to ensure that the batteries are handled in accordance with required best practices. - Spill kits must be made available to address any incidents associated with the flow of chemicals from the batteries into the surrounding environment. - The assembly of the batteries on-site should be avoided as far as possible. Activities on-site for the BESS should only be limited to the placement of the container wherein the batteries are placed. - Undertake periodic inspections on the		

														BESS to ensure issues are identified timeously and addressed with the supplier where relevant. - The applicant in consultation with the supplier must compile and implement a Leak and Detection Monitoring Programme during the project life cycle of the BESS. - Batteries must be strictly maintained by the supplier or suitably qualified persons for the duration of the project life cycle. No unauthorised personnel should be allowed to maintain the BESS. - Damaged and used batteries must be removed from site by the supplier or any other suitably qualified professional for recycling or appropriate disposal. - The applicant should obtain a cradle to grave battery management plan from the supplier during the planning and design phase of the system. The plan		

													must be kept on site and adhered to.		
		SOCIAL/ECONOMIC ENVIRONMENT	Local unemployment rate	• Job creation. • Business opportunities. • Skills development.		+	L	S	D	CR	NL	Yes	- See Table 6.3	M	Social Impact Assessment (Appendix E7)
			Economic multiplier effects	• Significance of the impact from the economic multiplier effects from the use of local goods and services.		+	P	S	Pr	CR	NL	Yes	- See Table 6.3	M	Social Impact Assessment (Appendix E7)
			Improvements on shared infrastructure	• Investment into upgrading and maintain shared infrastructure such as roads and stormwater infrastructure on farms may benefit farming operations	+		P	S	Pr	CR	NL	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Potential loss of productive farmland	• The potential loss in productive farmland during the construction phase, due to factors such as the construction of roads, the preparation of foundations, power lines, offices etc.	-		S	S	Pr	BR	ML	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Influx of jobseekers and change in population in the study area.	• In-migration of labourers in search of employment opportunities, and a resultant change in population, and increase in pressure on local resources and social networks, or existing services and infrastructure	-		L	P	Pr	IR	SL	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Safety and security impacts	• Temporary increase in safety and security concerns associated with the influx of people during the construction phase	-		L	S	Pr	CR	NL	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Daily living and movement patterns	• Temporary increase in traffic disruptions and movement patterns during the construction phase.	-		P	S	Pr	PR	ML	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)

			Nuisance impacts (noise and dust)	• Nuisance impacts in terms of temporary increase in noise and dust, and wear and tear on access roads to the site.	-		L	S	D	CR	NL	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Increased risk of potential veld fires	• The potential loss of livestock, crops, and farmsteads in the area. • This also includes the damage and loss of farm infrastructure and the threatening of human lives that are associated with the increased risk of veld fires	-		L	S	Pr	PR	SL	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Sense of place	• Intrusion impacts from construction activities will have an impact on the area's "sense of place".	-		L	S	D	PR	NL	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Visual landscape	• Visual impact of construction activities on sensitive visual receptors in close proximity to the SEF	-		L	S	D	PR	ML	Yes	- See Table 6.3	L	Visual Impact Assessment (Appendix E3)
			Traffic volumes	• Increase in development trips for the duration of the construction Phase • Associated noise, dust and exhaust pollution	-		L	M	D	CR	NL	Yes	- See Table 6.3	L	Traffic Impact Assessment (Appendix E8)
			Tourism industry	• Since there are no sensitive tourism facilities in close proximity to the site, the proposed activities will not have an impact on tourism in the area.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• As no sites, features or objects of cultural historic significance have been identified in the project area, there would be no impact as a result of the proposed development	+		S	S	U	CR	NL	N/A	- For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.	L	Heritage Impact Assessment (Appendix E5)

			Paleontological Heritage	• Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	-		S	P	-	IR	CL	N/A	N/A	L	Paleontological Impact Assessment (Appendix E6)
OPERATIONAL PHASE															
Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* Activity 12(ii)(a)(c) (GN.R. 327): *"The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."* *Activity 1 (GN.R 325): "The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."* Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b)*	Habitat disturbance Habitat disturbance as a result of construction and operational activities The key components of the proposed project are described below: • PV Panel Array - To produce up to 240 MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the yield. • Electrical reticulation network – Energy generated by the PV array will be transmitted via underground medium voltage cables (i.e., up to 33 kV) to the onsite Luckhoff Solar 2 substation (the onsite facility substation) where it will be	BIOPHYSICAL ENVIRONMENT	Flora	• Infestation of Alien Plant Species • If laydown areas and roads are not rehabilitated, these disturbed areas can become places for alien invasive species to become established, and if left unmitigated, these species can spread and establish themselves in intact vegetation, resulting in the displacement of indigenous species and possible local extinctions of SCC. • Three exotic species (*Schinus molle, Argemone ochroleuca* and *Cymbopogon pospischilii*) were recorded within the project site. *Argemone ochroleuca* is listed as a Category 1b species.	-		L	M	Po	CR	SL	Yes	- See Table 6.4	L	Ecological Impact Assessment (Appendix E1)
			Fauna	• Disturbance to Faunal Species • Operation activities may generate disturbance to faunal species disrupting foraging and/or breeding behaviour.	-		L	L	Pr	BR	ML	Yes	- See Table 6.4	L	Ecological Impact Assessment (Appendix E1)
			Fauna	• Mortality of faunal species • Operation activities may kill terrestrial vertebrate fauna specifically driving across the site.	-		L	P	Po	IR	ML	Yes	- See Table 6.4	M	Ecological Impact Assessment (Appendix E1)

in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."	stepped-up to 132 kV. Thereafter, the electricity will pass to offsite facility substation infrastructure (~2.5 km southeast of the facility) via a 132 kV overhead powerline. • <u>Supporting Infrastructure</u> – The following auxiliary buildings including a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre. The project requires the need for both temporary and permanent laydown areas • <u>Roads</u> – The majority of the access road will follow existing, gravel farm roads that may require widening up to 6 -10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road of up to 33 km, each with a width of up to 6 m, will be constructed to provide access to the various components of the PV development. Access will be obtained via the S572 off the R48, an existing gravel road located adjacent to the site.			• Fauna perceived as dangerous may be persecuted out of fear.										
			Air quality	• The proposed development will not result in any air pollution during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Geology	• Collapsible soil. • Active soil (high soil heave). • Erodible soil. • Hard/compact geology. If the bedrock occurs close to surface it may present problems when driving power line columns. • The presence of undermined ground. • Instability due to soluble rock. • Steep slopes or areas of unstable natural slopes. • Areas subject to seismic activity. • Areas subject to flooding.	-		S	S	Po	PR	ML	Yes	- Surface drainage should be provided to prevent water ponding. - Mitigation measures proposed by the detailed engineering geological investigation should be implemented.	L	-
			Groundwater	• Leakage of hazardous materials. The development will comprise of a distribution substation and will include transformer bays which will contain transformer oils. Leakage of these oils can contaminate water supplies.	-		L	L	Po	PR	ML	Yes	- All areas in which substances potentially hazardous to groundwater are stored, loaded, worked with or disposed of should be securely bunded (impermeable floor and sides) to prevent accidental discharge to groundwater.	L	-
			Aquatic Ecology	• Potential spread of alien vegetation	-		L	L	Pr	IR	NL	Yes	- See Table 6.4	L	Aquatic Ecological Assessment (Appendix E1)
		SOCIAL/ECONOMIC	Employment opportunities	• The creation of employment opportunities and skills development		+	P	L	Pr	BR	NL	Yes	- See Table 6.4	M	Social Impact Assessment (Appendix E7)

	• Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 3.5 meters will be used.		and skills development	opportunities during the operation phase for the country and local economy.											
			Development of non-polluting, renewable energy infrastructure	• Development of non-polluting, renewable energy infrastructure		+	I	L	D	CR	ML	No	- N/A	M	Social Impact Assessment (Appendix E7)
			Loss of agricultural land and overall productivity	• Loss of agricultural land and overall productivity as a result of the operation of the proposed project on an agricultural property.	-		S	L	Pr	PR	SL	Yes	- See Table 6.4	L	Social Impact Assessment (Appendix E7)
			Contribution to LED and social upliftment	• Contribution to LED and social upliftment during the operation of the project		+	I	L	D	PR	NL	Yes	- See Table 6.4	H	Social Impact Assessment (Appendix E7)
			Impact on tourism	• The potential impact on tourism due to the establishment of the Luckhoff Solar 2 SEF	- +		L	L	Pr	CR	NL	Yes	- See Table 6.4	L	Social Impact Assessment (Appendix E7)
			Sense of place	• Visual impacts and sense of place impacts associated with the operation phase of Luckhoff Solar 2 SEF.	-		L	L	Pr	CR	SL	Yes	- See Table 6.4	L	Social Impact Assessment (Appendix E7)
			Increase in household earnings	• The creation of employment opportunities and skills development opportunities during the operation phase for the households involved in the project would create an opportunity for an increasement in household earnings.		+	P	L	Pr	BR	NL	Yes	- See Table 6.4	M	Social Impact Assessment (Appendix E7)
			Visual landscape	• Visual impact on sensitive visual receptors within a 1km radius from the SEF	-		L	L	D	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)
			Visual landscape	• Visual impact on sensitive visual receptors between a	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)

				1km and 3km radius from the SEF												
			Visual landscape	• Visual impact on sensitive visual receptors within a 3-5km radius from the SEF	-		L	L	Po	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)
			Visual landscape	• Visual impact on sensitive visual receptors within a 5-10km radius from the SEF	-		L	L	Po	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)
			Visual landscape	• Visual impacts of lighting at night on sensitive visual receptors in close proximity to the proposed facility	-		L	L	D	IR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)
			Visual landscape	• Visual impacts of glint and glare as a visual distraction and possible air travel hazard	-		L	L	U	CR	NL	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)
			Visual landscape	• Visual impacts on sense of place associated with the operational phase of the SEF	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)
			Traffic volumes	• Slight increase in trips due to permanent staff on site. • Increase in trips around twice a year for transport of water to site for the cleaning of solar panels (water source to be clarified – borehole or transported to site / size of water tankers if water is to be delivered on site).	-		L	S	Pr	CR	NL	Yes	- See Table 6.4	L	Traffic Impact Assessment (Appendix E8)
			Health & Safety	• The proposed development will not result in any health and safety impacts during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	N/A
			Noise levels	• The proposed development will not result in any noise pollution during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

			Heritage resources	• As no sites, features or objects of cultural historic significance have been identified in the project area, there would be no impact as a result of the proposed development	+		S	S	U	CR	NL	N/A	For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.	L	Heritage Impact Assessment (Appendix E5)
			Electricity supply	• Generation of additional electricity. The power line will transport generated electricity into the grid.	+		I	L	D	I	N/A	Yes	-	N/A	-
			Electrical infrastructure	• Additional electrical infrastructure. The proposed solar facility will add to the existing electrical infrastructure and aid to lessen the reliance of electricity generation from coal-fired power stations.	+		I	L	D	I	N/A	Yes	-	N/A	-
DECOMMISSIONING PHASE															
-	<u>Dismantlement of infrastructure</u> During the decommissioning phase the Solar PV Energy facility and its associated infrastructure will be dismantled. <u>Rehabilitation of biophysical environment</u> The biophysical environment will be rehabilitated.	BIOPHYSICAL ENVIRONMENT	Flora	• Loss of Indigenous Vegetation • The decommissioning of the Photovoltaic Solar Facility will require laydown areas and will disrupt vegetation that has re-established around the areas that were disturbed during the construction phase. • The loss of vegetation will be similar to the construction phase impacts.	-		S	L	P	BR	ML	Yes	- See Table 6.5	L	Ecological Impact Assessment (Appendix E1)
			Fauna	• Disturbance to Faunal Species • Decommissioning activities may generate disturbance to faunal species disrupting foraging and/or breeding behaviour.	-		L	L	Pr	BR	ML	Yes	- See Table 6.5	L	Ecological Impact Assessment (Appendix E1)

