ENVIRONMENTAL IMPACT REPORT

Draft – 19 June 2023

THE PROPOSED CARMEL SOLAR 2 PHOTOVOLTAIC SOLAR ENERGY FACILITY AND GRID CONNECTION INFRASTRUCTURE NEAR CARLETONVILLE GAUTENG PROVINCE

ENVIRONAMICS

PROJECT DETAIL

DFFE Reference No.	:	14/12/16/3/3/2/2311
Project Title	:	Proposed Carmel Solar 2 Photovoltaic Solar Energy Facility and Grid Connection Infrastructure near Carletonville, Gauteng Province
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Reviewed	:	Ms. Roschel Maharaj
Client	:	Carmel 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 8.4 GW 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, Carmel Solar 2 (Pty) Ltd is proposing the development of a photovoltaic solar facility and associated infrastructure (including grid connection infrastructure) for the purpose of commercial electricity generation on an identified site located on Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118, Registration Division IQ, Gauteng Province situated within the Merafong Local Municipality area of jurisdiction (refer to Figure A and B for the locality and regional maps respectively). 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.

The project entails the generation of up to 200 MW electrical power through photovoltaic (PV) technology. The total development footprint of the project will be approximately 271 hectares for the PV facility (including supporting infrastructure) within the 370 hectares identified and assessed as a part of the scoping process. An additional 56 ha was assessed for the proposed grid connection corridor. The development footprint of the grid connection will be restricted to pylon footprints only. Based on the environmental sensitivities identified on the project site during the scoping phase, the development footprint of the PV facility (including supporting infrastructure) has been reduced to avoid high sensitivity areas.

The Carmel Solar 2 PV facility forms a part of the Carletonville Solar Cluster comprising a total of five (05) proposed PV facilities located in close proximity to one another. Each solar PV facility is concurrently undergoing individual S&EIR processes.

EXECUTIVE SUMMARY

Like many other developing municipalities in the country, the Merafong City Local Municipality faces a number of challenges in addressing the needs of sustainable growth and providing quality services (IDP, 2020-2021). The Merafong City Local Municipality, IDP (2020/2021), has identified specific issues that require special attention including but not limited to poverty; job creation; unemployment; and inequalities.

The Merafong City 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, 2020/21). The IDP considers the economic structure and performance and how the municipality relies heavily on the agricultural and mining 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.

Carmel Solar 2 (Pty) Ltd intends to develop a 200 MW photovoltaic solar facility and associated infrastructure on Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118, Registration Division IQ, Gauteng Province situated within the Merafong City Local Municipality and West Rand District Municipality area of jurisdiction. The town of Carletonville is located approximately 8 km north east of the proposed development (refer to Figure A and B for the locality and regional maps respectively). The total development footprint is approximately 271 ha for the PV facility (including supporting infrastructure) with an additional 56 ha assessed for the proposed grid connection corridor. 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 Carmel 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 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(c)(ii)(iv) (GN.R. 324): "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (c) the Gauteng province, (ii) National Protected Area Expansion Strategy Focus Areas (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*
- Activity 10(c)(ii)(iv) (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 (c) Gauteng province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*
- Activity 12(c)(ii) (GN.R. 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation (c) in the Gauteng Province, (ii) within Critical Biodiversity Areas or*

Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans."

- Activity 14(ii)(a)(c)(c)(ii)(iv) (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 (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*

- Activity 18(c)(ii)(iv) (GN.R. 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*

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 of the EIA Regulations in order to obtain Environmental Authorisation. Environamics has been appointed as the independent consultant to undertake the Scoping and Environmental Impact Reporting (S&EIR) on behalf of Carmel 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, collision and electrocutions of avifauna and visual impact of sensitive visual receptors located within a 10 km radius of the proposed development and powerline. 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 six (06) other solar facilities have been proposed in relatively close proximity to the proposed activity.

The potential for cumulative impacts may therefore exist. The Draft EIA 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 Forestry, Fisheries and the Environment 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 19 June 2023 to 19 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 and prepare all required reports. All correspondence to the EAP can be directed to:

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	Daniel Miller & 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
Terrestrial Biodiversity Report	David Hoare Consulting (Pty) Ltd	David Hoare	Postnet Suite #116 Private Bag X025 Lynnwood Ridge 0040	Cell: 083 284 5111	david@davidhoareconsulting.co.za
Animal Species Compliance Statement	David Hoare Consulting (Pty) Ltd	David Hoare	Postnet Suite #116 Private Bag X025 Lynnwood Ridge 0040	Cell: 083 284 5111	david@davidhoareconsulting.co.za
Plant Species Compliance Statement	David Hoare Consulting (Pty) Ltd	David Hoare	Postnet Suite #116 Private Bag X025 Lynnwood Ridge 0040	Cell: 083 284 5111	david@davidhoareconsulting.co.za
Phase 1 Cultural Heritage Impact Assessment	J A 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 12 October 2022.
- Site notices were erected on site on 14 October 2022 informing the public of the commencement of the EIA process.
- A newspaper advertisement was placed in the Carletonville Herald on 10 November 2022, informing the public of the EIA 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 14 November 2022.
- A pre-application meeting request was submitted to DFFE on 16 November 2022.
- It was then confirmed that a pre-application meeting is not required via email dated 22 November 2022.
- An application form and the draft Scoping Report has been submitted to DFFE on 14 February 2023.
- The draft Scoping Report was made available for a 30-day review and comment period from 14 February 2023 to 15 March 2023.
- The final Scoping Report was submitted to the DFFE on 31 March 2023 for decision-making and approval of the Plan of Study for the EIA
- The DFFE accepted the Final Scoping Report (FSR) on 09 May 2023
- The Draft EIR Report was submitted to the DFFE (and registered I&APs) on 19 June 2023 for the 30-day review and comment period which will be from 19 June 2023 to 19 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 January 2024 – see Table 1.2.

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

Activity	Prescribed timeframe	Timeframe
Site visit		12 October 2022

Public participation (BID)	30 Days	14 November – 14 December 2022
Submit application form and DSR	-	14 February 2023
Public participation (DSR)	30 Days	14 February 2023 – 15 March 2023
Submit FSR	44 Days	31 March 2023
Department acknowledges receipt	10 Days	31 March 2023
Department approves/reject	43 Days	09 May 2023
Public participation (DEIR)	30 Days	19 June 2023 – 19 July 2023
Submission of FEIR & EMPr	-	July/August 2023
Department acknowledges receipt	10 Days	July/August 2023
Decision	107 Days	December 2023
Department notifies of decision	5 Days	December 2023
Registered I&APs notified of decision	14 Days	December 2023
Appeal	20 Days	December 2023 /January 2024

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 Carmel Solar 2 PV facility

Tasks to be performed	October				November				December				January				February				March				April				May				June				July				August				September				October			
	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																																																		
– 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																																																	
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– Receive specialist studies																																																		
Draft EIR Report																																																		
- Circulate																																																		
Final EIA Report & EMP																																																		
- Submission																																																		

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 21 – 24 of the EIA Regulations.

The requirement for the submission of a Screening Report for the Carmel 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 Application for EA as originally submitted to the DFFE on 14 February 2023 and updated again on 19 June 2023. The screening tool reports are also appended 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) within the different applicable categories, 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 PV facility and specialist studies completed

Study identified in the DFFE Screening Tool and sensitivity	Study included?	Appendix
Agricultural Impact Assessment Sensitivity: High	Yes	An Agricultural Compliance Statement is included in Appendix E5.
Animal Species Assessment Sensitivity: Medium	Yes	An Animal Species Compliance Statement is included in Appendix E2.
Aquatic Biodiversity Impact Assessment Sensitivity: Very High	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 E6, as per the

Sensitivity: Low		requirements of the National Heritage Resources Act.
Avian Impact Assessment Sensitivity: Low	Yes	An Avifaunal scoping report is included in Appendix E3.
Civil Aviation Assessment Sensitivity: Low	No	The identification of the site as low sensitivity considering civil aviation is agreed to by the EAP. This is based on the current land use of the site being used for agricultural purposes. 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 affected property is confirmed to be used for agricultural purposes and therefore the development will not have any impact on defence. The sensitivity for the entire extent of the site is low and therefore no assessment has been included. The South African National Defence Force 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.
Landscape / Visual Impact Assessment Sensitivity: Very High	Yes	A Visual Impact Assessment is included in Appendix E4.
Palaeontological Impact Assessment Sensitivity: Very High	Yes	A Palaeontological Impact Assessment is included in Appendix E7, as per the requirements of the National Heritage Resources Act.
Plant species Assessment Sensitivity: Medium	Yes	A Plant Species Compliance Statement is included in Appendix E2.
RFI Assessment Sensitivity: Medium	No	The RFI theme sensitivity is medium for the entire extent of the project. The South African Radio Astronomy Observatory (SARAO) 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 SARAO regarding the project. The project is also not located within an area considered to be of a high sensitivity.
Terrestrial Biodiversity Impact Assessment Sensitivity: Very High	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.

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 E10.
Socio-Economic Assessment Sensitivity: Not indicated	Yes	A Social Impact Assessment is included in Appendix E8.

Table 1.5: Specialist studies identified by the DFFE screening tool for the substation and specialist studies completed

Study identified in the DFFE Screening Tool and sensitivity	**Study included?**	**Appendix**
Agricultural Impact Assessment Sensitivity: High	Yes	An Agricultural Compliance Statement is included in Appendix E5.
Animal Species Assessment Sensitivity: Medium	Yes	An Animal Species Compliance Statement is included in Appendix E2 of the Scoping Report.
Aquatic Biodiversity Impact Assessment Sensitivity: Very High	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 E6, as per the requirements of the National Heritage Resources Act.
Civil Aviation Assessment Sensitivity: Medium	No	The screening tool report identified the civil aviation theme as medium sensitivity. However, the site is located between 8 and 15 km of other civil aviation aerodrome which is highly unlikely to be impacted upon by the proposed project. The Civil Aviation Authority has been consulted regarding the development of the project since the commencement of the S&EIR Process. No comment 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 affected property is confirmed to be used for agricultural purposes and therefore the development will not have any impact on defence. The sensitivity for the entire extent of the site is low and therefore no assessment has been included. The South African National Defence Force 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: Very High	Yes	A Palaeontological Impact Assessment is included in Appendix E7, as per the requirements of the National Heritage Resources Act.
Plant species Assessment Sensitivity: Medium	Yes	A Plant Species Compliance Statement is included in Appendix E2.
Terrestrial Biodiversity Impact Assessment Sensitivity: Very High	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.
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 E10.
Socio-Economic Assessment Sensitivity: Not indicated	Yes	A Social Impact Assessment is included in Appendix E8.

Table 1.6: Specialist studies identified by the DFFE screening tool for the powerline and specialist studies conducted

Study identified in the DFFE Screening Tool and sensitivity	Study included?	Appendix
Agricultural Impact Assessment Sensitivity: High	Yes	An Agricultural Compliance Statement is included in Appendix E5.
Animal Species Assessment Sensitivity: Medium	Yes	An Animal Species Compliance Statement is included in Appendix E2.
Aquatic Biodiversity Impact Assessment Sensitivity: Very High	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 E6, as per the requirements of the National Heritage Resources Act.
Civil Aviation Assessment Sensitivity: High	No	The proposed length of the grid corridor lies between medium and high sensitivity with on a very small portion within high sensitivity. The proposed activity is approximately 8 and 15 km from other civil aviation aerodrome. The grid corridor length is relatively short i.e., 4.5 km from the proposed PV facility which was identified as low sensitivity. The proposed pylons are anticipated to only reach a heigh of up to 32m from the ground. It is not anticipated that the proposed activities will cause

		any interference with civil aviation aerodromes located at a fair distance away. 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 affected property is confirmed to be used for agricultural purposes and therefore the development will not have any impact on defence. The sensitivity for the entire extent of the site is low and therefore no assessment has been included. The South African National Defence Force 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: Very High	Yes	A Palaeontological Impact Assessment is included in Appendix E7, as per the requirements of the National Heritage Resources Act.

Plant species Assessment Sensitivity: Medium	Yes	A Plant Species Compliance Statement is included in Appendix E2.
Terrestrial Biodiversity Impact Assessment Sensitivity: Very High	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.
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 E10.
Socio-Economic Assessment Sensitivity: Not indicated	Yes	A Social Impact Assessment is included in Appendix E8.

Kindly refer to the Site Verification Report included under Appendix D of the DEIR. The site verification report further details reasons for exclusion of specialist studies where applicable.

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 Tables 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.	5
(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;	
	(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;	
	(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-	6
	(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-	8
	(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;	
(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 Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118, Registration Division IQ, Gauteng Province situated within the Merafong City Local Municipality area of jurisdiction. The proposed development is located in the Gauteng Province in the northern interior of South-Africa (refer to Figure B for the regional map). The town of Carletonville is located approximately 8 km northeast of the proposed development (refer to Figure A for the locality map).

The project entails the generation of up to 200 MW electrical power through the installation and operation of photovoltaic (PV) panels. The total area assessed as part of this EIA Report (hereinafter referred to as the "development area") is 370 ha. The development footprint of Carmel Solar 2 is proposed to be up to 271 ha (including supporting infrastructure) with an additional 56 ha assessed for the proposed solar grid infrastructure corridor. 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 Carmel 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 facility substation/Eskom switching station to the Carmel Main Transmission Substation via a new 132 kV powerline.

Table 2.1: General site information

Description of affected farm portion	Solar PV Facility: • Portion 1 of the Farm Doornfontein No. 118 • Portion 11 of the Farm Doornfontein No. 118 • Portion 28 of the Farm Doornfontein No. 118 Powerline: • Portion 1 of the Farm Doornfontein No. 118 • Portion 23 of the Farm Doornfontein No. 118 • Portion 28 of the Farm Doornfontein No. 118 Access Roads: • Portion 28 of the Farm Doornfontein No. 118
Province	Gauteng
District Municipality	West Rand District Municipality
Local Municipality	Merafong City Local Municipality
Ward numbers	5
Closest towns	The town of Carletonville is located approximately 8 km northeast of the proposed development.
21 Digit Surveyor General codes	Solar PV Facility: • Portion 1 of the Farm Doornfontein No. 118 T0IQ00000000011800001 • Portion 11 of the Farm Doornfontein No. 118 T0IQ00000000011800011 • Portion 28 of the Farm Doornfontein No. 118

	T0IQ00000000011800028 Powerline: • Portion 1 of the Farm Doornfontein No. 118 T0IQ00000000011800001 • Portion 23 of the Farm Doornfontein No. 118 T0IQ00000000011800023 • Portion 28 of the Farm Doornfontein No. 118 T0IQ00000000011800028 Access Road: • Portion 28 of the Farm Doornfontein No. 118 T0IQ00000000011800028
Title Deed	Solar PV Facility: • Portion 1 of the Farm Doornfontein No. 118 o T86110/2014 • Portion 11 of the Farm Doornfontein No. 118 o T86110/2014 • Portion 28 of the Farm Doornfontein No. 118 o T37012/2018 Powerline: • Portion 1 of the Farm Doornfontein No. 118 o T86110/2014 • Portion 23 of the Farm Doornfontein No. 118 o T45426/1980 • Portion 28 of the Farm Doornfontein No. 118 o T37012/2018 Access Roads: • Portion 28 of the Farm Doornfontein No. 118

	○ T37012/2018
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 • Pylons ~32m
Battery storage	Within a 5 ha area of the development footprint
Surface area to be covered (development footprint)	Approximately 271 ha (excluding linear activities)
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 areas will occupy up to 5 hectares. Permeant laydown area will occupy up to 1 hectare. PV arrays will cover an area of up to 259 ha while 7 ha will be utilised for permanent hard stand area i.e., BESS, facility substation, and auxiliary buildings.
Generation capacity	Up to 200 MW
Expected production	N/A - this will be dependent on the chosen technology.

The site is located outside urban areas and is bordered by agricultural (mainly cattle grazing) land uses, as well as mining activities. The site survey revealed that the affected property currently consists of agricultural activities – refer to plates 1-8 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 Carmel Solar 2 substation (the onsite facility substation) where it will be stepped-up to 132 kV. Energy generated by the facility will be transmitted from the facility substation into Carmel Main Transmission Substation.
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 or (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 the Channelled Valley Bottom wetlands located along the eastern boundary of the site. A 100 m buffer will be maintained between the PV facility and the channelled valley bottom wetlands; however, the overhead powerline will span over the channelled valley bottom wetlands with pylon location within riparian areas of the watercourse. The project further requires an informal access road (e.g., jeep track) that will span the length of the proposed powerline (i.e., ~4.5 km in length).
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 entails the placement of pylons within identified riparian areas (east of the

		proposed development) resulting to the excavation, removal or moving of soil from a watercourse of more than 10 cubic metres. The project further requires an informal access road (e.g., jeep track) that will span the length of the proposed powerline (i.e., ~4.5 km in length).
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 access roads to Carmel 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. The main access road follows an existing track but will be widened to suit the project needs. The project further requires an informal access road (e.g., jeep track) that will span the length of the proposed powerline (i.e., ~4.5 km in length).
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 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 up to 271 ha (excluding linear activities).
GNR. 327 (as	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*

amended in 2017)		*reserve exists, where the existing road is wider than 8 metres…"* • Activity 56(ii) is triggered as existing roads will require widening of up to 6 m to accommodate the movement of heavy vehicles and cable trenching activities. The project further requires an informal access road (e.g., jeep track) that will span the length of the proposed powerline (i.e., ~4.5 km in length).
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 200 megawatts electricity through the use of a renewable resource.
GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • Activity 15 is triggered as the cumulative area of indigenous vegetation to be cleared for the entire Project (excluding linear components) will exceed 20 hectares. The development area (excluding linear activities) is approximately 271 ha.
GNR. 324 (as amended in 2017)	Activity 4 (c)(ii)(iv)	• "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (c) the Gauteng province, (ii) National Protected Area Expansion Strategy Focus Areas (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."* • Activity 4(c)(ii)(iv) is triggered as internal and perimeter access roads with a width of between 6 and 10 meters will be constructed. The project further requires an informal access road (e.g., jeep track) that will span the length of the proposed powerline (i.e., ~4.5 km in length). According to the Terrestrial Biodiversity Impact Assessment, parts of the site are within a Critical Biodiversity Area and Ecological Support Area. Furthermore, a small portion of the site has

		been identified as a NPAES Priority Focus Areas (FA) for inclusion in future protected areas.
GNR. 324 (as amended in 2017)	Activity 10 (c)(ii)(iv)	• *"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 (c) Gauteng province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."* • Activity 10(c)(ii)(iv) 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. According to the Terrestrial Biodiversity Impact Assessment, parts of the site are within a Critical Biodiversity Area and Ecological Support Area. Furthermore, a small portion of the site has been identified as a NPAES Priority Focus Areas (FA) for inclusion in future protected areas.
GNR. 324 (as amended in 2017)	Activity 12 (c)(ii)	• *"The clearance of an area of 300 square metres or more of indigenous vegetation (c) in the Gauteng Province, (ii) within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans."* • Activity 12(c)(ii) is triggered since the proposed development is located in the Gauteng province and portions of the site has not been lawfully disturbed during the preceding ten years and therefore indigenous vegetation is present on the site. The development footprint requires more than 300 square meters of vegetation to be cleared (excluding linear activities). According to the Terrestrial Biodiversity Impact Assessment, parts of the site are within a Critical Biodiversity Area and Ecological Support Area.
GNR. 324 (as amended in 2017)	Activity 14(ii)(a)(c)(c)(ii)(iv)	• "*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 (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans." • Activity 14(ii)(a)(c)(c)(ii)(iv) is triggered as the project is located within the Gauteng Province. The proposed overhead powerline will span over the channelled valley bottom wetland identified along the eastern boundary of the project area with pylon location within the riparian area of a watercourse. The project further requires an informal access road (e.g., jeep track) that will span the length of the proposed powerline (i.e., ~4.5 km in length). According to the Terrestrial Biodiversity Impact Assessment, parts of the site are within a Critical Biodiversity Area and Ecological Support Area. Furthermore, a small portion of the site has been identified as a NPAES Priority Focus Areas (FA) for inclusion in future protected areas.
GNR. 324 (as amended in 2017)	Activity 18 (c)(ii)(iv)	• *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."* • Activity 18(c)(ii)(iv) is triggered since the existing main access road to the site will need to be widened by more than 4 metres. The project requires internal and perimeter access roads which will be widened by more than 4 m. The project further requires an informal access road (e.g., jeep track) that will span the length of the proposed powerline (i.e., ~4.5 km in length). The project is located within the Gauteng Province and according to the Terrestrial Biodiversity Impact Assessment, parts of the site are within a Critical Biodiversity Area and Ecological Support Area. Furthermore, a small portion of the site has been identified as a NPAES Priority Focus Areas (FA) for inclusion in future protected areas.

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 200 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.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480 V up to 33 kV to up 132 kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480 V and this is fed into step up transformers to 132 kV. An onsite substation will be required to step the voltage up to 132 kV, after which the power will be evacuated into the national grid. Energy generated by the facility will be transmitted from the facility substation/Eskom switching station to the Carmel Main Transmission Substation via a new 132 kV powerline. The Project will inject up to 200 MW into the National Grid.

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4 m underground as far as practically possible.

- Supporting Infrastructure – The following auxiliary buildings including a gate house, ablutions, workshops, storage and warehousing areas, site offices, control centre and a 33 kV switch room 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 – A Battery Storage Facility with a maximum height of 8 m and development footprint of ~5 ha and associated operational, safety and control infrastructure.

- Roads – The majority of the access road will follow existing, gravel farm roads that will require widening between 6 to10 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 (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 existing D92 District 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 H1 to H5. 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 and perimeter fences). Limited features of environmental significance exist on site. These features have been avoided in the layout of the solar facility. A final layout plan is included as Figure I 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 259 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	132 kV
Area occupied by both permanent and construction laydown areas	Permanent and Temporary Laydown Area: up to 5 ha Hard Stand Area: o Auxiliary buildings – Up to 1 ha o BESS – Up to 5 ha o Facility substation – Up to 1 ha o PV array – Up to 259 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 hectares. Maximum height of the BESS is 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
Height of fencing	Approximately 3.5 meters
Height of powerline	Up to 32 m
Capacity of the power line	132 kV
Eskom Switching Station	132 kV
Electricity Grid Infrastructure Corridor	The total area assessed for the Electricity Grid Infrastructure up to 56 ha.
Grid connection corridor width	Up to 100 m assessment corridor
Grid connection corridor length	Up to 4.5 km assessment corridor
Power line servitude width	Up to 36 m
Type of pylon to be used	Lattice or monopole

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

Table 2.4: Project co-ordinates

Co-ordinates			
Project Boundary	A	26°26'53.24"S	27°17'1.33"E
	B	26°26'41.94"S	27°17'36.81"E
	C	26°26'54.81"S	27°17'43.27"E
	D	26°26'43.86"S	27°18'16.69"E
	E	26°26'44.10"S	27°18'27.13"E
	F	26°26'54.59"S	27°18'29.21"E
	G	26°26'50.90"S	27°18'42.27"E
	H	26°26'51.30"S	27°18'59.11"E
	I	26°27'2.63"S	27°18'59.99"E
	J	26°27'17.64"S	27°18'10.82"E
	K	26°27'24.58"S	27°18'9.80"E
	L	26°27'47.54"S	27°17'4.99"E

	M	26°27'23.81"S	27°16'54.77"E
	N	26°27'11.02"S	27°17'7.34"E
PV Array	A	26°27'23.75"S	27°16'54.90"E
	B	26°27'10.92"S	27°17'7.47"E
	C	26°27'7.64"S	27°17'6.60"E
	D	26°27'7.17"S	27°17'22.09"E
	E	26°26'56.57"S	27°18'28.41"E
	F	26°26'51.13"S	27°18'42.38"E
	G	26°26'51.56"S	27°18'53.52"E
	H	26°27'4.49"S	27°18'54.02"E
	I	26°27'18.95"S	27°18'11.02"E
	J	26°27'24.59"S	27°18'9.48"E
	K	26°27'46.81"S	27°17'5.04"E
Associated Infrastructure			
BESS	A	26°26'58.84"S	27°17'4.35"E
	B	26°26'56.22"S	27°17'11.30"E
	C	26°27'4.37"S	27°17'5.71"E
	D	26°27'2.22"S	27°17'13.77"E
Laydown Area	C	26°27'4.37"S	27°17'5.71"E
	D	26°27'2.22"S	27°17'13.77"E
	E	26°27'1.32"S	27°17'17.40"E
	F	26°27'6.27"S	27°17'19.26"E
	G	26°27'6.85"S	27°17'22.37"E
	H	26°27'6.53"S	27°17'23.75"E
	I	26°27'6.98"S	27°17'23.75"E
	J	26°27'6.94"S	27°17'6.44"E
Facility Substation	K	26°26'56.05"S	27°17'11.50"E

	L	26°26'54.80"S	27°17'14.72"E
	M	26°26'59.02"S	27°17'12.70"E
	N	26°26'57.69"S	27°17'16.00"E
Auxiliary Building	O	26°26'59.23"S	27°17'12.87"E
	P	26°26'58.01"S	27°17'16.10"E
	Q	26°27'2.22"S	27°17'13.97"E
	R	26°27'0.91"S	27°17'17.25"E
Access Road – Alternative 1 (Preferred)			
Start Point	A	26°26'51.42"S	27°18'53.38"E
Bend Point 1	B	26°26'39.13"S	27°18'57.33"E
Middle Point	C	26°26'24.71"S	27°18'50.51"E
Bend Point 2	D	26°26'7.56"S	27°18'40.60"E
End Point	E	26°26'6.20"S	27°18'48.83"E
Access Road – Alternative 2			
Start Point	F	26°27'18.53"S	27°18'11.54"E
Bend Point 1	G	26°27'25.19"S	27°18'10.00"E
Middle Point	H	26°27'21.23"S	27°19'12.43"E
End Point	I	26°26'51.32"S	27°20'3.97"E
Grid Corridor			
Start Point	A	26°26'57.27"S	27°17'13.62"E
Bend Point 1	B	26°26'50.95"S	27°17'12.16"E
Bend Point 2	C	26°26'35.21"S	27°17'26.53"E
Bend Point 3	D	26°26'14.39"S	27°17'25.96"E
Middle Point	E	26°25'47.76"S	27°17'15.00"E
End Point	F	26°25'24.30"S	27°18'20.70"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 PV array

