PROPOSED ALTINA 120MW SOLAR PHOTOVOLTAIC & 40MW BATTERY ENERGY STORAGE SYSTEMS PROJECT NEAR THE TOWN OF ORKNEY, FREE STATE PROVINCE

BASIC ASSESSMENT REPORT

DFFE REFERENCE NO.: 14/12/16/3/3/1/2591

AMENDED DRAFT

NOVEMBER 2022

APPLICANT: ENERGYTEAM (PTY) LTD

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TITLE AND APPROVAL PAGE

Project Name:	Proposed Altina 120MW Solar Photovoltaic & 40MW Battery Energy Storage Systems Project near the town of Orkney, Free State Province
Report Title:	Basic Assessment Report
Authority Reference:	14/12/16/3/3/1/2591
Report Status:	Amended Draft

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EXECUTIVE SUMMARY

A. PROJECT BACKGROUND AND MOTIVATION

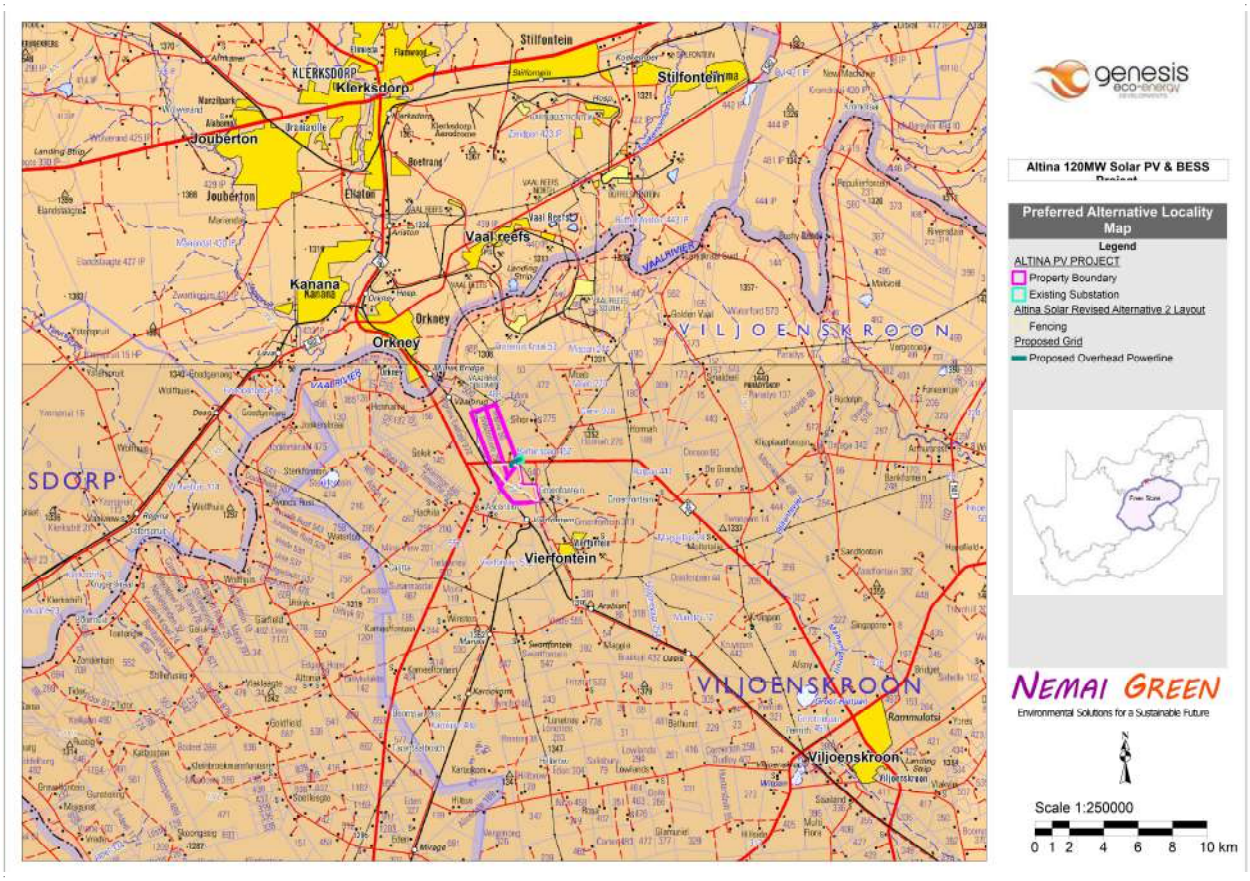
The South African Government ratified the Paris Agreement in 2016, and thereby showed the country's commitment to contribute to the global effort to address the challenge of climate change. Electricity generation sources need to be diversified to ensure security of supply and reduction in the carbon footprint created by the current heavy reliance of South Africa (SA) on coal to produce electricity. The electricity demand is increasing in SA, and in order to match that demand there is a need to supply a diversified power generation that includes renewable energy technologies. These technologies include solar, wind, small utility scale hydro, biomass, biogas and energy storage that the Department of Mineral Resources and Energy (DMRE) intends to develop and implement as identified in the approved Integrated Resource Plan (IRP) 2019.

The Applicant has proposed the development of the Altina 120MW Solar PV and 40MW BESS Project near the town of Orkney, in the Free State Province. The electricity generated by the Project will be injected into the existing Eskom 132 kV distribution system.

The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA.

B. PROJECT LOCATION

The Project is located in the northern part of the Free State Province and north-western part of the Fezile Dabi District Municipality (FDDM) and falls within Ward 22 of the Moqhaka Local Municipality (MLM). The site is located approximately 7km to the south of the town of Orkney and is accessed directly from the R76 which runs to the north of the site.



Locality map of the Project Area

C. PROJECT DESCRIPTION

The technical details of the proposed PV facility are tabulated below.

Technical details of the proposed PV facility

No.	Component	Description / Dimensions
1.	Height of PV panels	± 2m
2.	Area of PV Array	± 132 ha
3.	Total area of Project	± 180 ha
4.	Number of inverters required	Approximately 25
5.	Area occupied by inverter / transformer stations / substations	Area occupied by inverters = ± 1 ha Area occupied by on-site substation = ± 1.5 ha
6.	Capacity of on-site substation	160MW, 132 kV/22kV
7.	Area occupied by both permanent and construction laydown areas	Construction Laydown area = ± 2.1 ha Overall hardstanding area (inclusive of laydown area, OSS, O&M area, BESS) = ± 9ha.
8.	Area occupied by buildings	Area occupied by Operation & Maintenance (O & M) infrastructure = ± 1 ha

No.	Component	Description / Dimensions
9.	Length of internal roads	~13 km
10.	Width of internal roads	12m reserve and 4m – 10m road widths
11.	Length of powerline from OSS to Grid Connection	~800 m
12.	Height of fencing	1.8m - 2.4m
13.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing

D. LEGISLATION AND GUIDELINES CONSIDERED

Pertinent legislation that has possible bearing on the proposed Project from an environmental perspective is briefly discussed in the Basic Assessment Report.

The relationship between the Project and the following key pieces of environmental legislation is also explained:

- National Environmental Management Act (No. 107 of 1998);
- National Environmental Management: Waste Act (Act No. 59 of 2008);
- National Water Act (Act No. 36 of 1998);
- National Environmental Management Air Quality Act (Act No. 39 of 2004);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004); and
- National Heritage Resources Act (Act No. 25 of 1999).

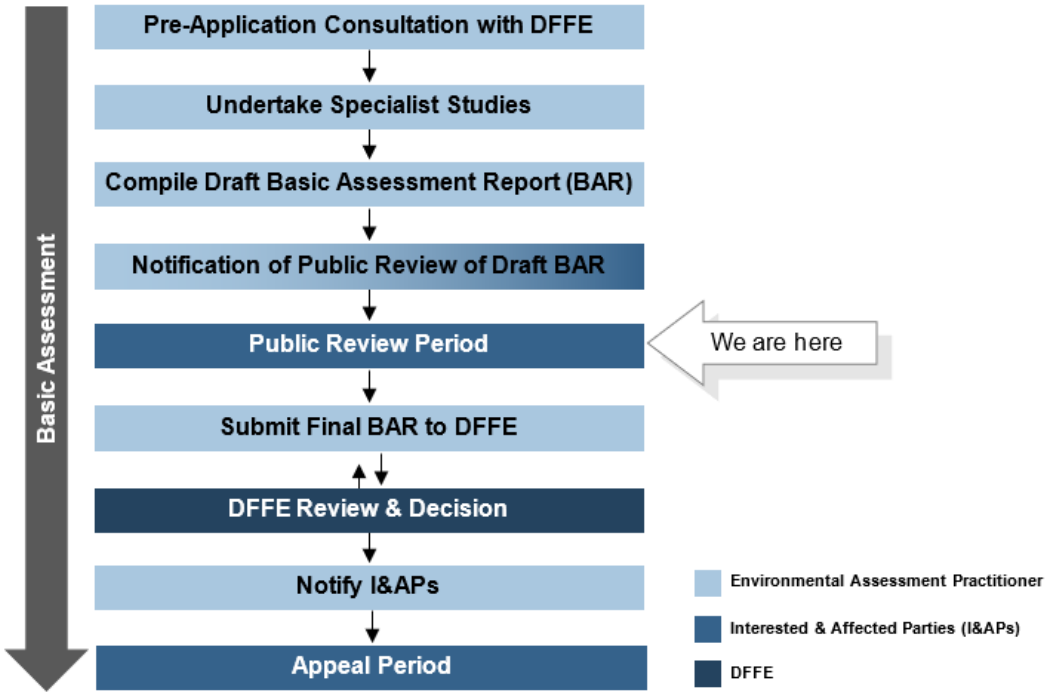
E. BASIC ASSESSMENT PROCESS

An Application for Environmental Authorisation in terms of the National Environmental Management Act (Act No. 107 of 1998) and the Environmental Impact Assessment Regulations of 2014 (as amended) has been made for the proposed Project. In terms of the aforementioned Act, the lead decision-making authority for the environmental assessment is the Department of Forestry, Fisheries and the Environment (DFFE).

The process for seeking authorisation is undertaken in accordance with Government Notice No. R. 982 of 4 December 2014 (as amended). The Project triggers activities listed in Listing Notices 1, 2 and 3, however a Basic Assessment Process is being undertaken as the Project is located within the Klerksdorp REDZ, as published in Government Notice No. 142 of 26 February 2021.

Additional information has been added to the draft BAR, namely a draft Rehabilitation Strategy, and therefore, the amended draft BAR is placed for a 30-day review period.

An outline of the Basic Assessment Process is provided in the diagram to follow.



Overview of Basic Assessment Process

F. PROFILE OF THE RECEIVING ENVIRONMENT

The Basic Assessment Report provides a general description of the status quo of the receiving environment in the Project area. This serves to provide the context within which the assessment was conducted and allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed Project.