			Fauna	• Mortality of faunal species • Decommissioning activities may kill terrestrial vertebrate fauna specifically driving across the site. • Fauna perceived as dangerous may be persecuted out of fear	-		L	P	Po	IR	ML	Yes	- See Table 6.5	L	Ecological Impact Assessment (Appendix E1)
			Air quality	• Air pollution due to the increase of traffic of construction vehicles.	-		S	S	D	CR	NL	Yes	- Regular maintenance of equipment to ensure reduced exhaust emissions.	L	-
			Geology	• It is not foreseen that the decommissioning phase will impact on the geology of the site or vice versa.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Existing services infrastructure	• Generation of waste that needs to be accommodated at a licensed landfill site. • Generation of sewage that needs to be accommodated by the municipal sewerage system and the local sewage plant. • Increase in construction vehicles.	-		L	S	D	I	NL	Yes	-	L	-
			Groundwater	• Pollution due to construction vehicles.	-		S	S	Pr	CR	ML	Yes	-	L	-
			Aquatic Ecology	• Loss of habitat containing protected species or Species of Special Concern • Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)

				• Loss can also include a functional loss, through change in vegetation type via alien encroachment, reducing aquatic biodiversity.											
			Aquatic Ecology	• Loss of CBAs or potential areas with conservation potential • Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones and have been included in any Critical Biodiversity Areas	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)
			Aquatic Ecology	• Loss of riparian and or wetland habitat • During construction/decommissioning, complete clearing of the PV panel areas, as well any ancillary structures (offices and substations) will be required, which may impact the aquatic function or any corridors or connections between aquatic systems. However, these areas can be avoided by the proposed layout.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)
			Aquatic Ecology	• Changes to the hydrological regime and increase potential for erosion • Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)

				new crossings are made, or large hard engineered surfaces are placed within the buffer zones and have been included in any Critical Biodiversity Areas											
			Aquatic Ecology	• Changes to surface water quality characteristics • During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. • Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. • This can result in possible deterioration in aquatic ecosystem integrity and species diversity.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)
			Traffic volumes	• Increase in development trips for the duration of the construction Phase • Associated noise, dust and exhaust pollution	-		L	M	D	CR	NL	Yes	- See Table 6.3	L	Traffic Impact Assessment (Appendix E8)
			Tourism industry	• Since there are no tourism facilities in close proximity to the site, the decommissioning activities will not have an impact on tourism in the area.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

The recommended mitigation measures are included in the Environmental Management Programme for the project. The EMPr for the Solar PV facility is included in Appendix F1. The Generic EMPr for the substation and powerline are included in Appendix F2 and F3 respectively.

6.2 KEY ISSUES IDENTIFIED

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

6.2.1 Impacts During the Construction Phase

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

- Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."*
- Activity 12(ii)(a)(c) (GN.R. 327): "*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."*
- Activity 19 (GN.R. 327): *"The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."*
- Activity 24 (ii) (GN.R 327): *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters."*
- Activity 27 (GN.R. 327): *"The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation…"*
- Activity 28(ii) (GN.R. 327): *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."*
- Activity 56 (ii) (GN.R 327): " *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"*
- Activity 1 (GN.R. 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more..."*
- Activity 15 (GN.R. 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation..."*
- Activity 4 (b)(i)(ee)(gg) (GN.R 324): "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other*

protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."

- Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

- Activity 12 (b)(ii)(iv) (GN.R 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (ii) within critical biodiversity areas identified in bioregional plans (iv) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

- Activity 14(ii)(a)(c)(b)(i)(ff)(hh) (GN.R 324): "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve."*

- Activity 18 (b)(i)(gg)(hh) (GN.R 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) Free State (i) outside urban areas, within (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

During the construction phase temporary negative impacts are foreseen over the short term. Table 6.3 summarizes the potentially most significant impacts and the mitigation measures that are proposed during the construction phase.

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Ecological Impact Assessment (Appendix E1)	Loss of Northern Upper Karoo The clearing of vegetation for the construction of the SEF and associated infrastructure will result in the permanent loss of approximately 480ha of Northern Upper Karoo. The extent of vegetation that will be impacted equates to 1.2% of the remaining extent of this vegetation unit. The loss of this vegetation type, which is listed as Least Concern, will have an overall impact of low significance. This impact is difficult to mitigate as the loss of vegetation is definite and permanent and as such the	Negative Low	Negative Low	• Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint. • Topsoil (20 cm, where possible) must be collected and stored in an area of low (preferable) and medium sensitivity and used to rehabilitate impacted areas that are no longer required during the operational phase (e.g., laydown areas). • Only indigenous species must be used for rehabilitation. • Where possible, lay down areas must be located within previously disturbed sites. • Employees must be prohibited from making open fires during the construction phase. • Employees must be prohibited from collecting plants. It is recommended that spot checks of pockets and bags are done on a regular basis to ensure that no unlawful harvesting of plant species is occurring. • An alien invasive management plan for the site must be created. • An in-situ search and rescue plan must be developed and implemented for succulents and geophytes that will be impacted by the construction of the project site. • Plant translocation to adjacent suitable habitat may only be done for species that are not range restricted and for populations that have not been quantified as regionally significant.

	impact will remain of low significance even after mitigation measures have been implemented.			• In such cases that this is not feasible, any requirement for translocation must be discussed with the relative authorities prior to translocation taking place.
	Loss of faunal habitat The clearing of vegetation for the construction of project infrastructure will result in the permanent loss of approximately 480ha of faunal habitat. This impact is difficult to mitigate as the loss of habitat is definite and permanent and as such the impact will remain even after mitigation measures have been implemented.	Negative Low	Negative Low	• Existing roads must be used as far as possible and road networks consolidated. • Construction vehicles and machinery must not encroach into areas outside the project footprint. • Where possible, lay down areas must be located within previously disturbed sites. • Employees must be prohibited from making open fires during the construction phase.
	Disturbance to terrestrial vertebrate faunal species that may use the site and immediate surrounds Construction activities may generate noise, dust, vibrations and light pollution. This disturbance may cause faunal species to	Negative Low	Negative Low	• Any fencing required must be wildlife permeable especially at strategic places such as along drainage lines. This allows for small and small-medium sized animals to move between their natural habitat unencumbered. If electrified strands are to be used, there must be no strands within 30 cm of the ground. As an example, if a tortoise touches this strand it automatically retreats into its shell and does not move because it senses danger, and the repeated shocks eventually kill it (Arnot & Moteno, 2017).

	leave the area or disrupt foraging and/or breeding behaviour of those that remain.			• Ensure walls allow access for small fauna (openings at the base at intervals) within the developed area. • External night lighting must be down lights, placed as low to the ground as possible and of low UV emitting lights, such as most LEDs. Lighting in open space areas within development must be minimised. This is to avoid attracting insects and their predators to the lights and minimising unnecessary mortalities. • Vehicles and machinery must meet best practice standards in terms of noise • Dust suppression techniques such as road watering required during windy periods • Minimise barriers to faunal movement (construct side walls of pavements, gutters, and trenches with a gradual slope and not at right angles to allow small faunal species to exit).
	Loss of Plant Species of Conservation Concern No restricted range species or CR, EN or VU species were recorded within the site during the field survey. Additionally, the desktop assessment did not identify any SCC with a high likelihood of occurrence within the site. The impact is therefore negligible.	Negligible	Negligible	• N/A

	Loss of faunal Species of Conservation Concern Only one faunal SCC has a high likelihood of occurrence, the NT African Striped Weasel (*Poecilogale albinucha*). Although listed this species has a large distribution and considered locally common.	Negative Low	Negative Low	• A clause must be included in contracts for all personnel working on site stating that: "no wild animals will be hunted, killed, poisoned or captured. No wild animals will be imported into, exported from or transported in or through the province. No wild animals will be sold, bought, donated and no person associated with the development will be in possession of any live wild animal, carcass or anything manufactured from the carcass." A clause relating to fines, possible dismissal and legal prosecution must be included should any of the above transgressions occur.
	Disruption of Ecosystem Function and Process Fragmentation is one of the most important impacts on vegetation as it creates breaks in previously continuous vegetation, causing a reduction in the gene pool and a decrease in species richness and diversity. This impact occurs when more and more areas are cleared, resulting in the isolation of functional ecosystems, which results in reduced	Negative Low	Negative Low	• In addition to the mitigation measures listed under impact 1, the following should be implemented: ○ Rehabilitate laydown areas ○ Use existing access roads and upgrade these where necessary

	biodiversity and reduced movement due to the absence of ecological corridors. The infrastructure associated with the Photovoltaic Solar Facility, particularly the roads, will increase habitat fragmentation by creating breaks in the environment. However, the movement of species (fauna and seeds) will not be entirely prohibited due to the nature of the infrastructure and the ecological functioning of the site can still be maintained.			
	Mortality of faunal species due to accidental death and/or persecution Construction activities may inadvertently kill terrestrial vertebrate fauna during vegetation clearing, earth	Negative Medium	Negative Low	• During construction induction material must iterate safety to fauna and personnel through avoidance of wildlife. • Speed restrictions within the development for all vehicles (30km/h is recommended) should be in place to reduce the impact of killed fauna on the project roads. • Any terrestrial vertebrate fauna found on site during construction must be relocated to habitat immediately adjacent to the development and should these be SCC recorded on iNaturalist.

	works and driving across the site. Fauna perceived as dangerous may be persecuted out of fear.			• A snake handler should be on call to provide removal and relocation service should any snakes be found on site or in neighbouring homes, note that October is when snakes are most active as they emerge from hibernation. • Mortality of terrestrial vertebrate species on roads must be monitored and reported (carcasses need to be collected and frozen and circumstances of roadkill investigated).
Avifauna Impact Assessment (Appendix E2)	Displacement of priority avian species from important habitats (PV array and associated infrastructure)	Negative High	Negative Medium	• It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. The PV facilities and associated infrastructure occur predominantly on habitat types of medium sensitivity. The best practicable mitigation will be to consolidate infrastructure. • Avoid and buffer artificial livestock watering points, or remove/relocate watering points. • Buffer nearby Secretarybird nesting/roosting sites by at least 1.5 km. • All road networks must be planned with care to minimise dissection or fragmentation of important avifaunal habitat type. Where possible, the use of existing roads is encouraged.
	Displacement of resident avifauna through increased disturbance (PV array and associated infrastructure)	Negative High	Negative Medium	• It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. The PV facilities and associated infrastructure occur predominantly on habitat types of medium sensitivity. The best practicable mitigation will be to consolidate infrastructure. • Avoid and buffer artificial livestock watering points, or remove/relocate watering points. • Buffer nearby Secretarybird nesting/roosting sites by at least 1.5 km.

				• All road networks must be planned with care to minimise dissection or fragmentation of important avifaunal habitat type. Where possible, the use of existing roads is encouraged.
	Loss of important avian habitats (PV array and associated infrastructure)	Negative Medium	Negative Medium	• It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. The PV facilities and associated infrastructure occur predominantly on habitat types of medium sensitivity. The best practicable mitigation will be to consolidate infrastructure. • Avoid and buffer artificial livestock watering points, or remove/relocate watering points.
	Displacement of priority avian species from important habitats (Power Line)[5]	Negative Medium	Negative Low	• It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. The grid connection infrastructure occurs predominantly on habitat types of medium and low sensitivity. The best practicable mitigation will be to consolidate infrastructure (e.g., proposed powerline) to areas where existing impacts occur (e.g., placing the proposed powerline alongside existing powerlines and or road infrastructure). • Conduct a "walk-through" of the powerline servitude to identify potential areas where threatened bird species utilise the area – either re-align the powerline or move pylon footprints. • Avoid and buffer artificial livestock watering points, or remove/relocate watering points. • Buffer nearby Secretarybird nesting/roosting sites by at least 1.5 km.

[5] Note that the proposed solar grid infrastructure will be assessed via a separate Basic Assessment application process. The mitigation measures listed are to ensure thoroughness in the specialist findings and will be further expanded during the powerline assessment.

				• All road networks must be planned with care to minimise dissection or fragmentation of important avifaunal habitat type. Where possible, the use of existing roads is encouraged.
	Displacement of resident avifauna through increased disturbance (Power Line)[6]	Negative Medium	Negative Low	• It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. The grid connection infrastructure occurs predominantly on habitat types of medium sensitivity. The best practicable mitigation will be to consolidate infrastructure (e.g., proposed powerline) to areas where existing impacts occur (e.g., placing the proposed powerline alongside existing powerlines). • All road networks must be planned with care to minimise dissection or fragmentation of important avifaunal habitat type. Where possible, the use of existing roads is encouraged
	Loss of important avian habitats (Power Line)[7]	Negative Medium	Negative Low	• Avoid and buffer habitat with high preliminary avian sensitivities. Where necessary, relocate or remove artificial watering points. • Avoid and buffer artificial livestock watering points, or remove/relocate watering points. • Conduct a "walk-through" of the powerline servitude to identify potential areas where threatened bird species utilise the area – either re-align the powerline or move pylon footprints.