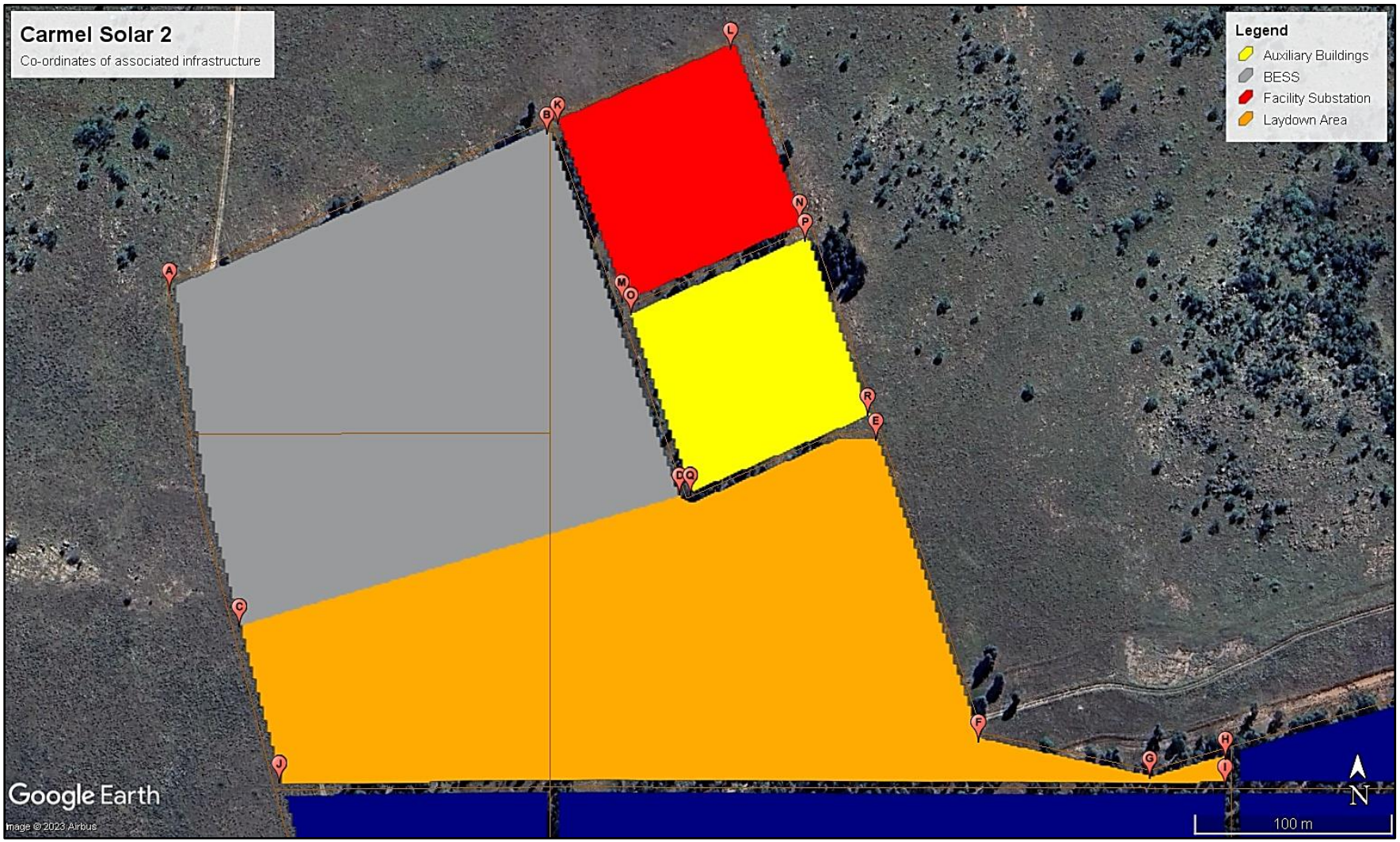


Figure 2.4: Co-ordinate points of associated infrastructure

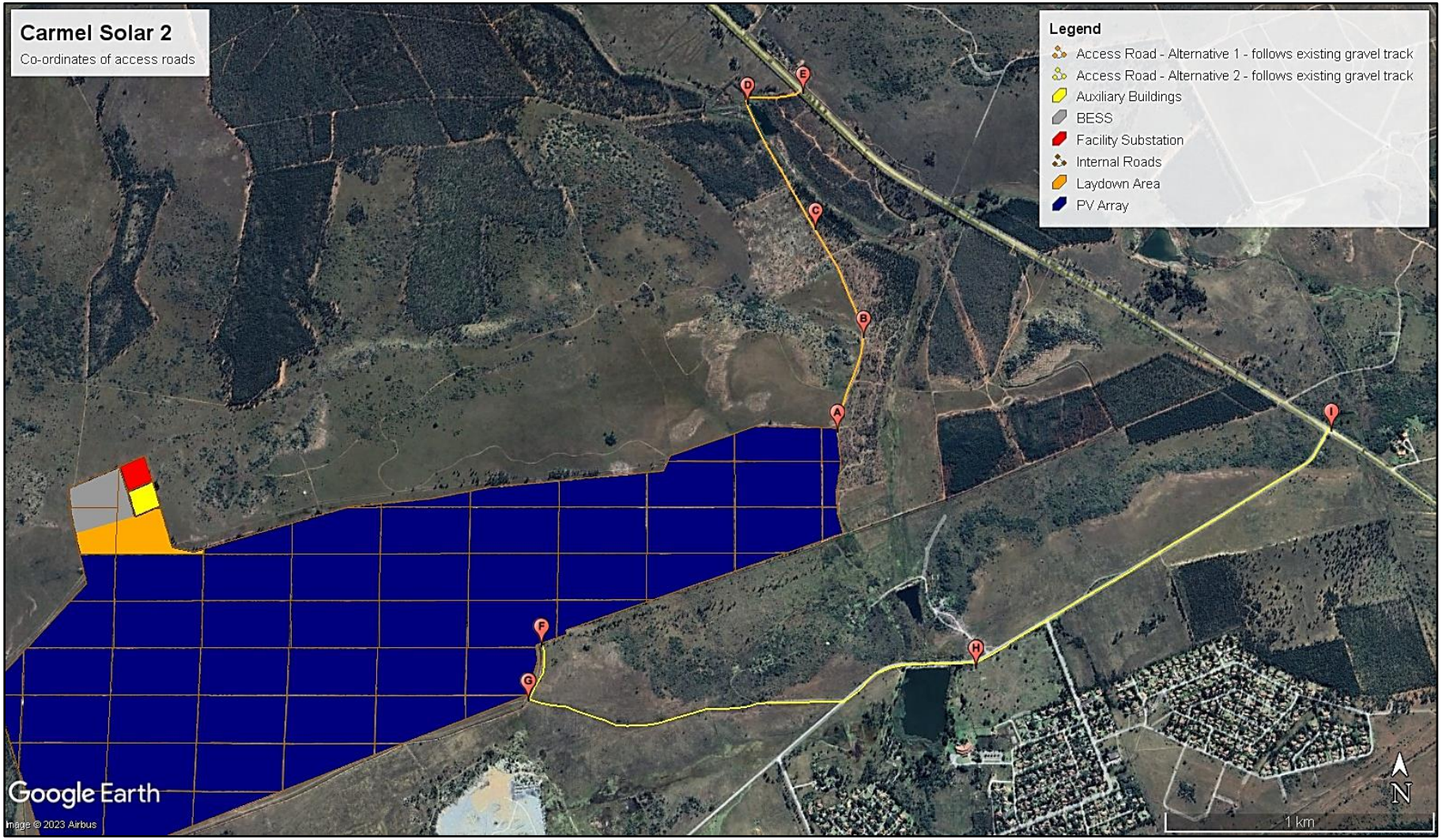


Figure 2.5: Co-ordinate points of access roads

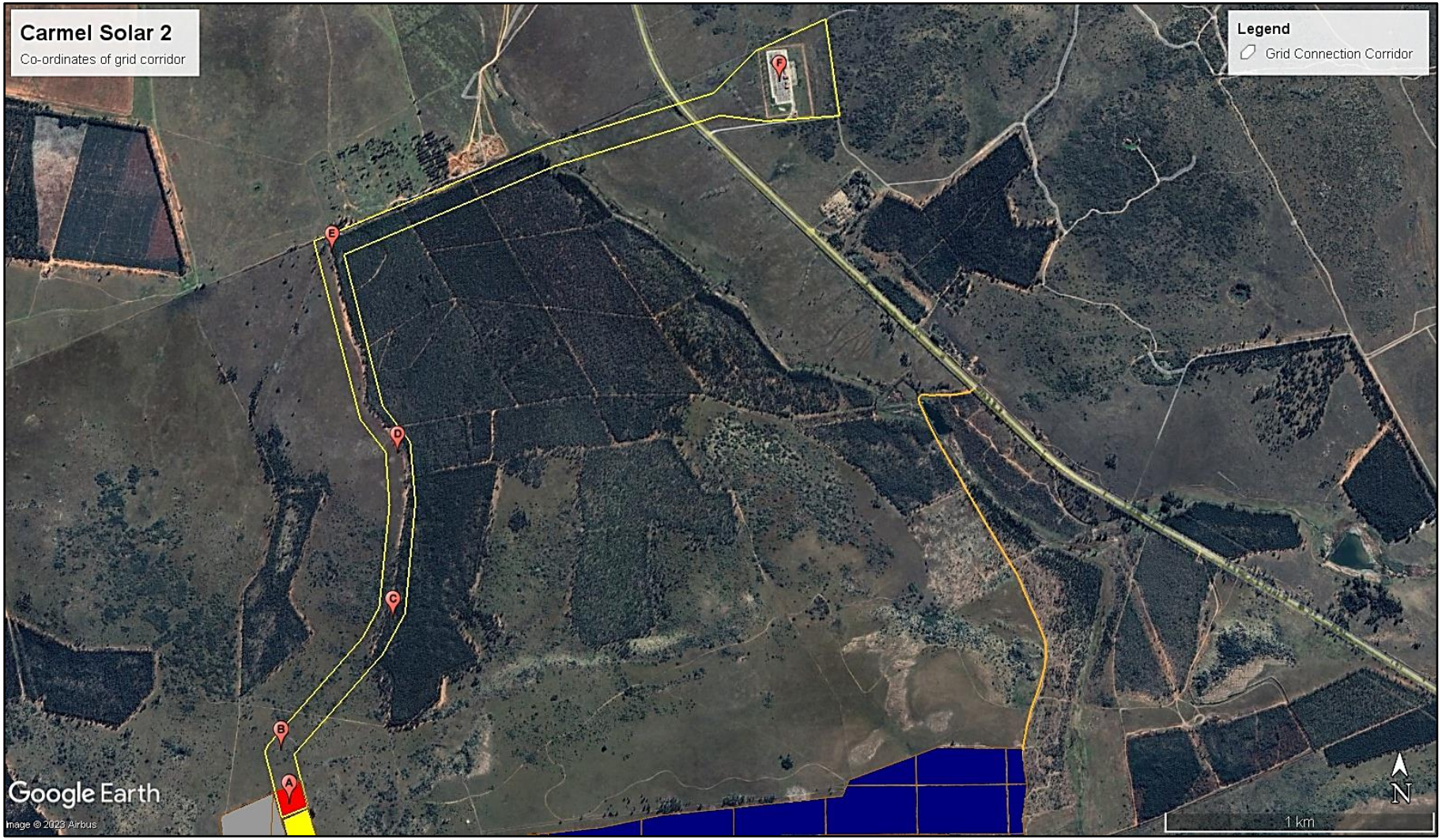


Figure 2.6: Co-ordinate points of grid corridor

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 34 100 kl. 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 tank/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)
- Gauteng Provincial Spatial Development Framework (PSDF) (2012)
- West Rand DM Integrated Development Plan (IDP) 2017 – 2021 (2017)
- Merafong City Local Municipality Integrated Development Plan 2020/2021 (2020)
- Merafong City Local Municipality Spatial Development Framework (2017)

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 Carmel 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 Gauteng Province	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.

	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 Carmel 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 Carmel 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 Gauteng Shale Mountain Bushveld (Svcb10) and Carletonville Dolomite Grassland (Gh15) vegetation units, associated with the upper reaches of the Mooirivierloop River (C23E) and Mooi River (C23G) catchments. 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 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 Water Use License (WUL); or • MEDIUM or HIGH, then the water user is excluded from General Authorisation (GA) and the water user is required to comply with the conditions of a WULA. Since the PV facility is located within 500 m of a watercourse, a GA is most likely to be followed. Furthermore, the grid infrastructure associated with the project will span over the channelled valley bottom wetland with pylons being located within the riparian area of watercourses. The existing access road that spans over the watercourse is most likely to be expanded to suit the project needs. The applicant has initiated the GA 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 waste management 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 Carmel Solar 2 PV facility with case reference number 20160, 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 E6, and the Palaeontological Impact Assessment is included as Appendix E7.
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. An Agricultural Compliance statement has been undertaken for the Carmel Solar 2 PV facility and is included as Appendix E5.
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. A Terrestrial Biodiversity Impact Assessment has been undertaken for the Carmel Solar 2 PV facility and is included in Appendix E2.

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 Carmel 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 Carmel 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 Carmel Solar 2 PV facility. 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 Carmel 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 Carmel 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 Carmel 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 Carmel 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 Carmel 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 Carmel 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 Carmel Solar 2 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 Carmel 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 were 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 Carmel 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.
Gauteng Provincial Spatial Development Framework (PSDF) (2012)	Gauteng Provincial Government	2012	The Gauteng Spatial Development Framework has a number of aspects that need to be taken into account when developing the SDF. In particular, this framework is, "*premised on building Gauteng as a City Region that allows agriculture to provide a link between rural and urban economic development, shaped by infrastructure led investment*". The framework seeks to: o Provide a clear future provincial spatial structure that is robust to accommodate growth and sustainability.

		○ Specify a clear set of spatial objectives for municipalities to achieve in order to ensure realisation of the future provincial spatial structure. ○ Propose a set of plans that municipalities have to prepare in their pursuit of these objectives. ○ Provide a common language and set of shared planning constructs for municipalities ○ to use in their planning processes and plans. ○ Enable and direct growth. In the Gauteng Spatial Development Framework (GSDF), the province outlines issues of population growth with a predicted population of 28 million people in the Gauteng City Region (GCR) by 2055 and therefore Gauteng requires a serious overhaul of its planning fundamentals to address the social, environmental and economic needs of an added 16 million people in the Gauteng province. The GSDF has mentioned that there are too many inadequacies and inequalities that exist in the present Gauteng economic system, and these are in many respects deeply embedded in failings in the spatial structure of the city region. In addition to the GSDF there are various policies and strategies that have been developed that provide direction to municipalities with regard to the type of developments to promote in the area. Some of these documents included the Integrated Energy Strategy, Green Economy Strategy, ICT Strategy and the Innovation Strategy. Although these strategies do not directly impact on the spatial development of the regions, it does provide some guidance with regard to the types of activities to be promoted. These strategies promote manufacturing related to the green economy, better use of broadband and fibre optic infrastructure that may facilitate developments such as BPO parks. The development of the Carmel Solar 2 PV facility is in-line with the framework based on the contributions and opportunities presented by a development of this nature.
West Rand District Municipality Integrated Development	West Rand District Municipality 2017	The long-term vision of the West Rand District Municipality (WRDM) is to: *"Integrating District Governance to achieve a better life for all".* The above stated vision defines what WRDM would like to attain over medium to long-term, and for that achievement to effectively materialize, their mission is: *"to provide an integrated and excellent developmental district governance system in the West Rand".*

Plan (IDP) 2017 – 2021 (2017)			The core values for the DM are set to be the following: o Service excellence; o Pride; o Integrity; o Responsibility; o Transparency; o Accountability; o Innovation; and o Teamwork The West Rand District Municipality lies to the west of Johannesburg, about 50 minutes from OR Tambo International Airport. It borders the North West Province and accessibility is easy from all major Gauteng centres. This region is a great base from which to explore this fascinating and ancient part of South Africa. The West Rand Region has a rich and diverse landscape with the lovely Magaliesberg Mountains forming the backdrop. Towns in the region include Krugersdorp, Randfontein; Westonaria and Carletonville. The development of the Carmel Solar 2 PV facility will contribute to the goals of the area, albeit to a limited extent.
Merafong City Local Municipality Integrated Development Plan (IDP)	Merafong City Local Municipality	2020/ 21	The Vision, Mission and Values were confirmed as follows. Vision: “A prosperous, Sustainable and Community-oriented City” Mission: “To provide quality services to our community through accountable governance” Values: “Integrity, Accountable, Committed, Teamwork, Proactive, Service excellence”. The Municipality towards building a South Africa that is united, non-racial, non-sexist democratic and prosperous in character. A clarion call by the National democratic revolution that dictates that we should develop concrete programmes to address poverty, to create jobs and grow an inclusive, productive economy to address the persisting problems of unemployment, poverty and inequalities through radical economic transformation.

			The development of the Carmel Solar 2 PV facility will contribute to the goals of the area, albeit to a limited extent.
Merafong City Spatial Development Framework 2019/2020 (SDF) (2017)	Merafong City 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 Merafong City Municipal Spatial Development Framework (MSDF), forms part of a hierarchy of plans feeding into the Integrated Development Plan (IDP). The Spatial Development Framework serves as an input into the IDP and concentrates on the spatial aspects of development planning, whereas the IDP focuses on broader developmental issues. During 2013 the Spatial Planning & Land Use Management Act (Act 16 of 2013) (SPLUMA) was promulgated this legislation puts forward principles to influence spatial planning, land use management and land development. It also provides for national and regional spatial frameworks as well as provincial and municipal frameworks, meaning that a package of plans will be undertaken from national to municipal level to direct spatial planning as well as land use management, while providing for uniform regulation of land use management. The general principles endorsed by this Act is that spatial planning, land use management and land development must promote and enhance five main Development Principles, namely Spatial Justice, Spatial Sustainability; Spatial Efficiency; Spatial Resilience, and Good Administration. The development of the Carmel 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 Carmel 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 Carmel 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 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 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 Gauteng 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 Merafong City Local Municipality is desirable as a large portion of households live within the poverty level (51%) which has an annual income of less than R38 200 (Merafong City IDP, 2020/2021).
- 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: 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 Carmel Solar 2 (Pty) Ltd in the Carletonville area to potentially establish the Carmel Solar 2 PV facility. From a local perspective Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118 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 has been 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. 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 are high sensitivity avifauna areas as well as the channelled valley bottom wetlands identified along the eastern boundary. 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.

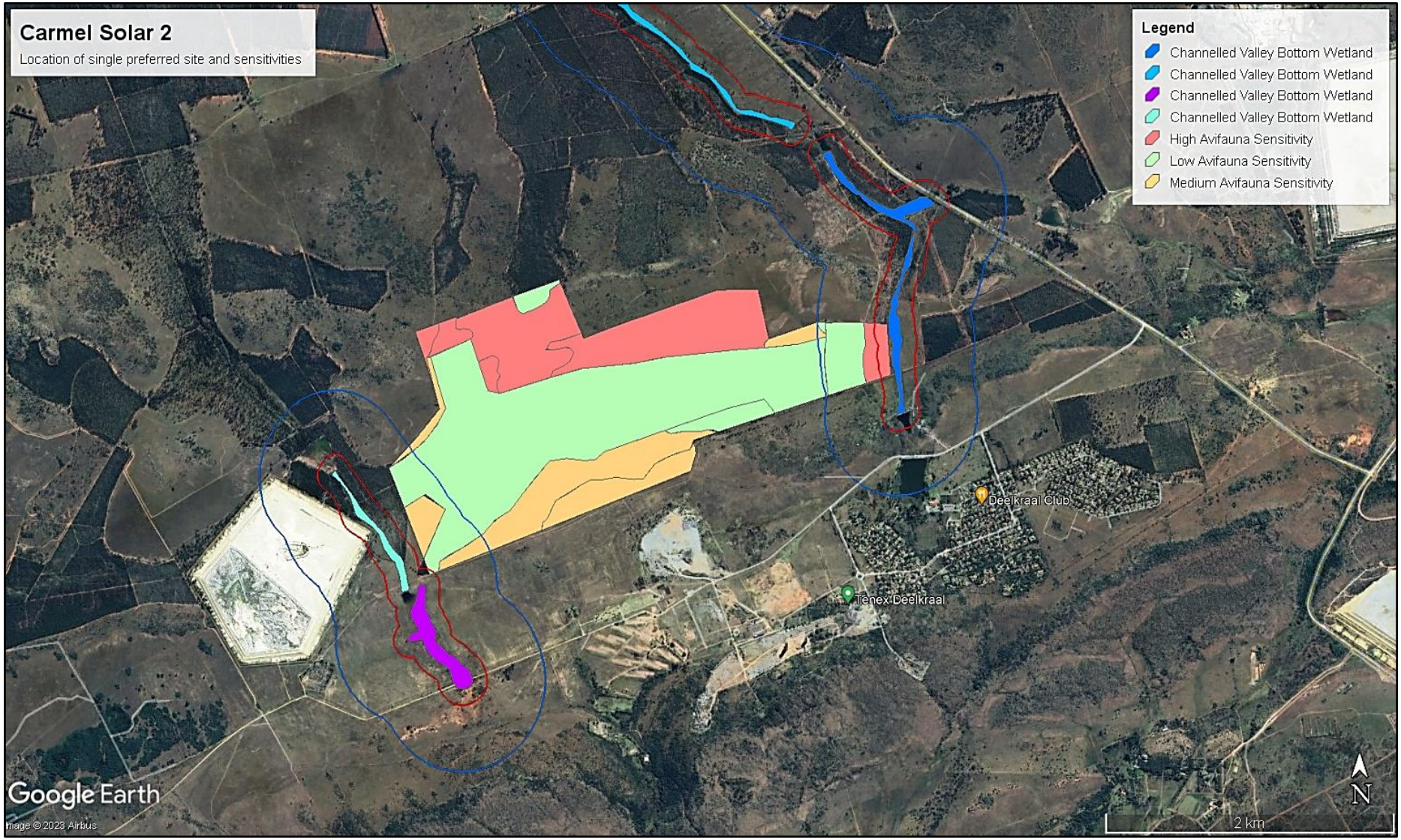


Figure 5.1: Location of the single preferred property alternative**.** Development footprint located within the assessment area.

5.1.3 Activity Alternatives

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

- Photovoltaic (PV) solar facility – Carmel Solar 2 (Pty) Ltd is part of a portfolio of solar PV projects throughout South Africa. Carmel 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 Carletonville 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.

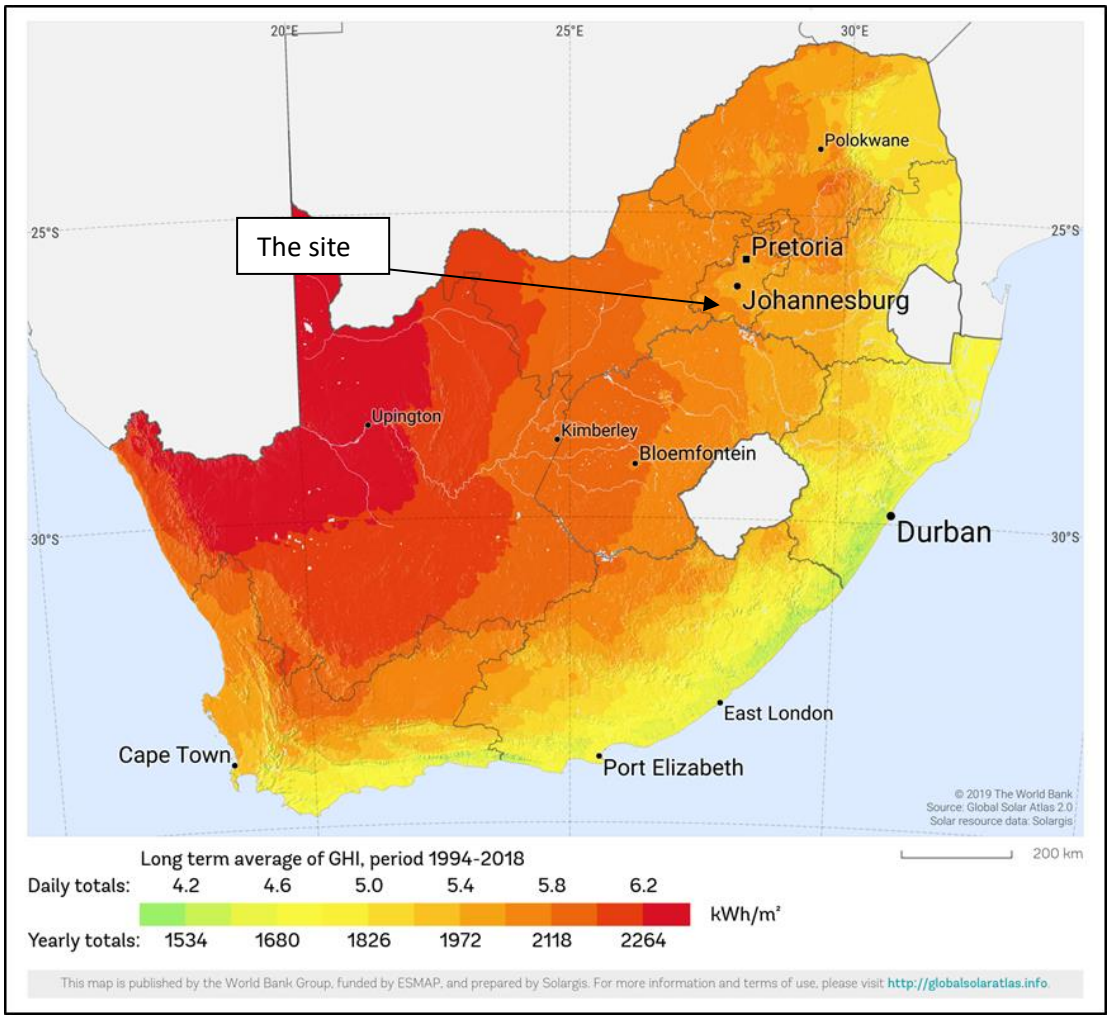


Figure 5.2: Global horizontal irradiation values for South Africa (Solar GIS, 2021) and the Carmel Solar 2 PV facility development footprint

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 I.

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 H1 to H5). 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 verification assessment (refer to Appendix D) was conducted using the DFFE National web-based screening tool as well as undertaking various specialised assessments on Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118 and the farm was 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. Two (02) access alternatives are presented:

- Alternative 1 – ~1.7 km in length
    - Alternative 1 is approximately 1.7 km in length and will follow an existing gravel track from the D92 District Road. Alternative 1 is the preferred alternative.

- Alternative 2 - ~4 km in length
    - Alternative 2 is approximately 4 km in length and will follow an existing gravel track from the D92 District Road.

The technically preferred alternative is the alternative 1 route from a development and technical perspective. The length of the access route is considerably shortened. This option provides the most technically sensible solution for the transportation of goods and services to and from the sites, including consideration of the road requirement for the transportation of the facility components. It is therefore requested that the preferred Alternative 1 be authorised for the developments. Refer to Figure 5.3.

Access points considered by the Developer are further highlighted in the Traffic Impact Assessment Report attached as Appendix E.

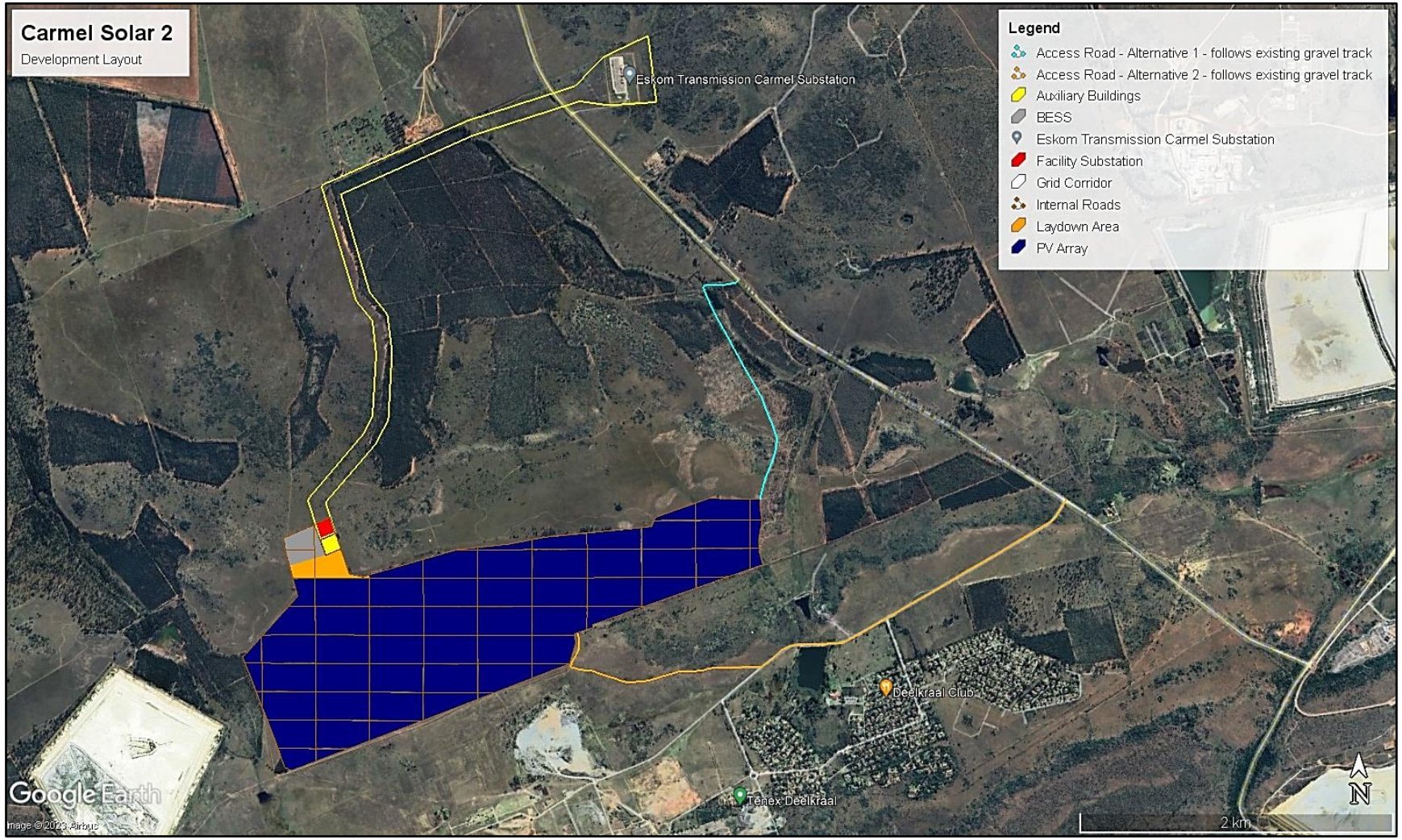


Figure 5.3: Final layout plan for the Carmel Solar 2 PV facility and grid infrastructure

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 132kV 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 Gauteng 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 choice of structure to be used for the powerline will be determined in consultation with Eskom once the Engineers have assessed the geotechnical and topographical conditions and decided on a suitable structure which meets the prescribed technical requirements. The choice of structures to be used will not have any adverse impacts on the environment. The line will be constructed according to the authorised standards for a power line approved by Eskom Holdings SoC Ltd.