The receiving environment is explained in terms of the following:

- Land Use
- Climate
- Geology and Soils
- Topography
- Surface Water
- Flora & Fauna
- Socio-Economic Environment
- Agriculture
- Planning
- Existing Structures and Infrastructure
- Transportation
- Air quality
- Noise
- Heritage & Palaeontological Features
- Health

G. SPECIALIST STUDIES

The specialist studies 'triggered' by the nature of the proposed development and its receiving environment include the following:

- Terrestrial Ecological Assessment;
- Avifaunal Assessment;
- Wetland Delineation and Risk Assessment

- Heritage Impact Assessment;
- Social Impact Assessment;
- Desktop Palaeontological Impact Assessment;
- Visual Impact Assessment; and
- Agricultural Potential Impact Assessment.

The information obtained from the respective specialist studies was incorporated into the Basic Assessment Report in the following manner (amongst others):

1. The information was used to complete the description of the receiving environment in a more detailed and site-specific manner;
2. A summary of each specialist study is provided, focusing on the approach to each study, key findings and conclusions drawn;
3. The specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment;
4. The evaluations performed by the specialists on the alternatives of the Project components were taken into consideration in the identification of the most favourable options; and
5. Salient recommendations made by the specialists were taken forward to the final Conclusions.

H. IMPACT ASSESSMENT

The Basic Assessment Report assessed the pertinent environmental impacts that could potentially be caused during the pre-construction, construction and operational phases of the Project.

Impacts were identified as follows:

- Impacts associated with listed activities contained in Government Notice No. R. 983 and R. 985 of 4 December 2014, as amended, for which Environmental Authorisation have been applied for;
- An appraisal of the Project's activities and components;
- An assessment of the receiving biophysical, social, economic and built environments;
- Findings from specialist studies;
- Issues highlighted by environmental authorities; and
- Comments received during public participation.

The impacts and the proposed management measures are discussed on a qualitative level and thereafter quantitatively assessed to ultimately determine the significance of the impacts. The assessment considered impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

The proposed mitigation of the impacts associated with the Project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. The Environmental Management Programme (EMPr) provides a comprehensive list of mitigation measures for specific elements of the Project, which extends beyond the impacts evaluated in the body of the Basic Assessment Report.

The implications of the “no-go option” are also assessed. The “no-go option” was considered in light of the motivation as well as the need and desirability of the overall Project. In contrast, should the proposed Project not go ahead, any potentially significant environmental issues associated with the Project would be irrelevant and the status quo of the local receiving environment would not be affected by the Project-related activities. The objectives of this Project would, however, not be met. This will *inter alia* mean that the Project’s intended benefits will not materialise. The “no-go option” is thus not preferred

Cumulative impacts were evaluated in terms of renewable energy projects in proximity to the proposed Project footprint. From a desktop scan it can be seen that these other renewable energy project sites are similar in nature to the proposed PV site. Cumulative impacts may be caused by these various developments, including loss of biodiversity and habitat fragmentation, visual and landscape character impacts, noise, reduction in air quality, traffic disruptions, impacts to water resources, as well as pressures on local facilities, goods and services. The aforementioned impacts in relation to the Project were assessed and mitigation measures were developed for each of the impact areas.

Other aspects considered in terms of cumulative impacts included:

- Traffic-related impacts in terms of the local road network;
- The clearance of vegetative cover for the Project’s development footprint;
- Increase in the dust levels during the construction phase;
- Problems associated with the influx of employment seekers;
- Positive cumulative economic effects from the construction of multiple developments in the area.

I. ANALYSIS OF ALTERNATIVES

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, Alternative 2 was identified as the Best Practicable Environmental Option (BPEO).

The BPEO also includes the revised layout, which avoids the environmental sensitive areas identified through the specialist studies as far as possible. The BPEO provides a balance between technological, energy and environmental aspects, while retaining the flexibility required in the final design stage of the Project.

J. PUBLIC PARTICIPATION

The Basic Assessment Report provides the details of the following tasks undertaken as part of the public participation process:

- Compiling the database of Interested and Affected Parties (I&APs);
- Notification of the project and review of the Draft Basic Assessment Report;
- Supplying of copies of the Draft Basic Assessment Report to Authorities; and
- Notification of the I&APs of the decision reached by the DFFE.

K. CONCLUSIONS

The following key tasks were undertaken during the Basic Assessment for the proposed Project:

- Specialist studies were undertaken and the findings were incorporated into the Basic Assessment Report in terms of understanding the environmental status quo and sensitive features, assessing the potential impacts and establishing concomitant mitigation measures, as well as identifying the preferred alternatives;
- Potentially significant impacts pertaining to the pre-construction, construction and operational phases of the Project were identified and assessed, and mitigation measures were provided; and
- Alternatives for achieving the objectives of the proposed activity were considered, and the preferred options were identified. The “no-go” option is not supported when considered the implications of not implementing the Project.

Attention is drawn to specific sensitive environmental features for which mitigation measures are included in the BAR and EMPr.

An Environmental Impact Statement is also provided, which includes highlighting key findings from the Basic Assessment, which may also influence the conditions of the Environmental Authorisation (if granted).

With the selection of the BPEO, the adoption of the mitigation measures included in the BAR and the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this Project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the Project and that Environmental Authorisation can be issued for Alternative 2, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

AMENDMENTS PAGE

Date	Nature of Amendment	Amendment No.
September 2022	Draft for Review by Authorities and the Public	0
November 2022	Amended draft BAR for Review by Authorities and the Public	1

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LIST OF ACRONYMS & ABBREVIATIONS

AC	Alternating Current
AEL	Atmospheric Emission Licence
ASAPA	Association for Southern African Professional Archaeologists
BESS	Battery Energy Storage System
BPEO	Best Practicable Environmental Option
CBA	Critical Biodiversity Area
CBD	Central Business District
COD	Commercial Operation Date
COVID-19	Coronavirus Disease 2019
CPV	Concentrated Photovoltaics
CR	Critically Endangered
DARD	Department of Agriculture and Rural Development
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DEL	Department of Employment and Labour
DESTEA	Department of Economic, Small Business Development, Tourism and Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DC	Direct Current
DMRE	Department of Mineral Resources and Energy
DPRT	Department of Police, Roads and Transport
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EHS	Environmental, Health, and Safety
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
FSHRA	Free State Heritage Resources Authority
GHG	Greenhouse Gas
GIS	Geographical Information System
GN	Government Notice
GVA	Gross Value Added
HV	High Voltage
I&APs	Interested and Affected Parties
IBA	Important Bird & Biodiversity Area
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer

IRP	Integrated Resource Plan
KZN	KwaZulu-Natal
MOSS	Metropolitan Open Space System
Na	Sodium
NaS	Sodium-Sulphur
NEMA	National Environmental Management Act (No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008)
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
OHS	Occupational Health and Safety
PS	Performance Standards
PV	Photovoltaic
REDZ	Renewable Energy Development Zones
REEA	Renewable Energy EIA Application
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RFI	Radio Frequency Interference
S	Sulphur
S&EIR	Scoping and Environmental Impact Reporting
SA	South Africa
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency
SANS	South African National Standard
SAPAD	South African Protected Areas Database
SARAO	South African Radio Astronomy Observatory
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SIP	Strategic Integrated Projects
SOTER	Soil and Terrain
ToR	Terms of Reference
UFS	University of the Free State
VFB	Vanadium Flow Battery
VRB	Vanadium Redox Battery
VU	Vulnerable
WMA	Water Management Area

UNITS OF MEASUREMENT

°C	Degrees Celsius
ha	Hectare
km	Kilometre
kV	Kilovolt
l/s	Litres per Second
m	Metre
m^2	Square metre
mm	Millimetre
MW	Megawatt
MWh	Megawatt hour
%	Percentage

1 PURPOSE OF THIS DOCUMENT

Nemai Green was appointed by energyTEAM (Pty) Ltd (the "Applicant") as the independent Environmental Assessment Practitioner (EAP) to apply for Environmental Authorisation for the proposed development of the **proposed Altina 120MW Solar Photovoltaic (PV) and 40MW Battery Energy Storage Systems (BESS) Project near the town of Orkney, in the Free State Province** (the "Project"). It should be noted that the Project Applicant was initially Genesis Eco-Energy Developments (Pty) Ltd., which was partnered with energyTEAM (Pty) Ltd. The partnership was dissolved, and the Project will fall under energyTEAM (Pty) Ltd moving forward. An amended Application Form accompanies this amended draft BAR.

The Basic Assessment is being undertaken according to the process prescribed in the Environmental Impact Assessment (EIA) Regulations of 2014, published under Government Notice (GN) No. 982 in Gazette No. 38282 of 4 December 2014 and amended by GN 326 of 7 April 2017 published in Gazette No. 40772 (the "EIA Regulations"). The EIA Regulations were promulgated in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA).

This document serves as the **draft Basic Assessment Report** (BAR) for the proposed Project. According to the EIA Regulations, the objectives of the Basic Assessment Process are to undertake the following, through a consultative process:

(a) Determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
(b) Identify the alternatives considered, including the activity, location, and technology alternatives;
(c) Describe the need and desirability of the proposed alternatives;
(d) Through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine -
    (i) The nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
    (ii) The degree to which these impacts can be reversed, may cause irreplaceable loss of resources, and can be avoided, managed, or mitigated.
(e) Through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to -
    (i) Identify and motivate a preferred site, activity and technology alternative;
    (ii) Identify suitable measures to avoid, manage or mitigate identified impacts; and
    (iii) Identify residual risks that need to be managed and monitored.

The amended draft BAR will be made available to Interested and Affected Parties (I&APs) for a 30-day review period from **04 November until 05 December 2022**. All comments received will be addressed in the final BAR and will also be included in the Comments and Responses Report. The

final BAR will then be submitted to the Department of Forestry, Fisheries and the Environment (DFFE), who is the Competent Authority in respect to this proposed development in terms of NEMA.

2 DOCUMENT ROADMAP

As a minimum, the BAR aims to satisfy the requirements stipulated in Appendix 1 of the EIA Regulations. **Table 1** below presents the document's composition in terms of the aforementioned regulatory requirements.

Table 1: BAR Roadmap

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
1.	Purpose of this Document	–	–
2.	Document Roadmap	–	–
3.	Project Background and Motivation	3(1)(b), (c), (d) & (q)	(b) the location of the activity, including - (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties. (c) a plan which locates the proposed activity or activities applied for as well as 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 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 - (ii) a description of the activities to be undertaken including associated structures and infrastructure. (q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised.
4.	Project Location		
5.	Project Description		
6.	Alternatives		(h) a full description of the process followed to reach the proposed preferred alternative within the site
7.	Need and Desirability	3(1)(f)	(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.

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
8.	Legislation and Guidelines Considered	3(1)(e)	(d) a description of the scope of the proposed activity, including - (i) all listed and specified activities triggered and being applied for. (e) a description of the policy and legislative context within which the development is proposed including - (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;
9.	Basic Assessment Process	3(1)(a)	(a) Details of - (i) the Environmental Assessment Practitioner (EAP) who prepared the Environmental Management Programme (EMPr); and (ii) the expertise of that EAP to prepare an EMPr, including curriculum vitae.
10.	Assumptions and Limitations	3(1)(o)	(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed.
11.	Financial Provisions	3(1)(s)	(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.
12.	Resource Use and Process Details	–	–
13.	Profile of the Receiving Environment	3(1)(h)	(h) a full description of the process followed to reach the proposed preferred alternative within the site, including - (iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.
14.	Summary of Specialist Studies	3(1)(k) & (m)	(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report. (m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr.