[6] Note that the proposed solar grid infrastructure will be assessed via a separate Basic Assessment application process. The mitigation measures listed are to ensure thoroughness in the specialist findings and will be further expanded during the powerline assessment.

[7] Note that the proposed solar grid infrastructure will be assessed via a separate Basic Assessment application process. The mitigation measures listed are to ensure thoroughness in the specialist findings and will be further expanded during the powerline assessment.

Aquatic Ecological Assessment (Appendix E1)	Loss of habitat containing protected species or Species of Special Concern	Negative Medium	Negative Low	Mitigation measures to reduce residual risk or enhance opportunities: • A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). To minimise the impact of the access roads: • Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible. • Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • All pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that

				headcut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert. • The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities. • Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted. • All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.

	Loss of CBAs or potential areas with conservation potential	Negative Medium	Negative Low	Mitigation measures to reduce residual risk or enhance opportunities: • The aquatic systems have been mapped to a finer scale and have taken cognizance of any potential CBAs. If High / No-Go are avoided by the major infrastructure, then aquatic zones associated with the development can be avoided, noting that at Present the Free State Province does not have any spatial data on Aquatic CBAs • A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). To minimise the impact of the access roads: • Use existing roads or upgrade existing tracks to cross wetlands rather than constructing entirely new roads wherever possible. • Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the

				adjoining natural vegetation cover or soils. • All pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert. • The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities. • Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted. • All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species

				shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.
	Potential spread of alien vegetation	Negative Medium	Negative Low	Mitigation measures to reduce residual risk or enhance opportunities: • Alien vegetation management must be initiated at the beginning of the construction period and must extend into any remaining areas into the operation phase on the facility • The revegetation of any temporary sites as well as any previously degraded areas must begin from the onset of the project, with the involvement of a botanist to assist with the revegetation specifications • Regeneration of alien vegetation must be monitored once all areas have been cleared, forming part of a long-term alien vegetation management plan
	Loss of riparian and or wetland habitat	Negative Medium	Negative Low	Mitigation measures to reduce residual risk or enhance opportunities: • A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). To minimise the impact of the access roads:

				• Use existing roads or upgrade existing tracks to cross wetlands rather than constructing entirely new roads wherever possible. • Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • All pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert. • The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.

				• Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted. • All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.
	Changes to the hydrological regime and increase potential for erosion	Negative Medium	Negative Low	Mitigation measures to reduce residual risk or enhance opportunities: • The preferred option is recommended as all aquatic systems have been avoided • No stormwater discharged may be directed to delineated aquatic zones or the associated buffers. • A stormwater management plan must be developed post EA, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems. • Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas To minimise the impact of the access roads: • Use existing roads or upgrade existing tracks to cross wetlands rather than constructing entirely new roads wherever possible.

				• Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • All pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert. • The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.

				• Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted. • All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.
	Changes to surface water quality characteristics	Negative Medium	Negative Low	Mitigation measures to reduce residual risk or enhance opportunities: • All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely. • Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). • Mechanical plant and bowsers must not be refueled or serviced within 100m of a river channel or wetland. • All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses. • Littering and contamination associated with construction activity must be avoided through effective construction camp management.

				• No stockpiling should take place within or near a water course. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable. • ESO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur, are quickly rectified.
Visual Impact Assessment (Appendix E3)	Visual impact of construction activities on sensitive visual receptors in close proximity to the SEF	Negative Medium	Negative Low	Planning: • Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction: • Ensure that vegetation is not unnecessarily removed during the construction phase. • Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) where possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. • Ensure that rubble, litter, etc. are appropriately stored (if it can't be removed daily) and then disposed of regularly at a licenced waste site. • Reduce and control dust during construction by utilising dust suppression measures. • Limit construction activities between 07:00 and 18:00, where possible, in order to reduce the impacts of construction lighting. • Rehabilitate all disturbed areas immediately after the completion of construction work and maintain good housekeeping.
	The creation of direct and indirect employment opportunities during the	Low Positive	Medium Positive	Enhancement: • A local employment policy should be adopted to maximise opportunities made available to the local labour force.

Social Impact Assessment (Appendix E7)	construction phase of the project			• Labour should be sourced from the local labour pool, and only if the necessary skills are unavailable should labour be sourced from (in order of preference) the greater Letsemeng LM, Xhariep DM, Free State Province, South Africa, or elsewhere. • Where feasible, training and skills development programmes should be initiated prior to the commencement of the construction phase. • As with the labour force, suppliers should also as far as possible be sourced locally. • As far as possible local contractors that are compliant with Broad-Based Black Economic Empowerment (B-BBEE) criteria should be used. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
	Significance of the impact from the economic multiplier effects from the use of local goods and services.	Low Positive	Medium Positive	Enhancement: • It is recommended that a local procurement policy is adopted to maximise the benefit to the local economy. • A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g., construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable. • Local procurement is encouraged along with engagement with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible.
	Investment into upgrading and maintain shared infrastructure such as roads	Low Positive	Low Positive	Enhancement:

	and stormwater infrastructure on farms may benefit farming operations			• The project would contribute to an upgrade in the shared infrastructure of the LM as well as in the maintenance of this infrastructure. • The LM would be encouraged to participate in this maintenance and upgrade where it would be feasible for them to be involved. • A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g., construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created (or sourced from the local Municipality, where available) and companies listed thereon should be invited to bid for project-related work where applicable and this would include the maintenance of this shared infrastructure.
	The potential loss in productive farmland during the construction phase, due to factors such as the construction of roads, the preparation of foundations, power lines, offices etc	Negative Medium	Negative Low	• The proposed site for the Luckhoff Solar 2 SEF needs to be fenced off prior to the construction phase and all construction related activities should be confined in this fenced off area. • Livestock grazing on the proposed site need to be relocated. • All affected areas, which are disturbed during the construction phase, need to be rehabilitated prior to the operational phase and should be continuously monitored by the Environmental Control Officer (ECO). • Implement, manage and monitor a grievance mechanism for the recording and management of social issues and complaints.
	In-migration of labourers in search of employment opportunities, and a resultant change in population, and increase in pressure on local resources	Negative Medium	Negative Low	• Develop and implement a local procurement policy which prioritises “locals first” to prevent the movement of people into the area in search of work. • Engage with local community representatives prior to construction to facilitate the adoption of the locals first procurement policy.

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

				• The appointed EPC Contractor must appoint a security company to ensure appropriate security procedures and measures are implemented. • Access in and out of the construction site should be strictly controlled by a security company appointed to the project. • A CLO should be appointed as a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process. • The EPC Contractor should implement a stakeholder management plan to address neighbouring farmer concerns regarding safety and security. • The project proposed must prepare and implement a Fire Management Plan; this must be done in conjunction with surrounding landowners. • The EPC Contractor must prepare a Method Statement which deals with fire prevention and management.
	Temporary increase in traffic disruptions and movement patterns during the construction phase.	Negative Medium	Negative Low	• All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. • Heavy vehicles should be inspected regularly to ensure their road worthiness. • Provision of adequate and strategically placed traffic warning signs, that have to be maintained for the duration of the construction phase, and control measures along the S572 and R48 regional road to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be always visible, especially at night. • Implement penalties for reckless driving to enforce compliance to traffic rules.

				• Avoid heavy vehicle activity during “peak” hours (when children are taken to school, or people are driving to work). • The developer and EPC Contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities. • The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if disturbed due to construction activities. • The EPC Contractor must ensure that damage / wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase. • A method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.
	Nuisance impacts in terms of temporary increase in noise and dust, and wear and tear on access roads to the site	Negative Medium	Negative Low	• The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible. • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. • Ensure all vehicles are road worthy, drivers are qualified and are made aware of the potential noise and dust issues. • A CLO should be appointed, and a grievance mechanism implemented.
	The potential loss of livestock, crops, and farmsteads in the area. This also includes the damage	Negative Medium	Negative Low	• A firebreak should be implemented before the construction phase. The firebreak should be controlled and implemented around the perimeters of the project site.

	and loss of farm infrastructure and the threatening of human lives that are associated with the increased risk of veld fires			• Adequate fire-fighting equipment should be provided and readily available on site and all staff should be trained in firefighting and how to use the fire-fighting equipment. • No staff (except security) should be accommodated overnight on site and the contractor should ensure that no open fires are allowed on site. The use of cooking or heating implements should only be used in designated areas. • Contractors need to ensure that any construction related activities that might pose potential fire risks, are done in the designated areas where it is also managed properly. • Precautionary measures need to be taken during high wind conditions or during the winter months when the fields are dry. • The contractor should enter an agreement with the local farmers before the construction phase that any damages or losses during the construction phase related to the risk of fire and that are created by staff during the construction phase, are borne by the contractor.
	Intrusion impacts from construction activities will have an impact on the area's "sense of place".	Negative Low	Negative Low	• Implement mitigation measures identified in the Visual Impact Assessment (VIA) prepared for the project. • Limit noise generating activities to normal daylight working hours and avoid weekends and public holidays. • The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible. • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.

				• All vehicles must be road-worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits. • Communication, complaints, and grievance channels must be implemented and contact details of the CLO must be provided to the local community in the study area.
Traffic Impact Assessment (Appendix E8)	Increase in development trips for the duration of the construction Phase Associated noise, dust and exhaust pollution	Negative Medium	Negative Low	• Stagger component delivery to site. • Reduce the construction period. • Stagger the construction Phase. • The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network • Staff and general trips should occur outside of peak traffic periods as much as possible. • Maintenance of haulage routes. • Design and maintenance of internal roads. • Provide two access points to the site to split construction vehicle trips.

6.2.2 Impacts During the Operational Phase

During the operational phase the site will serve as a solar plant. The potential impacts will take place over a period of 20 – 25 years. During the operational phase the following activities will have various potential impacts on the biophysical and socio-economic environment:

- Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."*
- Activity 1 (GN.R 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."*
- Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

During the operational phase minor negative impacts are foreseen over the long term. The latter refers to at least a 20-year period. Table 6.4 summarizes the potentially most significant impacts and the mitigation measures that are proposed during the operational phase.

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Ecological Impact Assessment (Appendix E1)	Infestation of Alien Plant Species If laydown areas and roads are not rehabilitated, these disturbed areas can become places for alien invasive species to become established, and if left unmitigated, these species can spread and establish themselves in intact vegetation, resulting in the displacement of indigenous species and possible local extinctions of SCC. Three exotic species (*Schinus molle, Argemone ochroleuca* and *Cymbopogon pospischilii*) were recorded within the project site. *Argemone*	Negative Low	Negative Low	• The site must be checked regularly for the presence of alien invasive species. When alien invasive species are found, immediate action must be taken to remove them. • *Argemone ochroleuca* currently noted on site must be removed and disposed of. • An alien invasive management plan must be incorporated into the EMPr. • The ECO must create a list with accompanying photographs of possible alien invasive species that could occur on site prior to construction. This photo guide must be used to determine if any alien invasive species are present.

	ochroleuca is listed as a Category 1b species.			
	Disturbance to terrestrial vertebrate faunal species Operation activities may generate disturbance to faunal species disrupting foraging and/or breeding behaviour.	Negative Low	Negative Low	• Maintenance must be restricted to daylight hours • Vehicles must meet best practice standards in terms of noise • Dust suppression techniques such as road watering required during windy periods
	Mortality of faunal species Operation activities may kill terrestrial vertebrate fauna specifically driving across the site. Fauna perceived as dangerous may be persecuted out of fear.	Negative Medium	Negative Low	• Speed restrictions within the development for all vehicles (30km/h is recommended) should be in place to reduce the impact of killed fauna on the project roads. • Mortality of terrestrial vertebrate species on roads must be monitored and reported (carcasses need to be collected and frozen and circumstances of roadkill investigated). • Only cleaning chemicals least harmful to faunal species should be used during landscaping. Runoff can cause chemical to enter aquatic systems and may impact on faunal species that inhabit them.
Avifauna Impact Assessment (Appendix E2)	The creation of novel or new avian habitat for commensal bird species or superior competitive species.	Negative Low	Negative Low	• Apply bird deterrent devices and remove nest structures constructed on infrastructure associated with the PV facility under the guidance of the ECO.
	Collisions with PV panels leading to injury or loss of avian life	Negative High	Negative Medium	• Apply bird deterrent devices such as rotating flashers/reflectors to the panels for birds that may mistake the panels for open water and to prevent them from landing

				on the panels - these should especially be placed at panels nearest to watering points, drainage lines and canals (and agricultural land). Security/CCTV cameras may be installed to quantify mortalities (cameras are also installed along the perimeter fence for security measures and may also prove effective to quantify mortalities). • Buffer drainage lines and canals (and agricultural land) by at least 300 m. • Buffer artificial livestock watering points (by at least 100 m), or remove/relocate watering points. • Implement additional pre-construction monitoring to evaluate important bird flyways/dispersal routes. • Implement post-construction monitoring. If post-construction monitoring predicts and/or confirms any bird mortalities, an option is to employ video cameras at selected areas to document bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis.
	Collision when flying into power line infrastructure[8]	Negative High	Negative Medium	• Apply bird deterrent devices to the power lines and make use of "bird-friendly" pylon structures. • Avoid the placement of any watering points in close proximity to any overhead electrical infrastructure. If present, these should be relocated and/or removed. • To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to conduct direct