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 as specified in the Eskom Specifications and best international practice. Based on all current technologies available, single circuit overhead power lines are considered the most environmentally practicable technology available for the distribution of power. This option is considered appropriate for the following reasons:
  - More cost-effective installation costs;
  - Less environmental damage during installation; 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, and there is sufficient justification, Eskom will consider the use of double circuit (placing 2 power lines on either side of the same tower structure) to minimise impacts. 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 in consultation with Eskom and 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. No defined structure has been confirmed at this stage and will depend on Eskom's technical requirements. The 132 kV line must be constructed according to the authorised standards for a power line approved by Eskom Holdings SoC Ltd. The structure to be utilised for the power line towers will also be informed by the local geotechnical and topographical conditions. The following alternatives are considered with regards to the proposed structures:

- Steel lattice towers - The steel lattice towers provide the following advantages over the other tower types available:
  - Enables multipath earthing which enhances the overall electrical performance of the 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.

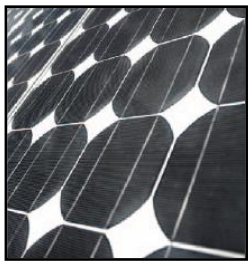
PV Panels:

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.

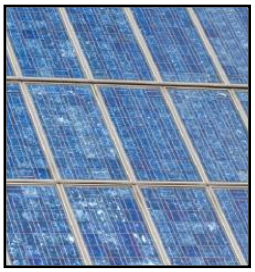
There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon and thin film. These technologies are discussed in more detail below:

- 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.



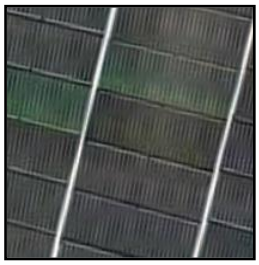
  - Poly-crystalline Silicon – poly-crystalline panels use solar cells that are cut from multifaceted silicon crystals. They are less uniform in appearance than mono-crystalline cells, resembling pieces of shattered glass. These are the most common solar panels on the market, being less expensive than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

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

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

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

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



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

- <u>Bifacial panels:</u>

  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.

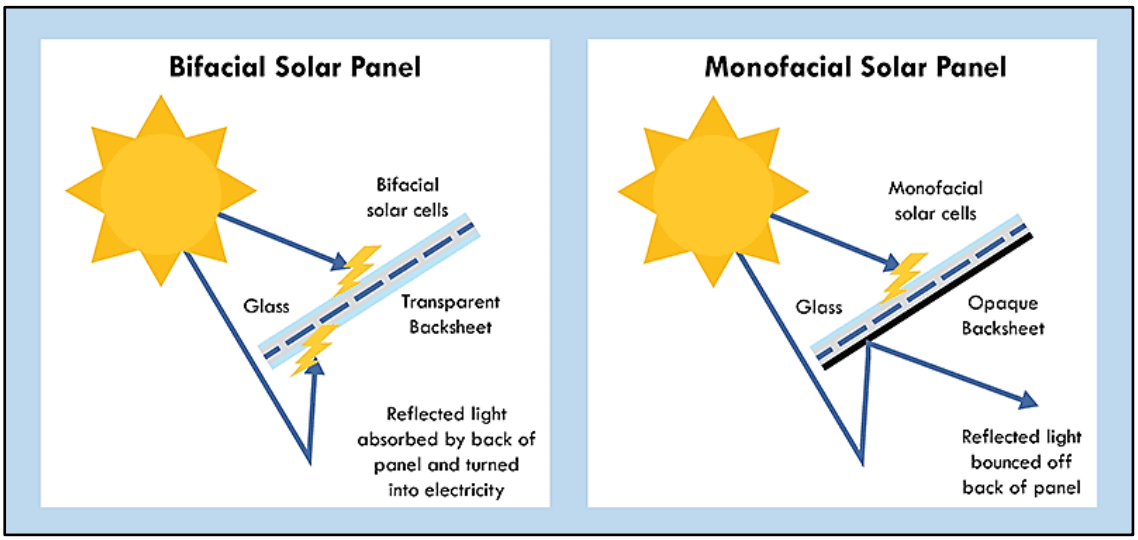


Figure 5.4: Bifacial vs Monoficial Solar Panel absorption

5.2 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 200 MW Carmel Solar 2 PV Facility on Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118; is the preferred option.

No other possible sites were identified for the Carmel 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 Carmel substation is located approximately 4.5 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 and the general area. 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.

Access roads are required during both the construction and operational phases of the development. Two (02) access alternatives are presented:

- Alternative 1 – ~1.7 km in length
    - Alternative 1 is approximately 1.7 km in length and will follow an existing gravel track from the D92 District Road. Alternative 1 is the preferred alternative.

- Alternative 2 - ~4 km in length
    - Alternative 2 is approximately 4 km in length and will follow an existing gravel track from the D92 District Road.

The technically preferred alternative is the alternative 1 route from a development and technical perspective. The length of the access route is considerably shortened. This option provides the most technically sensible solution for the transportation of goods and services to and from the sites, including consideration of the road requirement for the transportation of the facility components. It is therefore requested that the preferred Alternative 1 be authorised for the developments.

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 I). It may be concluded that this is the only location that will be assessed in further detail within sections 6 and 7.

5.3 PUBLIC PARTICIPATION PROCESS

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

5.3.1 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 anticipated impacts 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 60 cm x 42 cm) were erected on site on 14 October 2022 informing the public of the commencement of the S&EIR process. Photographic evidence of the site notices is included in Appendix C3.

- Newspaper advertisement

  An advertisement was placed in the Carletonville Herald on 10 November 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 14 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 14 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 14 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 14 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 14 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 14 February until 15 March 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 19 June 2023 and requested to provide their comments within 30 days (refer to Appendix C). The 30-day review and comment period is from 19 June 2023 up to and including 19 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.

5.3.2 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 C5 and C6.

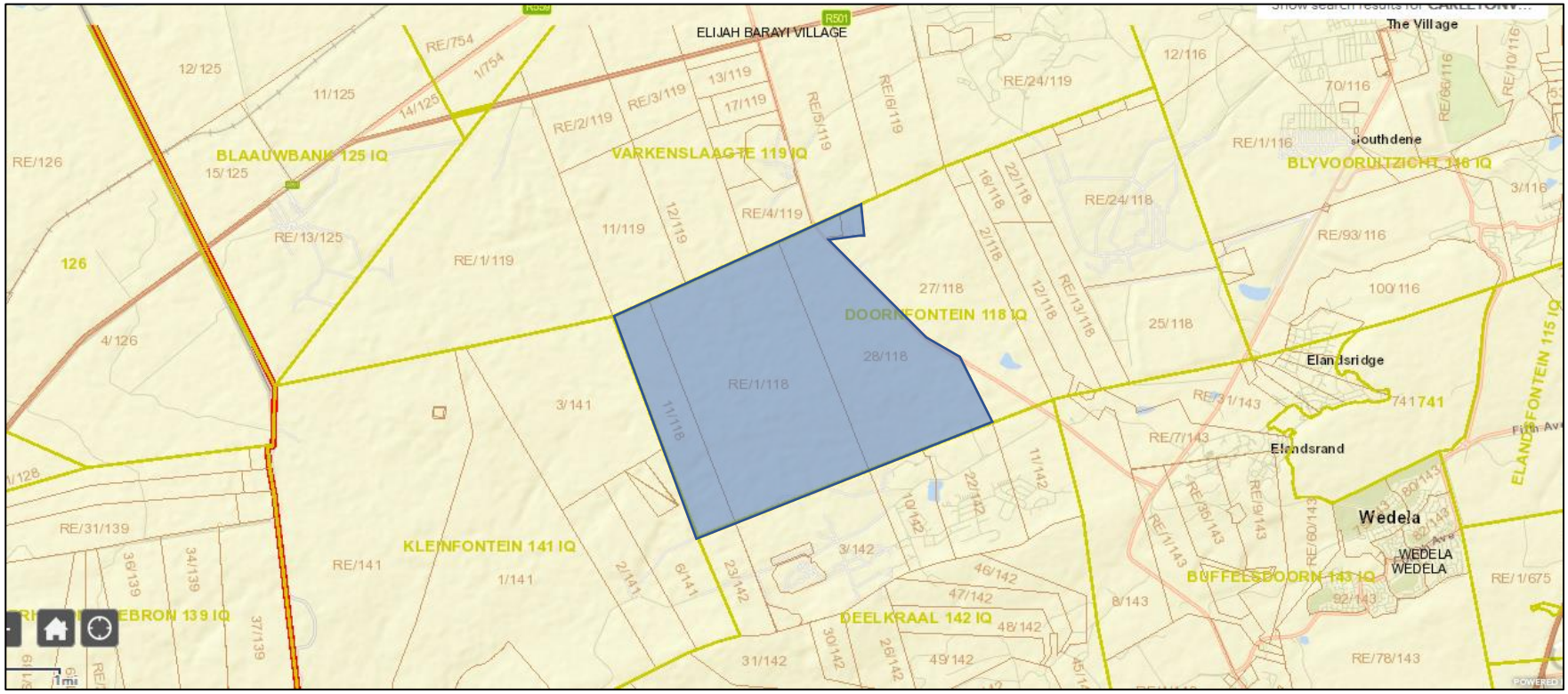


Figure 5.5: Affected properties (Blue) in relation to surrounding properties

5.3.3 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.

5.3.4 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.

5.4 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PREFERRED ALTERNATIVE

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

5.4.1 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.

The project site is currently mostly a combination of grassland and exotic woodlots. The majority of the solar PV area is within a previously cultivated area that currently contains secondary grassland, or exotic woodlots. The remaining areas are natural grassland. The site is located within cattle farming agricultural region. The predominant land use on the site and immediate surrounds is Eucalyptus plantations with some cattle grazing. There is no infrastructure on site, except for jeep tracks for access. An unknown tributary comprising of several Channelled Valley Bottom wetlands exists along the eastern boundary of the site. These features are described are described in more detail below.

5.4.1.1 Climate

The site has a summer rainfall with a mean annual rainfall of approximately 591 mm and a mean annual evaporation of approximately 1,355 mm (Schulze, 2009). The site is situated on hilly terrain at an altitude of around 1,565 metres and average slopes of approximately 4%. The geology is shale, slate and quartzite of the Pretoria Group with interlayered diabase sills and Hekpoort lava. Chert, dolomite, Black Reef quartzite, grit and shale occurs in places. Most of the site is on land type, Fb15 but the lower part also includes land type Fa14. The site is dominated by loamy soils limited in depth by underlying bedrock. Dominant soil forms are Hutton, Mispah and Glenrosa. Rock outcrops are common. Due to their limited depth, such soils have insufficient moisture capacity to reliably carry a crop through the season. Some deeper soils are likely to occur in places but will be of insufficient size and separated by shallow soils and rock outcrops so that they are not viable for crop production.

5.4.1.2 Geology

According to the Desktop Geotechnical study (Appendix E10), the general geology of the area comprises late Archean to early Proterozoic metasediments of the Transvaal Supergroup. The Carmel Solar 2 site is almost exclusively underlain by quartzites, shales, ferruginous shales, hornfels, chert breccia and conglomerates of the basal Rooihoogte Formation; Pretoria Group. The Transvaal metasediments have been intruded by igneous diabase rocks which appear to underly the Carmel Solar 2 site. According to the geological map, the extreme north western corner of the site comes close to the contact with the Malmani Formation dolomites of the Chunniespoort Group. Refer to Figure 5.6 for the Geological plan.

The Malmani Subgroup is divided into five formations based on the relative composition of cherts, stromatolites, limestones and shales. Geological mapping in this area would be required to confirm whether the contact lies within the Carmel Solar 2 site as these rocks are potentially high risk. Much younger quaternary aged surficial transported and residual soils are likely to occur overlying these rocks.

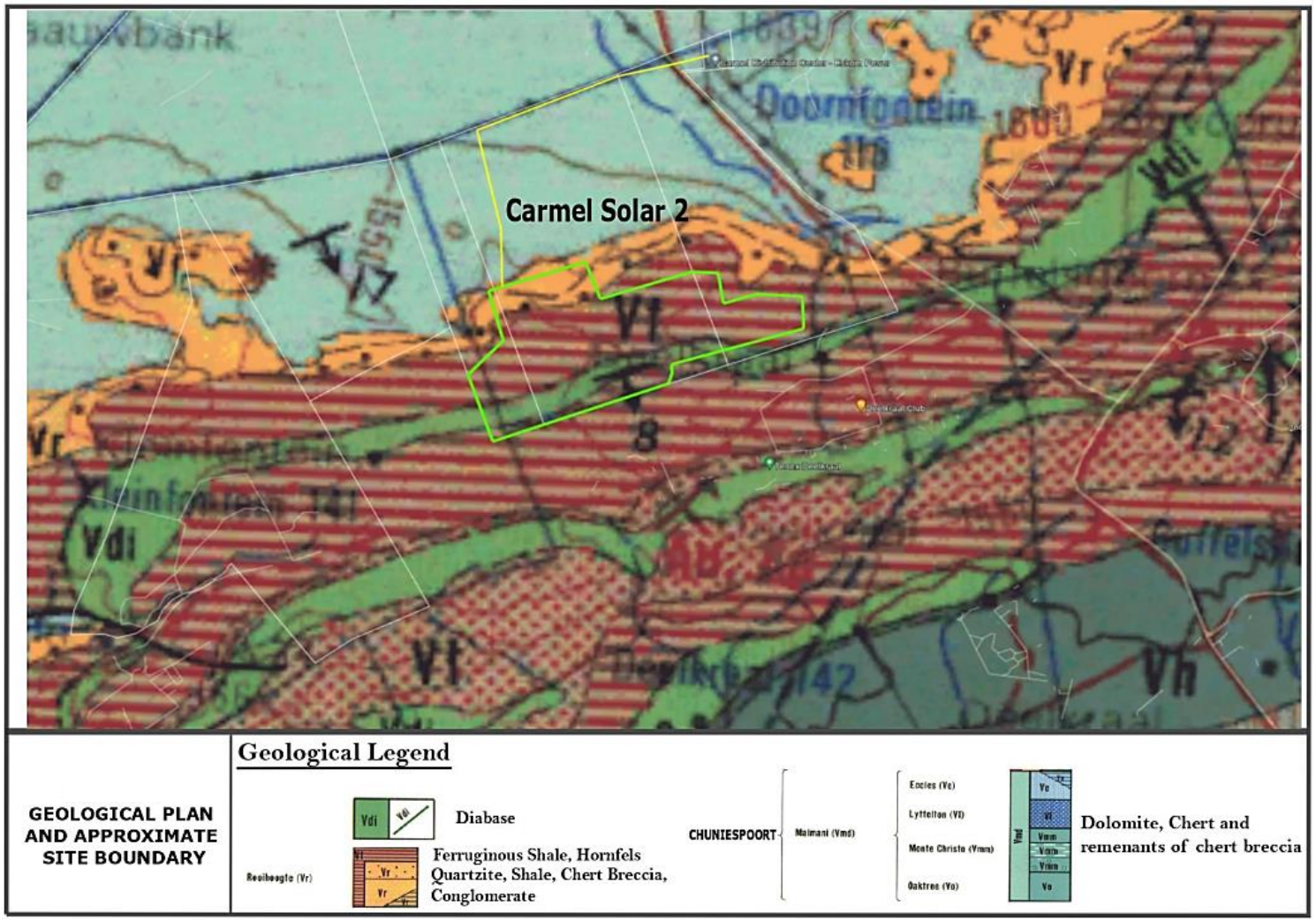


Figure 5.6: Geological plan

5.4.1.3 Topography

Topographically the area is relatively flat to slightly undulating at Turffontein and Varkenslaagte Solar sites (assessed via individual S&EIR processes) located to the relative north. While southward the terrain gradually increases and becomes more undulating towards the hills that skirt the southern boundaries of Carmel Solar 1 to 3 sites (assessed via individual S&EIR processes). Satellite imagery indicates large stands of man-made, presumably exotic forests, which overlie the proposed Carmel Solar 1 to 3 and Varkenslaagte Solar development sites while the remaining land surface over all the sites is dominated by veld grasses and shrubs (likely grazed by livestock), and bisected by an array of internal farm dirt roads. Satellite imagery also indicates sporadic rock outcrop as well as red soils indicated by shallow excavations. Besides the non-perennial river skirting the eastern boundary of Carmel Solar 1 site, no significant drainage lines seem to be present, however where the topography increases particularly in the south, at least minor drainage lines are to be expected.

5.4.1.4 Soils and Agricultural Potential

According to the Agriculture Compliance Statement (attached in Appendix E5), 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.

A generally reliable indication of soil cropping potential, or soil capability, is historical land use because the suitable versus the unsuitable soils get identified over time through trial and error. None of the land across the site has been used for crop production within the period covered by historical imagery available on Google Earth, which is eighteen years. This is further evidence that the site is highly unlikely to be suitable for viable crop production.

The agricultural sensitivity is a direct function of the capability of the land for agricultural production. All arable land that can support viable crop production, is classified as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable crop production is much less of a priority to conserve for agricultural use and is rated as medium or low agricultural sensitivity.

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.

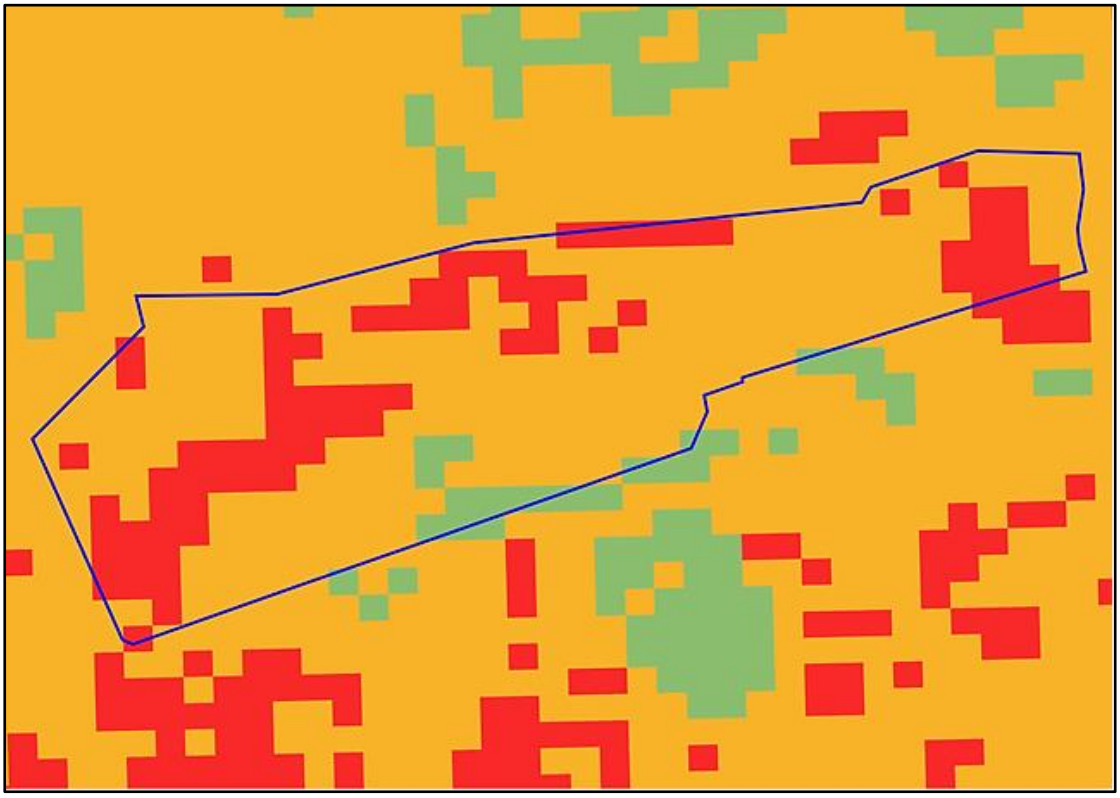


Figure 5.7: Agricultural sensitivity of the development footprint as per the results of the DFFE screening tool (Appendix B)

Based on Figure 5.7. above, none of the land is classified as cropland and agricultural sensitivity on the screening tool is therefore purely a function of land capability. The classified land capability of the sites is predominantly 7 to 9, but ranges from 5 to 9. 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, values of 6 to 8 translate to a medium agricultural sensitivity and values of 9 to 10 translate to a high agricultural sensitivity.

The land across the site is assessed as being unsuitable for viable crop production. According to the land type data confirmed by the site sensitivity verification, the site is dominated by soils limited in depth by underlying bedrock. Due to their limited depth, such soils have insufficient moisture capacity to reliably carry a crop through the season.

A land capability rating of ≥8 denotes land that is suitable for viable rain fed crop production. The land capability of this site is assessed as being < 8 due to the soil depth limitations and resultant lack of suitability for viable crop production. The high agricultural sensitivity of part

of the site, as identified by the screening tool, due to a classified land capability of up to 9, is therefore disputed by this assessment.

This site sensitivity verification verifies the entire site as having a land capability of less than 8 and therefore being of medium agricultural sensitivity. The required level of agricultural assessment is therefore confirmed as an Agricultural Compliance Statement.

5.4.1.5 Terrestrial Ecology

According to the Terrestrial Biodiversity Assessment (attached in Appendix E2), the study area falls within the grassland biome. The Grassland Biome in South Africa occurs mainly on the high central plateau (Highveld), the inland areas of the eastern seaboard, the mountainous areas of KwaZulu-Natal and the central parts of the Eastern Cape. The topography is mainly flat to rolling, but also includes mountainous regions and the Escarpment. The temperate grasslands of southern Africa occur where there is summer to strong summer rainfall and winter drought. The rainfall may vary spatially from 400 – 2 500 mm per year and corresponds to the amount of rainfall found in other parts of the world where similar vegetation is found. Frost is a common phenomenon; the coldest periods (June–August) are exacerbated by aridity or along an increasing elevation gradient. Fog is found on the upper slopes of the Great Escarpment and seaward scarps, which support hygrophilous mistbelt vegetation. The biome has high lightning flash densities, making the incidence of lightning-induced fire a relatively high likelihood (Mucina & Rutherford, 2006).

Grasslands are structurally simple and strongly dominated by grasses (Poaceae). The canopy cover is moisture-dependant and decreases with lower mean annual rainfall, but is influenced by the amount and type of grazing and by the presence of fire. Minimum temperature plays a decisive role in structurally distinguishing temperate grasslands from those where frosts are rare (Walker 1993). Woody species, where they occur, are limited to specialised niches/habitats. Forbs form an important component of grasslands and, although not usually dominant, probably contribute more to the species richness of grasslands than grass species do (Mucina & Rutherford, 2006).

Regional Vegetation Patterns

There are two regional vegetation types occurring on site, namely Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld. Refer to Figure 5.8. below.

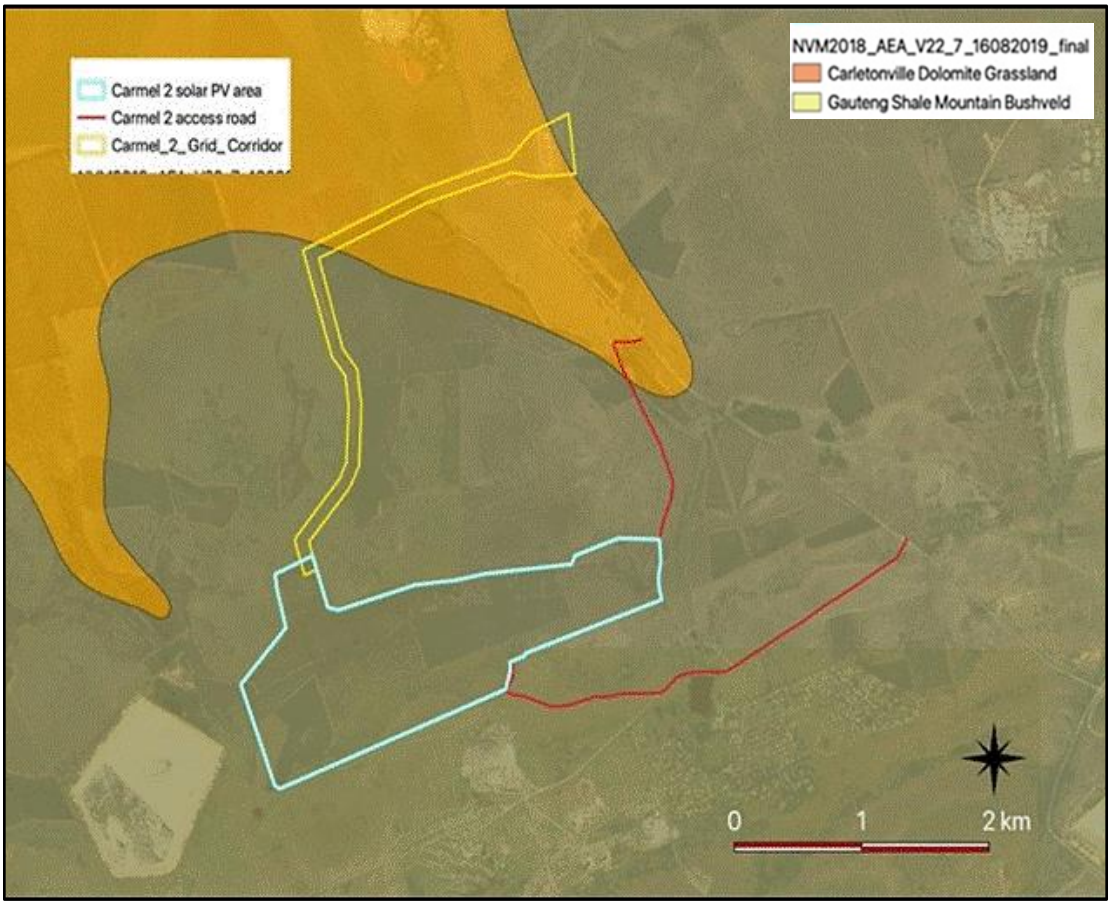


Figure 5.8: Regional vegetation types of the study area

Carletonville Dolomite Grassland

Found in North-West (mainly) and Gauteng and marginally into the Free State Province. It is found in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province. It is found at an altitude range of 1 360 – 1 620 m, but largely from 1 500 – 1 560 m. The vegetation type occurs on slightly undulating plains dissected by prominent rocky chert ridges. It is generally a species-rich grassland forming a complex mosaic pattern dominated by many species. Dolomite and chert of the Malmani Subgroup (Transvaal Supergroup) supporting mostly shallow Mispah and Glenrosa soil forms typical of the Fa land type, dominating the landscapes of this unit. Deeper red to yellow apedal soils (Hutton and Clovelly forms) occur sporadically, representing the Ab land type. It occurs in warm-temperate, summer-rainfall region, with overall MAP of 593 mm. Summer temperatures high. Severe frequent frost occurs in winter.

Gauteng Shale Mountain Bushveld

Gauteng and North-West Provinces: Occurs mainly on the ridge of the Gatsrand south of Carletonville–Westonaria–Lenasia. Also occurs as a narrow band along the ridge that runs from a point between Tarlton and Magaliesberg in the west, through Sterkfontein, Pelindaba, Atteridgeville to Klapperkop and southeastern Pretoria in the east. Altitude 1 300–1 750 m. it

occurs in low, broken ridges varying in steepness and with high surface rock cover. Vegetation is a short (3–6 m tall), semi-open thicket dominated by a variety of woody species. Dominated by shale and some coarser clastic sediments as well as significant andesite from the Pretoria Group (Transvaal Supergroup), all sedimentary rocks. A part of the area is underlain by Malmani dolomites of the Chuniespoort Group (Transvaal Supergroup). Soils are mostly shallow Mispah, but are deeper at the foot of the slopes. Land type is mostly Fb, with some Ib. It occurs in areas with summer rainfall with very dry winters. MAP 600 – 750 mm, increasing from west to east as well as with higher elevation. Frost frequent, higher in the west and south.