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
15.	Impact Assessment	3(1)(h), (i) and (j)	(h) a full description of the process followed to reach the proposed preferred alternative within the site, including - (v) the impacts and risks identified for each alternative, 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 associated with the alternatives; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) the outcome of the site selection matrix; (xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity. (i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; (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; (vii) the degree to which the impact and risk can be avoided, managed or mitigated.

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
16.	Analysis of Alternatives	3(1)(h) & (g)	(h) full description of the process followed to reach the proposed preferred alternative within the site, including - (i) details of all the alternatives considered. (g) a motivation for the preferred site, activity and technology alternative.
17.	Public Participation Process	3(1)(h)	(h) a full description of the process followed to reach the proposed preferred alternative within the site, including - (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.
18.	Conclusions and Recommendations	3(1)(l), (m), (n) & (p)	(I) an environmental impact statement which contains - (i) a summary of the key findings of the environmental impact assessment; (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives. (m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr. (n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation. (p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.
Appendix N	Oath of Environmental Assessment Practitioner	3(1)(r)	(r) an undertaking under oath or affirmation by the EAP in relation to - (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
			responses by the EAP to comments or inputs made by interested and affected parties;
N/A		3(1)(t)	Where applicable, any specific information required by the Competent Authority.
N/A		3(1)(u)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act.

3 PROJECT BACKGROUND AND MOTIVATION

The South African Government ratified the Paris Agreement in 2016, and thereby showed the country's commitment to contribute to the global effort to address the challenge of climate change. Electricity generation sources need to be diversified to ensure security of supply and reduction in the carbon footprint created by the current heavy reliance of South Africa (SA) on coal to produce electricity. The electricity demand is increasing in SA, and in order to match that demand there is a need to supply a diversified power generation that includes renewable energy technologies. These technologies include solar, wind, small utility scale hydro, biomass, biogas and energy storage that the Department of Mineral Resources and Energy (DMRE) intends to develop and implement as identified in the approved Integrated Resource Plan (IRP) 2019.

The Applicant has proposed the development of the Altina 120MW Solar PV and 40MW BESS Project near the town of Orkney, in the Free State Province. The electricity generated by the Project will be injected into the existing Eskom 132 kV distribution system.

The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA.

4 PROJECT LOCATION

4.1 Location of the Project relative to Solar Yield Area

The location of the Project in relation to SA's PV power potential is shown in **Figure 1** below. The Project Area is considered to have favourable solar irradiation levels, which makes it ideal for the production of solar power via PV Panels.

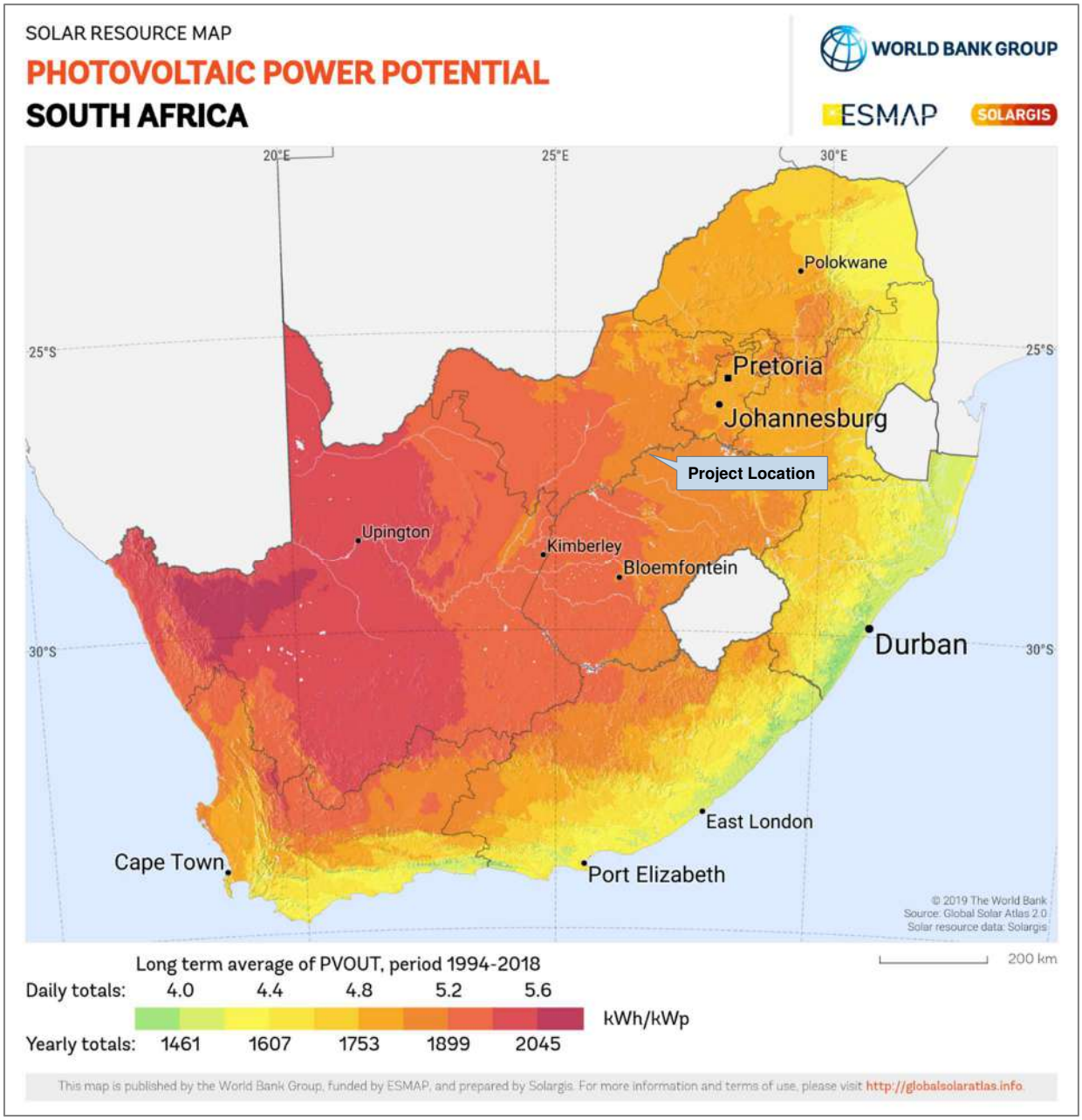


Figure 1: Location of the Project relative to PV Power Potential
(© 2019 The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis)

4.2 Geographical Context

The Project is located in the northern part of the Free State Province and north-western part of the Fezile Dabi District Municipality (FDDM) and falls within Ward 22 of the Moqhaka Local Municipality (MLM). The site is located approximately 7km to the south of the town of Orkney and is accessed directly from the R76 which runs to the north of the site. The locality maps are provided in **Figures 2 - 4** below, and are also contained in **Appendix A**.

The combined area of the proposed PV footprint (132 ha) and hardened area (including BESS, facility substation, laydown area and operation and maintenance building) is approximately 180 ha. The Project intends to connect to the existing 88kV/132kV Jersey Distribution Substation, which is located approximately 800 m to the north-east of the site.

The details of the properties affected by the footprint of the Project are provided in **Table 2** below.

Table 2: Details of the affected properties

Farm Name	Portion	21-digit Surveyor General No.
PV Site		
Batsfontein 290	0	F03600000000029000000
Altona 50	0	F03600000000005000000
Rietvlei 539	0	F03600000000053900000
Power Line		
Altona 50	0	F03600000000005000000
Barberspan 452	4	F03600000000045200004

The Project's coordinates are provided in **Table 3** (Alternative 1) and **Table 4** (Alternative 2) and shown in **Figure 5** and **Figure 6** below.

Table 3: Project coordinates for Alternative 1

No.	Project Component	Coordinates
	PV Site	
	Block 1	
1A	North-Western Corner	27°2'51.2128"S; 26°43'41.2392"E
1B	North-Eastern Corner	27°2'49.9333"S; 26°44'19.4395"E
1C	South-Eastern Corner	27°3'1.5574"S; 26°44'24.1483"E
1D	South-Western Corner	27°3'2.8912"S; 26°43'46.366"E
	Block 2	
2A	North-Western Corner	27°3'6.1963"S; 26°43'47.8168"E
2B	North-Eastern Corner	27°3'7.6799"S; 26°44'43.3543"E
2C	South-Eastern Corner	27°3'52.6842"S; 26°44'58.1589"E
2D	South-Western Corner	27°3'38.4106"S; 26°44'11.9965"E
	Block 3	
3A	North-Western Corner	27°3'47.0401"S; 26°44'11.0404"E
3B	North-Eastern Corner	27°4'7.8625"S; 26°45'3.1759"E

No.	Project Component	Coordinates
3C	South-Eastern Corner	27°4'16.6019"S; 26°44'58.2626"E
3D	South-Western Corner	27°4'16.2657"S; 26°44'32.1205"E
	Power Line	
4A	Start point (PV Site)	27°3'6.4876"S; 26°44'41.347"E
4B	Bend Point 1	27°3'4.941"S; 26°44'44.5189"E
4C	Bend Point 2	27°2'58.402"S; 26°44'41.9658"E
4D	End point (Eskom Substation)	27°2'56.5066"S; 26°44'46.7117"E

Table 4: Project coordinates for Alternative 2

No.	Project Component	Coordinates
	PV Site	
	Block 1	
1A	North-Western Corner	27° 3'6.41"S; 26°43'48.66"E
1B	North-Eastern Corner	27° 3'8.45"S; 26°44'42.97"E
1C	South-Western Corner	27° 4'2.27"S; 26°45'6.62"E
1D	South-Eastern Corner	27° 3'46.40"S; 26°45'18.88"E
	Block 2	
2A	Western Corner	27° 4'8.78"S; 26°45'11.42"E
2B	Northern Corner	27° 3'57.72"S; 26°45'19.87"E
2C	South-Western Corner	27° 4'12.85"S; 26°45'20.02"E
2D	South-Eastern Corner	27° 4'12.30"S; 26°45'25.20"E
	Power Line	
3A	Start point (PV Site)	27° 3'9.77"S; 26°44'28.57"E
3B	Bend Point 1	27° 3'6.03"S; 26°44'27.56"E
3C	Bend Point 2	27° 3'0.93"S; 26°44'31.84"E
3D	End point (Eskom Substation)	27° 2'55.93"S; 26°44'47.22"E