[8] Note that the proposed solar grid infrastructure will be assessed via a separate Basic Assessment application process. The mitigation measures listed are to ensure thoroughness in the specialist findings and will be further expanded during the powerline assessment.

				observations and carcass searches on a regular and systematic basis. • Collisions will be reduced if the grid corridor is placed alongside existing powerlines.
	Electrocution when perched on power line infrastructure[9]	Negative Medium	Negative Low	• Avoid the placement of watering points in close proximity to any overhead electrical infrastructure. • Make use of bird-friendly pylons and bird guards as recommended by EWT.
Aquatic Ecological Assessment (Appendix E1)	Potential spread of alien vegetation	Negative Medium	Negative Low	• Refer to Construction Phase mitigation (Table 6.3)
Visual Impact Assessment (Appendix E3)	Visual impact on sensitive visual receptors within a 1km radius from the SEF	Negative Medium	Negative Low	Planning: • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. • Where insufficient natural vegetation exists next to the property, a 'screen' can be planted if the landowner requests additional mitigation. This can be done using endemic, fast growers that are water efficient. Operations: • Maintain general appearance of the facility as a whole.
	Visual impact on sensitive visual receptors between a 1km and 3km radius from the SEF	Negative Medium	Negative Low	
	Visual impact on sensitive visual receptors within a 3-5km radius from the SEF	Negative Low	Negative Low	

[9] Note that the proposed solar grid infrastructure will be assessed via a separate Basic Assessment application process. The mitigation measures listed are to ensure thoroughness in the specialist findings and will be further expanded during the powerline assessment.

	Visual impact on sensitive visual receptors within a 5-10km radius from the SEF	Negative Low	Negative Low	
	Visual impacts of lighting at night on sensitive visual receptors in close proximity to the proposed facility	Negative Medium	Negative Low	Planning & Operation As far as practically possible: • Shield the source of light by physical barriers (walls, vegetation etc.) • Limit mounting heights of lighting fixtures, or alternatively use footlights or bollard level lights. • Make use of minimum lumen or wattage in fixtures. • Make use of down-lighters, or shield fixtures. • Make use of low-pressure sodium lighting or other types of low impact lighting. • Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. • The use of night vision or thermal security cameras are very effective and can replace security lighting entirely.
	Visual impacts of glint and glare as a visual distraction and possible air travel hazard	Negative Low	Negative Low	• No mitigation measures are required.
	Visual impacts on sense of place associated with the operational phase of the SEF	Negative Medium	Negative Low	• It is believed that renewable energy resources are essential to the environmental well- being of the country and planet (WESSA, 2012). Aesthetic issues are subjective, and some people find solar farms and their associated infrastructure pleasant and optimistic while others may find it visually

				invasive; it is mostly perceived as symbols of energy independence; and local prosperity. • The subjectivity towards the project in its entirety can be influenced by creating a "Green Energy" awareness campaign, educating the local community and potentially tourists on the benefits of renewable energy. This can be achieved by also hosting an 'open day' where the local community can have the opportunity to view the completed project which may enlist a sense of pride in the renewable energy project in their area. • Implement good housekeeping measures.
Social Impact Assessment (Appendix E7)	The creation of employment opportunities and skills development opportunities during the operation phase for the country and local economy	Positive Low	Positive Medium	Enhancement: • It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. • Vocational training programs should be established to promote the development of skills.
	Development of non-polluting, renewable energy infrastructure	Positive Medium	Positive Medium	• N/A
	Loss of agricultural land and overall productivity as a result of the operation of	Negative Medium	Negative Low	• The proposed mitigation measures for the construction phase should have been implemented at this stage. • Mitigation measures from the Agricultural and Soil Report, should also be implemented.

	the proposed project on an agricultural property			
	Contribution to LED and social upliftment during the operation of the project	Positive Medium	Positive High	Enhancement: • A CNA must be conducted to ensure that the LED and social upliftment programmes proposed by the project are meaningful. • Ongoing communication and reporting are required to ensure that maximum benefit is obtained from the programmes identified, and to prevent the possibility for such programmes to be misused. • The programmes should be reviewed on an ongoing basis to ensure that they are best suited to the needs of the community at the time (bearing in mind that these are likely to change over time).
	The potential impact on tourism due to the establishment of the Luckhoff Solar 2 SEF	Positive/Negative Low	Positive/Negative Low	• Due to the extent of the project no viable mitigation measures can be implemented to eliminate the visual impact of the PV panels, but the subjectivity towards the PV panels can be influenced by creating a "Green Energy" awareness campaign, educating the local community and tourists on the benefits of renewable energy. Tourists visiting the area should be made aware of South Africa's movement towards renewable energy. This might create a positive feeling of a country moving forward in terms of environmental sustainability. This could be implemented by constructing a visitor's centre on the property allocated to the proposed solar farm which should be opened to school fieldtrips, the local community, and tourists

	Visual impacts and sense of place impacts associated with the operation phase of Luckhoff Solar 2 SEF	Negative Low	Negative Low	• To effectively mitigate the visual impact and the impact on sense of place during the operational phase of the proposed Luckhoff Solar 2 SEF, it is suggested that the recommendations made in the Visual Impact Assessment (specialist study) should be followed in this regard.
	The creation of employment opportunities and skills development opportunities during the operation phase for the households involved in the project would create an opportunity for an increasement in household earnings	Positive Low	Positive Medium	Enhancement: • It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community. • With the recruitment of the local community for job creation and increasement in household earnings will automatically be seen in the area surrounding the development.
Traffic Impact Assessment (Appendix E8)	Slight increase in trips due to permanent staff on site. Increase in trips around twice a year for transport of water to site for the cleaning of solar panels (water source to be clarified – borehole or transported to site/size of water tankers if water is to be delivered on site)	Negative Low	Negative Low	• Source on-site water supply if possible. • Utilise cleaning systems for the panels needing less vehicle trips. • Schedule trips for the provision of water for the cleaning of panels outside peak traffic times as much as possible.

6.2.3 Impacts During the Decommissioning Phase

The physical environment will benefit from the closure of the solar facility since the site will be restored to its natural state. Table 6.5 provides a summary of the impacts during the decommissioning phase. The decommissioning phase will however potentially result in impact on soils, pressure on existing service infrastructure, surface water and the loss of permanent employment. Skilled staff will be eminently employable, and a number of temporary jobs will also be created in the process. Decommissioning of a PV facility will leave a positive impact on the habitat and biodiversity in the area as the area will be rehabilitated to its natural state.

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Ecological Impact Assessment (Appendix E1)	Loss of Indigenous Vegetation The decommissioning of the Photovoltaic Solar Facility will require laydown areas and will disrupt vegetation that has re-established around the areas that were disturbed during the construction phase. The loss of vegetation will be similar to the construction phase impacts.	Negative Low	Negative Low	• Refer to mitigation measures listed under Table 6.3
	Disturbance to terrestrial vertebrate faunal species Decommissioning activities may generate	Negative Low	Negative Low	• Refer to mitigation measures listed under construction and operational impact (Table 6.3 and 6.4)

	disturbance to faunal species disrupting foraging and/or breeding behaviour			
	Mortality of faunal species Decommissioning activities may kill terrestrial vertebrate fauna specifically driving across the site. Fauna perceived as dangerous may be persecuted out of fear.	Negative Medium	Negative Low	• Refer to mitigation measures listed under construction and operational impact (Table 6.3 and 6.4)
Avifauna Impact Assessment (Appendix E2)	Displacement of priority avian species from important habitats	Negative – low (there are no planned or authorised wind or solar facilities within 30km of the proposed development)	Negative - low	• Avoid the temporary storage (laydown) of removed infrastructure on habitat with a high avian sensitivity. • Rehabilitation should make use of indigenous floristic species that are native to the study area.

	Displacement of resident avifauna through increased disturbance	Negative – low (there are no planned or authorised wind or solar facilities within 30km of the proposed development)	Negative - low	• Avoid the temporary storage (laydown) of removed infrastructure on habitat with a high avian sensitivity. • Rehabilitation should make use of indigenous floristic species that are native to the study area.
Aquatic Ecological Assessment (Appendix E1)	Loss of habitat containing protected species or Species of Special Concern	Negative Medium	Negative Low	• Refer to construction mitigation measures (Table 6.3)
	Loss of CBAs or potential areas with conservation potential	Negative Medium	Negative Low	• Refer to construction mitigation measures (Table 6.3)
	Loss of riparian and or wetland habitat	Negative Medium	Negative Low	• Refer to construction mitigation measures (Table 6.3)
	Changes to the hydrological regime and increase potential for erosion	Negative Medium	Negative Low	• Refer to construction mitigation measures (Table 6.3)

	Changes to surface water quality characteristics	Negative Medium	Negative Low	• Refer to construction mitigation measures (Table 6.3)
Social Impact Assessment (Appendix E7)	Loss of employment opportunities	Negative Low	Negative Low	• It is not expected that the facility will be decommissioned.
Traffic Impact Assessment (Appendix E8)	Increase in development trips for the duration of the construction Phase Associated noise, dust and exhaust pollution	Negative Medium	Negative Low	• Refer to construction mitigation measures (Table 6.3)

6.2.4 Impacts Associated with the Battery Energy Storage System (BESS)

Table 6.6: Impacts associated with the BESS

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
General Environment (risks associated with BESS)	Mechanical breakdown / Exposure to high temperatures Fires, electrocutions and spillage of toxic	Negative Medium	Negative Low	Operators are trained and competent to operate the BESS. Training should include the discussion of the following: ○ Potential impact of electrolyte spills on groundwater; ○ Suitable disposal of waste and effluent; ○ Key measures in the EMPr relevant to worker's activities; ○ How incidents and suggestions for improvement can be reported.

	substances into the surrounding environment. Spillage of hazardous substances into the surrounding environment. Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas. Water Pollution – spillages into surrounding watercourses as well as groundwater. Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as			○ Training records should be kept on file and be made available during audits. • Battery supplier user manuals safety specifications and Material Safety Data Sheets (MSDS) are filed on site at all times. • Compile method statements for approval by the Technical/SHEQ Manager for the operation and management and replacement of the battery units / electrolyte for the duration of the project life cycle. Method statements should be kept on site at all times. • Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock. Signage should also specify how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. the inhalation of toxic fumes, etc.). • Firefighting equipment should readily be available at the BESS area and within the site. • Maintain strict access control to the BESS area. • Ensure all maintenance contractors / staff are familiar with the supplier's specifications. • Undertake daily risk assessment prior to the commencement of daily tasks at the BESS. This should consider any aspects which could result in fire or spillage, and appropriate actions should be taken to prevent these. • Standard Operating Procedures (SOPs) should be made available by the Supplier to ensure that the batteries are handled in accordance with required best practices. • Spill kits must be made available to address any incidents associated with the flow of chemicals from the batteries into the surrounding environment.

	a primary source of water. Generation of hazardous waste			• The assembly of the batteries on-site should be avoided as far as possible. Activities on-site for the BESS should only be limited to the placement of the container wherein the batteries are placed. • Undertake periodic inspections on the BESS to ensure issues are identified timeously and addressed with the supplier where relevant. • The applicant in consultation with the supplier must compile and implement a Leak and Detection Monitoring Programme during the project life cycle of the BESS. • Batteries must be strictly maintained by the supplier or suitably qualified persons for the duration of the project life cycle. No unauthorised personnel should be allowed to maintain the BESS. • Damaged and used batteries must be removed from site by the supplier or any other suitably qualified professional for recycling or appropriate disposal. • The applicant should obtain a cradle to grave battery management plan from the supplier during the planning and design phase of the system. The plan must be kept on site and adhered to.