Conservation Status of Vegetation Types

Neither vegetation type is listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011). This status is the same for the National Biodiversity Assessment 2018 (Skowno et al. 2019). It is therefore verified that the site does not occur within any Listed Ecosystem, as listed in The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011) and therefore has LOW sensitivity with respect to this attribute.

Plant species that are Flagged for the Site

There are two plant species flagged for the site in the DEA Online Screening Tool output, one of which is listed as a sensitive species; therefore, their names and detail may not be provided here. The species occur in natural grassland. However, it was not found on site, despite a careful search in suitable areas of habitat.

The other species, *Khadia beswickii*, listed as Vulnerable, is found on shallow soil over rocks in grassland. Suitable habitat occurs on site but no individuals were found there.

There are no known additional listed species from further afield with a geographical distribution that may include the site.

Protected Trees

Tree species protected under the National Forest Act are listed in Appendix 2 of the Plant Species Compliance Statement. There are three that have a geographical distribution that includes the study area, *Boscia albitrunca* (Shepherd's Tree/Witgatboom/!Xhi), *Vachellia erioloba* (camelthorn), and *Pittosporum viridiflorum*.

None of these were found on site. Based on the detailed search of the site, it is considered unlikely that any occur there.

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).

A small number of declared alien invasive species were found on site. These are listed in Appendix 1 of the Plant Species Compliance Statement.

Biodiversity Conservation Plans

Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for ecosystems, species or ecological processes. CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species. The definitions for CBAs are (SANBI 2018):

- CBA 1: Areas that are irreplaceable for meeting biodiversity targets. There are no other options for conserving the ecosystems, species or ecological processes in these areas (SANBI 2018).
- CBA 2: Areas that are the best option for meeting biodiversity targets, in the smallest area, while avoiding conflict with other land uses.

The Gauteng C-Plan version 3.3 classifies the natural vegetation of the province according to conservation value in decreasing value, as follows:

- Protected
- Irreplaceable
- Important
- Ecological Support Area

According to the Gauteng Conservation Plan, a part of the site on the western side (most remaining areas of natural grassland) is mapped as "Important Area". The powerline corridor also passes through this area mapped as "Important Area". This indicates that some parts of the site are important for maintaining biodiversity patterns.

It is assumed that the terms “Irreplaceable” in the Gauteng C-Plan is equivalent of a CBA 1 and “Important” refers to a CBA 2. As such, a very small portion of the site falls within a CBA 2 area.

Note that the purpose of the specialist study, as undertaken here, is to verify whether the vegetation on site meets the standards for inclusion in a conservation zone or not. Provincial-level conservation assessments make use of remote methods for mapping and do not ground-truth all locations. It is necessary to verify on the ground whether there is natural habitat.

This desktop description verifies that the site is included in conservation zones and that an on-site assessment is required to verify the sensitivity of the site with respect to this attribute. The field assessment and sensitivity mapping confirm that these zones are in a natural state and therefore valid.

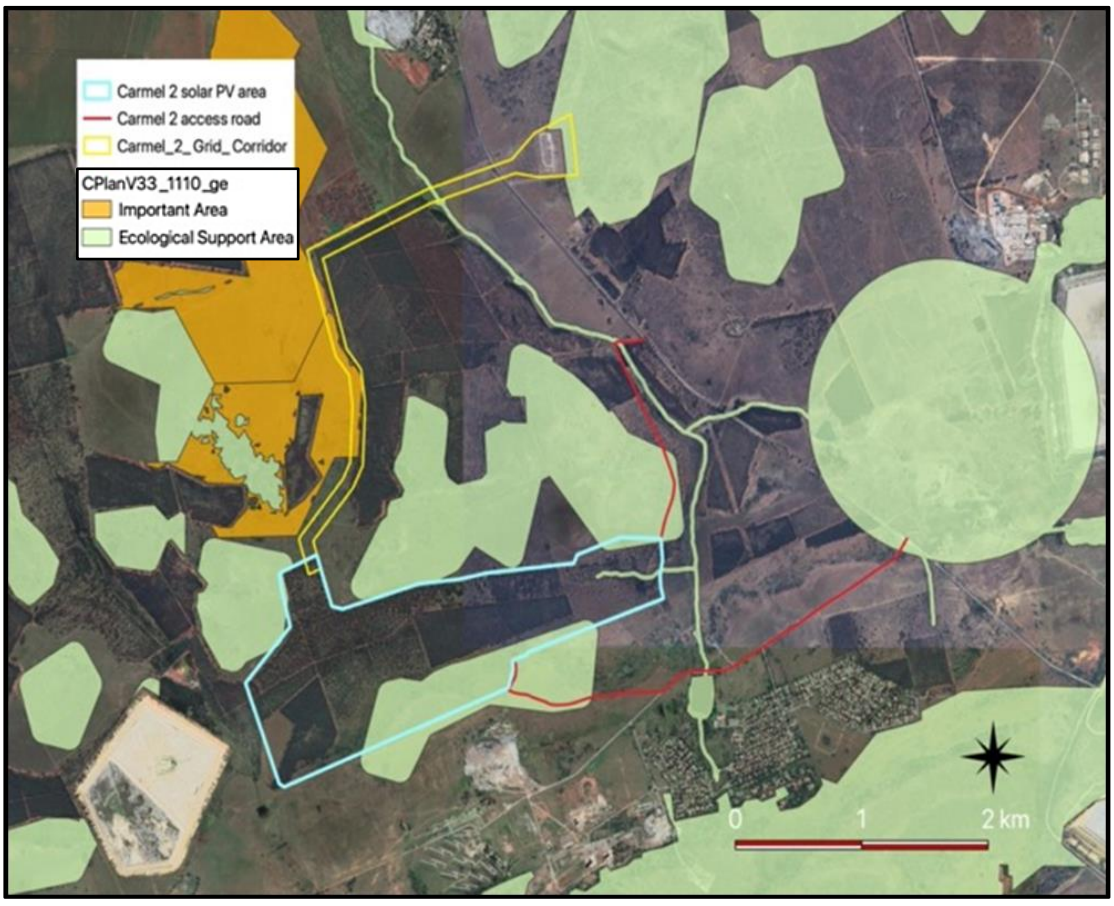


Figure 5.9: Gauteng CBA map for the study area

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

According to the NPAES 2018, a very small portion of the site (specifically the grid corridor) has been identified as a NPAES Priority Focus Areas (FA) for inclusion in future protected areas:

- This FA covers an area of approximately 808 ha.
- The project site is approximately 328 ha of which ~10 ha occur within a FA.
- The project site is located on the edge of the FA.

- Thus, the project site covers less than 1% of the FA.
- There will be direct loss of this FA, however, due to the size and location of this SEF, direct impact on this FA can be regarded as negligible and will not impact the conservation targets set out for this FA.

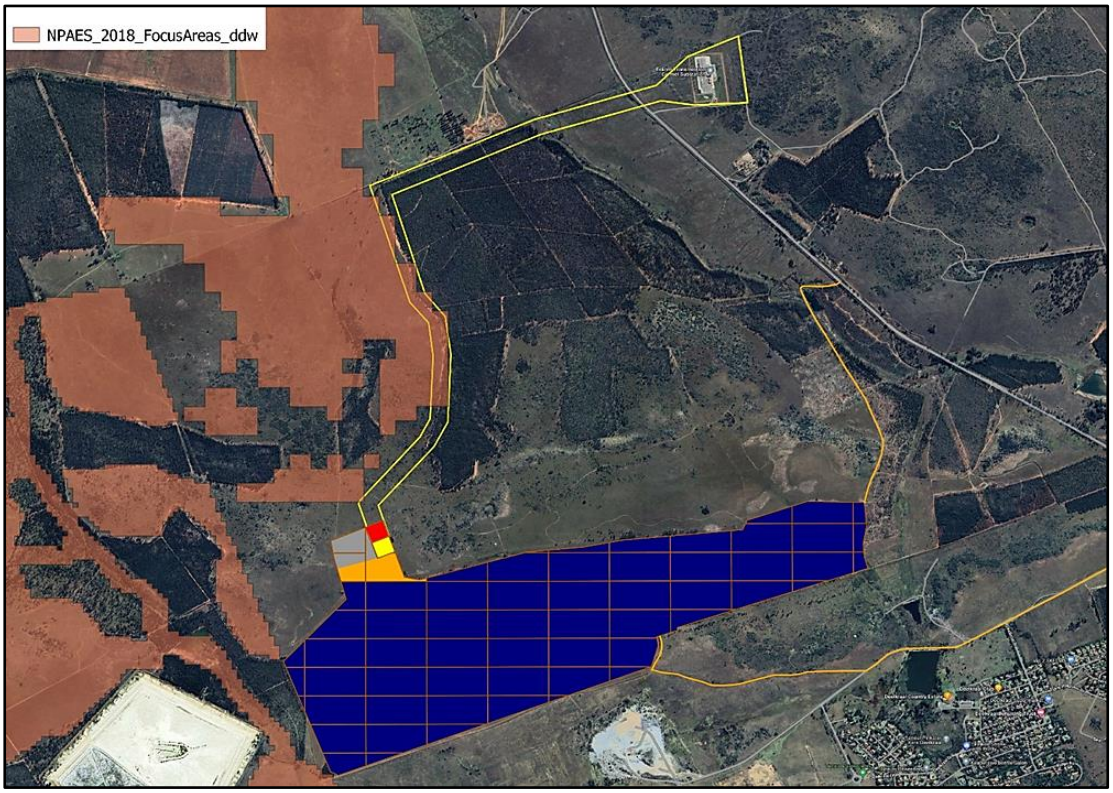


Figure 5.10: Site proximity to NPAES FAs

Habitats on site

A broad classification of the habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

1. Natural grassland (open grassland with original natural species composition);
2. Woodland (mostly thorn savanna with a diversity of broad-leaved shrubs included).

Transformed and degraded areas:

3. Alien trees (primarily formal woodlots, but also scattered escapees);
4. Wetlands (Channelled Valley Bottom wetlands with wetland-related vegetation).

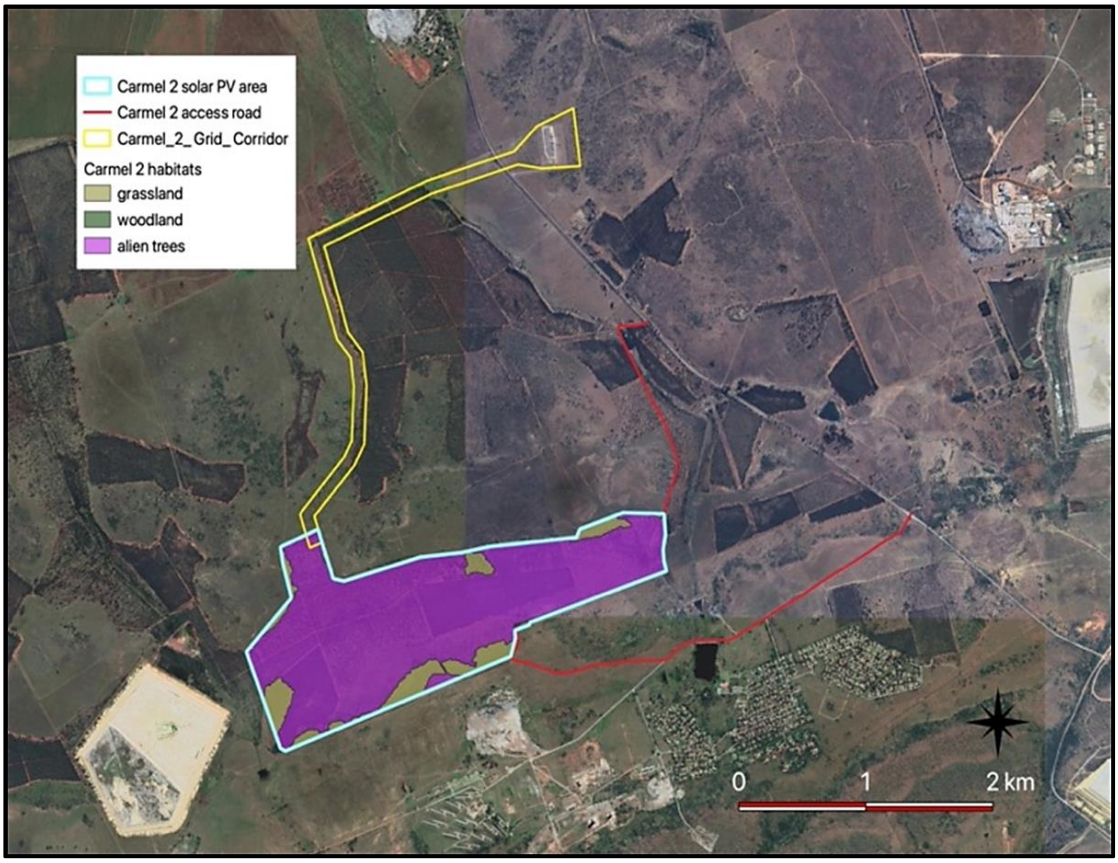


Figure 5.11: Main habitats of the study area

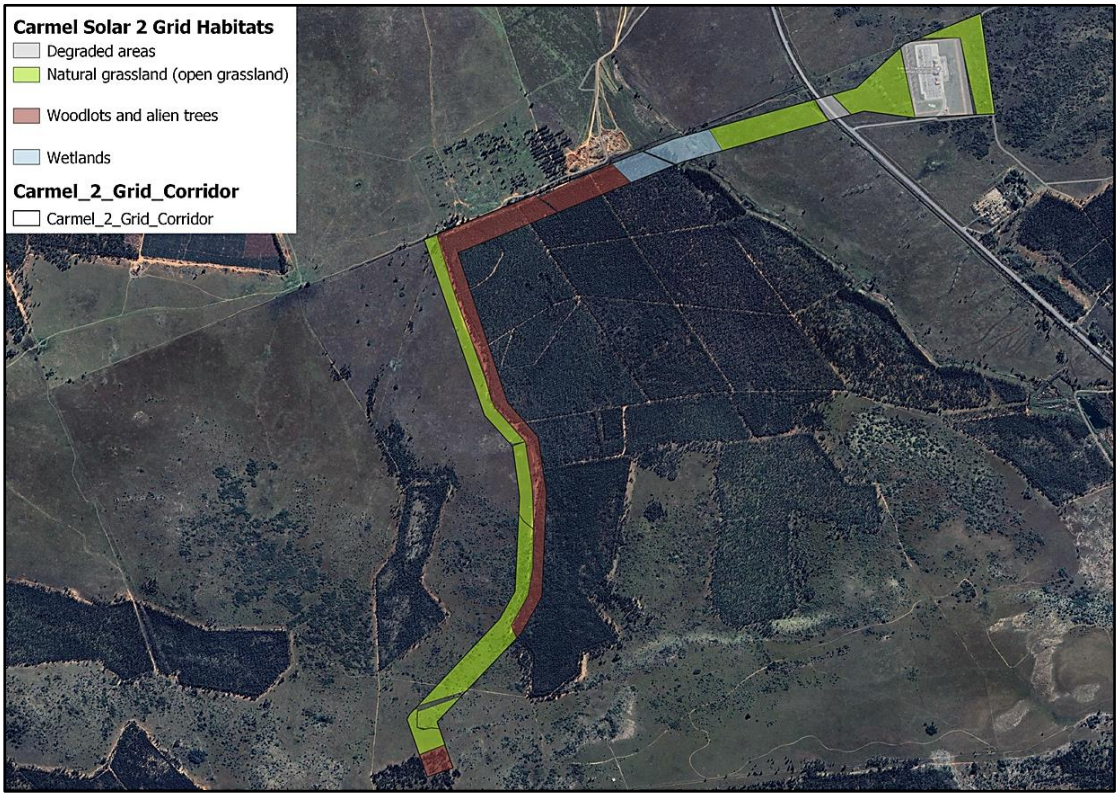


Figure 5.12: Main habitats of the grid corridor

Site Ecological Importance

The Species Environmental Assessment Guidelines (SANBI 2020) require that a Site Ecological Importance is calculated for each habitat on site, and provides methodology for making this calculation.

1. Natural grassland (open grassland);
2. Old lands (secondary grasslands on old lands);
3. Woodlots and alien trees;
4. Wetlands.

As per the Species Environmental Assessment Guidelines (SANBI 2020), Site Ecological Importance (SEI) is calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts (SEI = BI + RR). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. BI = CI + FI. The results are detailed in Table 5.1.

Table 5.1: SEI for habitats found on site

Habitat	Conservation importance	Functional integrity	Receptor resilience	Site Ecological Importance (BI)
Natural grassland	Low Natural habitat of LC ecosystem type - no level set in Ecosystem Guidelines - this is next lowest level after VU ecosystem.	Medium Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. (Chrissiesmeer Panveld is listed as EN) BUT Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.	Low Habitat that is unlikely to be able to recover fully after a relatively long period - based on the fact that, for most of the project, soil disturbance will not take place therefore potential for recovery is greater than for projects where significant soil works are undertaken.	Medium (BI = Low)
Natural woodland	Low Natural habitat of LC ecosystem type - no level set in Ecosystem Guidelines - this is next lowest level after VU ecosystem.	Medium Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. (Chrissiesmeer	Low Habitat that is unlikely to be able to recover fully after a relatively long period - based on the fact that, for most of the project, soil	Medium (BI = Low)

		Panveld is listed as EN) BUT Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.	disturbance will not take place therefore potential for recovery is greater than for projects where significant soil works are undertaken.	
Woodlots and alien trees	Low No natural habitat remaining.	Very low Several major current negative ecological impacts.	High Habitat that can recover relatively quickly (5-10 years) to restore >75% to restore the original species composition and functionality	Very low (BI = Very low)
Wetlands	Low Possibly natural habitat of LC ecosystem type in moderately poor condition - no level set in Ecosystem Guidelines - this is lowest level above "no natural habitat remaining".	Low Several minor and major current negative ecological impacts.	Medium Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	Low (BI = Low)

The habitat sensitivity based in Table 5.1. translates into Figure 5.13 and Figure 5.14 below.

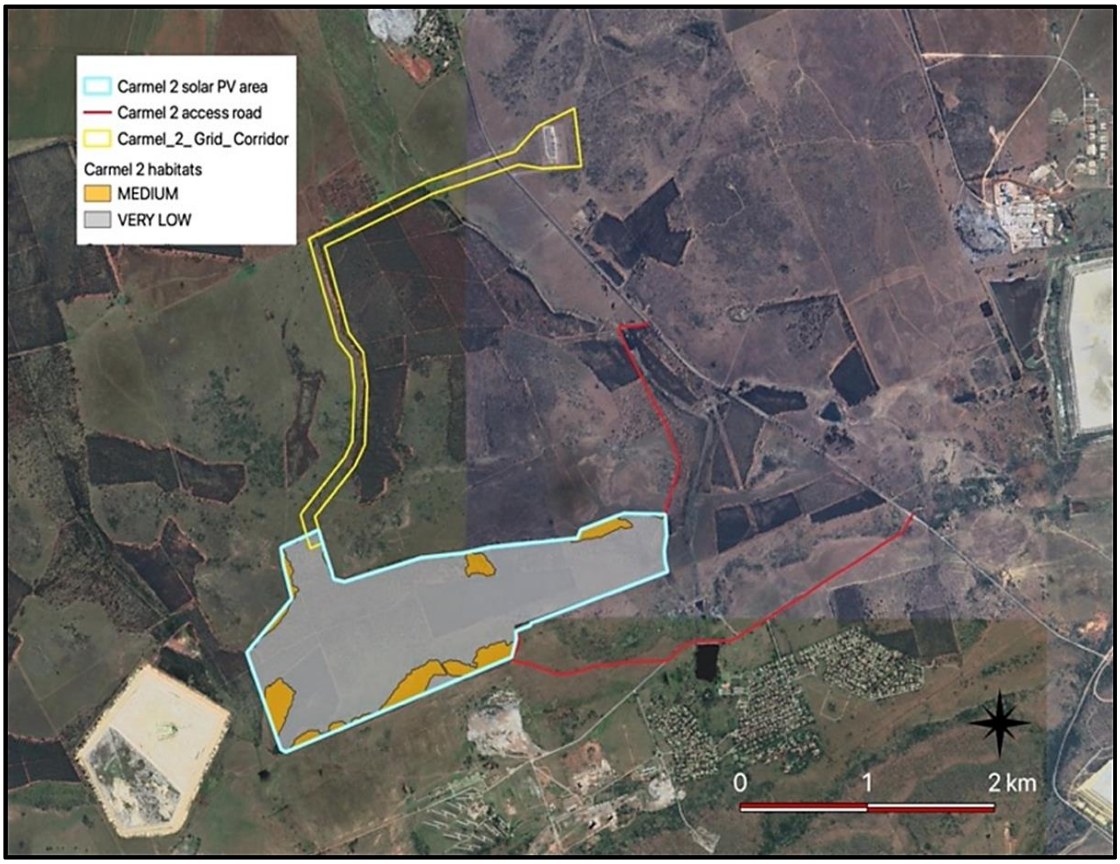


Figure 5.13: Habitat sensitivity of the study area based on Site Ecological Index

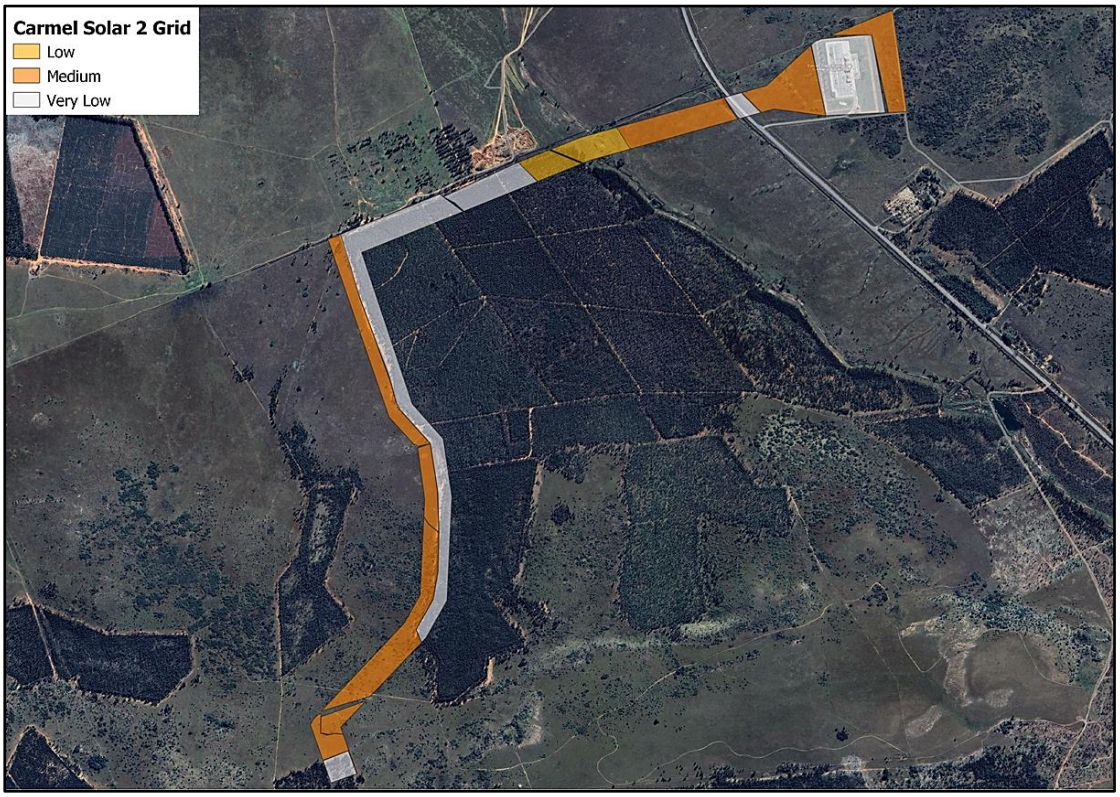


Figure 5.14: Habitat sensitivity of the grid corridor based on Site Ecological Index

The project study area consists significantly of exotic woodlots along with a band of natural grassland and woodland habitat. Existing impacts on natural habitat are related to planting of formal woodlots. The proposed project could potentially have significant effects on areas of natural habitat, even though Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld are not listed in the National Ecosystem List. Natural areas are avoided as far as practicably possible. On the basis of low to medium significance the proposed development layout can be authorised provided that the mitigation measures listed within the terrestrial report is implemented.

5.4.1.6 Wetlands and Riparian Features

According to the Aquatic Ecological Assessment (Appendix E1), the greater study area (20 km radius) was dominated by three major types of natural aquatic features and a number of artificial barriers associated with catchments and rivers, characterised as follows:

- Watercourses with Channelled Valley Bottom Wetlands;
- Grassland seepages areas; and
- Depressions, dominated by grass species.

The artificial barriers included dam, weirs and voids (pits) created by previous mining activities.

The study area (PV site) was situated predominantly within the Gauteng Shale Mountain Bushveld (Svcb10) and Carletonville Dolomite Grassland (Gh15) vegetation units, associated with the upper reaches of the Mooirivierloop River (C23E) catchment (Figure 5.15).

The site contains an unknown tributary, in which several Channelled Valley Bottom wetlands were observed. As the study area is largely on a karst system (dolomites/limestones), several seeps and or endorheic pans were also anticipated, however these are approximately 2 – 3 km from the proposed site. Furthermore, the study area was thus characterised grasslands and alien vegetation stands, as well as past mining activities, and present farming practices.

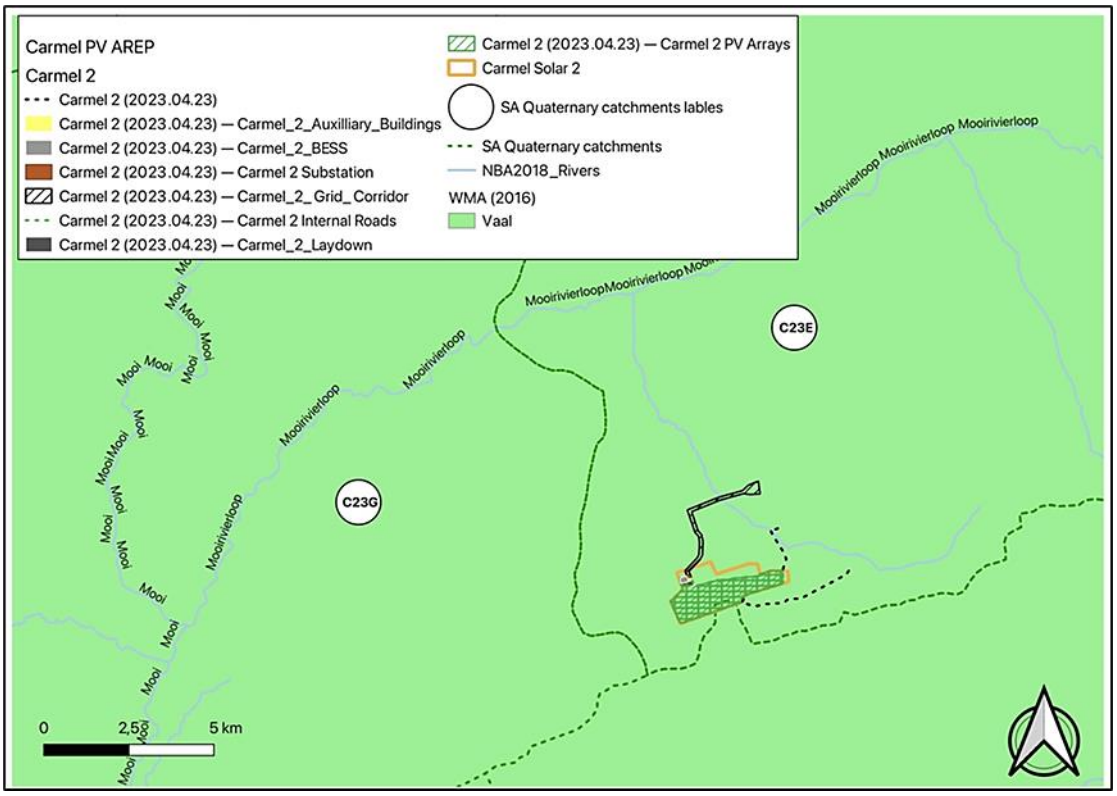


Figure 5.15: Locality map indicating the various quaternary catchments and mainstem rivers within the proposed project's boundaries

Two of the observed wetland areas were found along the length of the eastern and western boundaries of the Carmel Solar 2 site, located within the wetland buffers which had implications on the structure placement in the design phase. Especially considering that these wetland areas are considered CBA, and thus forms part of the Very High sensitivity area indicated in the DFFE Screening Tool. Thus, these have been avoided by the proposed layout except for the proposed access road, that will make used of an existing road, and the grid connection that could span the observed systems. A very degraded watercourse, currently covered in alien tree vegetation will however be cover by PV panel areas, but this system was considered to have moderate sensitivity and the proposed PV panels will have little impact on this systems hydrology.