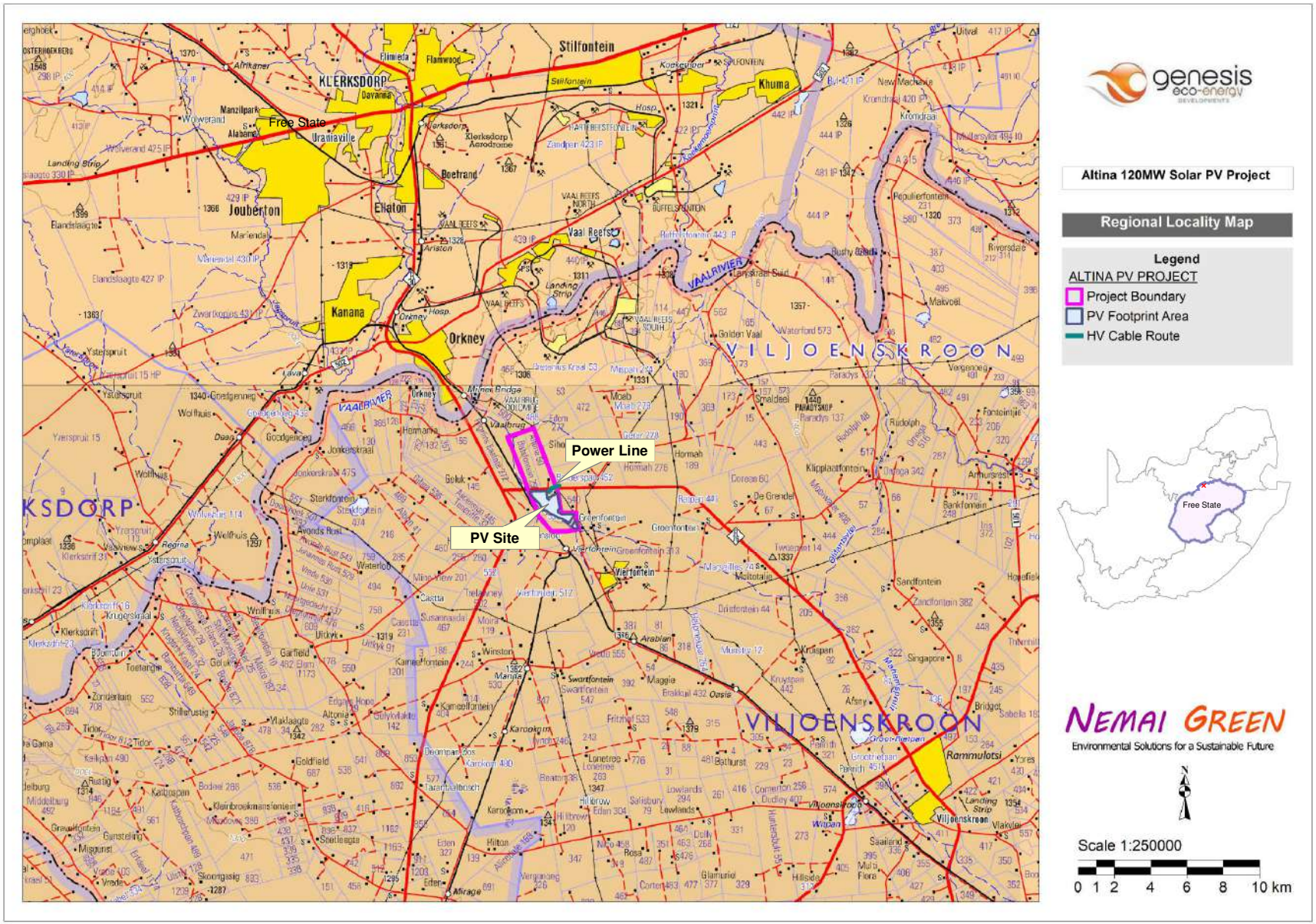


Figure 2: **Regional locality map** *(Note: not all Project components are shown due to scale)*