6.3 SUMMARY OF RECOMMENDATIONS FROM SPECIALIST STUDIES

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

- Aquatic Ecological Assessment – EnviroSci (Pty) Ltd (see Appendix E1)
- Ecological Scoping Report – Biodiversity Africa (see Appendix E1)
- Avifaunal Scoping Report– Pachnoda Consulting CC (see Appendix E2)
- Visual Impact Assessment – Donaway Environmental Consultants (see Appendix E3)
- Agricultural Compliance Statement – Johann Lanz Soil Scientist (see Appendix E4)
- Phase 1 Cultural Heritage Impact Assessment – J van Schalkwyk (see Appendix E5)
- Palaeontological Desktop Assessment – Banzai Environmental (Pty) Ltd (see Appendix E6)
- Social Impact Assessment – Donaway Environmental Consultants (see Appendix E7)
- Traffic Impact Assessment – iWink Consulting (Pty) Ltd (see Appendix E8)
- Geotechnical Desktop Study – Delta Geotech (see Appendix E9)
- A detailed assessment of the cumulative impacts associated with the proposed development – conducted by the lead consultant, Environamics, in conjunction with the project specialists (refer to Section 7 of this report).

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

6.3.1 Aquatic Ecological/Wetland Impacts

The potential impact of the proposed development on wetlands and riparian areas had to be determined. The main question which needs to be addressed is:

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

According to the Aquatic Ecological Assessment (Appendix E1), the study area is dominated by three major types of natural aquatic features and a small number of artificial barriers associated with catchments and rivers, characterised as follows:

- Ephemeral watercourses with riparian vegetation that included, *Vachellia karroo*, *Searsia lancea, Euclea undulata* and *Gymonsporia buxifolia*;
- Depressions dominated by grass species and
- Dams and weirs / berms with no wetland or aquatic features.

The study area is situated predominantly within the Northern Upper Karoo (NKu 3) vegetation unit, associated with the upper reaches of the Lemoenspruit River catchment (D33C), a small

subquaternary catchment linked to the Orange / Gariep River. This is located within the Orange River Water Management Area (Kimberley), in the Nama Karoo Eco-region.

The area is characterised by low lying areas surrounded by inselbergs (koppies). No known or observed watercourses occur within the study area, and only two small depression was encountered and delineated in this assessment. One of these is located within the proposed PV area but has been avoided in the final design process. Further, this pan cannot be used for any stormwater management purposes as this will alter the hydrological function of the system, which would then in turn create permanent wetland aquatic habitat and would then in turn attract birds and animals into the area.

The PES and functional importance of the Depression wetlands were assessed together as both wetlands share similar ecological characteristics and have been subjected to the same anthropogenic impacts. The Wet-Health2 assessment determined that the wetlands fall within the 'B' ecological category for present condition. The vegetation component scored particularly poorly due to transformation of natural habitat via grazing.

Sensitivity ratings were assigned to the identified features. The sensitivity ratings of High No-Go to Low were determined through an assessment of the habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e., existing road crossings within systems and considered acceptable since these areas have already been impacted).

During this phase of the investigation, it was found that the greatest number of impacts could occur within the construction phase, but as the High sensitivity / No-Go areas are avoided, the impacts are limited on the aquatic environment. The potential aquatic ecosystem impacts are as follows:

- Impact 1: Loss of habitat containing protected species or Species of Special Concern
- Impact 2: Loss of any critical corridors and connect habitats that are linked to any future conservation plans or protected areas expansion associated within any riverine or wetland systems
- Impact 3: The potential spread of alien vegetation
- Impact 4: Loss of riparian and or wetland habitat
- Impact 5: Changes to the hydrological regime and increased potential for erosion
- Impact 6: Changes to water quality
- Impact 7: Cumulative Impacts

The specialist has no objection to the authorisation of the proposed activities assuming that all mitigations especially within the buffer zones are implemented.

The significant impacts are associated with the access road crossings river systems. These systems are generally in a less modified state and still provide some habitat and important ecological functions. Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the

implementation of mitigation measures, the project has potential to cause a Moderate cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Low impact upon aquatic biodiversity.

6.3.2 Ecological Impacts

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

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

The Ecological Scoping Report (Appendix E1) confirmed that the development is situated within Northern Upper Karoo which is widespread and listed as Least Concern with few SCC likely to be present. The Site Ecological Importance (SEI) for this vegetation type was found to be of low sensitivity meaning that construction within these areas is permissible from an ecological perspective.

Based on the outcome of the specialist survey, comment has been provided in table 6.7 on the specialist's opinion of the sensitivity rating obtained from the DFFE screening tool report.

Table 6.7: Specialist comment on the results of the DFFE screening tool report

Theme	Sensitivity	Specialist Opinion
Animal Species Theme	Medium • Likely presence of *Neotis ludwigii* (Ludwig's Bustard)	The faunal species theme for reptiles, amphibians and mammals is of low sensitivity. The bird report must provide comment on this theme.
Plant Species Theme	Medium • Likely presence of *Tridentia virescens (*Rare)	The specialist disagrees with the medium plant species theme. Based on the sensitivity assessment for the site, this should be of low sensitivity.
Terrestrial Biodiversity Theme	Very High • CBA 1 and 2 present • ESA 1 and 2 present • Thanda Tula Reserve within close proximity	The project infrastructure is not located within a CBA. Project infrastructure is located within an ESA. The biodiversity feature driving the ESA is the vegetation type Northern Upper Karoo. Since 94% of this vegetation type remains intact, the development is unlikely to negatively affect the functioning of this feature.

		The development is unlikely to negatively impact the functioning of the Private Game Reserve. The specialist therefore disagrees with the Terrestrial Biodiversity Theme being very high and proposes, based on the findings within this assessment, that it is of low sensitivity.

It is recommended that the following conditions are included in the Final EMPr as well as the conditions of the Environmental Authorisation (EA), if granted:

Botanical

- The remaining vegetation within the property should remain intact so that it can continue to function as an ecological corridor for species movement.
- All necessary plant permits must be obtained prior to the commencement of any construction activities.
- Where feasible, laydown areas must be placed in previously disturbed sites.
- A walkthrough of the final layout must be undertaken by a botanist and if populations of SCC will be impacted, infrastructure should be moved to avoid these areas. Where this is not feasible, a search and rescue plan will be required.
- If any SCC are to be impacted, these must be relocated to nearest appropriate habitat.
- Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint.
- Topsoil (20 cm, where possible) must be collected and stored in an area of low sensitivity and used to rehabilitate impacted areas that are no longer required during the operational phase (e.g., laydown areas).
- Employees must be prohibited from collecting any plants.
- Alien invasive plant clearing should be undertaken in line with an Alien Vegetation Management plan, which should be compiled as part of the EMPr and implemented with immediate effect.
- Only indigenous plant species typical of the local vegetation and approved by a botanist should be used for the rehabilitation of natural habitat.

Fauna

- Any terrestrial vertebrate fauna found on site during construction must be relocated to habitat immediately adjacent to the development and should these be SCC recorded the ECO must record the release site on iNaturalist.
- Development must be designed to allow unencumbered movement of this species. e.g., trenches with sloped side to allow faunal species to exit.
- The development must consolidate road networks to minimise the loss of faunal habitat.
- Laydown areas must be rehabilitated with specific measures to create fauna habitat.
- Speed restrictions within the development for all vehicles (30km/h is recommended) should be in place to reduce the impact of killed fauna on the project roads.

- In addition to all mitigations listed above a clause must be included in contracts for ALL personnel working on site stating that: *"no wild animals will be hunted, killed, poisoned or captured. No wild animals will be imported into, exported from or transported in or through the province. No wild animals will be sold, bought, donated and no person associated with the development will be in possession of any live wild animal, carcass or anything manufactured from the carcass."* A clause relating to fines, possible dismissal and legal prosecution must be included should any of the above transgressions occur, especially for SCC.

Impacts on the terrestrial plant species and faunal habitats can be reduced to acceptable levels through the implementation of mitigation measures. The specialist is therefore of the opinion that the development can proceed, provided the recommendations contained in this report are implemented.

6.3.3 Avifaunal Impacts

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

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

Four major avifaunal habitat types were identified on the study site and surroundings, consisting of natural Northern Upper Karoo Shrubveld, artificial livestock watering points, open Upper Karoo Shrubland, microphyllous bush clumps and transformed areas. Approximately 169 bird species are expected to occur in the wider study area, of which 144 species were observed in the study area (during two independent surveys). The expected richness included nine threatened or near threatened species, 22 southern African endemics and 29 near-endemic species. In addition, seven threatened and near threatened bird species (c. endangered Secretarybird *Sagittarius serpentarius*, endangered Ludwig's Bustard *Neotis ludwigii*, vulnerable Lanner Falcon *Falco biarmicus,* critically endangered White-backed Vulture *Gyps africanus*, vulnerable Verreaux's Eagle *Aquila verreauxii*, near threatened Karoo Korhaan *Eupodotis vigorsii* and near threatened Blue Crane Grus *paradisea*) were recorded on the wider study area (in particular to the west of the study site), with most of these species regarded as occasional or irregular visitors to the physical study site. However, the open Upper Karoo Shrubland provided suitable foraging habitat for the occurrence of the endangered Secretarybird (*Sagittarius serpentarius*), the endangered Ludwig's Bustard (*Neotis ludwigii*) and the near threatened Karoo Korhaan (*Eupodotis vigorsii*). *A pair of Secretarybirds (Sagittarius serpentarius) were confirmed constructing a nest, which was located approximately 1km northwest of the study site.* Owing to the moribund condition of the graminoid layer pertaining to the Northern Upper Karoo Shrubland which dominated the study site, the occurrence of large terrestrial birds on the remainder of the study site was low. A high number of southern African endemics (c. 19 species and near-endemic species (c. 20 species) were confirmed on the study site, of which the Rufous-eared Warbler (*Malcorus pectoralis*), Cape Sparrow (*Passer melanurus*), Ant-eating Chat (*Myrmecocichla formicivora*) along with other noteworthy endemics such as Lark-like Bunting (*Emberiza impetuani*), Grey-backed Cisticola (*Cisticola subruficapilla*), Kalahari Scrub Robin (*Cercotrichas paena*), Sickle-

winged Chat (*Emarginata sinuata* – during the austral dry season), Layard's Warbler (*Curruca layardi* - uncommon) and Chestnut-vented Warbler (*C. subcoerulea*) were prominent species. In addition, total of 53 collision-prone bird species have been recorded from the study area and immediate surroundings (with 45 species observed from the study area), of which 26 species were waterbird taxa and 17 species were birds of prey. Approximately 46 of these species could interact with powerlines, while 26 species could interact with the panel infrastructure.

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was high to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (mainly large-bodied waterfowl such as Egyptian Goose *Alopochen aegyptiaca*, Spur-winged Goose *Plectropterus gambiensis* and South African Shelduck *Tadorna cana*) colliding with the PV infrastructure remained eminent due to the presence of nearby wetland-associated features and small farm dams in the region, which attracted large numbers of waterfowl when inundated. Post-construction monitoring was recommended along with the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds.

In conclusion, it was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g., post construction monitoring) be implemented during the construction and operational phase of the project.

6.3.4 Visual Impacts

Due to the extent of the proposed PV facility, it is expected that the facility will result in potential visual impacts. The main question which needs to be addressed is:

> *"To what extent will the proposed development be visible to observers and will the landscape provide any significant visual absorption capacity*".

According to the Visual Impact Assessment (Appendix E3), the significance of the visual impact will be a "Negative Low Impact". Sensitive receptors likely to be impacted by the proposed development are the nearby property owners, including a game, hunting and ecotourism farm, people travelling on the S572 secondary road and an unnamed secondary road located to the west. A large part of the visual landscape is reflecting a farming landscape with a better visual appearance.