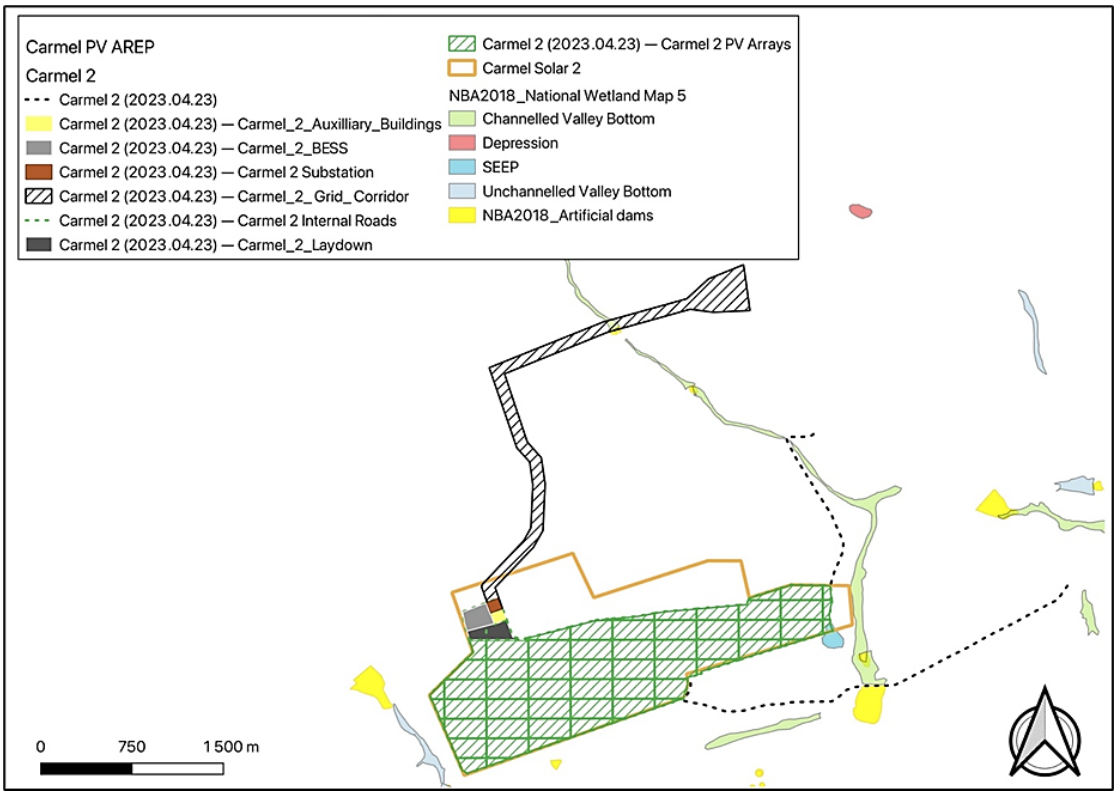


Figure 5.16: National Wetland Inventory wetlands and waterbodies (van Deventer et al., 2020).

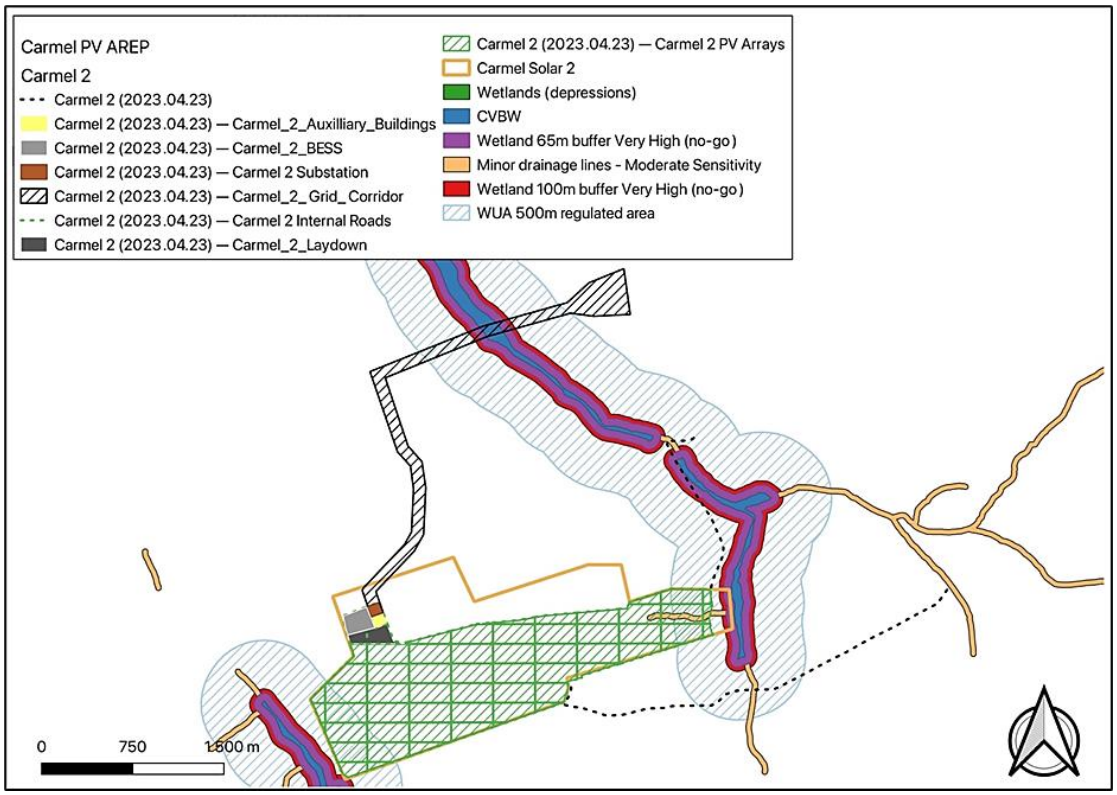


Figure 5.17: Waterbodies delineated in this assessment based on ground-truthing information collected for the Carmel Solar 2 site

Aquatic Species of Conservation Concern

Coupled to the aquatic delineations, information was collected on potential species that could occur within the watercourses, especially any conservation worthy species (Listed or Protected). However, no aquatic plant species with conservation concern were observed during this assessment.

Present Ecological State and Conservation Importance

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 Wet-Health2 assessment was conducted for the wetlands in close proximity to the sites, i.e., within the 500 m regulated area, namely Carmel Solar 2. It was determined that the wetlands fall within the 'D' ecological category for present condition. All the components scored particularly poorly due to transformation of natural habitat via past and present land use practices observed, especially the presence of the alien invasive tree stands, watercourse canalisation (infilling) and the large dams/slime dams within the catchments. Refer to table 5.2. below.

Table 5.2: Outcomes of WET-Health Version 2 assessment for Hydrogeomorphic 1-Channelled Valley Bottom Wetlands as both wetland areas were similar in form and function

	Wetland PES Summary			
Wetland name	**Wetland HGM 1 and 2**			
Assessment Unit	**HGM1 – CVBW & HGM 2 CVBW**			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4.3	5.1	4.1	4.1
PES Score (%)	52%	56%	41%	51%
Ecological Category	**D**	**D**	**D**	**D**
Combined Impact Score	4.5			
Combined PES Score (%)	50.2%			
Combined Ecological Category	**D**			
Confidence	High: Field-based 'Level 2' assessment area			

The trajectory of change for the 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 5.3 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. These proposed constraints/buffers do not include bird buffers/constraints as theirs buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

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.

Table 5.3: Results of the sensitivity rating/constraints assessment

Map Key	Sensitivity Rationale	Buffer	Features Identified on Site	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	100m	Channelled Valley Bottom wetlands	No buildings or structures (e.g., PV Panel Areas, Substations, O/M Buildings or temporary laydown areas should be placed within these zones.
Medium/Moderate	Areas that are deemed to be of medium sensitivity but should still ideally be avoided as this would minimise impacts and or the need for additional Water Use Authorisation in the case of any aquatic features	22m to aid delineation accuracy and prevent bank instability	Drainage lines	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	N/A	Artificial voids / dams	N/A

	perspective the vegetation or habitat is ubiquitous within the greater region or has seem some form of disturbance.			
Neutral	Unconstrained areas (left blank in mapping) from aquatic perspective	N/A		N/A

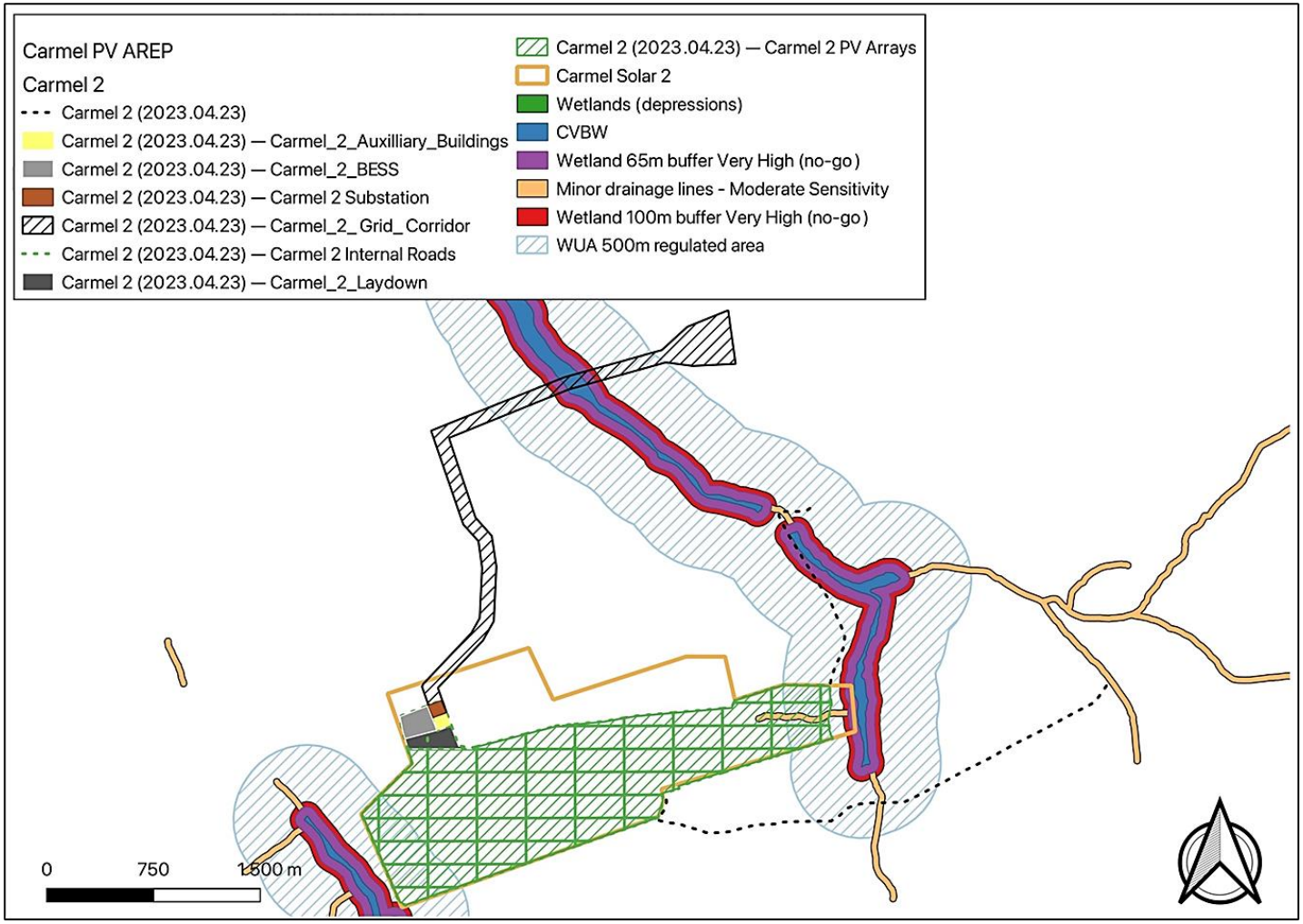


Figure 5.18: The delineated habitats inclusive of the respective buffers

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

The significant impacts are associated with the access road crossings river systems. These systems are generally in a modified state but 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.

5.4.1.7 Fauna

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.

There are seven animal species flagged for the site in the DEA Online Screening Tool output, namely the following:

Tyto capensis (African Grass Owl)
Aves
The African Grass Owl is listed as Vulnerable. It is confined to the higher rainfall areas in the eastern half of South Africa, where it typically roosts and breeds in tall, rank grass or sedges associated with damp substrates, such as permanent and non-perennial wetlands and streams. No suitable habitat was found on site. It is therefore not likely to occur there. A detailed avifaunal assessment has been undertaken for this project where additional information can be obtained regarding this species. A detailed avifaunal assessment has been undertaken for this project where additional information can be obtained regarding this species.

Eupodotis senegalensis (White-bellied Korhaan)
Aves
The White-bellied Korhaan, listed as Vulnerable, is found patchily throughout the Afrotropics. In South Africa, it is most common in the Highveld region, being a near endemic to the Grassland Biome. It prefers slightly longer grass than other bustards but may move into more open areas and into cultivated lands to forage. Threats to this species include all the general threats to grasslands in the country. On site, the most likely favoured habitat for the species is any of the intact grassland areas, although secondary grassland could also be favourable. It has been previously recorded almost 50 km to the north of the site but not nearby. It is theoretically possible that it occurs on site but not likely. A detailed avifaunal assessment has been undertaken for this project where additional information can be obtained regarding this species.

Lepidochrysops procera (Potchefstroom Blue Butterfly)
Insecta

The Potchefstroom Blue Butterfly (*Lepidochrysops procera*) is endemic to the Gauteng, KwaZulu-Natal, Mpumalanga, North West and Eastern Cape provinces in South Africa, from Kokstad in the south to Komatipoort in the north-east and Potchefstroom in the west. It is listed as Least Concern (Rare) and much of the Highveld population is under pressure from residential development and overgrazing. It occurs in rocky areas in grassland (and grassy areas in savanna), which occur on site. The larval host plant is reported variously as being *Ocimum obovatum* (Mecenero et al. 2013) or a combination of *Becium grandiflorum*, *Ocimum canum* and *Lippia scaberrima* (Woodhall 2005). The presence of the host ant (probably a *Camponotus* species) is an additional requisite. Broadly suitable habitat occurs on site (rocky areas in grassland), as well as the larval host plant, *Ocimum obovatum*. It is therefore possible for it to occur there. The species has been previously recorded in two adjacent grids (E and S of the site) but not within the current site (vmus.adu.org.za).

Lepidochrysops praeterita (Highveld Blue Butterfly)
Insecta
The Highveld Blue Butterfly (*Lepidochrysops praeterita*), listed as Endangered, is endemic to the Gauteng, Mpumalanga, North West and Free State provinces in South Africa, from Potchefstroom and Walkerville to Sasolburg. It occurs in flatlands and hillsides in grassland, or rocky hillsides in grassland. The larval host plant is reported as being *Ocimum grandiflorum* (Woodhall 2005). Broadly suitable habitat occurs on site (rocky areas in grassland). It is therefore possible for it to occur there but difficult to observe unless conditions are ideal. It emerges after early spring rains (September to November) in areas that have been burnt during the previous season. The species has been previously recorded in the current grid as well as three adjacent grids (E, SW and S of the site) (vmus.adu.org.za). One of the known locations is at Glenharvie, just to the south of Westonaria, which is approximately 30 km from the current site.

Crocidura maquassiensis (Maquassie Musk Shrew)
Mammalia
The Maquassie Musk Shrew (*Crocidura maquassiensis*), listed as Vulnerable, is endemic to South Africa, Eswatini and Zimbabwe, where it is found in moist grassland habitats in Savannah and Grassland Biomes. It appears to tolerate a wide range of habitats, although threats to the species have been inferred as being related to loss or degradation of moist, productive areas, such as rank grassland and wetlands. The species is patchily distributed within the north-eastern part of South Africa. The study area is within the known distribution of this species in the sense that there are records in quarter degree grids throughout the Highveld, although not from the current grid or any nearby grids. It is, however, flagged in the DFFE Online Screening Tool as potentially occurring on site. Broadly suitable habitat occurs on site, but it is very difficult to determine whether it occurs there or not without undertaking extensive trapping studies that may yield little additional information. It was not seen on site and it is assumed that it does not occur there.

Hydrictis maculicollis (Spotted-necked Otter)
Mammalia

The Spotted-necked Otter (*Hydrictus maculicollis*), listed as Vulnerable, is widely but patchily distributed in the higher parts of the eastern half of South Africa. It is also found in lakes and large rivers throughout much of Africa south of 10°N. They are restricted to areas of permanent fresh water where there is good shoreline cover and an abundant prey base (small fishes). They prefer water that is not silt-laden and is unpolluted, but are known to occur in relatively polluted rivers, such as the Braamfonteinspruit, Jukskei and Blesbokspruit in Gauteng. The site is within the known distribution of this species and there are historical records for one nearby grid, although not from the current grid. No suitable habitat was found on site. It is therefore not likely to occur there.

Clonia uvarovi (Uvarov's Bush Cricket)

Insecta

Uvarov's Clonia (*Clonia uvarovi*) is endemic to the highveld region of South Africa, and has only been recorded from Gauteng and North-West Provinces. It occurs in tall, woodland savannah. The threat status is Vulnerable. Its extent of occurrence is relatively small (~5,000 km^2), it has only been recorded in five locations, and the area, extent and quality of its habitat are expected to be in decline due to grazing pressure, cultivation, urban development, invasive alien plants and climate change. No suitable habitat occurs on site and it is unlikely to occur there.

Species of Conservation Concern (SCC)

No terrestrial vertebrate animal SCC were found on site or are likely to occur there. Significant parts of the site consist of alien woodlots. There are natural areas on the property, but these do not contain habitat suitable for any of the terrestrial animal species flagged for the site. The proposed development does not affect any habitats important for terrestrial animal species of concern and is therefore supported.

5.4.1.8 Avifauna

Avifaunal Species Richness

According to the Avifaunal Scoping Report (Appendix E3), approximately 262 bird species are expected to occur in the study area and immediate surroundings. 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 26% of the approximate 991 species listed for the southern African subregion (and approximately 30% of the 873 species recorded within South Africa). However, the mean species richness obtained from the pentad mapping units (c. 2620_2710, 2620_2715, 2625_2710 and 2625_2715) corresponding to the study area is lower than the expected number of species with an average of 55.70 species recorded for each full protocol card submitted (for observations of two hours or more; range = 07 - 97 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, 2023), the total number of species observed on the study area is *ca*. 179 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 survey detected nine bird species that are novel (new) species, which were observed for the first time within pentad grids. These species were previously overlooked and include:

- Golden-breasted Bunting (*Emberiza flaviventris*) – fairly common in *Senegalia caffra* and *Vachellia karoo* woodland;
- Fork-tailed Drongo (*Dicrurus adsimilis*) – observed from the edge of *Eucalyptus* plantation;
- Wahlberg's Eagle (*Hieraaetus wahlbergi*) – a single adult seen overhead on untransformed grassland;
- White-belied Korhaan (*Eupodotis senegalensis*) – a vocal pair observed from untransformed undulating grassland;
- Icterine Warbler (*Hippolais icterina*) – several birds observed from *Searsia* and *Vachellia* bush clumps mosaics;
- Marsh Warbler (*Acrocephalus palustris*) – several birds observed from *Searsia* and *Vachellia* bush clumps mosaics;
- Pearl-breasted Swallow (*Hirundo dimidiata*) – uncommon from open grassland with bush clump mosaics;
- Red-winged Francolin (*Scleroptila levaillantii*) – observed from *Protea caffra* scarp grassland; and
- Striped Pipit (*Anthus lineiventris*) – observed from *Protea caffra* scarp grassland.

According to Table 5.4, the study area is poorly represented by biome-restricted[3] (see Table 5.5) and local endemic bird species. However, regional endemic and near-endemic bird species are fairly well represented with up to 30% of the regional near-endemic species expected to be present. Approximately ten threatened or near threatened species are known to be present in the wider study area, of which the regionally vulnerable White-bellied Korhaan (*Eupodotis senegalensis*) was confirmed from the undulating untransformed grassland and scarp habitat units. Furthermore, a fairly high number of regional endemic bird species are present, with 15 southern African endemics and 15 near-endemic species confirmed on the study site and the immediate surroundings, with many of these species restricted to the *Protea caffra – Senegalia caffra* scarp and rocky grasslands.

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

Table 5.4: 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*	262 (30 %)	179 (68 %)
Number of Red Listed species**	10 (7 %)	1 (10 %)
Number of biome-restricted species – Zambezian, Namib-Karoo and Kalahari-Highveld Biomes*	3 (21 %)	3 (100 %)
Number of local endemics (BirdLife SA, 2022)*	3 (8 %)	3 (100 %)
Number of local near-endemics (BirdLife SA, 2022)*	9 (30 %)	7 (78 %)
Number of regional endemics (Hockey *et al.,* 2005)**	20 (19 %)	15 (75 %)
Number of regional near-endemics (Hockey *et al.,* 2005)**	18 (30 %)	15 (83 %)

Table 5.5: Expected and observed biome-restricted species (Marnewick et al, 2015) likely to occur on the study site and immediate surroundings.

Species	Kalahari-Highveld	Zambezian	Frequency of occurrence
Kalahari Scrub Robin (*Cercotrichas paena)*	X		Common (confirmed)
White-bellied Sunbird (*Cinnyris talatala*)		X	Common (confirmed0
White-throated Robin-chat (*Cossypha humeralis*)		X	Uncommon (confirmed)

Table 5.6 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 5.6, a total of 10 species could occur on the study area, of which the regionally vulnerable White-bellied Korhaan (*Eupodotis senegalensis*) was confirmed from the study area. These include two globally threatened species, two globally near threatened species, four regionally threatened species and two regionally near threatened species. The species confirmed from the study area include the globally Vulnerable Cape Vulture (*Gyps coprotheres*), the globally Endangered Secretarybird (*Sagittarius serpentarius*), the globally near threatened Lesser Flamingo (*Phoeniconaias minor*), the globally near threatened Pallid Harrier (*Circus macrourus*), the regionally Vulnerable White-bellied Korhaan (*Eupodotis senegalensis*), the regionally Vulnerable Verreaux's Eagle (*Aquila verreauxii*), the regionally endangered African Marsh-harrier (*Circus*

ranivorus), the regionally endangered Yellow-billed Stork (*Mycteria ibis*) and the regionally near threatened Greater Flamingo (*Phoenicopterus roseus*).

The White-bellied Korhaan (*Eupodotis senegalensis*) was confirmed from the study area, of which the undulating untransformed grassland and *Protea caffra – Senegalia caffra* scarps and rocky grassland units provide optimal breeding, roosting and foraging habitat for this species. In addition, more than 50 ha of suitable habitat is present on the study area, which is likely to sustain at least one to two pairs of White-belied Korhaan. It is highly recommended that the ecological integrity and connectivity of the untransformed and rocky grasslands be maintained in order to provide a minimum sustainable habitat for this species to occur. *It is likely to be present on the undulating untransformed grassland and Protea caffra – Senegalia caffra scarps and rocky grassland units on the study site.*

In addition, a small drainage line and seep area along the eastern boundary of the study area provide potential foraging habitat for the regionally endangered African Marsh-harrier (*Circus ranivorus*), although the habitat structure was regarded as sub-optimal for this species to utilise during breeding. However, it does increase the ecological connectivity of the system with the nearby Wonderfonteinspruit, where this species is resident (to the north of the study site). This wetland feature was buffered by at least 350 m, based on Semlitsch and Bodie (2003) recommendation with the requirement to facilitate and maintain healthy populations of prey species for harrier taxa. Nevertheless, *it has a low probability to be present on the physical study site owing to the absence oof suitable habitat.*

The Cape Vulture (*Gyps coprotheres*) is a wide-ranging species with opportunistic foraging behaviour pending the availability of food (e.g., carcasses for vultures). Therefore, this species could utilise the entire study area pending the availability of prey or carcasses. In addition, reporting rate for the Secretarybird (*Sagittarius serpentarius*) in the study area is low, irrespective of the occurrence of suitable habitat. The grassland units, in particular the undulating grassland units provide suitable foraging habitat for this species to be present.

The remaining species as listed by Table 5.6 are regarded as highly irregular foraging visitors due to the absence of suitable habitat on the physical study site. In addition, the occurrence of the vulnerable African Grass-owl (*Tyto capensis*) as suggested by the outcome of the screening tool on the study site is low owing to the absence of any suitable habitat (e.g., large extensive wetlands with tall moist grassland, in particular patches of *Imperata cylindrica, Arundinella nipalensis* and or Cyperoid dominated grassland).

Table 5.6: 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
Ciconia abdimii (Abdim's Stork)	-	Near-threatened	0.77	A non-breeding summer visitor to open	Highly irregular foraging visitor in summer. Highly

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
				grassland and recently tilled agricultural land.	seasonal and often absent in some years. Last recorded from study area during 2016 (post-2007).
Circus ranivorus (African Marsh Harrier)	-	Endangered	7.60	Restricted to permanent wetlands with extensive reedbeds.	An irregular foraging visitor to wetland system that borders the eastern boundary of the study site (absent on the physical study site). Known from 10 records in the area with recent records during 2022 (probably most stemming from the Wonderfonteinspruit in the north).
Circus macrourus (Pallid Harrier)	Near threatened	Near threatened	0.77	Dry and moist open grassland, especially in the vicinity of wetland systems	Regarded as an irregular summer foraging visitor. It has not been observed on the study area since 2011 (pentad grid scale).
Gyps coprotheres (Cape Vulture)	Vulnerable	Endangered	6.11	Mainly confined to mountain ranges, especially near breeding site. Ventures far afield in search of food.	An irregular foraging/scavenging visitor to the study area pending the presence of food/carcasses. It was last observed during 2022 on the study area
Aquila verreauxii (Verreaux's Eagle)	-	Vulnerable	3.10	Breeds in mountainous rugged habitat and isolated hills and “koppies in the Karoo.	An irregular foraging visitor to the study site. Known from four records in the area with recent records during 2018.

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
Mycteria ibis (Yellow-billed Stork)	-	Endangered	6.9	Wetlands, pans and flooded grassland.	An infrequent foraging visitor to the impoundments adjacent to the study site (probably absent from the physical stie boundary). Known from nine records in the area with recent records during 2021.
Phoenicopterus roseus (Greater Flamingo)	-	Near-threatened	25.38	Restricted to large saline pans and other inland water bodies.	Unlikely to be present (suitable habitat absent). Most records stem from observation of foraging birds along the Wonderfonteinspruit (north oof the study area).
Phoeniconaias minor (Lesser Flamingo)	Near-threatened	Near-threatened	9.23	Restricted to large saline pans and other inland water bodies containing cyanobacteria.	Unlikely to be present (suitable habitat absent). Most records stem from observation of foraging birds along the Wonderfonteinspruit (north oof the study area).
Eupodotis senegalensis (White-bellied Korhaan)		Vulnerable	New record for the study area	Restricted to extensive late-successional grassland on undulating and hilly topographies	A resident pair occurs on untransformed mixed grassland on undulating topographies in close proximity to the study site. It has a high probability to be present on the untransformed and scarp/rocky grasslands on the study site.

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
Sagittarius serpentarius (Secretarybird)	Endangered	Endangered	0.76	Prefers open grassland or lightly wooded habitat.	An uncommon foraging visitor to the physical study site. Only known from a single observation during 2012, although the various grassland habitat provides suitable foraging habitat for this species to occur.