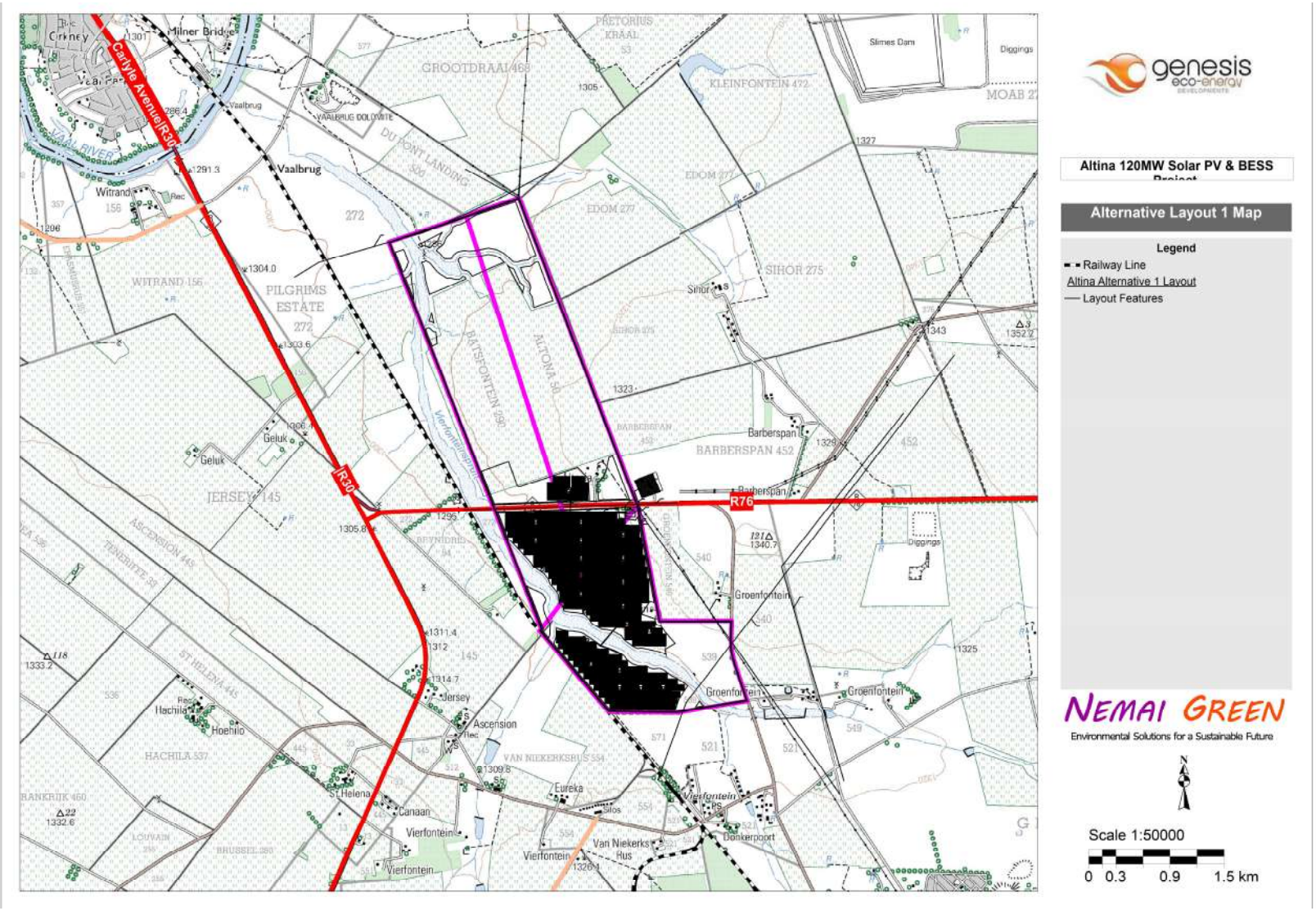


Figure 3: **Locality map Alternative 1 (topographical map)**

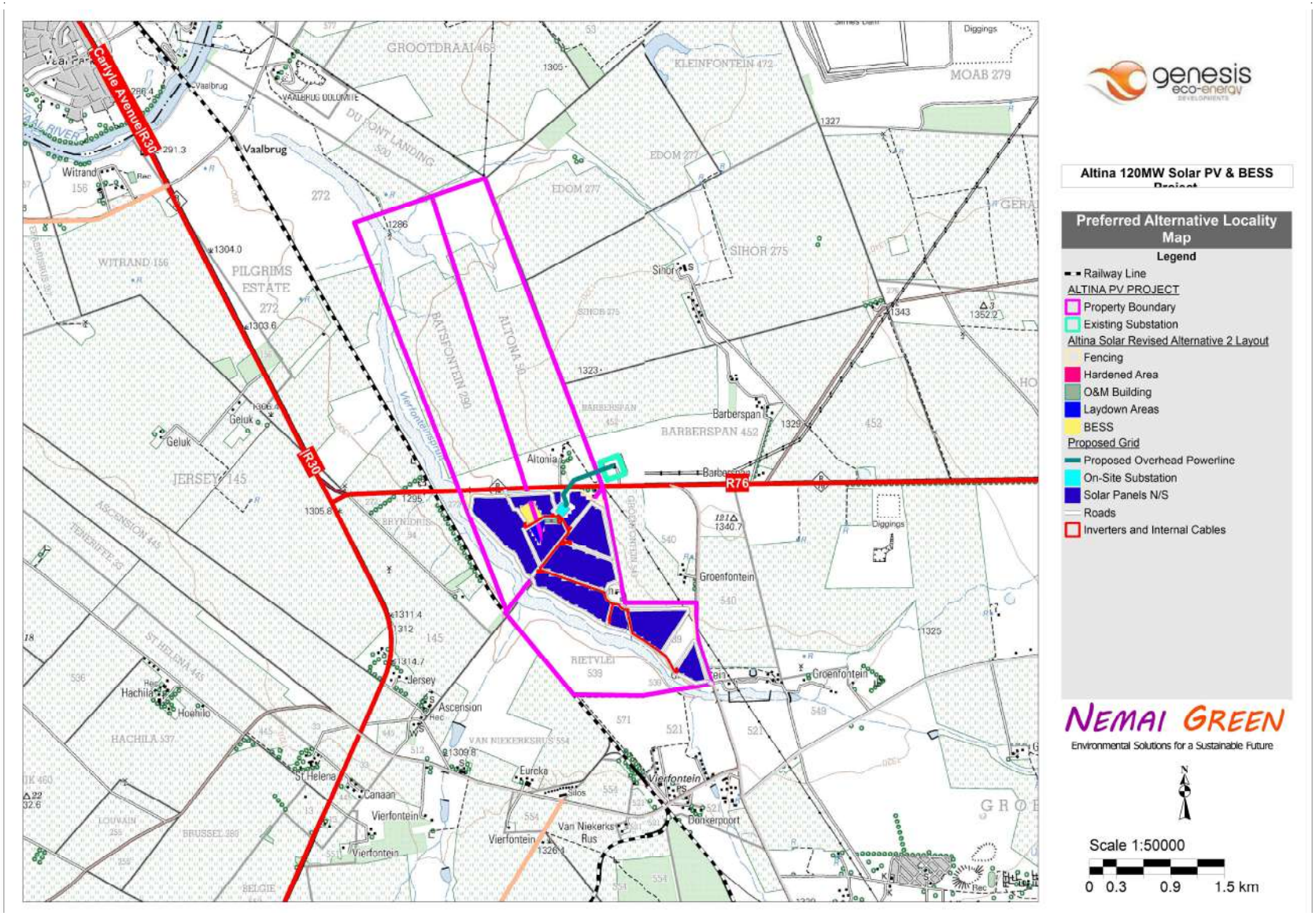


Figure 4: **Locality map Alternative 2 (topographical map)**

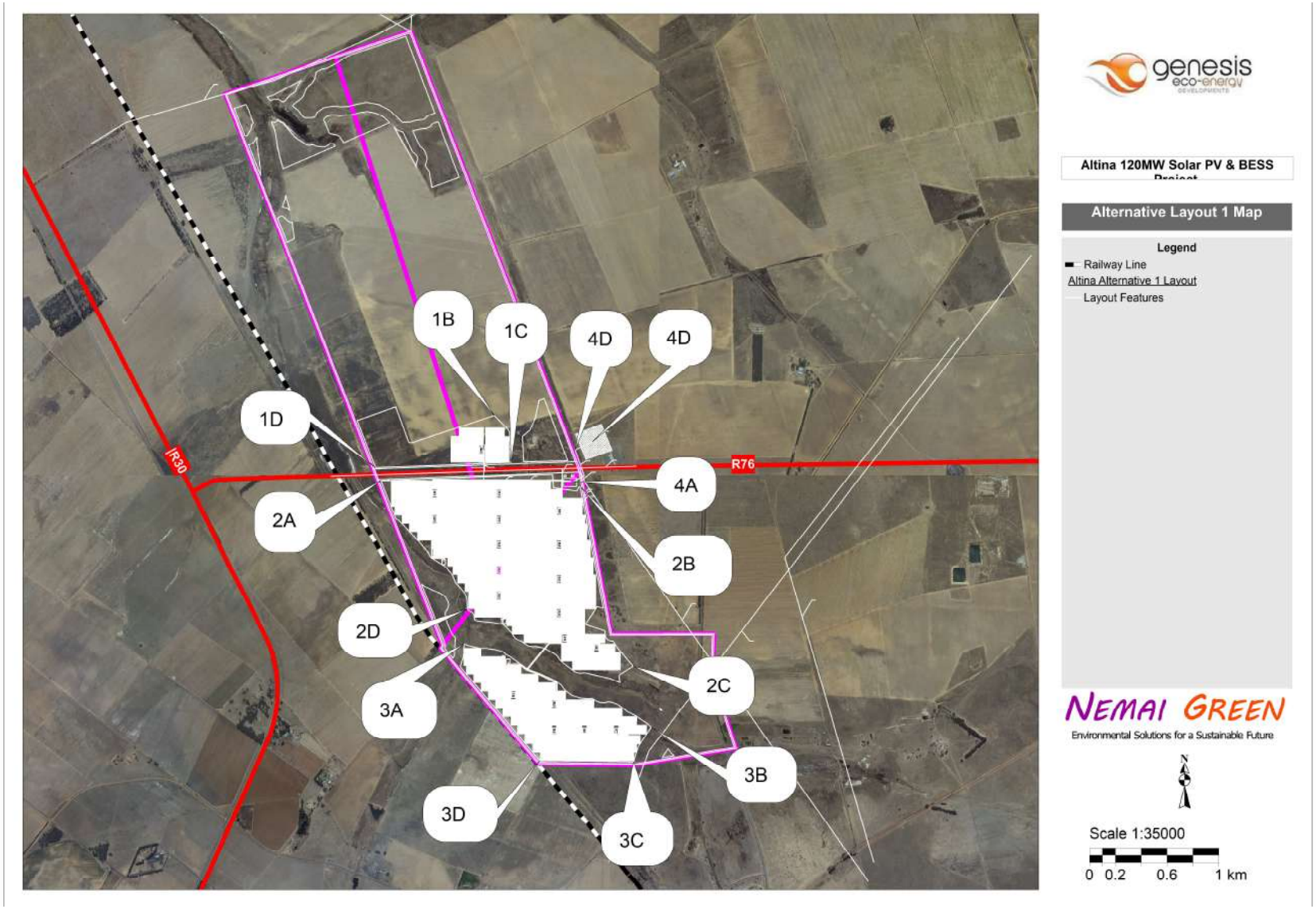


Figure 5: **Project coordinate points – Alternative 1 (orthophotograph)**

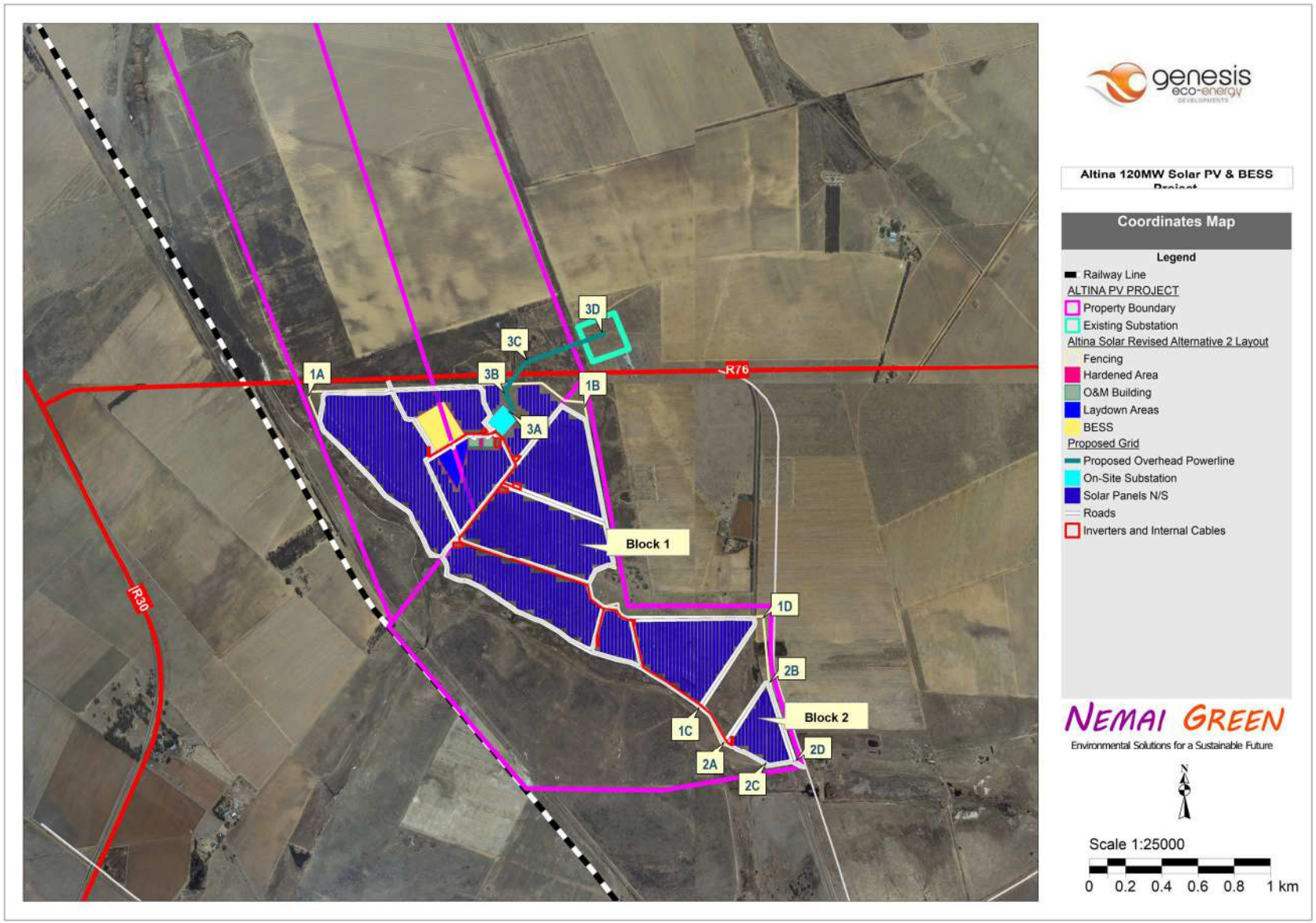


Figure 6: **Project coordinate points – Alternative 2 (orthophotograph)**

5 LEGISLATION AND GUIDELINES CONSIDERED

5.1 International Finance Corporation - Performance Standards & Guidelines

Where relevant, the Project will strive to satisfy and incorporate the International Finance Corporation (IFC) Performance Standards (PS), which serve as an international benchmark for identifying and managing environmental and social risks.

The IFC PS offer a framework for understanding and managing environmental and social risks for high profile, complex, international and potentially high impact projects. The IFC PS encompass the following eight topics:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety, and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage.

IFC's Environmental, Health, and Safety (EHS) Guidelines provide technical guidelines with general and industry-specific examples of good international industry practice to meet IFC PS.

5.2 Legislation

5.2.1 Environmental Statutory Framework

The legislation that has possible bearing on the proposed Project from an environmental perspective is captured in **Table 5** below. Note that this list does not attempt to provide an exhaustive explanation, but rather represents an identification of some of the most appropriate sections from pertinent pieces of legislation.

Table 5: Environmental Statutory Framework

Legislation	Description and Relevance
Constitution of the Republic of South Africa (No. 108 of 1996)	▪ Chapter 2 – Bill of Rights. ▪ Section 24 – Environmental Rights.
National Environmental Management Act (Act No. 107 of 1998)	▪ Key sections (amongst others): o Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment). o Section 28 – Duty of care and remediation of environmental damage.

Legislation	Description and Relevance	
	▪ Environmental management principles. ▪ Authorisation type – Environmental Authorisation. ▪ Authorities – DFFE (national) (competent authority for this application) and the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA) (provincial).	
EIA Regulations	▪ Purpose - regulate the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.	
GN No. R. 983 of 4 December 2014 (as amended) (Listing Notice 1)	▪ Purpose - identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. ▪ The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of the EIA Regulations. However, according to Regulation 15(3) of the EIA Regulations, Scoping and Environmental Impact Reporting (S&EIR) must be applied to an application if the application is for two or more activities as part of the same development for which S&EIR must already be applied in respect of any of the activities. ▪ The following activities under Listing Notice 1 are relevant to this Project:	
	GN No. R.983 – 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; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;* *excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is —* *(a) temporarily required to allow for maintenance of existing infrastructure;* *(b) 2 kilometres or shorter in length;* *(c) within an existing transmission line servitude; and* *(d) will be removed within 18 months of the commencement of development.*	*Proposed 132kV overhead power line outside an urban area, of approximately 779 m in length, linking the proposed solar facility to the existing Eskom Substation. Proposed on-site substation with capacity of 160MW, 132 kV/22kV.*
	GN No. R.983 – Activity 12(ii)(a) & (c): *The development of -* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs -* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -* *excluding -* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area;*	*Encroachment of project-related infrastructure into wetlands and within 32m of watercourses.* *This activity may be triggered for the development infrastructure and rehabilitation activities where erosion control structures may be constructed within wetland areas or within 32m of watercourses.*

Legislation	Description and Relevance	
	(ee) where such development occurs within existing roads, road reserves or railway line reserves; or *(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.*	
	GN No. R.983 – 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;* *but excluding where such infilling, depositing, dredging, excavation, removal or moving -* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.*	*Encroachment of project-related infrastructure into wetlands. This activity may also be triggered during rehabilitation of wetlands.*
	GN No. R.983 – Activity 24(ii): *The development of a road -* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road -* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	*New roads required for the Project (construction and operational phases).* *Internal Roads will have a 12m reserve and a road width of 4m – 10m.*
	GN No. R.983 – Activity 27: *The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	*Clearance of areas associated with the construction footprint.* *Approximately 9 ha to be cleared for hardstanding infrastructure. Only the support legs of the PV panels will impact on the clearance of vegetation.*
	GN No. R.983 – Activity 28(ii): *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	*Footprint of Project on land that was previously used for agricultural purposes, outside of an urban area, with a footprint of approximately 180 ha.*
	GN No. R.983 – Activity 56 (i & ii)	*Internal roads (existing farm roads) within the PV site to be*