The construction and operational phase of the proposed Luckhoff Solar 2 SEF and its associated infrastructure, will have a visual impact on the study area, especially within (but not restricted to) a 1 km radius from the proposed SEF. The visual impact will differ amongst places, depending on the distance to the SEF. Receptors that might be the most sensitive to the proposed development are residents living on farms, a game, hunting and ecotourism farm bordering the project, people travelling on the S572 secondary road and on an unnamed gravel road to the west. The proposed SEF development might have a negative low impact after mitigation. The ZTV model also reflects a very low theoretical visibility with an average coverage of approximately 32% within the 10 km radius. Sensitive visual receptors are very

sparsely scattered within the 10 km radius, making the site location favourable out of a visual point of view. Although people travelling on roads are only temporary receptors, they might still be sensitive to development. The proposed project is located in very close proximity to the S572 secondary road and the unnamed secondary road located to the west; Extreme safety measures should be implemented to avoid accidents. Dust suppression and traffic management will play a very important role.

Due to the extent of the project, no viable mitigation measures can be implemented to eliminate the visual impact of the PV facility entirely, but the possible visual impacts can be reduced. Several mitigation measures have however been proposed regardless of whether mitigation measures will reduce the significance of the anticipated impacts, they are considered good practice and should be implemented and maintained throughout the construction, operational and decommissioning phases of the project, if possible.

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

It is believed that renewable energy resources are essential to the environmental well-being of the country and planet (WESSA, 2012). Aesthetic characteristics are subjective, and some people find solar farms and their associated infrastructure pleasant and optimistic while others may find it visually invasive; It is mostly perceived as symbols of energy independence, and local prosperity. The visual impact is also dependant on the land use of an area and the sensitivity thereof in terms of visual impact, such as protected areas, parks and other tourism related activities.

Considering all positive factors of such a development including economic factors, social factors and sustainability factors, especially in a semi-arid country, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view. It is therefore Donaway Environmental's recommendation that the project be approved.

6.3.5 Agricultural / impacts on the soil

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

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

According to the Site Sensitivity Verification and Agricultural Compliance Statement (Appendix E4), the site has low agricultural potential and no dryland cropping potential predominantly because of aridity constraints but also because of soil constraints. As a result of the constraints, agricultural production is limited to low density grazing. The land across the site is verified in this assessment as being of low to medium agricultural sensitivity.

Two potential mechanisms of negative agricultural impact were identified, occupation of agricultural land and soil degradation. Two potential mechanisms of positive agricultural impact were identified as increased financial security for farming operations and improved security against stock theft and other crime.

All mechanisms are likely to lead to low impact on the agricultural production potential and the agricultural impact is therefore assessed as having low significance. The conclusion of this assessment is that the agricultural impact of the proposed development is acceptable because:

- It will occupy land that is of very limited land capability, which is insufficient for crop production. There is not a scarcity of such agricultural land in South Africa and its conservation for agricultural production is not therefore a priority.
- The amount of agricultural land use by the development is within the allowable development limits prescribed by the agricultural protocol. These limits reflect the national need to conserve valuable agricultural land and therefore to steer, particularly renewable energy developments, onto land with low agricultural production potential.
- The PV panels will not necessarily totally exclude agricultural production. The area may still be used to graze sheep that will, in addition, be protected against stock theft within the security area of the facility.
- All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country.

From an agricultural impact point of view, it is recommended that the development be approved. The conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any conditions, other than recommended mitigation.

6.3.6 Heritage and Archaeological Impacts

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

"Will the proposed development impact on any heritage or archaeological artefacts?"

The Heritage Impact Assessment (Appendix E5) describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations

and mitigation measures proposed relevant to this. The investigation consisted of a desktop study (archival sources, database survey, maps and aerial imagery) and a physical survey that also included the interviewing of relevant people. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's approval.

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a very limited pre-colonial Stone Age and Iron Age occupation. The second and much later component is a colonial farmer one, with a very limited urban component consisting of a number of smaller towns, most of which developed during the last 120 to 150 years.

Most of the archaeological remains recorded in the larger region of the project area consist of a background scatter of weathered and patinated, typologically mixed Middle Stone Age (MSA) artefacts, with a few isolated samples dating to the Fauresmith period. These artefacts occur dispersed within the surface gravels, rather than as discrete concentrations. The fact that there appears to be no stratigraphic context and no organic remains are preserved would suggest that most of the proposed Luckhoff 2 development area is of low archaeological heritage sensitivity.

During the survey no sites, features or objects of cultural significance were identified. During the site visit, the high and dense vegetation that covered the project area limited ground visibility very much. Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development. For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.

From a heritage point of view, it is recommended that the proposed project be allowed to continue on acceptance of the conditions proposed below:

- The Palaeontological Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo) indicate that the southern and western section of the project area has a high sensitivity of fossil remains to be found and therefore a desktop palaeontological assessment would be required. Based on the outcome of that, a field assessment is likely.
- Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

6.3.7 Paleontological Impacts

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

"How will the proposed development impact on the Palaeontological resources?"

According to the Palaeontological Impact Assessment (Appendix E6), the proposed development is underlain by Quaternary aeolian sand, calcrete and a small portion of Jurassic Dolerite of the Karoo Igneous Province.The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the calcretes is High, Quaternary sands has a Moderate Palaeontological Sensitivity while that of the Jurassic dolerite is Zero as it is igneous in origin (Almond and Pether, 2009; Almond *et al*., 2013). Update geology (Council for Geosciences, Pretoria) indicates that the proposed Luckhoff 2 Solar Energy Facility is underlain by calcrete, surface limestones and Hardpan as well as alluvium, colluvium, eluvium, gravel, scree, sand, soil and debris.

The Palaeontological Significance of the proposed Solar Energy Facility is considered to be Low and will not lead to detrimental impacts on the palaeontological resources of the area. The construction of the development may therefore be authorised as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If significant fossil remains are discovered during any phase of construction, either on the surface or uncovered by excavations, the ECO/site manager in charge of these developments must be notified immediately. These discoveries must be secured and the ECO/site manager must alert SAHRA so that appropriate mitigation (documented and collection) can be undertaken by a professional palaeontologist (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports must meet the minimum standards for palaeontological impact studies developed by SAHRA.

It is considered that the proposed Luckhoff Solar Energy Facility and associated infrastructure will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised in its whole extent.

6.3.8 Socio-Economic Impacts

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

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

According to the Social Impact Assessment (Appendix E7), there are some vulnerable communities within the project area that may be affected by the development of Luckhoff

Solar 2 SEF and its associated infrastructure. Traditionally, the construction phase of a PV solar development is associated with most social impacts. Many of the social impacts are unavoidable and will take place to some extent but can be managed through the careful planning and implementation of appropriate mitigation measures. Several potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are sufficiently significant to allow them to be classified as “fatal flaws”.

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

- The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focussed on the construction of solar PV projects (these relate to an influx of non-local workforce and jobseekers, intrusion and disturbance impacts (i.e., noise and dust, wear and tear on roads) and safety and security risks), and could be reduced with the implementation of the mitigation measures proposed. The significance of such impacts on the local communities can therefore be mitigated.
- The development will introduce employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during operation phase.
- The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases. This positive impact is likely to be compounded by the cumulative impact associated with the development of several other solar facilities within the surrounding area, and because of the project’s location within an area which is characterised by high levels of solar irradiation, and which is therefore well suited to the development of commercial solar energy facilities.
- The proposed development also represents an investment in infrastructure for the generation of non-polluting, Renewable Energy, which, when compared to energy generated because of burning polluting fossil fuels, represents a positive social benefit for society.
- When considering Luckhoff Solar 2 SEF, it is also important to consider the cumulative social impacts that may arise with other proposed solar PV projects in the area.
- It should be noted that the perceived benefits associated with the project, which include RE generation and local economic and social development, outweigh the perceived impacts associated with the project.

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

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

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

6.3.9 Traffic Impacts

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

> *"How will the proposed development impact on the traffic on main delivery routes to the site?"*

According to the Traffic Impact Assessment (Appendix E8), the potential traffic and transport related impacts for the construction, operation and decommissioning phases of the proposed Luckhoff Solar 2 PV Facility plant were identified and assessed.

- The main impact on the external road network will be during the construction phase. This phase is temporary in comparison to the operational period. The number of abnormal loads vehicles was estimated and to be found to be able to be accommodated by the road network.
- During operation, it is expected that maintenance and security staff will periodically visit the facility and water be transported to site possibly twice a year for the cleaning of panels. The generated trips can be accommodated by the external road network and the impacts are rated negative low.
- The traffic generated during the construction phase, although significant, will be temporary and impacts are considered to be of negative low impact after mitigation.
- The traffic generated during the decommissioning phase will be similar to or even less than the construction phase traffic and the impact on the surrounding road network will also be considered to be of negative low impact after mitigation.

- For the cumulative impact, it was assumed that all listed developments in a radius of 30 km from the site will be developed at the same time (which will in reality be unlikely). After mitigation, a rating of a negative medium impact is given.

The potential mitigation measures mentioned in the construction and decommissioning phases are:

- Dust suppression of internal gravel roads and the access roads.
- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- The use of mobile batching plants and quarries near the site would decrease the impact on the surrounding road network, if available and feasible.
- Staff and general trips should occur outside of peak traffic periods.
- A "dry run" of the preferred route. Should the haulage company be familiar with the route, evidence is to be provided to the Client and the Contractor.
- Design and maintenance of the internal gravel roads and maintenance of the access roads.
- If required, any low hanging overhead lines (lower than 5.1m) e.g., Eskom and Telkom lines, along the proposed routes will have to be moved (to be arranged by haulage company) or raised to accommodate the abnormal load vehicles.

The construction and decommissioning phases of a solar power facility are the only significant traffic generators and therefore noise and dust pollution will be higher during these phases. The duration of these phases is of temporary nature, i.e., the impact of the solar power facility on the external traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

From a transport engineering perspective, the proposed development alternatives (i.e., electrical infrastructure compound location alternatives and the technology options for the BESS) are acceptable as they do not have any relevant impact on the traffic on the surrounding road network and the proposed development is supported to be approved.

6.3.10 Geotechnical Desktop Study

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

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

According to the Desktop Geotechnical Assessment (Appendix E9), the recommendations are based solely on the perceived site conditions and a detailed geotechnical investigation will be required to confirm site conditions. This will be done prior to construction related activities.

Subgrade and Foundations

Though confirmation will be required through detailed investigations, it is anticipated that the granular transported soils will be loose from surface to approximately 0.10m begl and rapidly become medium dense to dense. Calcrete soils would be very dense in consistency. Where at least medium dense the soils and rock should form a suitable in-situ subgrade for proposed roadways. While expect shallow foundations for all structures. Depending on the thickness of

the aeolian sands precautions such as compaction and modified construction techniques may be required to account for variability in density.

Excavatability

Excavation in fill and soils would classify as "Soft" and possibly "Boulder Class B" in places, excavation in terms of the SANS 1200DM Earthworks Specification. Whilst excavation in the highly weathered medium hard rock would classify as "Intermediate" excavation. Any moderately to unweathered hard rock would classify as "Hard Rock" excavation and may require the use of tracked excavators with rock buckets and pneumatic hammers, as well as controlled blasting (dolerites and sandstone)

Possible Geotechnical Restraints to be Overcome

The following restraints could potentially occur:

- Compressible soils associated with deeper aeolian and colluvial soils.
- Saturated soils during peak rainfall episodes may result in difficulties associated with access around the site.
- Potential sporadic boulder class B excavation requirements associated with alluvial soils.
- Intermediate and Hard rock excavation likely to occur at shallow depths.

These restraints can be overcome through allowance of effective construction procedures and equipment as well as effective engineering designs informed from actual geotechnical parameters obtained in the field.

In summary the conditions according to the desktop study appear favourable for the proposed Luckhoff Solar 2 Facility. Good quality in-situ soils for selected and in-situ subgrades for pavements and surface beds as well as shallow competent founding on calcrete and rock. Excavations in soils in the upper approximately 250mm begl which classify as "soft excavation" but rapidly grade towards hard excavation in the underlying calcrete and rock. As indicated all of the above will require confirmation through site walkover and a detailed geotechnical investigation.

6.3.11 Risk Assessment for Battery Storage System

Battery storage facilities are a relatively new technology, particularly in South Africa. Batteries, as with most electrical equipment, can be dangerous and may catch fire, explode or leak dangerous pollutants if damaged, possibly injuring people working at the facility or polluting the environment. Common failure scenarios of Li-ion batteries include: electrical, mechanical, and thermal. The potential hazards associated with them are fire with consequent emission of gas and explosion. The major risks include thermal runaway, difficulty of fighting battery fires, failure of control systems and the sensitivity of Li-ion batteries to mechanical damage and electrical transients.