Avifaunal Sensitivity

Apart from the regional vegetation type, the local composition and distribution of the vegetation associations on the study area is diverse and are a consequence of a combination of factors simulated by topography and altitude, anthropogenic activities and grazing intensity (presence of livestock and game) and afforestation (*Eucalyptus plantations*) which have culminated in five major broad-scale habitat units:

- *Protea caffra - Senegalia caffra scarps and rocky grassland:* This unit is highly restricted on the study area, where it occurs on rocky souls and scarps at higher altitudes. This habitat was identified with a **high avifaunal sensitivity and importance** due to the unique avian composition pertaining to it and the presence of suitable habitat for White-belied Koorhaan to occur. Some sections of this grassland are ecologically connected with untransformed open grassland which also support habitat of 50 ha and more for at least one to two pairs of White-bellied Korhaan individuals to occur in the study region.

- *Untransformed Mixed Grassland on sloping/undulating topographies:* This unit is dominant at higher altitudes and characterised by a floristic composition and structure that is reminiscent of untransformed, albeit slightly grazed grassland. This habitat was identified with a **high avifaunal sensitivity and importance** due to the presence of suitable habitat for White-belied Koorhaan to occur, and a high general bird richness (many of the species associated with this habitat is restricted to grassland habitat and absent from the bushveld and woodland type). Some sections of this grassland are ecologically connected with untransformed open grassland which also supported habitat of 50 ha and more for at least one to two pairs of White-bellied Korhaan individuals to occur in the study region. However, some sections of this grassland habitat contain a high proportion of secondary species and was subsequently classed with a medium **avifaunal sensitivity and importance.**

- *Senegalia caffra and Vachellia karoo woodland:* This habitat is represented by a microphylous woodland and is highly localised and scattered on the study area. This habitat was identified with a **medium avifaunal sensitivity and importance** since it is

geographically widespread in South Africa and hold a high richness of bird species that are also widespread in the eastern parts of South Africa.

- *Eucalyptus plantations:* This habitat type features the presence of *Eucalyptus* plantations and was a prominent feature on the study site. This habitat was identified with a **low avifaunal sensitivity and importance** since it is of artificial origin and represented by a non-native and highly monotonous floristic composition.

- *Wetlands, seeps and drainage lines:* This unit is represented by a number of small artificial dams, seeps and drainage lines, with a large system occurring in the east and southern parts of the study area, which drains the study area in a northerly direction towards the Wonderfonteinspruit. This habitat was identified with a **high avifaunal sensitivity and importance** since it contributes towards avian flyways and ecological connectivity on a landscape scale. In addition, it was recommended that the drainage line on the eastern part of the study area be buffered by at least 350 m. The 350 m buffer area was based on Semlitsch and Bodie (2003) with the requirement to facilitate and maintain healthy populations of prey species for carnivorous taxa such as owls (e.g., Marsh Owl *Asio capensis*) and harrier taxa (*Circus* species) which may utilise the habitat during dispersal or during foraging bouts.

- *Transformed areas*: These are represented by habitat that was historically transformed by anthropogenic activities which include tilling, inappropriate grazing regimes resulting in severe overgrazing and soil erosion as well as build-up land represented by the Carmel MTS and roads. This habitat was identified with a **low avifaunal sensitivity and importance**.

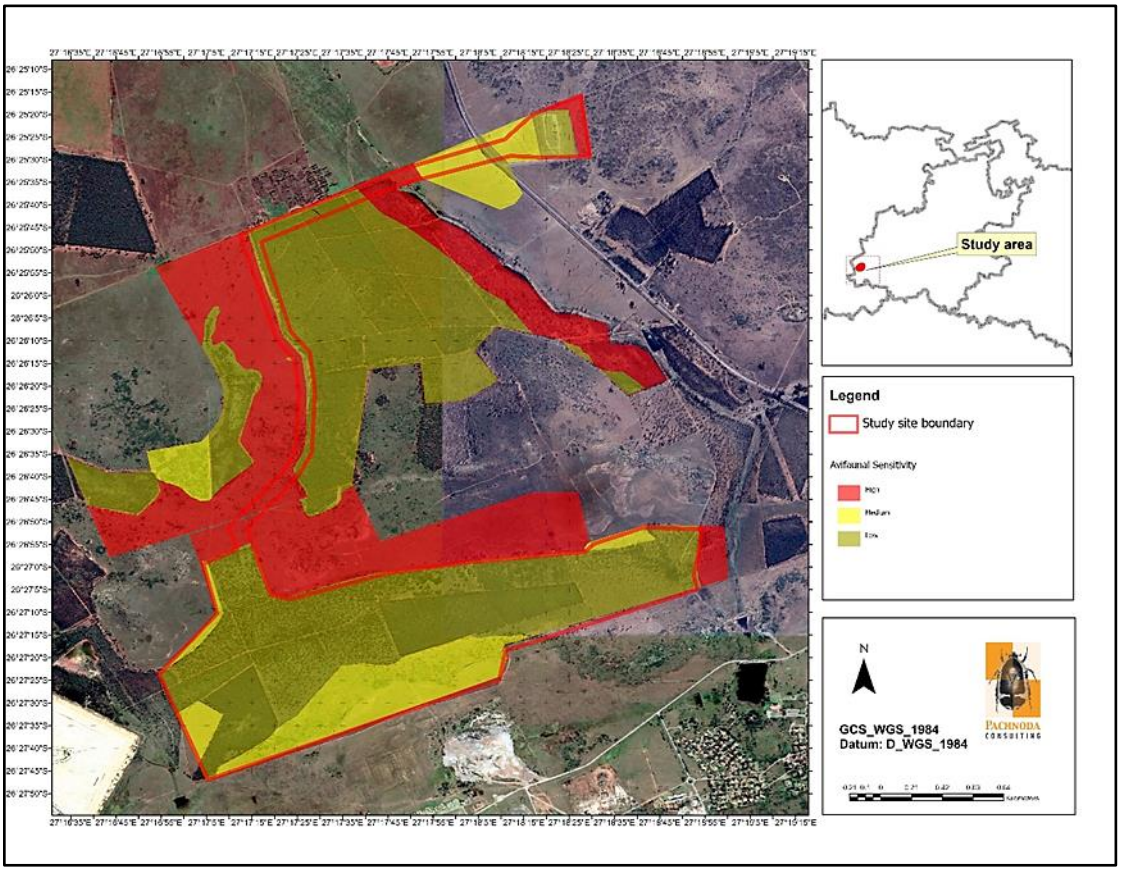


Figure 5.19: A map illustrating the avifaunal sensitivity of the study site based on habitat types supporting bird taxa of conservation concern and important ecological function.

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was high to low after mitigation. 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.

5.4.2 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 limited pre-colonial (Stone Age and Iron Age) occupation and a much later colonial (farmer) component. The second component is an urban one consisting of a number of smaller towns, most of which developed during the last 150 years or less. Added to this is the development of a number of gold mines in the region.

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.

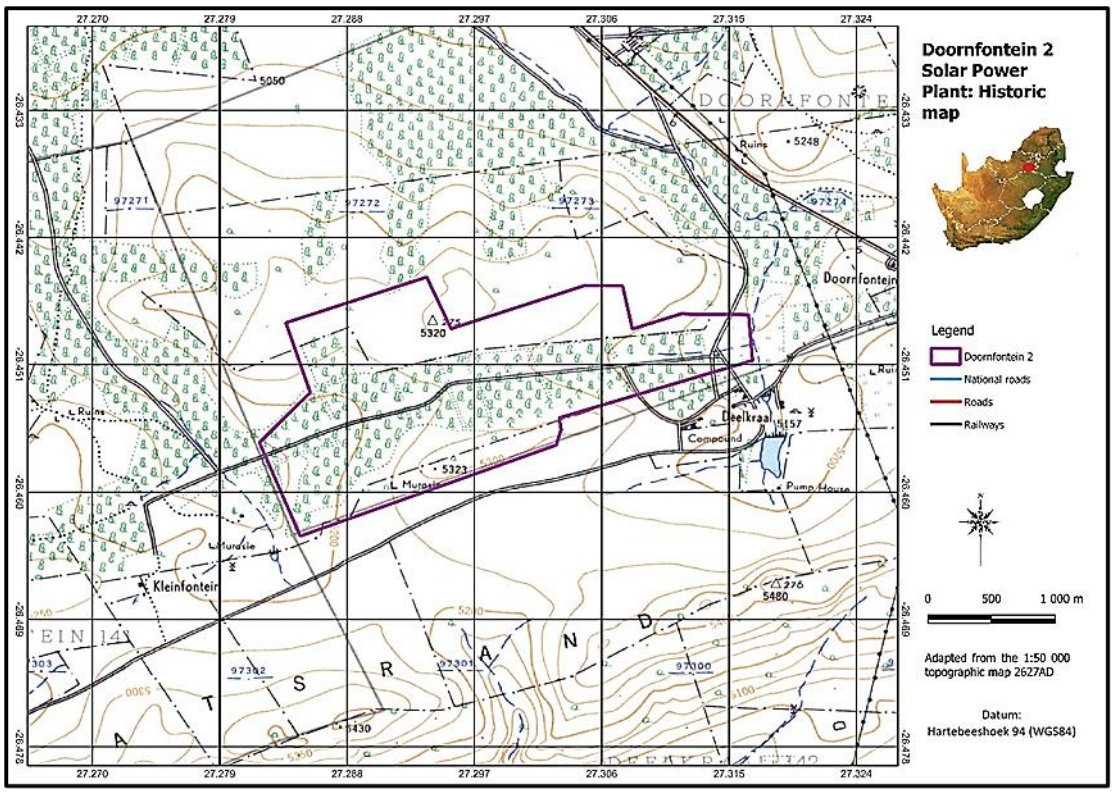


Figure 5.20: The project area on the 1958 version of the 1:50 000 topographic map

Figure 5.21: 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.

5.4.2.1 Historical, Archaeological and Built Environment

Stone Age

Very little habitation of the central highveld area took place during Stone Age times. Tools dating to the Early Stone Age period are mostly found in the vicinity of larger watercourses, e.g., the Vaal River or the Harts River and especially in sheltered areas such as at the Taung fossil site. During Middle Stone Age (MSA) times (c. 150 000 – 30 000 BP), people became more mobile, occupying areas formerly avoided. In many cases, tools dating to this period are found on the banks of the many pans that occur all over. The MSA is a technological stage characterized by flakes and flake-blades with faceted platforms, produced from prepared cores, as distinct from the core tool-based ESA technology. The repeated use of caves indicates that MSA people had developed the concept of a home base and that they could make fire. These were important steps in the cultural evolution of humanity. Furthermore, the widespread use of red ochre, presumably as body paint, also shows that MSA behaviour had become more human.

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

The LSA people have also left us with a rich legacy of rock art, which is an expression of their complex social and spiritual believes. It is essentially religious (Lewis-Williams 1981). Among other aspects, the art expresses beliefs about the role of shamans in controlling rain and game, and animals of power, such as eland and rhino, figure prominently.

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

Iron Age

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

The occupation of the larger geographical area (including the study area) did not start much before the 1500s. By the 16th century things changed, with the climate becoming warmer and wetter, creating condition that allowed Late Iron Age (LIA) farmers to occupy areas previously unsuitable, for example the treeless plains of the Free State and North West Province. In areas devoid of trees, Sotho-Tswana-speakers built in stone to mark internal and external boundaries. Because of the need for stone, most stonewalled settlements were sited near rocky outcrops. Typically, a rubble core filled the space between two outer faces. Most were

similar in that animal enclosures formed a circle around a central open space. Adult cattle stayed in large enclosures in the circle and calves in the smaller kraals. The number of adult kraals reflects the number of cattle-owning families living in the homestead. If there is only one family, then only one kraal stands in the centre without a central open space.

This was also a period of great military tension. Armed Qriqua and Korana raiders on horseback were active in the northern Cape and Orange Free State by about 1790. The Xhosa were raiding across the Orange River about 1805. Military pressure from Zululand spilled onto the highveld by at least 1821. Various marauding groups of displaced Sotho-Tswana moved across the plateau in the 1820s. Mzilikazi raided the plateau extensively between 1825 and 1837. The Boers trekked into this area in the 1830s. And throughout this time settled communities of Tswana people also attacked each other.

As a result of this troubled period, Sotho-Tswana people concentrated into large towns for defensive purposes. In some instances, they took shelter in caves such as in Irene in Pretoria and at Lephalong, where they developed a whole town inside a cave (Hall 1995).

The earliest Iron Age settlers who moved into the North-West Province region were Tswana-speakers such as the Tlhaping, Hurutshe, Fokeng, Kgatla and Rolong. In the region of the study area, it was mostly the Bakwena baMare-a-Phogole who settled under their chief Kokosi in the region of Losberg south of Fochville (Vorster 1969:52).

Stone walled sites dating to the Late Iron Age and which can probably be linked to the baMare-a-Phogole occupation of the area, are found on the farm Kraalkop, which is possibly the origin of the fam's name.

This type of settlement has been classified as belonging to the Molokwane settlement type, which originates with the Western Tswana groups such as the Hurutshe. According to Huffman (2007:41) this type of settlement stretches across the hilly areas of Gauteng west to Zeerust and they date from the late eighteenth century to the beginning of the historic period. The sites of Jachtfontein clearly shows the typical layout of these settlement, showing amalgamation into larger units increasing from west to east.

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

Historic period

White settlers moved into the area during the first half of the 19th century. They were largely self-sufficient, basing their survival on cattle/sheep farming and hunting. Few towns were established, and it remained an undeveloped area until the discovery of coal and later gold. Potchefstroom was established in 1838, with Parys following a bit later in 1876, and following much later, Fochville in 1920 and Carletonville in 1948.

In 1837 the establishment of a trekker settlement at Klerksdorp marked the beginning of a new phase in the history of the region. Originally twelve trekker families settled on the farm Elandsheuvel, belonging to C.M. du Plooy. This settlement, known as 'Oude Dorp', had its first landdros Jacob de Clercq, after which the settlement was then named. In 1853, the name was

changed to Klerksdorp. With the discovery of gold in 1886 on the farm Rietpoort, the gold rush gave rise to a new settlement called 'Nieuwe Dorp'. In 1897 the railway line from Krugersdorp reached Klerksdorp. The railway line from Fourteen Streams (Warden region), on the main line from Kimberley to Zimbabwe (then Rhodesia) was completed in 1906. (SESA 1973).

Gold made the Transvaal powerful, but it also created a clash between the Republicans and British immigrants who rushed to the goldfields. The ZAR government denied political rights to these Uitlanders, precipitating the ill-timed Jameson Raid of 1895/6. As is well known, Uitlander support did not materialize, and Jameson surrendered on January 2, 1896, near Krugersdorp.

During the Anglo-Boer War, a number of skirmishes occurred in the larger area. Most of these had to do with the British using the Vaal River as a border to catch the elusive Boer commandos. One such event took place in early August 1900, when Lord Methuen, coming from the south, forced Gen. De Wet across the Vaal River at Venterskroon, forcing the latter to retreat in the direction of what later was to become Fochville (Cloete 2000). What became known as the Battle of Frederickstad, located to the west of the project area, took place on 20 to 25 October 1900. Due to the hesitancy of Gen. P. J. Liebenberg to commit his forces to the battle, lead to a large number of them killed, whereas the British did not suffer as much. The Republican dead were buried near the Frederickstad railway station (Van den Bergh 1996).

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

5.4.2.2 Palaeontology

The Power line of the Carmel 2 Solar development is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) while the rest of the facility is underlain by the Rooihoogte and Timeball Hill Formations (Pretoria Group, Transvaal Supergroup) as well as unfossiliferous diabase. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Malmani Subgroup is Very High, that of the Timeball Hill Formation is High, while the Rooihoogte has a Low Palaeontological Sensitivity. The Palaeontological Significance of the diabase is Zero as it is igneous in origin (Almond et al, 2013; SAHRIS website).

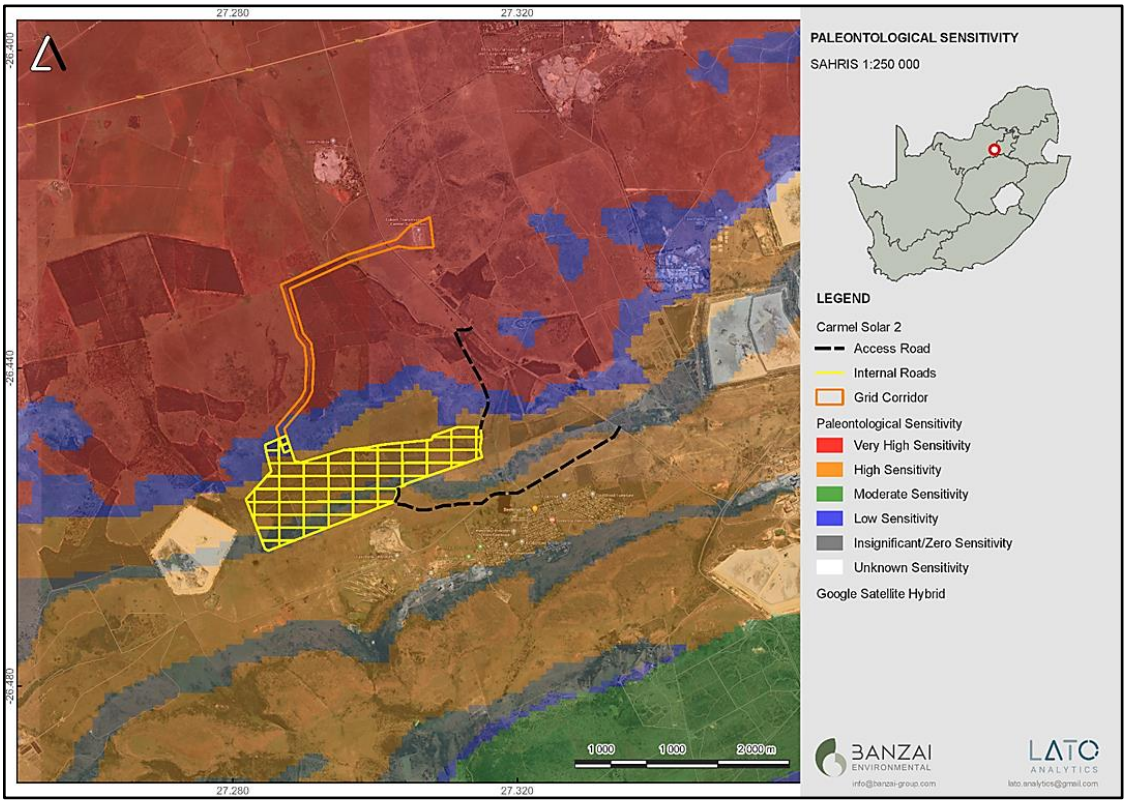


Figure 5.22: Extract of the 1: 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed Carmel Solar 2 Photovoltaic Solar Energy Facility

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 3 November 2022. During the site investigation no fossiliferous outcrops were detected. It is thus considered that the proposed Carmel Solar 2 Photovoltaic Solar Energy Facility 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 palaeontologist. 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.

5.4.3 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.

5.4.3.1 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 from the proposed development, which due to use could be sensitive to landscape change. They include:

- **Area Receptors** which include:
  - Deelkraal.
  - Wedela.
  - Welverdiend.
  - Khutsong.
  - Carletonville.
  - Blyvooruitzicht.
  - Abe Bailey Nature Reserve.
  - Elandsrand.
- **Linear Receptors** which include:
  - N12 National Road.
  - R501 Regional Road.
  - Buffelsdoorn Road.
- **Point Receptors** which include:
  - Homesteads on Farms.
  - Smallholdings.
  - Sports and Recreational Facilities.
  - Tourism and Lodging Facilities.

5.4.3.2 Zone of Theoretical Visibility

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 5.7: ZTV Assumptions

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

Table 5.8. below reflects the visibility rating in terms of proximity on sensitive receptors from the Solar Energy Facility (SEF) within a 10 km radius.

Table 5.8: ZTV rating in terms of proximity from the SEF

Radius	Visual Receptors	Visibility rating in terms of proximity
0-1km	- One homestead on a farm. - Buffelsdoorn road. - Deelkraal. **Coverage: 74%**	Very High
1-3km	- One homestead on a farm. - Deelkraal. - Buffelsdoorn road. **Coverage: 50%**	High
3-5km	- Elandsrand. - Buffelsdoorn road. **Coverage: 24%**	Medium
5-10km	- 18 homesteads on farms. - Welverdiend. - Abe Bailey Nature Reserve. - Elandsrand. - N12 National Road. - R501 regional road. **Coverage: 10%**	Low

Refer to Figures 5.23 and 5.24: Zone of Theoretical Visibility (ZTV). These maps indicate all areas that are in direct line of site of the proposed development up to a distance of 10 km as per Table 5.8. above.

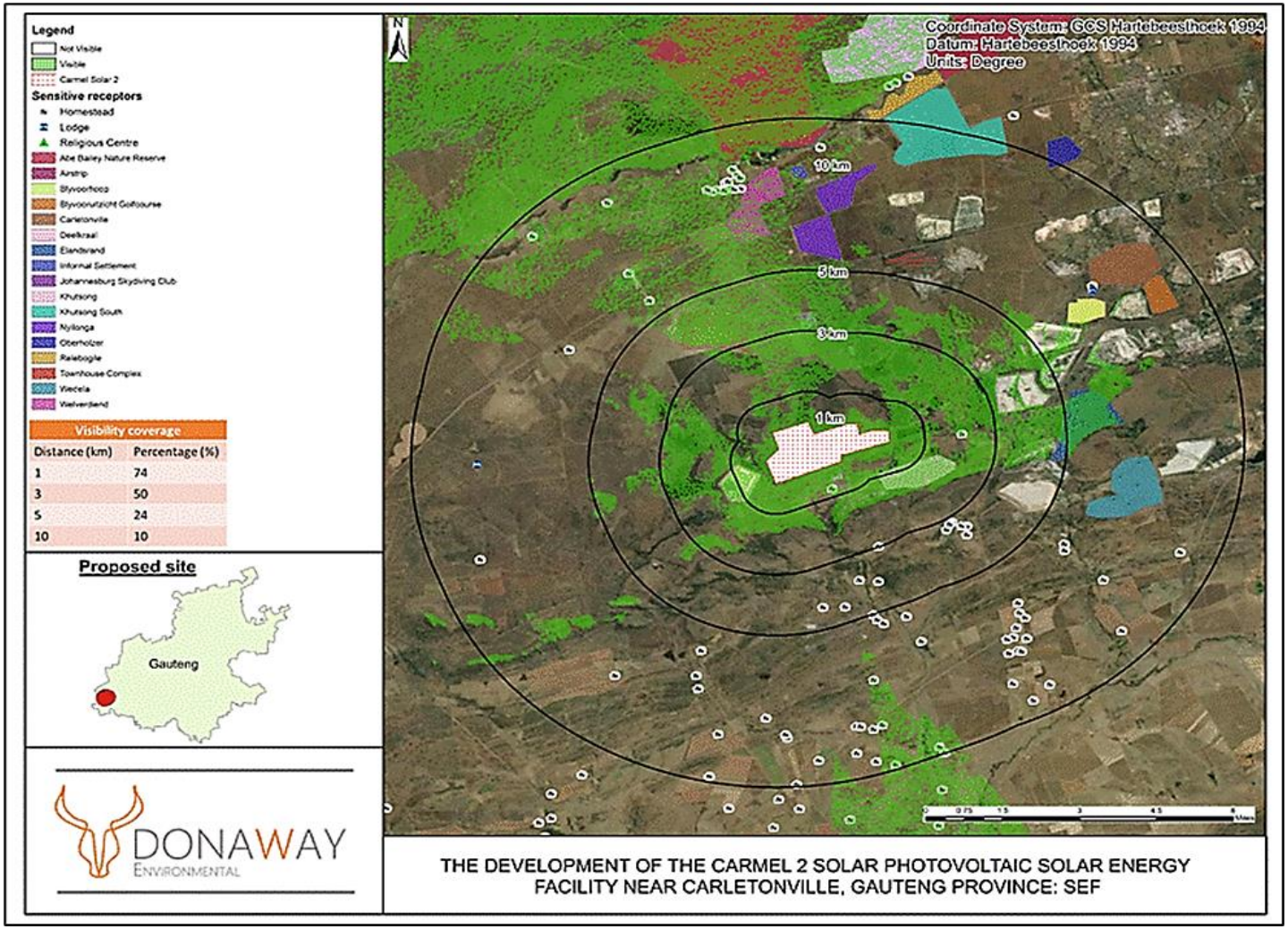


Figure 5.23: Zone of Theoretical Visibility (ZTV) for the Solar Energy Facility (SEF), satellite view

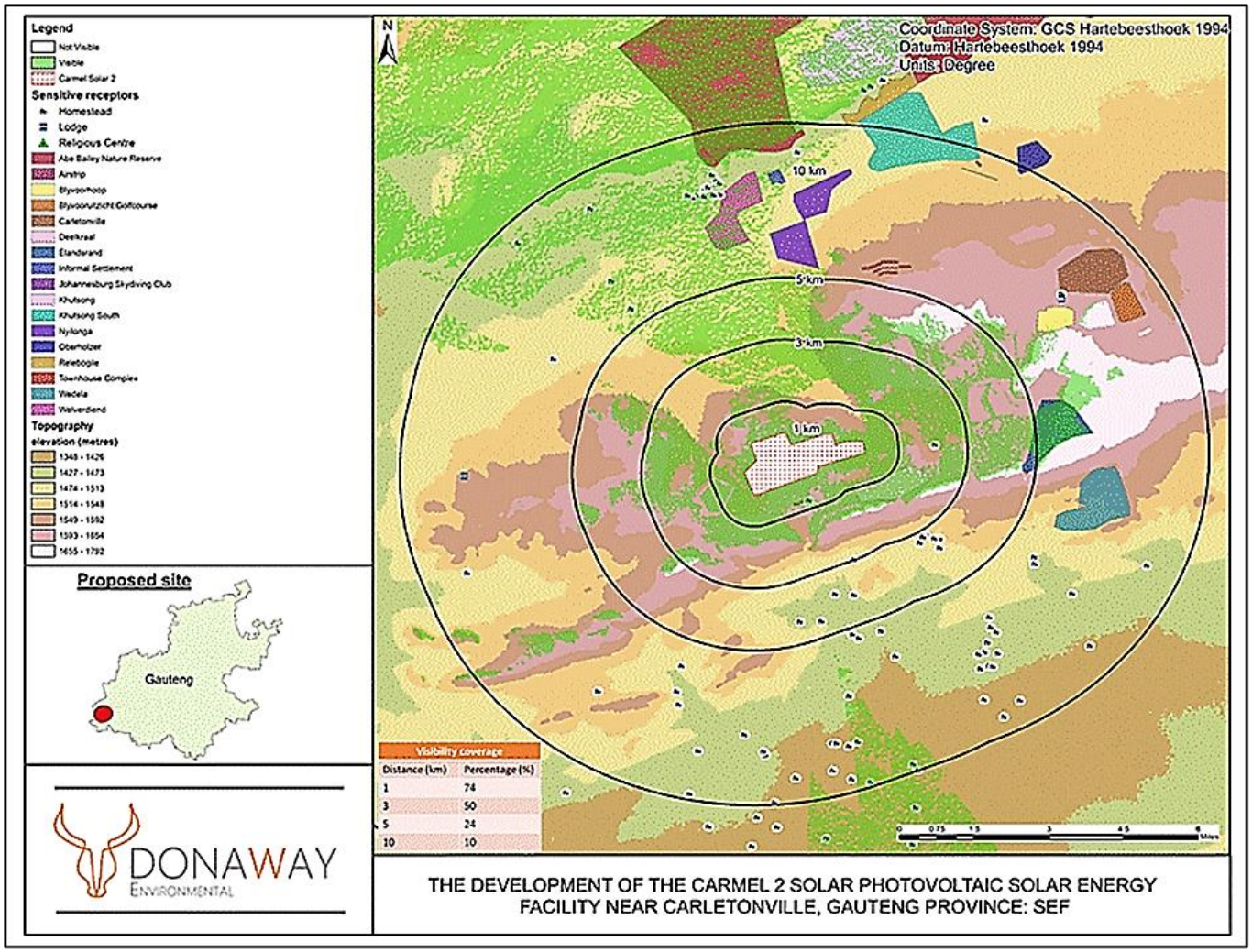


Figure 5.24: Zone of Theoretical Visibility (ZTV) for the Solar Energy Facility (SEF), topography view

Table 5.9. below reflects the visibility rating in terms of proximity on sensitive receptors from the Powerline (PL) within a 10 km radius.