Legislation	Description and Relevance	
	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* *excluding where widening or lengthening occur inside urban areas.*	*incorporated as far as possible and may be lengthened and widened.*
GN No. R. 984 of 4 December 2014 (as amended) (Listing Notice 2)	▪ Purpose - identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. ▪ The investigation, assessment and communication of potential impact of activities must follow a S&EIR process, as prescribed in regulations 21 to 24 of the EIA Regulations. ▪ The following activities under Listing Notice 2 are relevant to this Project:	
	GN No. R.984 – 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, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs -* *(a) within an urban area; or* *(b) on existing infrastructure.*	*The proposed Project involves the development of a PV facility with a total generation capacity of 120MW renewable solar energy with 40MW BESS.*
	GN No. R.984 – Activity 15: *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	*Cumulative area to be cleared for entire Project (except linear components) will exceed 20 hectares.*
GN No. R. 985 of 4 December 2014 (as amended) (Listing Notice 3)	▪ Purpose - list activities and identify competent authorities under sections 24(2), 24(5) and 24D of NEMA, where environmental authorisation is required prior to commencement of that activity in specific identified geographical areas only. ▪ The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of the EIA Regulations. However, according to Regulation 15(3) of the EIA Regulations, S&EIR must be applied to an application if the application is for two or more activities as part of the same development for which S&EIR must already be applied in respect of any of the activities. ▪ The following activities under Listing Notice 3 are relevant to this Project:	
	GN No. R.985 – Activity 4 - (b)(i)(cc) & (ee): *The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *b. Free State* *i. Outside urban areas:* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans* *adopted by the competent authority or in bioregional plans.*	*Sections of the Project's new roads encroach into the following sensitive areas:* ▪ *Critical Biodiversity Area (CBA) 1 in terms of the Free State Biodiversity Plan.*
	GN No. R.985 – Activity 12 - (b)(i), (ii) & (iv): *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *b. Free State* *i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area*	*Clearance of areas of indigenous vegetation as part of the development footprint within the following sensitive areas:* ▪ *Areas consisting of an endangered ecosystem (Vaal-Vet Sandy Grassland according to SANBI, 2011);* ▪ *CBA 1; and* ▪ *100 m from the edge of a watercourse or wetland.*

Legislation	Description and Relevance	
	that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004 *ii. Within critical biodiversity areas identified in bioregional plans;* *iv. Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.*	
	GN No. R.985 – Activity 14(ii) - (b)(i)(dd) & (ff): *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.* *b. Free State* *i. Outside urban areas:* *(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.*	*Development footprint within watercourse(s) / within 32 m from watercourse(s) within the following sensitive areas:* ▪ *CBA 1; and* ▪ *Moqhaka EMF.* *This activity will be triggered for the development infrastructure for the Project and rehabilitation activities where erosion control structures may be constructed.*
	GN No. R.985 – Activity no. 18(b)(i)(ee) & (hh) *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *b. Free State* *i. Outside urban areas:* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(hh) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.*	*Internal roads (existing farm roads) within the PV site to be incorporated as far as possible and may be lengthened and widened, within CBAs and within 100 m from the edge of a watercourse or wetland.*
National Water Act (Act No. 36 of 1998)	▪ Sustainable and equitable management of water resources. ▪ Key sections (amongst others): o Chapter 3 – Protection of water resources. o Section 19 – Prevention and remedying effects of pollution. o Section 20 – Control of emergency incidents. o Chapter 4 – Water use. ▪ Authorisation type – General Authorisation / Water Use Licence. ▪ Authority – Department of Water and Sanitation (DWS).	
National Environmental Management: Waste Act (Act No. 59 of 2008)	▪ Management of waste. ▪ Key sections (amongst others): o Section 16 – General duty in respect of waste management. o Chapter 5 – licensing of waste management activities listed in GN No. R. 921 of 29 November 2013 (as amended). ▪ Authorisation type – Waste Management Licence (*not required for the Project*). ▪ Authority – DFFE (national) and DESTEA (provincial).	
National Environmental Management Air Quality Act (Act No. 39 of 2004)	▪ Air quality management. ▪ Key sections (amongst others): o Section 32 – Dust control. o Section 34 – Noise control. ▪ Authorisation type – Atmospheric Emission License (*not required for the Project*).	

Legislation	Description and Relevance
	▪ Authority – DFFE (national), DESTEA (provincial) and District Municipality.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	▪ Management and conservation of the country's biodiversity. ▪ Protection of species and ecosystems. ▪ Authorisation type – Permit (*relevance to the Project to be confirmed*). ▪ Authority – DFFE (national) and DESTEA (provincial).
National Forests Act (Act No. 84 of 1998)	▪ Supports sustainable forest management and the restructuring of the forestry sector, as well as protection of indigenous trees in general. ▪ Section 15 – Authorisation required for impacts to protected trees. ▪ Authorisation type – Licence (*relevance to the Project to be confirmed*). ▪ Authority – DFFE.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	▪ Protection and conservation of ecologically viable areas representative of SA's biological diversity and natural landscapes.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	▪ Equitable access to and sustainable development of the nation's mineral and petroleum resources and to provide for matters related thereto. ▪ Key sections (amongst others): o Section 22 – Application for mining right. o Section 27 – Application for, issuing and duration of mining permit. o Section 53 – Use of land surface rights contrary to objects of Act. ▪ Authorisation type – Mining Permit / Mining Right (*not required for the Project*). ▪ Authority – Department of Mineral Resources and Energy (DMRE).
National Heritage Resources Act (Act No. 25 of 1999)	▪ Key sections: o Section 34 – protection of structure older than 60 years. o Section 35 – protection of heritage resources. o Section 36 – protection of graves and burial grounds. o Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m^2 in extent, etc. ▪ Authorisation type – Permit (*relevance to the Project to be confirmed*). ▪ Authority – South African Heritage Resources Agency (SAHRA) and Free State Heritage Resources Authority (FSHRA).
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	▪ Control measures for erosion. ▪ Control measures for alien and invasive plant species. ▪ Authority – Free State Department of Agriculture and Rural Development (DARD).
Free State Province Nature Conservation Ordinance 8 of 1969	▪ Provides for the listing of certain protected plant species.
Occupational Health & Safety Act (Act No. 85 of 1993)	▪ Provisions for Occupational Health & Safety. ▪ Authority – Department of Employment and Labour (DEL). ▪ Relevant regulations, such as Electrical Installation Regulations, Construction Regulations, etc.
Hazardous Substance Act (No 15 of 1973) and Regulations	▪ Provides for the control of substances which may cause injury or ill-health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the generation of pressure thereby in certain circumstances, and for the control of certain electronic products ▪ Provides for the division of such substances or products into groups in relation to the degree of danger. ▪ Provides for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances and products.

The relationship between the Project and certain key pieces of environmental legislation is discussed in the subsections to follow.

5.2.2 National Environmental Management Act

NEMA is the framework legislation regulating the environment in SA. According to Section 2(3) of NEMA, "*development must be socially, environmentally and economically sustainable*", which means the integration of these three factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

The proposed Project requires authorisation in terms of NEMA and the EIA is being undertaken in accordance the EIA Regulations, which consist of the following:

- EIA procedure - GN No. R 982 (4 December 2014), as amended;
- Listing Notice 1 - GN No. R 983 (4 December 2014), as amended;
- Listing Notice 2 - GN No. R 984 (4 December 2014), as amended; and
- Listing Notice 3 - GN No. R 985 (4 December 2014), as amended.

Although the Project triggers activities listed in Listing Notices 1, 2 and 3 (refer to **Table 5** above), a Basic Assessment Process is being undertaken as the Project is located within the Klerksdorp Renewable Energy Development Zone (REDZ), as published in Government Notice No. 142 of 26 February 2021 (refer to **Section 5.6** below).

Note that the dimensions of the Project's proposed infrastructure and components should be regarded as approximates due to the dynamic nature of the planning and design process. As a conservative approach, all possible activities that could possibly be triggered by the Project were included in the Application Form (contained in **Appendix B**) that will be submitted to DFFE together with the draft BAR.

5.2.3 National Environmental Management: Waste Act

Amongst others, the purpose of the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA) includes the following:

1. To reform the law regulating waste management in the country by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development;
2. To provide for institutional arrangements and planning matters;
3. To provide for specific waste management measures;
4. To provide for the licensing and control of waste management activities;
5. To provide for the remediation of contaminated land; and
6. To provide for compliance and enforcement.

"Waste" is defined in NEM:WA as "*any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act*".

Schedule 3 of the NEM:WA groups waste into two categories, namely hazardous waste and general waste. The classification of waste determines the associated management and licencing requirements. ''Hazardous waste'' is defined as "*any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological*

characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles".

GN No. R. 921 of 29 November 2013 (as amended) contains a list of waste management activities that have, or are likely to have, a detrimental impact on the environment. If any of the waste management activities are triggered in Category A and Category B, a Waste Management Licence is required. Activities listed in Category C need to comply with the relevant National Norms and Standards.

No authorisation will be required in terms of NEM:WA, as the Project will not entail any listed waste management activities. The following is noted with regards to waste management for the Project:

- Construction phase –
  - Temporary waste storage facilities will remain below the thresholds contained in the listed activities under Schedule 1 of NEM:WA; and
  - The Environmental Management Programme (EMPr) will make suitable provisions for waste management, including the storage, handling and disposal of waste.
- Operational phase –
  - Minimum waste will be generated during the operational phase;
  - Waste from the on-site office and workshop will be sent to licenced municipal waste disposal sites; and
  - Waste generated during maintenance or replacement of panels and inverters will be sent to suitable disposal sites.

5.2.4 National Water Act

The purpose of the National Water Act (Act No. 36 of 1998) (NWA) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors:

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Redressing the results of past racial and gender discrimination;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Providing for growing demand for water use; protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources;
- Meeting international obligations;
- Promoting dam safety; and
- Managing floods and droughts.

The Department of Water and Sanitation (DWS) is the custodian of South Africa's water resources.

Some key definitions from this Act include:

- "*Pollution*" – the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it (a) less fit for any beneficial purpose for which it may reasonably be expected to be used; or (b) harmful or potentially harmful;
- "*Waste*" – includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted; and
- "*Water resource*" – includes a watercourse, surface water, estuary, or aquifer.

The Project will entail the following activities that constitute water uses in terms of Section 21 of the NWA, based on the delineation of the watercourses:

- Section 21(c) - Impeding or diverting the flow of water in a watercourse; and
- Section 21(i) - Altering the bed, banks, course or characteristics of a watercourse.

A Water Use Licence Application (WULA) will be submitted to DWS to seek authorisation in terms of the NWA.

The necessary negotiations will be undertaken with the local Municipality or landowners to obtain water from approved sources for construction and operational purposes.

5.2.5 National Environmental Management: Air Quality Act

The purpose of the National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA) is to reform the law regulating air quality by providing measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development. This Act aims to promote justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government, and for specific air quality measures.