As with any fire or explosion, a potential consequence of Li-ion battery fires is the endangerment of life and property. These consequences are assessed based on their severity and likelihood. First, the severity of this consequence changes based on the quantity of cells in a system, as well as the system's proximity to people and property. Therefore, the size and

location of the installation should be taken into consideration. For the Luckhoff Solar 2 PV facility, the location of the BESS and the fact that the area is sparsely populated will reduce the risk associated with toxic chemicals, flammability and overpressure from explosions. The risk level is seen to be of a low risk that is unlikely to occur with the proper safety measures taken as mitigation. Provided that the facility is designed and managed properly, and the batteries are handled in the manner prescribed by the manufacturer, an incident is unlikely to happen. However, because of the risk, special management actions are recommended in the EMPr to reduce the risk of an incident and manage an incident should one ever occur.

6.4 METHOD OF ENVIRONMENTAL ASSESSMENT

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

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 6.8.

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

6.4.1 Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

Table 6.8: The rating system

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).

2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		

This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

7 CUMULATIVE EFFECTS ASSESSMENT

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

7.1 INTRODUCTION

The EIA Regulations (2017) determine that cumulative impacts, "*in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*." Cumulative impacts can be incremental, interactive, sequential or synergistic. EIAs have traditionally failed to come to terms with such impacts, largely as a result of the following considerations:

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

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

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

7.2 GEOGRAPHIC AREA OF EVALUATION

The geographic area of evaluation is the spatial boundary in which the cumulative effects analysis was undertaken. The spatial boundary evaluated in this cumulative effects analysis generally includes an area of a 30 km radius surrounding the proposed development – refer to Figure 7.1 below.

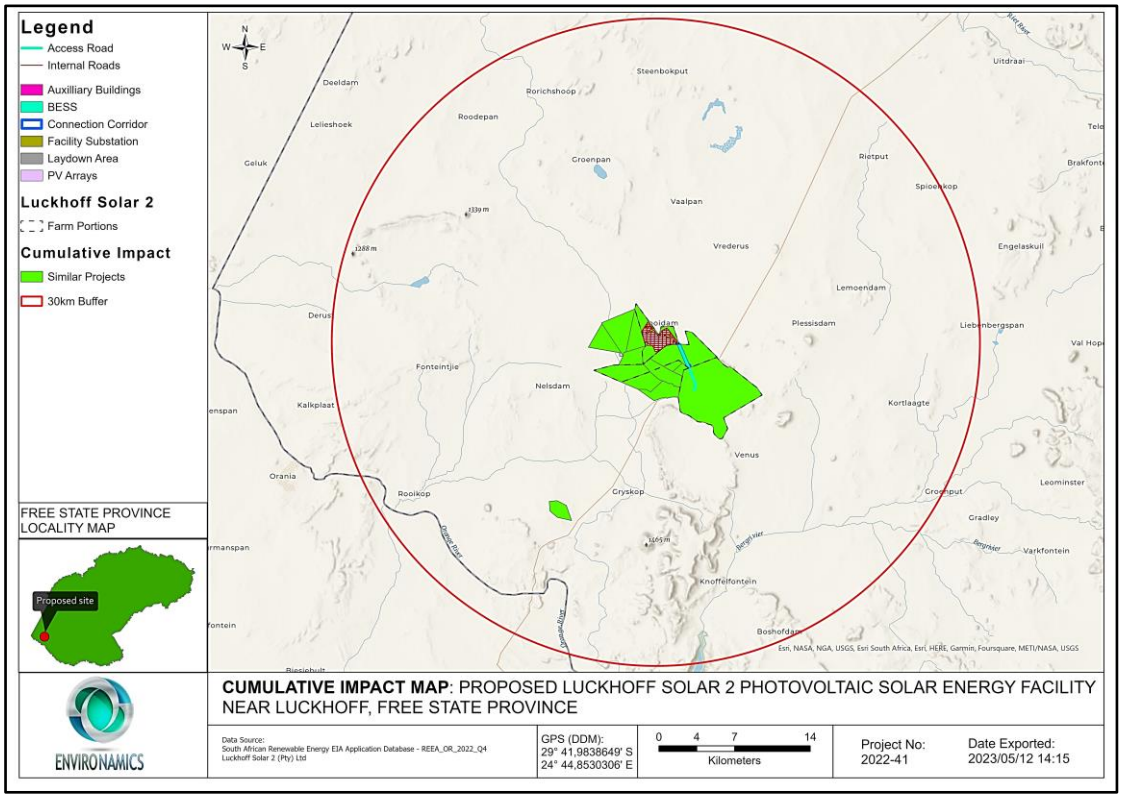


Figure 7.1: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines

The geographic spread of PV solar projects, administrative boundaries and any environmental features (the nature of the landscape) were considered when determining the geographic area of investigation. It was argued that a radius of 30 km would generally confine the potential for cumulative effects within this particular environmental landscape. The geographic area includes projects located within the Free State Province. A larger geographic area may be used to analyse cumulative impacts based on the specific temporal or spatial impacts of a resource. For example, the socio-economic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource where it differs from the general area of evaluation described above.

7.3 TEMPORAL BOUNDARY OF EVALUATION

A temporal boundary is the timeframe during which the cumulative effects are reasonably expected to occur. The temporal parameters for this cumulative effects analysis are the anticipated lifespan of the proposed project, beginning in 2023/204 and extending out at least 20 years, which is the minimum expected project life of the proposed project. Where appropriate, particular focus is on near-term cumulative impacts of overlapping construction schedules for proposed projects in the area of evaluation.

7.4 OTHER PROJECTS IN THE AREA

7.4.1 Existing Projects in the Area

According to the DFFE's database, 3 solar PV facility applications have been submitted to the Department within the geographic area of investigation - refer to Table 7.1.

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

Site name	Distance from study area	Proposed generating capacity	DFFE reference	EIA process	Project status
Luckhoff Solar 1[10]	0km	240MW	14/12/16/3/3/2/2284	S&EIA	In Process
Luckhoff Solar 3[11]	0km	240MW	14/12/16/3/3/2/2286	S&EIA	In Process
Grootpoort PV	16km	100MW	14/12/16/3/3/2/835	S&EIA	Approved

It is unclear whether other projects not related to renewable energy is or has been constructed in this area, and whether other projects are proposed. In general, development activity in the area is focused on agriculture and mining. It is quite possible that future solar farm development may take place within the general area.

7.5 SPECIALIST INFORMATION ON CUMULATIVE EFFECTS

In line with the Terms of Reference (ToR) specialists were requested to, where possible, take into consideration the cumulative effects associated with the proposed development and other projects which are either developed or in the process of being developed in the local area – refer to Figure 7.2 for process flow. The following sections present their findings.

[10] Environamics are the appointed responsible environmental consultants

[11] Environamics are the appointed responsible environmental consultants

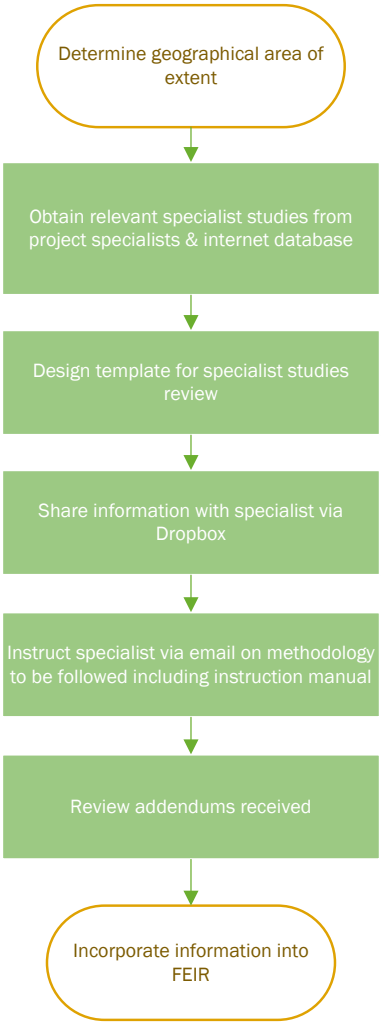


Figure 7.2: Process flow diagram for determining cumulative effects

7.5.1 Visual

According to the Visual Impact Assessment (refer to Appendix E3), the cumulative impact might be a negative medium impact due to the fact that the landscape is visually pleasant reflecting a farming landscape and some ridges to the east and south. The potential for cumulative impacts to occur as a result of the projects is therefore likely. On the other hand, the location of the SEFs within the study area will contribute to the consolidation of SEF structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region.

Due to the extent of the project, no viable mitigation measures can be implemented to eliminate the visual impact of the PV facility entirely, but the possible visual impacts can be reduced. Several mitigation measures have however been proposed regardless of whether mitigation measures will reduce the significance of the anticipated impacts, they are considered good practice and should be implemented and maintained throughout the construction, operational and decommissioning phases of the project, if possible.

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

7.5.2 Soil, Land Capability and Agricultural Potential

According to the Agriculture Compliance Statement (Appendix E4), the cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present, or reasonably foreseeable future activities that will affect the same environment.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this: What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

The Department Forestry, Fisheries and the Environment (DFFE) requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

DFFE compliance for this project requires considering all renewable energy applications within a 30 km radius. There are a total of 3 renewable energy project applications in the area within 30 km of the proposed site. All of these projects have the same agricultural impacts in an almost identical agricultural environment, and therefore the same mitigation measures apply to all.

In quantifying the cumulative impact, the area of land taken out of grazing as a result of all the renewable energy developments within 30 km (total generation capacity of 720 MW) will amount to a total of approximately 1,800 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30 km radius (approximately 282,700 ha), this amounts to 0.64 % of the surface area. That is within an acceptable limit in terms of loss of low potential agricultural land which is only suitable for grazing and of which there is no scarcity in the country. This is particularly so when

considered within the context of the following point.

In order for South Africa to develop the renewable energy generation that it urgently needs, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no crop production potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are far higher in this region than in regions with higher agricultural potential.

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

As discussed above, the risk of a loss of agricultural potential by soil degradation can effectively be mitigated for renewable energy developments and the cumulative risk is therefore low.

Due to all of the considerations discussed above, the cumulative impact of loss of future agricultural production potential will be of low significance and will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it be approved.

7.5.3 Heritage

The Heritage Impact Assessment (Refer to Appendix E5), states that from a review of available databases, publications, as well as available heritage impact assessments done for the purpose of developments in the region, it was determined that the Luckhoff 2 PV project is located in an area with a very low presence of heritage sites and features.

Most of the archaeological remains recorded in the larger region of the project area consist of a background scatter of weathered and patinated, typologically mixed Middle Stone Age (MSA) artefacts, with a few isolated samples dating to the Fauresmith period. These artefacts occur dispersed within the surface gravels, rather than as discrete concentrations. The fact that there appears to be no stratigraphic context and no organic remains are preserved would suggest that most of the proposed Luckhoff 2 development area is of low archaeological heritage sensitivity.

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

For the project area, the impacts to heritage sites are expected to be of low significance. This can be further ameliorated by implementing mitigation measures, include isolating sites, relocating sites (e.g., burials) and excavating or sampling any significant archaeological material found to occur within the project area during the project development phases. The

chances of such material being found, however, are negligible. After mitigation, the overall impact significance would stay low.

7.5.4 Palaeontology

According to the Palaeontological Impact Assessment (refer to Appendix E6), the geographic spread of PV solar projects, administrative boundaries and any environmental features (the nature of the landscape) were considered when determining the geographic area of investigation. It was argued that a radius of 30km would generally confine the potential for cumulative effects within this particular environmental landscape. The geographic area includes projects located within the Free State Province specific temporal or spatial impacts of a resource. For example, the socioeconomic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource where it differs from the general area of evaluation described above.

A temporal boundary is the timeframe during which the cumulative effects are reasonably expected to occur. The temporal parameters for these cumulative effects analysis is the anticipated lifespan of the Proposed Project, beginning in 2024 and extending out at least 20 years, which is the minimum expected project life of the proposed project. Where appropriate, particular focus is on near-term cumulative impacts of overlapping construction schedules for proposed projects in the area of evaluation.