Table 5.9: ZTV rating in terms of proximity from the PL

Radius	Visual Receptors	Visibility rating in terms of proximity
0-1km	- Buffelsdoorn road. **Coverage: 92%**	Very High
1-3km	- Buffelsdoorn road. **Coverage: 66%**	High
3-5km	- Two homesteads on farms. - R501 regional road. - Deelkraal. - Welverdiend. **Coverage: 34%**	Medium
5-10km	- 19 homesteads on farms and smallholdings. - Welverdiend. - Khutsong. - Abe Bailey Nature Reserve. - Elandsrand. **Coverage: 19%**	Low

Refer to Figures 5.25 and 5.26: Zone of Theoretical Visibility (ZTV). These maps indicate all areas that are in direct line of site of the proposed development up to a distance of 10 km as per Table 5.9. above.

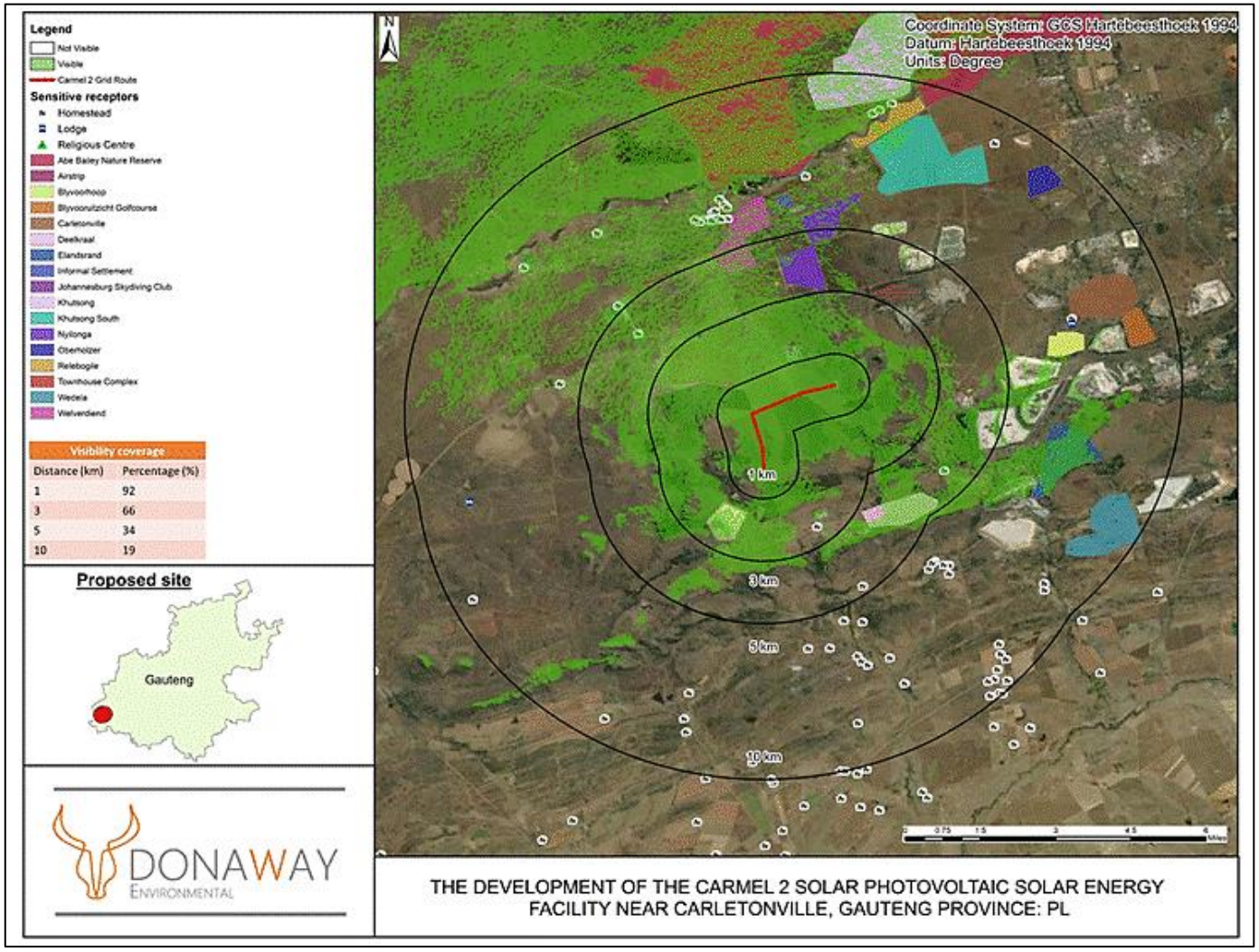


Figure 5.25: Zone of Theoretical Visibility (ZTV) for the Powerline (PL), satellite view

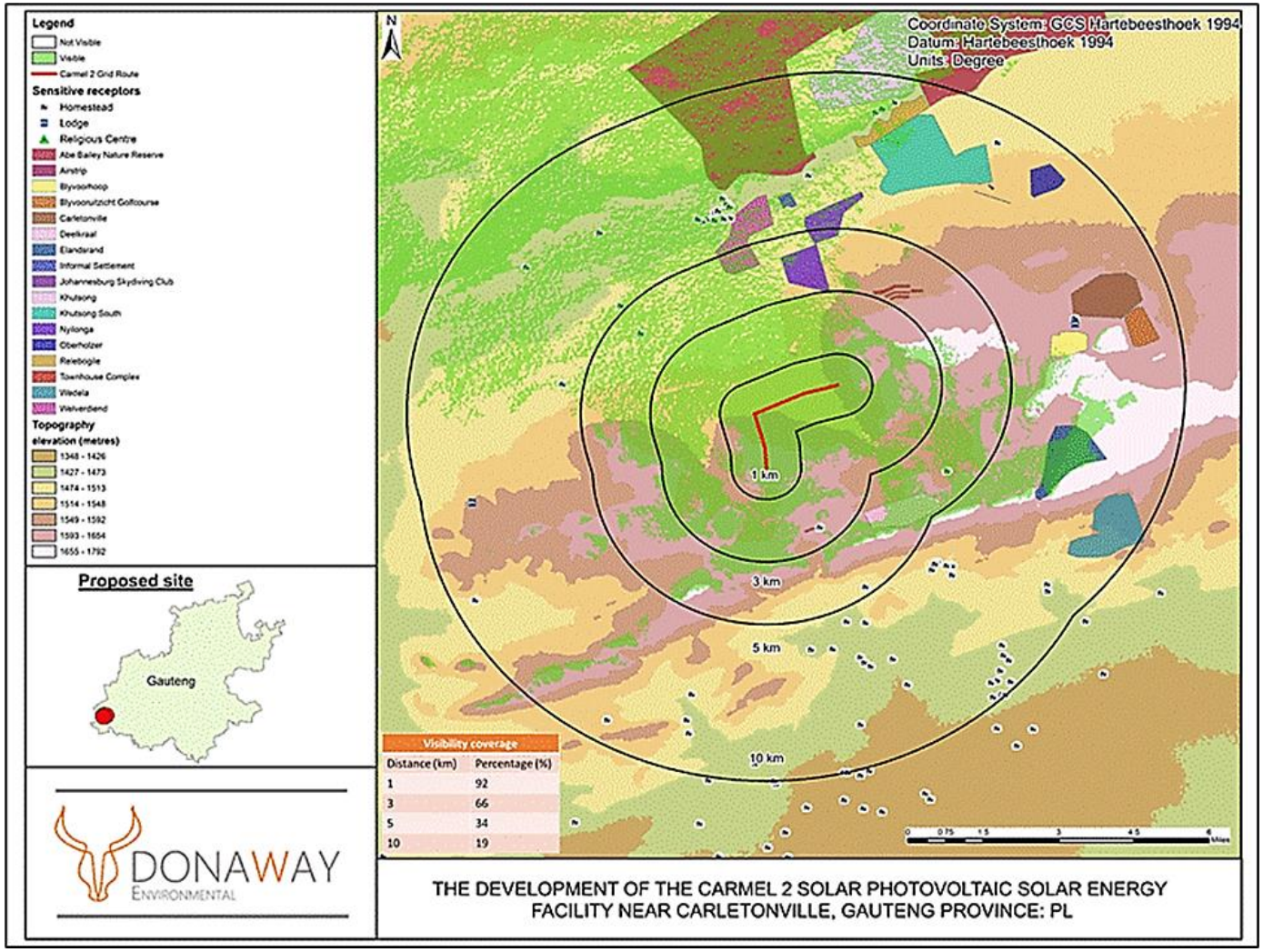


Figure 5.26: Zone of Theoretical Visibility (ZTV) for the Powerline (PL), topography view

The significance of the visual impact will be a "Negative Low Impact". The only receptors likely to be impacted by the proposed development are the nearby property owners and nearby roads. However, a large part of the visual landscape is still reflecting a farming and intensive mining landscape with a much lower visual quality.

Following receipt of the development layout, the visual specialist stated: *"The final development footprint for the Carmel Solar 2 Photovoltaic Solar Energy Facility was reduced, thus the visual impacts will be reduced, but only by a small margin. Donaway Environmental does not foresee any additional negative impacts, making the final layout acceptable."*

5.4.4 Traffic Consideration

5.4.4.1 Access Points

According to the Traffic Impact Study (Appendix E9), as no formal access points are established, two access options are recommended taking into consideration any existing access gates and have been assessed in line with access spacing requirements, required sight lines and road safety considerations. Construction vehicles can travel towards the site either from a southern direction via the N12 or from a northern direction via the R501 (Figure 5.27).

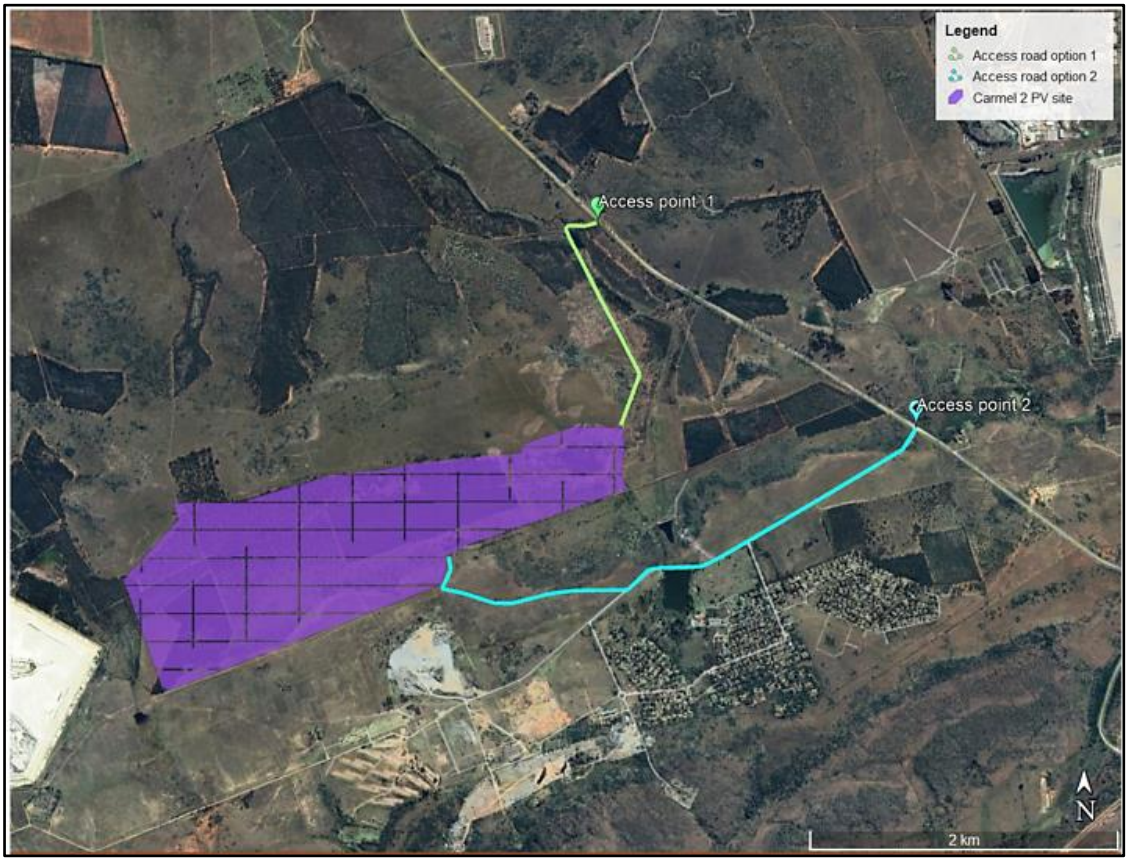


Figure 5.27: Aerial view of the proposed access points 1 and 2 from D92

Access Point 1

The proposed access point 1 is an existing gate and gravel surfaced access to the proposed site. This access option is the preferred option. This access point is well suited from a sight distances point of view. The vegetation at this access point requires cutting back to achieve acceptable sight lines for vehicles leaving this access point. This access point will require upgrading to cater for larger construction vehicles.

Access Point 2

Access point 2 is located approximately 2.5 kms south-west of Access point 1 on D92 at an existing intersection. Sight lines from the side road, as well as from the D92 entering the side road, are acceptable.

General

The access roads leading from the recommended access point options need to be wide enough for heavy vehicles and large construction vehicles to navigate (minimum width of 8 m should be kept). The radii at the bends at the two access points need to be large enough to allow for all construction vehicles to turn safely. It is further recommended that the access points be security controlled during the construction phase. Sight distances are deemed good; however, any sight line limitations will need to be addressed (i.e., cutting back of trees or shrubbery that obstruct a clear view of the road ahead). It is advised to make use of both access points for the duration of the construction phase due to the size of the Carmel Solar 2 development and taking into consideration that Carmel Solar 2 will be one of five solar developments for the Doornfontein (Carmel) Solar Power Cluster.

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 impact on the traffic on the surrounding road network.

5.4.5 Description of the Socio-Economic Environment

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

5.4.5.1 Socio-Economic Conditions

According to the Social Impact Assessment (Appendix E8), Gauteng is the smallest of South Africa's provinces, covering an area of 18 178km² or approximately 1.4% of the total surface area of South Africa. It is bordered by the Gauteng, North West, Limpopo and Mpumalanga provinces. While being the smallest province, it is also the most populous, being home to 13 399 725 people – 24.1% of the national population. Gauteng lies on the highest part of the interior plateau on the rolling plains of South Africa's Highveld.

Its capital is Johannesburg, and it also contains the city of Pretoria, as well as the East Rand, West Rand and Vaal areas.

Gauteng continues to serve as the economic engine room of the country and the subcontinent, responsible for over 34.8% of the country's GDP. Gauteng is the powerhouse of South Africa and the heart of its commercial business and industrial sectors. The most important sectors contributing to GDP are finance, real estate and business services; manufacturing; and general government services. Gauteng is also the financial services capital of Africa. More than 70 foreign banks have their head offices here, as do at least the same number of South African banks, stockbrokers and insurance giants.

The major gold and diamond mining houses all have their headquarters in Johannesburg, the biggest being Anglo American and De Beers. Gold mining constitutes 80% of Gauteng's mineral production output.

Gauteng is divided into three metropolitan municipalities, the City of Ekurhuleni, City of Johannesburg and City of Tshwane Metropolitan Municipalities, as well as two district municipalities, which are further subdivided into six local municipalities.

West Rand District Municipality

The West Rand District Municipality is a Category C municipality located in the west of the Gauteng Province. The West Rand extends from Randfontein (the seat of the district) in the west to Roodepoort in the east, and includes the town of Krugersdorp. It is bordered by Bojanala Platinum to the north-west, City of Tshwane to the north-east, City of Johannesburg to the east, Sedibeng to the south-east, and Dr Kenneth Kaunda to the south-west. It comprises three local municipalities: Merafong, Mogale and Rand West Cities.

The municipality is situated relatively closely to the hub of economic activity in Gauteng, and is traversed by major national roads, namely the N12 and N14. Its main contribution lies primarily within the mining sector, however, areas such as Krugersdorp fulfil a residential function for many people working in Johannesburg. The West Rand remains the poorest region contributing to Gauteng's GDP.

The Cradle of Humankind falls under the jurisdiction of Mogale City and Merafong City, and forms part of the World Heritage Site.

The main economic sectors include Manufacturing (22%), mining (19%), community services (19%), finance (16%), trade (10%), transport (6%), construction (4%).

In 2011 the Municipality had a population of 820 995 with a dependency ratio of 39.2 By 2016 the population has increased to 838 594 and the dependency ratio was reduced to 39.4.

Merafong City Local Municipality

The Merafong City Local Municipality is a Category B municipality situated within the West Rand District in the Gauteng Province. It is the largest of three municipalities in the district, making up almost half of its geographical area. It is situated about 65km from Johannesburg and is serviced by a number of major roads, including the N12 from Johannesburg to Cape Town and the N14, which is the main road between Gauteng and Mahikeng (previously Mafikeng) via Ventersdorp. Its boundaries enclose some of the richest gold mines in the world.

Formerly a cross-border municipality, the entire municipality was transferred to the North West Province following the abolition of cross-border municipalities by an amendment to the South African Constitution in 2005. The municipality was part of the North West Province from 2005 to 2009, when it was reincorporated into the Gauteng Province by another amendment to the Constitution, following often violent protests in the township of Khutsong.

Merafong's historical development is closely knit with the discovery of rich gold deposits in the early 1930s. Fochville is the oldest town in the region and was declared a town in 1951. The town Carletonville was named after Guy Carleton Jones, an engineer from the Gold Fields Ltd mining company, who played a prominent role in the discovery of the West Wits gold field, of which Carletonville forms a part. The mining company decided, in November 1946, to establish the town. Carletonville was proclaimed in 1948 and attained Town Council Status on 1 July 1959.

Wedela is situated between Western Deep Levels and Elandsrand mine. The town's name is derived from the prefixes of the two mines: the ‘Wed-' from Western Deep Levels and the ‘-ela' from Elandsrand. Wedela was established as a mining village in December 1978 by Harry Oppenheimer, and municipal status was granted to the town on 1 January 1990.

There are three towns in the municipality, namely Carletonville, Fochville, Wedela

The main economic sectors in the municipality are Mining (50.7%), trade (9.7%), finance and business services (9.9%), community services (9.2%), general government (9.1%).

5.5 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 Gauteng 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 point is located 4.5 km away and within the affected properties which minimizes the length of power line development and consolidates the overall impacts and disturbance of the project within the affected property). Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118, 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. Gauteng 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 200 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. Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118, 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 200 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 existing access gates along the D92 District Road.
- 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 consists of land used for agriculture and intensive mining activities. Channelled Valley Bottom wetlands are located in close proximity to the development footprint, and parts of the site are within a CBA 2 and ESA. Sections of the development site has also been identified as high avifaunal sensitive areas.

It is evident from the discussion above that Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118 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 footprint avoids areas that are of high sensitivity 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.

5.6 CONCLUDING STATEMENT

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 200 MW Carmel Solar 2 PV Facility on Portions 1, 11, 23 and 28 of the Farm Doornfontein No. 118 is the preferred option. Refer to Figure I.

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;

6.1 SCOPING METHODOLOGY

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

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

6.1.1 Checklist Analysis

The independent consultant conducted a site visit on 12 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	✕			Channeled Valley Bottom wetlands are located along the eastern boundary of the project site. The wetland system must be avoided with a 100 m buffer.
II. A conservation or open space area	✕			According to the Terrestrial Biodiversity Assessment, parts of the site are within a Critical Biodiversity Area and an Ecological Support Area.

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	×			According to the Terrestrial Biodiversity Assessment, the site is currently mostly a combination of grassland and exotic woodlots.
X. Bird nesting sites		×		The Avifauna Scoping Assessment (refer to Appendix E3) does not make any reference to nesting sites on the area earmarked for the development.
XI. Red data species		×		The Avifauna Scoping Assessment (refer to Appendix E3) 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 VIA (refer to Appendix E4) confirmed that the significance of the visual impact will be a "Negative Low Impact". The only receptors likely to be impacted by the proposed development are the nearby property owners and nearby roads.
III. Noise pollution	×			Construction activities will result in the generation of noise over a period of 18-24 months. The noise impact is unlikely to be significant.

IV. Construction of an access road	×			Two (02) access options have been proposed both of which are off the D92 District Road.
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 peak construction phase and 50 employment opportunities during the operation phase of the PV facility.
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 peak construction phase and 50 employment opportunities during the operation phase of the PV facility.
IX. Traffic generation	×			It was estimated that approximately 242 daily site trips will be made which comprises of solar 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	×			Channeled Valley Bottom wetlands are located along the eastern boundary of the project site. The wetland system must be avoided with a 100 m buffer.
II. A conservation or open space area	×			According to the Terrestrial Biodiversity Assessment, parts of the site are within a Critical Biodiversity Area and an Ecological Support Area.
III. An area that is of cultural importance		×		None.
IV. A site of geological significance		×		None.
V. An area of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.
VII. A tourist resort		×		None.
VIII. A formal or informal settlement	×			The town of Carletonville is located approximately 8 km northeast 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. Please refer to **Appendix E** (specialist studies) for a more in-depth assessment of the potential environmental impacts.

Table 6.2: Matrix analysis

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

Low significance	Medium significance	High significance	Positive impact

LISTED ACTIVITY (The Stressor)	ASPECTS OF THE DEVELOPMENT /ACTIVITY		POTENTIAL IMPACTS		SIGNIFICANCE AND MAGNITUDE OF POTENTIAL IMPACTS							MITIGATION OF POTENTIAL IMPACTS			SPECIALIST STUDIES / INFORMATION
			Receptors	Impact description / consequence	Minor	Major	Extent	Duration	Probability	Reversibility	Irreplaceable loss of resources	Possible Mitigation	Possible mitigation measures	Level of residual risk	
CONSTRUCTION PHASE															
Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* Activity 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*	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 circle for trucks will also be taken into consideration.	BIOPHYSICAL ENVIRONMENT	Indigenous natural vegetation	• Loss, degradation or fragmentation of vegetation through direct clearing		-	S	P	D	IR	SL	Yes	- See Table 6.3	M	Terrestrial Biodiversity Impact Assessment (Appendix E2)
			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	-

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*	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.			• 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	-

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(c)(ii)(iv) (GN.R. 324): “*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (c) the Gauteng province, (ii) National Protected Area Expansion Strategy Focus Areas (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans.”* Activity 10(c)(ii)(iv) (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 (c) Gauteng province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans.”*			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)

<u>Activity 12(c)(ii) (GN.R. 324):</u> *"The clearance of an area of 300 square metres or more of indigenous vegetation (c) in the Gauteng Province, (ii) within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans."* <u>Activity 14(ii)(a)(c)(c)(ii)(iv) (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 (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."* <u>Activity 18(c)(ii)(iv) (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 (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng*			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)

Conservation Plan or in bioregional plans."				• 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 E8)
			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 E8)
			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 E8)
			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 E8)
			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 E8)
			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 E8)
			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	M	Social Impact Assessment (Appendix E8)

			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 E8)
			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 E8)
			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 E8)
			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 E4)
			Visual landscape	• Visual impact of construction activities on sensitive visual receptors in close proximity to the power line	-		L	S	Pr	PR	ML	Yes	- See Table 6.3	L	Visual Impact Assessment (Appendix E4)
			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 E9)
			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	+		S	S	U	CR	NL	N/A	- For the current study, as no sites, features or objects of cultural significance were identified, no	L	Heritage Impact Assessment (Appendix E6)

				impact as a result of the proposed development									mitigation measures are proposed.		
			Paleontological Heritage	• Construction stage Carmel solar 2 • 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 E7)
			Paleontological Heritage	• Construction stage powerline • Loss of fossil 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 E7)
OPERATIONAL PHASE															
<u>Activity 11(i) (GN.R. 327):</u> *"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."* <u>Activity 28(ii) (GN.R. 327):</u> *"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."* <u>Activity 1 (GN.R. 325):</u> *"The development of facilities or*	The key components of the proposed project are described below: • <u>PV Panel Array</u> - To produce up to 200 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.	BIOPHYSICAL ENVIRONMENT	Vegetation	• Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	-		S	L	Pr	BR	ML	Yes	- See Table 6.4	L	Terrestrial Biodiversity Impact Assessment (Appendix E2)
			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.	-		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	-

infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more...” Activity 10(c)(ii)(iv) (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 (c) Gauteng province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans.”*	• Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480 V up to 33 kV up to 132 kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480 V and this is fed into step up transformers to 132 kV. An onsite substation will be required to step the voltage up to 132 kV, after which the power will be evacuated into the national grid. Energy generated by the facility will be transmitted from the facility substation/Eskom switching station to the Carmel Main Transmission Substation via a new 132 kV powerline. The Project will inject up to 200 MW into the National Grid. • Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4 m underground as far as practically possible. • Supporting Infrastructure – The following auxiliary buildings including a gate			• Areas subject to seismic activity. • Areas subject to flooding.										
			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 and skills development	• The creation of employment opportunities and skills development opportunities during the operation phase for the country and local economy.		+	P	L	Pr	BR	NL	Yes	- See Table 6.4	M	Social Impact Assessment (Appendix E8)
			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 E8)
			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 E8)
			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 E8)

	house, ablutions, workshops, storage and warehousing areas, site offices, control centre and a 33 kV switch room will be required with basic services including water and electricity. The project requires the need for both temporary and permanent laydown areas. • Roads – The majority of the access road will follow existing, gravel farm roads that will require widening between 6 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 (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 existing D92 District Road. • Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing		Impact on tourism	• The potential impact on tourism due to the establishment of the Carmel Solar 2 SEF	- +		L	L	Pr	CR	NL	Yes	- See Table 6.4	L	Social Impact Assessment (Appendix E8)
			Sense of place	• Visual impacts and sense of place impacts associated with the operation phase of Carmel Solar 2 SEF.	-		L	L	Pr	CR	ML	Yes	- See Table 6.4	L	Social Impact Assessment (Appendix E8)
			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 E8)
			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 E4)
			Visual landscape	• Visual impact on sensitive receptors within a 1km radius from the power line	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			Visual landscape	• Visual impact on sensitive visual receptors between a 1km and 3km radius from the SEF	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			Visual landscape	• Visual impact on sensitive receptors between a 1km and 3km radius from the power line	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			Visual landscape	• Visual impact on sensitive visual receptors within a 3km and 5km radius from the SEF	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			Visual landscape	• Visual impact on sensitive receptors between a 3km and 5km radius from the power line	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			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 E4)

	with a height of 3.5 m will be used.		Visual landscape	• Visual impact on sensitive receptors within a 5-10km radius from the power line	-		L	L	Po	PR	NL	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			Visual landscape	• Visual impacts of lighting at night on sensitive visual receptors in close proximity to the proposed facility	-		L	L	Po	CR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			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 E4)
			Visual landscape	• Visual impacts on sense of place associated with the operational phase of the SEF	-		L	L	Pr	PR	SL	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			Visual landscape	• Visual impacts and sense of place impacts associated with the operation phase of the PL	-		L	L	Po	CR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E4)
			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 E9)
			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 E6)

			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	Vegetation	• Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites	-		S	P	Pr	PR	ML	Yes	- See Table 6.5	L	Terrestrial Biodiversity Impact Assessment (Appendix E2)
			Vegetation	• Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	-		S	L	Pr	BR	ML	Yes	- See Table 6.5	L	Terrestrial Biodiversity Impact Assessment (Appendix E2)
			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.	-		L	S	D	I	NL	Yes	-	L	-

				• Increase in construction vehicles.											
			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. • 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	• 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)	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)

				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.											
			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. • Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota.	-		L	L	Pr	IR	NL	Yes	- See Table 6.3	L	Aquatic Ecological Assessment (Appendix E1)

				• This can result in possible deterioration in aquatic ecosystem integrity and species diversity.											
			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 E9)
			Tourism industry	• Since there are no tourism facilities in close proximity to the site, the decommissioning activities will not have an impact on tourism in the area.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• 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 E6)

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's 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 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(c)(ii)(iv) (GN.R. 324): "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (c) the Gauteng province, (ii) National Protected Area Expansion Strategy Focus Areas (iv) Sites identified as Critical Biodiversity Areas*

(CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."