Some key definitions from this Act include:

- "*Air pollution*" – any change in the composition of the air caused by smoke, soot, dust (including fly ash), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances.
- "*Atmospheric emission*" or "*emission*" – any emission or entrainment process emanating from a point, non-point or mobile source that results in air pollution.
- "*Non-point source*" – a source of atmospheric emissions which cannot be identified as having emanated from a single identifiable source or fixed location, and includes veld, forest and open fires, mining activities, agricultural activities and stockpiles.
- "*Point source*" – single identifiable source and fixed location of atmospheric emission, and includes smoke stacks and residential chimneys.

This Act provides for the listing of activities which result in atmospheric emissions that pose a threat to health or the environment. No person may without an Atmospheric Emission Licence (AEL) conduct any such listed activity. No AEL is required for the Project. Provision is made in the EMPr to manage impacts to air quality as a result of the Project during the construction phase.

5.2.6 National Environmental Management: Biodiversity Act

The purpose of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA) is to provide for the management and conservation of SA's biodiversity within the framework of NEMA.

The Act allows for the publication of provincial and national lists of ecosystems that are threatened and in need of protection. The list should include:

- *Critically Endangered Ecosystems*, which are ecosystems that have undergone severe ecological degradation as a result of human activity and are at extremely high risk of irreversible transformation.
- *Endangered Ecosystems*, which are ecosystems that, although they are not critically endangered, have nevertheless undergone ecological degradation as a result of human activity.
- *Vulnerable Ecosystems*, which are ecosystems that have a high risk of undergoing significant ecological degradation.
- *Protected Ecosystems*, which are ecosystems that are of a high conservation value or contain indigenous species at high risk of extinction in the wild in the near future.

Similarly, the Act allows for the listing of endangered species, including critically endangered species, endangered species, vulnerable species and protected species. A person may not carry out a restricted activity (including trade) involving listed threatened or protected species without a permit.

Some key definitions from this Act include:

- "*Alien species*" –
  - A species that is not an indigenous species; or
  - An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
- "*Biological diversity*" or "*biodiversity*" – the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.

- "*Indigenous* species" – a species that occurs, or has historically occurred, naturally in a free state in nature within the borders of the Republic, but excludes a species that has been introduced in the Republic as a result of human activity.
- "*Invasive species*" – any species whose establishment and spread outside of its natural distribution range -
  - Threaten ecosystems, habitats or other species or have demonstrable potential; and
  - May result in economic or environmental harm or harm to human health.
- "*Species*" – a kind of animal, plant or other organism that does not normally interbreed with individuals of another kind, and includes any sub-species, cultivar, variety, geographic race, strain, hybrid or geographically separate population.

The Regulations on the management of Listed Alien and Invasive Species were promulgated on 1 August 2014. The Listed Invasive Species were also published on this date and were subsequently amended in GN 864 of 29 July 2016.

The implications of NEM:BA for the Project include *inter alia* the requirements for managing invasive and alien species, protecting threatened ecosystems and species, as well as for rehabilitating the areas affected by the Project (outside of the development footprint).

The findings from the Aquatic Assessment, Terrestrial Ecology Assessment and Avifaunal Assessment that were undertaken for the Project are included in **Section 13.4**, **Section 13.5** and **Section 13.6** below, respectively.

5.2.7 National Heritage Resources Act

The purpose of the National Heritage Resources Act (Act No. 25 of 1999) (NHRA) is to protect and promote good management of SA's heritage resources, and to encourage and enable communities to nurture and conserve their legacy so it is available to future generations.

In terms of Section 38 of the NHRA, certain listed activities require authorisation from provincial agencies, which include the following:

- The construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- The construction of a bridge or similar structure exceeding 50 m in length;
- Any development or other activity which will change the character of a site -
  - Exceeding 5 000 m^2 in extent; or
  - Involving three or more existing erven or subdivisions thereof; and
- The re-zoning of a site exceeding 10 000 m^2 in extent.

The findings from the Heritage Impact Assessment and Desktop Palaeontological Impact Assessment that were undertaken for the Project are included in **Section 13.8** and **Section 13.9** below, respectively.

5.3 Governance of Energy in SA

SA has expressed and entrenched its commitment to promoting the use of renewable energy and implementing Energy Efficiency through the following (amongst others):

- SA is a signatory to various international treaties and conventions relating to climate change and greenhouse gas (GHG), such as –
  - United Nations Framework Convention on Climate Change;
  - Kyoto Protocol; and
  - Paris Agreement.
- SA has developed the following related policy frameworks –
  - White Paper on Energy Policy (1998);
  - White Paper on Renewable Energy (2003);
  - Integrated Energy Plan (2003);
  - IRP 2010;
  - IRP 2019
  - National Climate Change Response White Paper (2011);
  - Post-2015 National Energy Efficiency Strategy;
  - The National Development Plan (2030);
  - Climate Change Bill (2018); and
  - Carbon Tax Bill (2019).
- SA has developed the following related legal frameworks –
  - Electricity Regulation Act (Act No. 4 of 2006);
  - National Energy Act (Act No. 34 of 2008); and
  - Income Tax Act (1962) - tax incentive provided for Section 12L.
- The former Department of Environmental Affairs (DEA), which is now known as DFFE, developed EIA Guideline for Renewable Energy Projects (2015).
- SA's related voluntary instruments include –
  - South African National Standard (SANS) 941 energy-efficiency of electrical and electronic equipment; and
  - SANS 50001 energy management standard.

5.4 Guidelines

The following guidelines were considered during the preparation of the Scoping Report:

- Integrated Environmental Management Information Series, in particular Series 2 – Scoping (DEAT, 2002);
- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP, 2010a);

- Guideline on Need and Desirability (DEA, 2017);
- Integrated Environmental Management Guideline Series 7: Public Participation in the EIA Process (DEA, 2010);
- EIA Guideline for Renewable Energy Projects (Department of Environmental Affairs (DEA, 2015); and
- Guidelines for Involving Specialists in the EIA Processes Series (Brownlie, 2005).

5.5 National and Regional Plans

The following regional plans were considered during the preparation of the BAR (amongst others):

- Spatial Development Frameworks for MLM and FDDM;
- Integrated Development Plans for MLM and FDDM; and
- Free State Biodiversity Plan (2015) (Collins, 2016).

5.6 Renewable Energy Development Zones & Strategic Transmission Corridors

A Strategic Environmental Assessment (SEA) was undertaken by the former DEA, which is now known as DFFE, in order to identify geographical areas most suitable for the rollout of wind and solar PV energy projects and the supporting electricity grid network. These areas are referred to as Renewable Energy Development Zones (REDZs), in which development will be incentivised and streamlined. The Project is located within the Klerksdorp REDZ, as published in Government Notice No. 142 of 26 February 2021 (see **Figure 7** below).

As shown in **Figure 7** below, the Project also falls within the Central Corridor of the Strategic Transmission Corridors, in terms of GN No. 113 of 16 February 2018. The Strategic Transmission Corridors were identified through the SEA for Electricity Grid Infrastructure in SA. These corridors are important for the rollout of the supporting large scale electricity transmission and distribution infrastructure in terms of Strategic Integrated Project 10: Electricity Transmission and Distribution.

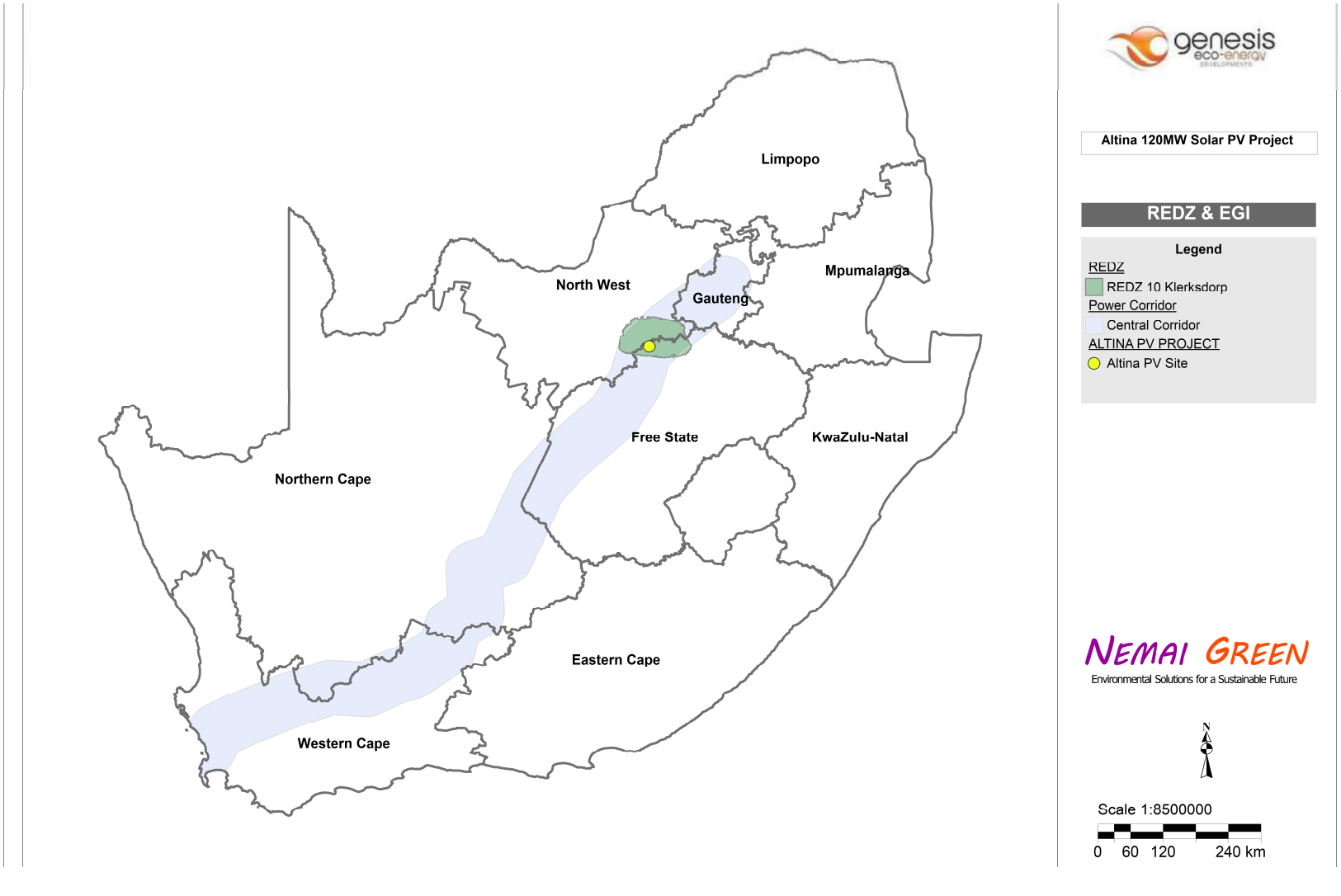


Figure 7: **The Project in relation to the Klerksdorp REDZ and Central Corridor**

6 BASIC ASSESSMENT PROCESS

6.1 Environmental Assessment Authorities

In terms of NEMA the lead decision-making authority for the environmental assessment is DFFE, as the competent authority for renewable energy related applications. Due to the geographic location of the Project, DESTEA is regarded as one of the key commenting authorities in terms of NEMA during the execution of the EIA, and all documentation will thus be copied to this Department.