The general Palaeontological Sensitivity of the area is Low to High. However, it is important to note that the quality of preservation of these different sites will most probably vary and it is thus difficult to allocate a Cumulative Sensitivity to the projects. If all the mitigation measures are carried out, a conservative estimate of the Cumulative impacts on fossil Heritage will vary between Low and Medium.

7.5.5 Social Impact Assessment

According to the Social Impact Assessment (refer to Appendix E7), Luckhoff Solar 2 SEF and the establishment of other solar power projects within the area has the potential to result in significant positive cumulative impacts, specifically with regards to the creation of a number of socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local, regional, and national economy through employment and procurement of services are more considerable than that of Luckhoff Solar 2 SEF alone.

While the development of a single solar power project may not result in a major influx of people into an area, the development of three solar projects may have a cumulative impact on the in-migration and movement of people. In addition, the fact that the project is proposed within an area characterised by good levels of solar irradiation suitable for the development of commercial solar energy facilities implies that the surrounding area is likely to be subject to considerable future applications for PV energy facilities. Levels of unemployment, and the low level of earning potential may attract individuals to the area in search of better employment opportunities and higher standards of living.

It is exceedingly difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring.

7.5.6 Traffic

According to the Traffic Impact Assessment (refer to Appendix E8), this is a precautionary approach as in reality, these projects would be subject to a highly competitive bidding process and not all the projects may be selected to enter into a Power Purchase Agreement. Even if all the facilities are constructed and/or decommissioned at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

The construction and decommissioning phases of a renewable energy project are the only significant traffic generators. The duration of these phases is short term, i.e., the potential impact of the traffic generated during the construction and decommissioning phases on the surrounding road network is temporary and solar projects, when operational, do not add any significant traffic to the road network.

As indicated in Table 7.1 above, Luckhoff Solar 1 and 3 form part of the Luckhoff Solar PV Cluster and are investigated in separate reports.

For the purpose of this study, it is assumed that Luckhoff Solar 1 and 3 will generate similar construction trips, as they are of similar size (240 MW each, approximately ~240 daily construction trips) and that Grootpoort PV will generate around 110 daily construction trips (100 MW development). However, as Grootpoort PV is already approved, it can be expected that construction will take place before the Luckhoff Solar project.

It is further noted that it is unlikely that all above developments will be constructed at the same time. However, for the event that the developments have similar construction periods, it is recommended to agree on a delivery schedule between the projects to reduce development trips and consequently the impact on the external road network.

7.6 IMPACT ASSESSMENT

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

7.6.1 Potential Cumulative Effects

The receptors (hereafter referred to as Valued Ecosystem Components (VECs) presented in Section 6 (refer to the matrix analysis) have been examined alongside other past, present and future projects for potential adverse cumulative effects. A summary of the cumulative effects discussed are summarized in Table 7.2. There have been specific VECs identified with reference to the Solar Project (Table 6.2), which relates to the biophysical and socio-economic

environments. Table 7.2 indicates the potential cumulative effects VECs and the rationale for inclusion/exclusion.

Table 7.2: Potential Cumulative Effects for the proposed project

	Valued Ecosystem Components (VECs)	Rationale for Inclusion / Exclusion	Level of Cumulative Effect
Construction Phase			
Aquatic Ecology Impact Assessment	Impacts on the aquatic resources of the area	The cumulative impact assessment considers the combined impact of the remaining and other renewable projects within a 30km radius, that are also in the development phase and the associated grid lines on the aquatic resources. The rating below is based on the premised that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact	- Low
Social Impact Assessment	An increase in employment opportunities, skills development and business opportunities with the establishment of more than one solar power facility	The establishment of several SEFs under the REIPPP Programme in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted, and local services providers are utilised by the developers to maximise the project opportunities available to the local community.	+ Medium
	Impact with large-scale in-migration of people	While the development of a single solar power project may not result in a major influx of people into an area, the development of three other projects may have a cumulative impact on the in-migration and movement of people. In addition, the fact that the project is proposed within an area characterised by good levels of solar irradiation suitable for the development of commercial solar energy facilities implies that the surrounding area is likely to be subject to considerable future applications for PV energy facilities. Levels of unemployment, and the low level of earning potential may attract individuals to the area in search of better employment opportunities and higher standards of living. It is exceedingly difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local	- Medium

		employment policy in order to reduce the potential of such an impact occurring.	
Traffic Impact Study	Further increase of development trips during construction phase if the developments listed in Table 7.1 will be constructed at the same time as the proposed Luckhoff Solar 2 PV Facility	It is noted that it is unlikely that all developments will be constructed at the same time. However, for the event that the developments have similar construction periods, it is recommended to agree on a delivery schedule between the respective projects.	- Medium
Operational Phase			
Visual Impact Assessment	Visual intrusion of the development on observers within the area	The anticipated cumulative visual impact for the SEF is expected to include the change in sense of place, as well as the precedent being set for SEFs in the area where currently there is only a precedent for agricultural related activities. Further construction and operation of the SEF in the area is likely to have a negative impact.	- Medium
Decommissioning Phase			
General	Generation of waste	During the decommissioning of the facility waste will be generated that will need to be disposed of where recycling and re-use is not available. This may lead to pressure on waste disposal facilities in the area.	- Medium

7.7 CONCLUSION

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

The potential most significant cumulative impacts relate to:

- <u>Cumulative effects during construction phase:</u>
  - Impacts on the aquatic resources of the area (- Low)
  - Impacts of employment opportunities, business opportunities and skills development (+ Medium)
  - Impact with large-scale in-migration of people (- Medium)

- Further increase of development trips during construction phase if the developments (-Medium)

➢ Cumulative effects during the operational phase:

- Visual intrusion (- Medium)

➢ Cumulative effects during the decommissioning phase:

- Generation of waste (- Medium)

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

Photovoltaic solar energy technology is a clean technology which contributes toward a better-quality environment. The proposed project will contribute to local economic growth by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Free State Province. No cumulative impacts with a high residual risk have been identified.

In terms of the desirability of the development of sources of renewable energy therefore, it may be preferable to incur a higher cumulative loss in such a region as this one (where the landscape has already experienced degradation), than to lose land with a higher environmental value elsewhere in the country. Also, the low acceptable cumulative impacts expected will not result in a whole-scale change of the environment and therefore are considered to be acceptable, and considering the associated positive impacts associated with the development of solar energy facilities the proposed facility is considered desirable.

8 ENVIRONMENTAL IMPACT STATEMENT

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

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

(l) an environmental impact statement which contains-

(i) a summary of the key findings of the environmental impact assessment:

(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and

(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;

(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;

(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;

(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;

8.1 SUMMARY OF KEY FINDINGS AND ASSESSMENT RESULTS

Based on the contents of the report the following key environmental issues were identified, which were addressed in this EIA report: *(Note the pre-mitigation impact rating is included here)*

- Impacts during construction phase:
  - Direct habitat destruction (- Medium)
  - Habitat Fragmentation (- Medium)
  - Impact on the characteristics of the watercourse (- Medium)
  - Creation of direct and indirect employment opportunities (+ Medium)
  - Economic multiplier effects from the use of local goods and services (+ Medium)
  - Impacts on daily living patterns (- Medium)

- Impacts during the operational phase:
    - Habitat destruction and fragmentation (- Medium)
    - Displacement of priority avian species from important habitats (- Medium)
    - Impact on the characteristics of the watercourse (- Medium)
    - Creation of employment opportunities and skills development. (+ Medium)
    - Development of non-polluting, renewable energy infrastructure. (+ Medium)
    - Contribution to LED and social upliftment (+ High)
- Impacts during the decommissioning phase:
    - Improvement of habitat through revegetation / succession over time (+ Medium)
- Cumulative biophysical impacts resulting from similar development in close proximity to the proposed activity.

Cumulative biophysical impacts resulting from similar development in close proximity to the proposed activity are expected to occur, however the cumulative impact assessment included in Section 7 of this report has indicated that all cumulative impacts will be of a medium or low significance, with no impacts expected to be of a high and unacceptable significance.

8.2 SENSITIVITY ANALYSIS SUMMARY AND SITE-SPECIFIC CONDITIONS

The sensitivity analysis has guided the developer in optimising the layout of the Luckhoff Solar 2 PV facility through identifying specific environmental areas and features present within the site which needs to be avoided through the careful placement of infrastructure as part of the development footprint. Refer to Section 6.4 for the complete sensitivity analysis and Figure J to N for the final layout map which avoids the areas required to be conserved.

The main feature to be avoided is the small depression wetland located within the project site and two (02) watercourses. These areas have been avoided by the proposed layout as per Figures J, K and L. The site also comprises of an artificial watering point; however, this has been avoided will be maintained.

Further mitigation measures for the development, as recommended by the independent specialists, have been included in the EMPr(s) for the project as per Appendix F.

8.3 TECHNICAL DETAILS OF THE PROPOSED INFRASTRUCTURE TO BE AUTHORISED

- PV Panel Array - To produce up to 240 MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will

be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the yield.

- Wiring to Central Inverters - Sections of the PV array will be wired to central inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- Electrical reticulation network – Energy generated by the PV array will be transmitted via underground medium voltage cables (i.e., up to 33 kV) to the onsite Luckhoff Solar 2 substation (the onsite facility substation) where it will be stepped-up to 132 kV. Thereafter, the electricity will pass to an offsite facility collector substation located ~2.5 km southeast of the facility (at Luckhoff Solar 1 – assessed separately) via a 132 kV overhead powerline.
- Supporting Infrastructure – The following auxiliary buildings including a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre will be required with basic services including water and electricity. The project requires the need for both temporary and permanent laydown areas.
- Battery Energy Storage System – The Battery Storage Facility will occupy an area of up to 5 hectares. The specifications and the exact capacity of the battery storage remains unspecified at this stage.
- Roads – The majority of the access road will follow existing, gravel farm roads that will require widening between 6 -10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed/lengthened, this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road of up to 33 km, each with a width of up to 6 m, will be constructed to provide access to the various components of the PV development. Access will be obtained via the S572 an existing gravel road located adjacent to the site, off the R48 Regional Road.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 3.5 m will be used.

8.4 RECOMMENDATION OF EAP

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

- The scoping phase complied with the agreement and specification set out in Regulation 21 and Appendix 2 EIA Regulations (as amended in 2017) – already approved by the environmental authority.
- All key consultees have been consulted as required by Chapter 6 of the EIA Regulations (as amended in 2017) – already approved by the environmental authority.

- The EIA process has been conducted as required by the EIA Regulations (as amended in 2017), Regulations 23 and Appendix 3.
- The EMPr has been compiled in accordance with Appendix 4 of the EIA Regulations (as amended in 2017).
- The proposed mitigation measures will be sufficient to mitigate the identified impacts to an acceptable level.
- No additional specialist studies are proposed on any environmental issue raised and therefore, no terms of reference are provided for such studies.

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

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

The final recommendation of the EAP is that:

It is the opinion of the independent EAP that the proposed development will have a net positive impact for the area and will subsequently ensure the optimal utilisation of resources. All negative environmental impacts can further be effectively mitigated through the proposed mitigation measures and avoidance of certain areas within the site as recommended by the specialists. Based on the contents of the report it is proposed that an environmental authorisation be issued, which states (amongst other general conditions) that the Luckhoff Solar 2 PV facility, Registration Division Fauresmith, Free State Province be approved subject to the following conditions:

- Implementation of the proposed mitigation measures set out in the EMPrs (Appendix F)
- Implementation of the proposed mitigation measures set out in the specialist studies.
- The proposed solar facility must comply with all relevant national environmental laws and regulations.
- All actions and tasks allocated in the EMPr should not be neglected and a copy of the EMPr should be made available onsite at all times.
- Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.
- The required biodiversity walk-throughs must be undertaken prior to construction after which time an Alien Invasive Management Plan must be compiled and sent to this Department for approval prior to construction activities being undertaken.
- The period for which the Environmental Authorisation is required is between 7 and 10 years. This is based on the fact that the project is proposed to be bid as part of the DMRE REIPPP Programme, with there being uncertainty regarding the announcement of the next bidding rounds, and the need for a valid Environmental Authorisation. It must however be noted that the project will also participate in other programs/opportunities to generate power in South Africa, as available.

We trust that the department find the report in order and await your comments in this regard.

Ms. Roschel Maharaj
Environamics Environmental Consultants

ENVIRONAMICS

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