- Activity 10(c)(ii)(iv) (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 (c) Gauteng province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*

- Activity 12(c)(ii) (GN.R. 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation (c) in the Gauteng Province, (ii) within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans."*

- Activity 14(ii)(a)(c)(c)(ii)(iv) (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 (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*

- Activity 18(c)(ii)(iv) (GN.R. 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (c) Gauteng Province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*

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
Terrestrial Biodiversity Impact Assessment (Appendix E2)	Indigenous natural vegetation Loss, degradation or fragmentation of vegetation through direct clearing	Negative High	Negative Medium	• Avoid grassland area, if possible. • Minimise vegetation clearing and disturbance to footprint areas only. • Compile a rehabilitation programme and rehabilitate disturbed areas. • Compile and implement Alien Invasive Management Plan. • Undertake monitoring to evaluate whether further measures are required.
Avifauna Impact Assessment (Appendix E3)	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 wetland features, dams and artificial livestock watering points, or remove/relocate watering points. • 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 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 wetland features, dams and artificial livestock watering points, or remove/relocate watering points. • 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 wetland features, dams and artificial livestock watering points, or remove/relocate watering points.
	Displacement of priority avian species from important habitats (Power Line)	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 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 wetland features, dams and artificial livestock watering points, or remove/relocate watering points.

				• 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)	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 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). • Avoid and buffer wetland features, dams and artificial livestock watering points, or remove/relocate watering points. • 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)	Negative Medium	Negative Low	• Avoid and buffer habitat with high preliminary avian sensitivities. Where necessary, relocate or remove artificial watering points. • Avoid and buffer wetland features, dams and 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.
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. As High / No-Go have been avoided by the major infrastructure, the aquatic zones associated within the CBAs have also been avoided.

				• 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. This especially as a drainage line will be cleared. • 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: • No stormwater discharged may be directed to delineated aquatic zones or the associated buffers. • A stormwater management plan finalised 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 100 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 E4)	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.
	Visual impact of construction activities on sensitive visual receptors to the PL.	Negative Low	Negative Low	
	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 E8)	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 Merafong City LM, West Rand DM, Gauteng 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 Carmel 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. • Game 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. • Mitigation measures from the Agricultural and Soil Report, should also be implemented.
	In-migration of labourers in search of employment opportunities, and a resultant change in	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.

	population, and increase in pressure on local resources and social networks, or existing services and infrastructure			• Engage with local community representatives prior to construction to facilitate the adoption of the locals first procurement policy. • Provide transportation for workers (from Carletonville and surrounds) to ensure workers can easily access their place of employment and do not need to move closer to the project site. • As far as possible, 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	• As far as possible, 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 Medium	• All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. • Heavy vehicles should be inspected regularly to ensure their road worthiness. • Provision of adequate and strategically placed traffic warning signs, that have to be maintained for the duration of the construction phase, and control measures along the R501 and R500 roads to warn road

				users of the construction activities taking place for the duration of the construction phase. Warning signs must be always visible, especially at night. • Implement penalties for reckless driving to enforce compliance to traffic rules. • Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work). • The developer and EPC Contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities. • The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if disturbed due to construction activities. • The EPC Contractor must ensure that damage / wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase. • A method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.
	Nuisance impacts 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 and loss of farm infrastructure and the threatening of human lives that are associated with the increased risk of veld fires	Negative Medium	Negative Low	• A firebreak should be implemented before the construction phase. The firebreak should be controlled and implemented around the perimeters of the project site. • Adequate fire-fighting equipment should be provided and readily available on site and all staff should be trained in firefighting and how to use the fire-fighting equipment. • No staff (except security) should be accommodated overnight on site and the contractor should ensure that no open fires are allowed on site. The use of cooking or heating implements should only be used in designated areas. • Contractors need to ensure that any construction related activities that might pose potential fire risks, are done in the designated areas where it is also managed properly. • Precautionary measures need to be taken during high wind conditions or during the winter months when the fields are dry. • The contractor should enter an agreement with the local farmers before the construction phase that any damages or losses during the construction phase related to the risk of fire and that are created by staff during the construction phase, are borne by the contractor.
	Intrusion impacts from construction activities will have an impact on the area's "sense of place".	Negative Medium	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 E9)	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 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 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(c)(ii)(iv) (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 (c) Gauteng province (ii) National Protected Area Expansion Strategy Focus Area (iv) Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans."*

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
Terrestrial Biodiversity Impact Assessment (Appendix E2)	Vegetation Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	Negative Medium	Negative Low	• Compile and implement Alien Invasive Management Plan. Rehabilitate disturbed areas.
Avifauna Impact Assessment (Appendix E3)	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 Medium	Negative Low	• 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/seeps by at least 350m. • Buffer artificial livestock watering points (by at least 100m), 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	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 observations and carcass searches on a regular and systematic basis. • Apply bird diverters when wetland features or untransformed/scarp/rocky grassland habitat are to be crossed. • Collisions will be reduced if the grid corridor is placed alongside existing powerlines.
	Electrocution when perched on power line infrastructure	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	Potential spread of alien vegetation	Negative Medium	Negative Low	• Refer to Construction Phase mitigation (Table 6.3)

Assessment (Appendix E1)				
Visual Impact Assessment (Appendix E4)	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 receptors within a 1km radius from the power line	Negative Medium	Negative Low	Planning: • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. Operations: • Maintain general appearance of the power line corridor. • Screening can be established near sensitive receptors, upon request, rather than to mitigate the impact at the source.
	Visual impact on sensitive visual receptors between a 1km and 3km 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 receptors between a 1km and 3km radius from the power line.	Negative Medium	Negative Low	Planning: • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. Operations: • Maintain general appearance of the power line corridor. • Screening can be established near sensitive receptors, upon request, rather than to mitigate the impact at the source.
	Visual impact on sensitive visual receptors within a 3km and 5km 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 receptors between a 3km and 5km radius from the power line.	Negative Low	Negative Low	Planning: • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. Operations: • Maintain general appearance of the power line corridor. • Screening can be established near sensitive receptors, upon request, rather than to mitigate the impact at the source.

	Visual impact on sensitive visual receptors within a 5-10km radius from the SEF	Negative Low	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 receptors within a 5-10km radius from the power line	Negative Low	Negative Low	Planning: • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. Operations: • Maintain general appearance of the power line corridor. • Screening can be established near sensitive receptors, upon request, rather than to mitigate the impact at the source.
	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.
	Visual impacts and sense of place impacts associated	Negative Low	Negative Low	• It is believed that renewable energy resources are essential to the environmental well- being of the country and planet

	with the operation phase of the PL.			(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 E8)	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 the proposed project on an agricultural property	Negative Medium	Negative Low	• The proposed mitigation measures for the construction phase should have been implemented at this stage.
	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 Carmel 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.

	Visual impacts and sense of place impacts associated with the operation phase of Carmel 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 Carmel 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 E9)	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
Terrestrial Biodiversity Impact Assessment (Appendix E1)	Vegetation Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites	Negative Low	Negative Low	• No additional clearing of vegetation should take place without a proper assessment of the environmental impacts and authorization from relevant authorities. • If any additional infrastructure needs to be constructed, for example overhead powerlines, communication cables, etc., then these must be located next to existing infrastructure, and clustered to avoid dispersed impacts. • No driving of vehicles off-road. • Implement Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas. • Access to sensitive areas outside of development footprint should not be permitted during operation. • Surface runoff and erosion must be properly controlled and any issues addressed as quickly as possible.
	Vegetation Continued establishment and spread of alien invasive plant species due to the presence of migration corridors	Negative Medium	Negative Low	• Implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. • Undertake regular monitoring to detect alien invasions early so that they can be controlled. • Post-decommissioning monitoring should continue for an appropriate length of time to ensure that future problems are avoided.

	and disturbance vectors			• Do NOT use any alien plants during any rehabilitation that may be required.
Avifauna Impact Assessment (Appendix E3)	Displacement of priority avian species from important habitats	Negative Low	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	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)
Traffic Impact Assessment (Appendix E9)	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 substances into the surrounding environment.	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. ○ 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.

	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.			• 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.

	Generation of hazardous waste			• 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)
- Terrestrial Biodiversity Assessment, Animal Species Compliance Statement, and Plant Species Compliance Statement – David Hoare Consulting (Pty) Ltd (see Appendix E2)
- Avifaunal Scoping Report– Pachnoda Consulting CC (see Appendix E3)
- Visual Impact Assessment – Donaway Environmental Consultants (see Appendix E4)
- Agricultural Compliance Statement – Johann Lanz Soil Scientist (see Appendix E5)
- Heritage Impact Assessment – J van Schalkwyk (see Appendix E6)
- Palaeontological Impact Assessment – Banzai Environmental (Pty) Ltd (see Appendix E7)
- Social Impact Assessment – Donaway Environmental Consultants (see Appendix E8)
- Traffic Impact Assessment – iWink Consulting (Pty) Ltd (see Appendix E9)
- Desktop Geotechnical Assessment – Delta Geotech (see Appendix E10)
- 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 greater study area (20 km radius) was dominated by three major types of natural aquatic features and a number of artificial barriers associated with catchments and rivers, characterised as follows:

- Watercourses with Channelled Valley Bottom Wetlands;
- Grassland seepages areas; and
- Depressions, dominated by grass species

The study area (PV site) was situated predominantly within the Gauteng Shale Mountain Bushveld (Svcb10) and Carletonville Dolomite Grassland (Gh15) vegetation units, associated with the upper reaches of the Mooirivierloop River (C23E) catchment. The site contains an unknown tributary, in which several Channelled Valley Bottom wetlands were observed. As the study area is largely on a karst system (dolomites/limestones), several seeps and or endorheic pans were also anticipated, however these are approximately 2 – 3 km from the proposed site.

Two of the observed wetland areas were found along the length of the eastern and western boundaries of the Carmel Solar 2 site, located within the wetland buffers which had implications on the structure placement in the design phase. Especially considering that these wetland areas are considered CBA, and thus forms part of the Very High sensitivity area indicated in the DFFE Screening Tool. Thus, these have been avoided by the proposed layout except for the proposed access road, that will make used of an existing road, and the grid connection that could span the observed systems. A very degraded watercourse, currently covered in alien tree vegetation will however be cover by PV panel areas, but this system was considered to have moderate sensitivity and the proposed PV panels will have little impact on this systems hydrology.

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 if the High sensitivity / No-Go areas are avoided, then the impacts would be limited on the aquatic environment, even when considering that a small drainage line will be cleared. 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 and buffer zones are implemented. The significant impacts are associated with the access road crossings river systems. These systems are generally in a modified state but 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?"

According to the Terrestrial Biodiversity Assessment (Appendix E2), the parts of the site currently within established woodlots of alien trees are considered to have low sensitivity or biodiversity value, whereas remaining natural parts of the site are within a Critical Biodiversity Area and partly an Ecological Support Area and therefore have high sensitivity and biodiversity value.

The project study area consists significantly of exotic woodlots along with a band of natural grassland and woodland habitat. Existing impacts on natural habitat are related to planting of formal woodlots. The proposed project could potentially have significant effects on areas of natural habitat, even though Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld are not listed in the National Ecosystem List.

The most significant impact associated with the project is due to clearing of indigenous natural vegetation, of which significant areas could be affected, depending on the final layout. This impact was evaluated as having a significance of MEDIUM after mitigation, on condition natural areas are avoided as much as possible. All other assessed impacts had a significance of LOW after mitigation. One potential impact with the most significant risk in the absence of any management is due to the potential spread and growth of alien invasive plant species, which is facilitated by disturbance.

Natural areas are avoided as far as practicably possible. On the basis of low to medium significance the proposed development layout can be authorised provided that the mitigation measures listed within the terrestrial report is 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?"

According to the Avifauna Impact Assessment (Appendix E3), six major avifaunal habitat types were identified on the study site and surroundings, consisting of natural open grassland with bush clump mosaics, untransformed undulating grassland, scarp/rocky grassland, Eucalyptus plantations, microphyllous woodlands, wetland features and transformed habitat. Both the

untransformed undulating grassland and scarp grassland were identified with high avifaunal sensitivities since they supported high bird richness values and provided habitat for a unique avian assemblage, including habitat for the regionally vulnerable White-bellied Korhaan (*Eupodotis senegalensis*). Approximately 262 bird species are expected to occur in the wider study area, of which 179 species were observed in the study area. The expected richness included 10 threatened or near threatened species, 20 southern African endemics and 18 near-endemic species. A high number of southern African endemics (c. 15 species and near-endemic species (c. 15 species) were confirmed on the study site and immediate surroundings. In addition, a total of 90 collision-prone bird species have been recorded from the study area and immediate surroundings (with 42% of species confirmed from the study area), of which 51 species were waterbird taxa and 24 species were birds of prey.

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was high to low after mitigation. 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 although the rate of passing waterbird species were low. However, a high number of medium-sized bird of prey species occurred, which could interact with the electrical infrastructure. 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 E4), the significance of the visual impact will be a "Negative Low Impact". The only receptors likely to be impacted by the proposed development are the nearby property owners and nearby roads. However, a large part of the visual landscape is still reflecting a farming and intensive mining landscape with a much lower visual quality.

The construction and operational phase of the proposed Carmel 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 of 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 and working on nearby farms, people travelling on the Buffelsdoorn road and Deelkraal. The proposed SEF development might have a negative low impact after mitigation. The ZTV model also reflects a low average theoretical visibility of

approximately 40%. The area of Carletonville is visually polluted by mining activities and residents of the area might already be desensitised to industrial or service developments. The tourism sector in the area is very small due to the mines and most people living in the area are dependent on income from mines, mining services or secondary income from businesses related to mining activities and population numbers. The development of the SEF in this area will concentrate a negative visual impact in an already visually polluted landscape.

The construction and operational phase of the power line will have a visual impact on the study area, especially within (but not restricted to) a 1 km radius. The visual impact will differ amongst places, depending on the distance to the PL. Receptors that might be the most sensitive to the proposed development are residents living on farms and people travelling the Buffelsdoorn road. The ZTV model also reflects a low average theoretical visibility of approximately 53%.

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 and mining 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 E5), the land capability of this site is assessed as being insufficient for viable and sustainable crop production due to soil depth limitations. The entire site is therefore verified in this assessment as being of 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 insufficient land capability 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 E6), 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.

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 Carmel Solar 2 is in an area with a medium presence of heritage sites and features.

- Less frequently found are artefacts dating to the Stone Age. Those that have been reported on mostly date to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops.
- There is also a well-presented Late Iron Age element. Stone walled sites are scattered all over, especially on the higher, more rocky areas.
- The colonial period manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines. For this review, heritage sites located in urban areas have been excluded.

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 Paleontological Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo) indicate that the project area has a high sensitivity of fossil remains to be found and therefore a desktop paleontological 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 E7), the Carmel 2 Solar development is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup), the Rooihoogte and Timeball Hill Formations (Pretoria Group, Transvaal Supergroup) as well as unfossiliferous diabase. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Malmani Subgroup is Very High, that of the Timeball Hill Formation is High, while the Rooihoogte has a Low Palaeontological Sensitivity. The Palaeontological Sensitivity of the diabase is Zero as it is igneous in origin (Almond et al, 2013; SAHRIS website). Two access road alternatives are proposed for this project but as the geology of these roads are the same as that of the rest of the development there is no preference from a palaeontological point of view. The Very High Sensitivity of the Malmani Subgroup triggered a site investigation.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 3 November 2022. During the site investigation no fossiliferous outcrops were detected. A Low Palaeontological Significance has been allocated to the development. It is thus considered that the proposed Carmel Solar 2 Photovoltaic Solar Energy Facility 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 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 therefore considered that the proposed Carmel Solar 2 Photovoltaic Solar Energy Facility Power Plant will not lead to detrimental impacts on the palaeontological reserves of the area

if mitigation measures are adhered to. As such 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 E8), there are some vulnerable communities within the project area that may be affected by the development of Carmel Solar 2 SEF and its associated infrastructure. These communities include the people living in the surrounding areas of Carletonville and in the town itself. 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 Carmel 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 E9), the potential traffic and transport related impacts for the construction, operation and decommissioning phases of the proposed Carmel Solar 2 Photovoltaic Solar Energy Facility 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 and communicated to the respective service provider of the OHL) 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 impact on the traffic on the surrounding road network and as such the project is supported from a transport engineering perspective.

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 study (Appendix E10), 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 0.20m begl and rapidly become medium dense to dense. Pedogenic soils would be dense to very dense in consistency if encountered. While the residual soils if encountered could have a fine-grained component that may exhibit compressibility, heave potential and require some form of ground improvement.

In terms of founding, expect moderate founding depths in denser soils or rock for all structures. Pad footings or shallow screw piles may be options. Depending on the thickness of the transported sands and the expansiveness of possible residual soils, additional precautions such ground improvement in the form of soil mattresses may be required. Detailed geotechnical investigations will be required to confirm the geotechnical site conditions for the Carmel Solar 2 site.

Excavatability

Excavation in 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 (Diabase, Quartzites, Ferruginous Shale etc).

Possible Geotechnical Restraints to be Overcome

The following restraints could potentially occur:

- Compressible soils associated with deeper alluvial and colluvial soils
- Saturated soils during peak rainfall episodes may result in difficulties associated with access around the site.
- Moderately expansive soils associated with thicker wad residual soils.

- Potential sporadic boulder class A and B excavation requirements associated with alluvial soils if encountered.
- Intermediate and Hard rock excavation likely to occur at shallow to moderate depths of between 0.50m to 2.00m.

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, detailed geotechnical assessment is required to confirm site geology and groundwater regime. However, the site appears favourable for the proposed Carmel Solar 2 development. If the site is classified as low risk from these studies, then standard foundation solutions will be appropriate.

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 Carmel 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 6.7.

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 6.7: The rating system

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

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

INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		

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

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

7 CUMULATIVE EFFECTS ASSESSMENT

This section aims to address the 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 S&EIR process 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.

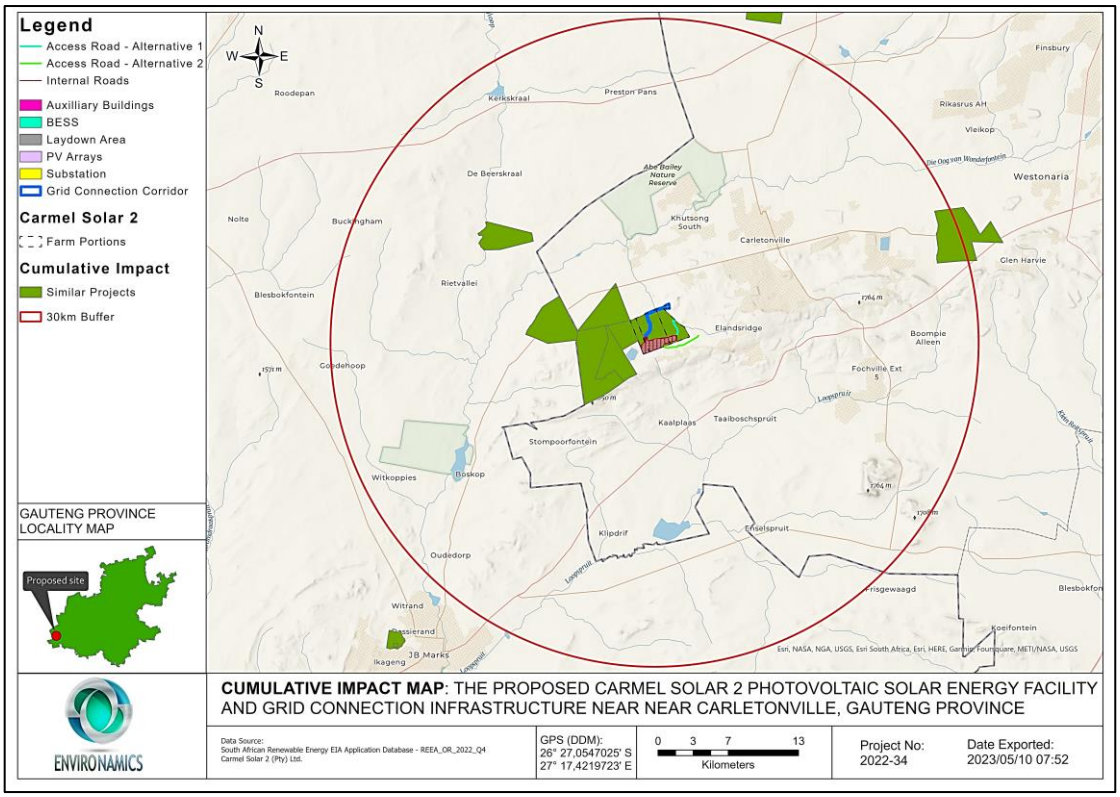


Figure 7.1: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines

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 Gauteng 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 2023/2024 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.

7.4 OTHER PROJECTS IN THE AREA

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

7.4.1 Existing Projects in the Area

According to the DFFE's database, six[4] (06) solar PV plant 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
PV Facility for Sibanye Gold	25km	200 MW	14/12/16/3/3/2/919	Scoping and EIA	Approved
Carmel Solar 3	1,82km	150 MW	14/12/16/3/3/2/2313	Scoping and EIA	In Process
Carmel Solar 1	0km	150 MW	14/12/16/3/3/2/2310	Scoping and EIA	In Process
Varkenslaagte Solar	1km	240 MW	14/12/16/3/3/2/2312	Scoping and EIA	In Process
Turffontein Solar 1	5,31km	240 MW	14/12/16/3/3/2/2314	Scoping and EIA	In Process
Rooidraai Solar	12,09km	150 MW	14/12/16/3/3/2/2344	Scoping and EIA	In Process

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

[4] Environamics is the appointed responsible environmental consultant for five (05) PV facility applications with the exception of the PV Facility for Sibanye Gold

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) provided as part of the scoping report, specialists were asked to, where possible, take into consideration the cumulative effects associated with the proposed development and other projects which are either developed or in the process of being developed in the local area – refer to Figure 7.2 for process flow. The following sections present their findings. The following sections present their findings.

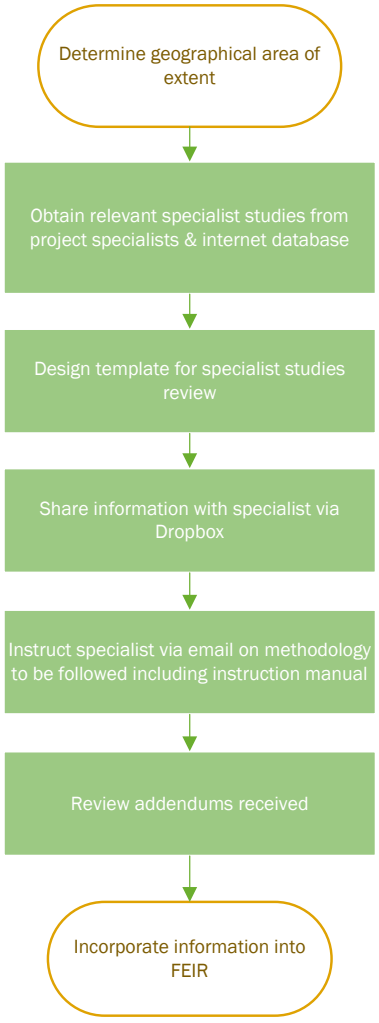


Figure 7.2: Process flow diagram for determining cumulative effects

7.5.1 Soil, Land Capability and Agricultural Potential

According to the Agriculture Compliance Statement (Appendix E5), 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?*

Department of 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 quantifying the impact of all renewable energy applications within a 30 km radius. There are a total of six renewable energy project applications within this radius 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 the six developments (total generation capacity of 1 330 MW) will amount to a total of approximately 3 325 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 1.18% of the surface area. That is well within an acceptable limit in terms of loss of land which is only suitable for grazing, of which there is no scarcity in the country. This is particularly so when considered within the context of the following point.

In order for South Africa to 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 that is of limited agricultural potential than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country.

In terms of the loss of agricultural land to renewable energy, it should also be noted that renewable energy development can only be located in fairly close proximity to a substation that has available capacity. This effectively protects most agricultural land in the country from

renewable energy development because only a small proportion of the country's total land surface is located in close enough proximity to an available substation to be viable for renewable energy development.

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

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

7.5.2 Terrestrial Biodiversity Impact Assessment

According to the Terrestrial Biodiversity Impact Assessment (refer to Appendix E2), the regional terrestrial vegetation types in the broad study area are listed as Least Concern. Loss of habitat will definitely occur (according to the current layout), but this will be a small area in comparison to the total area of the vegetation type. The vegetation type occupies an area of 8 945 km^2, of which approximately 0.2 km^2 occurs on site, an insignificant proportion (0.002%).

The site is already invaded. To construct the proposed infrastructure, alien trees will have to be cleared to a significant degree. The risk of alien invasion into surrounding areas will therefore be reduced or neutral. The significance will therefore be negligible, especially if control measures are implemented.

7.5.3 Visual

According to the Visual Impact Assessment (refer to Appendix E4), the anticipated cumulative visual impact for the SEF and power line are 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 and mining related activities. Further construction and operation of the SEF in the area is likely to have a negative impact.

The proposed development is located in a close proximity of existing power infrastructure and might have a cumulative impact on viewers. Several other SEFs are also proposed in the area and the potential for cumulative impacts to occur as a result of the projects are therefore very likely. The visual landscape mainly consists of agricultural and mining developments with a low visual quality. Permanent residents of the area might be desensitised over time with the construction of more SEFs, but will stay subjective for each viewer. 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.

7.5.4 Heritage

The Heritage Impact Assessment (Refer to Appendix E6), 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 Carmel 2 PV project is in

an area with a medium presence of heritage sites and features. Heritage resources which can be classified as highly significant (Grade 1) are absent from the region. However, Grade 2 sites, dating to the Late Iron Age as well as the historic times occur sporadically all over.

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

7.5.5 Palaeontology

According to the Palaeontological Impact Assessment (refer to Appendix E7), 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 Guateng 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.

7.5.6 Traffic

According to the Traffic Impact Assessment (refer to Appendix E9), 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.

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 SEF	Carmel 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	+ Medium

		employment and procurement of services are more considerable than that of Carmel Solar 2 SEF alone.	
	Negative impacts and change to the local economy with an in-migration of labourers, businesses and jobseekers to the area.	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 employment policy in order to reduce the potential of such an impact occurring.	- Medium
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 Carmel 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	Cumulative visual impacts related to the SEF and PL.	The anticipated cumulative visual impact for the SEF and power line are 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 and mining 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 phases. The information to date has shown that no significant adverse residual impacts are likely. However, cumulative impacts could arise as other similar projects are constructed in the area.

The potential most significant cumulative impacts relate to:

- Cumulative effects during construction phase:
  - 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 Gauteng 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.

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 Carmel 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 I for the final layout map which avoids the areas required to be conserved.

The main features to be avoided are the high avifaunal sensitive portions of the site. The sensitive features related to the ecology includes the Channelled Valley Bottom wetlands over which the proposed grid line with span. The facility will lie within 500 m of the identified Channelled Valley Bottom wetlands.

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

The key components of the proposed project are described below:

- PV Panel Array - To produce up to 200 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.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480 V up to 33 kV up to 132 kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480 V and this is fed into step up transformers to 132 kV. An onsite substation will be required to step the voltage up to 132 kV, after which the power will be evacuated into the national grid. Energy generated by the facility will be transmitted from the facility substation/Eskom switching station to the Carmel Main Transmission Substation via a new 132 kV powerline. The Project will inject up to 200 MW into the National Grid.

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4 m underground as far as practically possible.

- Supporting Infrastructure – The following auxiliary buildings including a gate house, ablutions, workshops, storage and warehousing areas, site offices, control centre and a 33 kV switch room 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 – A Battery Storage Facility with a maximum height of 8 m and development footprint of ~5 ha and associated operational, safety and control infrastructure.

- Roads – The majority of the access road will follow existing, gravel farm roads that will require widening between 6 to10 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 (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 existing D92 District 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 Carmel Solar 2 PV facility, Registration Division IQ, Gauteng Province be approved subject to the following conditions:

- Implementation of the proposed mitigation measures set out in the EMPr's (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.
- Two (02) access road alternatives have been presented both of which follow existing gravel tracks. The technically preferred alternative is the alternative 1 route from a development and technical perspective. The length of the access route is considerably shortened. This option provides the most technically sensible solution for the transportation of goods and services to and from the sites, including consideration of the road requirement for the transportation of the facility components. It is therefore requested that the preferred Alternative 1 be authorised for the developments.
- 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 finds the report in order and await your comments in this regard.

Ms. Roschel Maharaj
Environamics Environmental Consultants

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