Various other authorities with jurisdiction over elements of the receiving environment or project activities (refer to **Section 5.2** above) will also be consulted during the course of the EIA. Refer to the database of Interested and Affected Parties (I&APs) contained in **Appendix H** for a list of the government departments.

6.2 Environmental Assessment Practitioner

Nemai Green was appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment for the proposed Project.

In accordance with Appendix 2, Section 2(1)(a) of the EIA Regulations, this section provides an overview of Nemai Green and the company's experience with EIA's, as well as the details and experience of the EAP's that form part of the Basic Assessment team.

Nemai Green is an independent, specialist environmental, social development and Occupational Health and Safety (OHS) consultancy. The company is a 100% black female owned company, with a level 1 BBBEE rating. The company is directed by a team of experienced and capable environmental engineers, scientists, ecologists, sociologists, economists and analysts. The company has offices in Randburg (Gauteng) and Durban (KZN).

The core members of Nemai Green that are involved with the Basic Assessment Process for the Project are captured in **Table 6** below, and their respective Curricula Vitae are contained in **Appendix C**. The oath of the EAP is contained in **Appendix L**.

Table 6: Basic Assessment Core Team Members

Name	Qualifications	Selected Experience - Renewable Energy & Bulk Power Projects
D. Henning (21 years' experience)	MSc (River Ecology)	▪ Matjhabeng 400 MW Solar PV Power Plant with 80 MW (320 MWh) Battery Energy Storage Systems, Free State Province, SA. ▪ Beaufort West 75MW Solar PV Project, Western Cape, SA. ▪ Extraction of Gas and Electric Power Production Plant in the Rubavu District, Rwanda. ▪ Impompomo Hydropower Plant, Mpumalanga, SA.

Name	Qualifications	Selected Experience - Renewable Energy & Bulk Power Projects
		▪ Hydropower Plant within Hydraulic Network at Rand Water's Zoekfontein Site, Gauteng Province, SA. ▪ uMkhomazi Water Project Phase 1 with hydropower facilities, KwaZulu-Natal, SA. ▪ Neptune-Poseidon Transmission Line, including 200km of 400 kV transmission line, Eastern Cape, SA. ▪ Makalu B (Igesi) Substation and Associated Transmission Loop-In Lines, Free State Province, SA. ▪ Anderson Dinaledi Transmission Line, including 80km of 132 kV transmission line with substations, North-West Province, SA.
D. Naidoo (25 years' experience)	BSc Eng (Chem)	▪ Bronkhorstspruit Biogas Plant, Gauteng Province, SA. ▪ Construction of the Xina Solar One Parabolic Trough Technology 100MW Solar Plant, Northern Cape Province, SA. ▪ Construction of the Biotherm Solar Photovoltaic Power Plants, Northern Cape, SA. ▪ Construction of the Roodeplaat Wind Farm, Eastern Cape, SA. ▪ North-South Strengthening Scheme, including 300km of 400 kV transmission line with substations, Mpumalanga, SA. ▪ Mookodi-Mahikeng 400 kV Transmission Line, North-West Province, SA. ▪ Watershed 275/88/132 kV Substation, North-West Province, SA.

6.3 Environmental Screening

According to GN 960 of 5 July 2019, an application for Environmental Authorisation must be accompanied by the report generated by the National Web Based Environmental Screening Tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations of 2014 (as amended).

The aims of the National Web Based Environmental Screening Tool include the following:

- To screen a proposed site for any environmental sensitivity;
- To provide site specific EIA process and review information;
- To identify related exclusions and/or specific requirements including specialist studies applicable to the proposed site and/or development, based on the national sector classification and the environmental sensitivity of the site; and
- To allow for a Screening Report to be generated.

The Screening Report for the proposed Project is appended to the Application Form, which is included in **Appendix B**.

6.4 Environmental Assessment Triggers

Although the Project triggers activities listed in Listing Notices 1, 2 and 3 (refer to **Table 5** above), a Basic Assessment Process is being undertaken as the Project is located within the Klerksdorp REDZ, as published in Government Notice No. 142 of 26 February 2021 (refer to **Section 5.6** above).

6.5 Basic Assessment Process

6.5.1 Formal Process

The objectives of the Basic Assessment, based on the EIA Regulations of 2014 (as amended), are captured in **Section 1** above. An outline of the Basic Assessment Process is provided in **Figure 8** below.

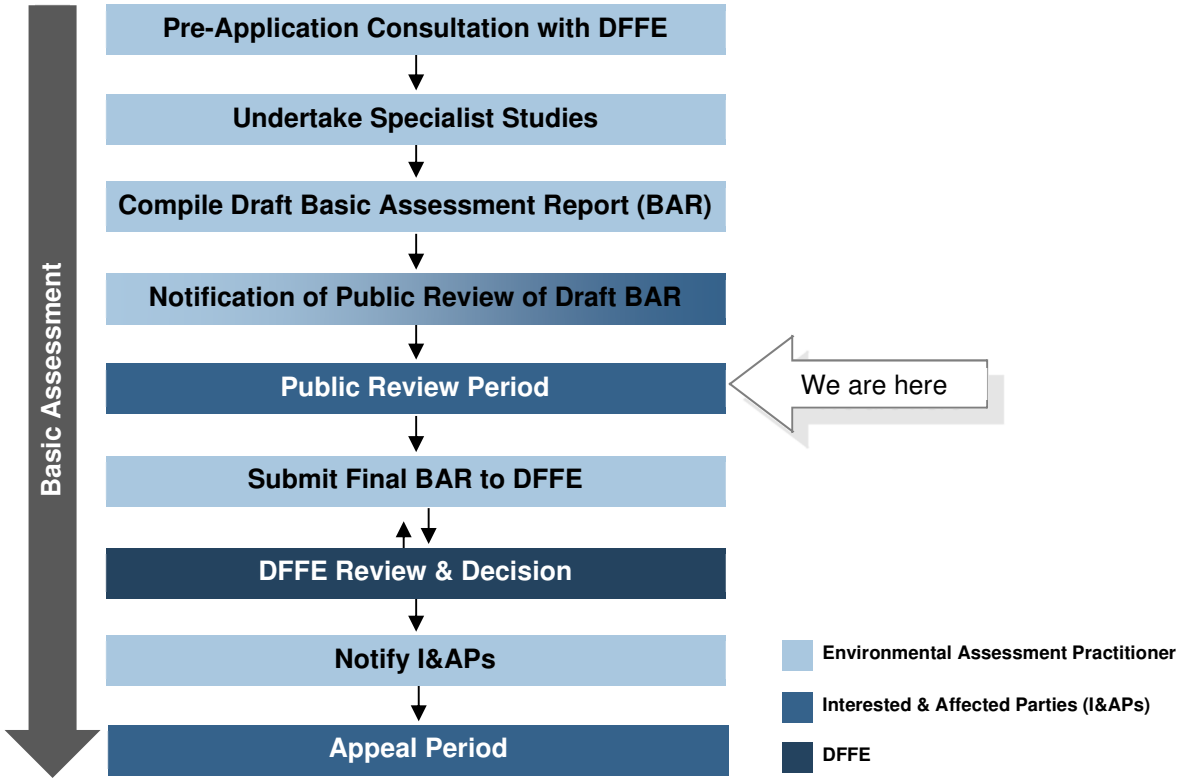


Figure 8: Basic Assessment Process

6.5.2 DFFE Pre-application Consultation

A Pre-Application Meeting was held with DFFE on 18 November 2021 (refer to the minutes of the meeting appended to the Application Form in **Appendix B**). The purpose of the meeting included the following:

- To present an overview of the Project to DFFE;
- To seek clarification regarding certain matters that pertain to the Basic Assessment Process; and
- To determine DFFE's requirements.

6.5.3 Landowner Consent & Landowner Notification

According to Regulation 39(1) of the EIA Regulations, if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an Environmental Authorisation in respect of such activity, obtain the written consent of the

landowner or person in control of the land to undertake such activity on that land. This requirement does not apply *inter alia* for linear developments (e.g., pipelines, power lines, roads) or if it is a Strategic Integrated Project (SIP) as contemplated in the Infrastructure Development Act, 2014.

The written consent of the landowner for the properties where the PV Site is proposed is appended to the Application Form, which is included in **Appendix B**.

6.5.4 Application Form

A copy of the Application Form, which will be submitted to DFFE together with the draft BAR, is provided in **Appendix B**.

The Application Form makes provision for all the activities associated with the Project's life-cycle. The activities triggered in terms of Listing Notices 1, 2 and 3 were confirmed based on the following:

- An understanding of the project description and the receiving environment;
- The findings from the National Web Based Environmental Screening Tool;
- Discussions held with DFFE during the pre-application meeting; and
- Technical input received from the Applicant and project team.

6.6 Other Renewable Energy Applications in the Project Area

DFFE created the SA Renewable Energy EIA Application (REEA) Database, which contains spatial data for renewable energy applications for Environmental Authorisation. It includes spatial and attribute information for both active (in process and with valid authorisations) and non-active (lapsed or replaced by amendments) applications.

According to the REEA Database for October 2021, the following renewable energy applications have been made for sites that are located within a 30km radius of the proposed Project (refer to **Figure 9** below):

1. 100MW Orkney PV SEF and 132KV powerline south-west of Orkney within the City of Matlosana Local Municipality in the North West Province (application: 14/12/16/3/3/2/954; status: Approved), which is located approximately 15km to the north-west of the Project;
2. Rietvlei Solar Plant in the Viljoenskroon District within MLM, Free State Province (application: 14/12/16/3/3/2/450; status: Withdrawn/Lapsed), which is located on Portion 0 of the Farm Rietvlei 539 on the same property as the south-eastern part of the Project;
3. 50MW Solar PV Energy Facility on the Farm Omega 342 in Viljoenskroon, Free State Province (application: 12/12/20/2280; status: Withdrawn/Lapsed), which is located approximately 18km to the north-east of the Project;
4. Various contiguous renewable energy developments –
    a. 75MW Kabi Witkop Solar 1 PV Facility (application 12/12/20/2507/1; status: In process) and 61MW Witkop Solar PV II Facility near Orkney, North West Province (application

12/12/20/2507/2; status: In process), which is located approximately 7km to the north-west of the Project; and

b. Kabi Vaalkop PV Facility, Substation and Powerlines near Orkney, North West Province (applications: 12/12/20/2513/1, 12/12/20/2513/1/AM1, 12/12/20/2513/1/AM2, 12/12/20/2513/1/AM3, 12/12/20/2513/2, 12/12/20/2513/2/AM1, 12/12/20/2513/3, 12/12/20/2513/3/AM1, 12/12/20/2513/3/AM2, 12/12/20/2513/3/AM3, 12/12/20/2513/4, 12/12/20/2513/4/AM1; status: Approved), which is located approximately 10km to the north-west of the Project.

5. Buffels Solar PV 1 Solar Energy Project near Orkney, North West Province (application: 14/12/16/3/3/2/777; status: Approved), which is located approximately 18km to the north-east of the Project; and
6. 100MW Buffels Solar 2 Solar Energy Facilities within the City of Matlosana Local Municipality (application: 14/12/16/3/3/2/778; status: Approved), which is located approximately 20km to the north-east of the Project.

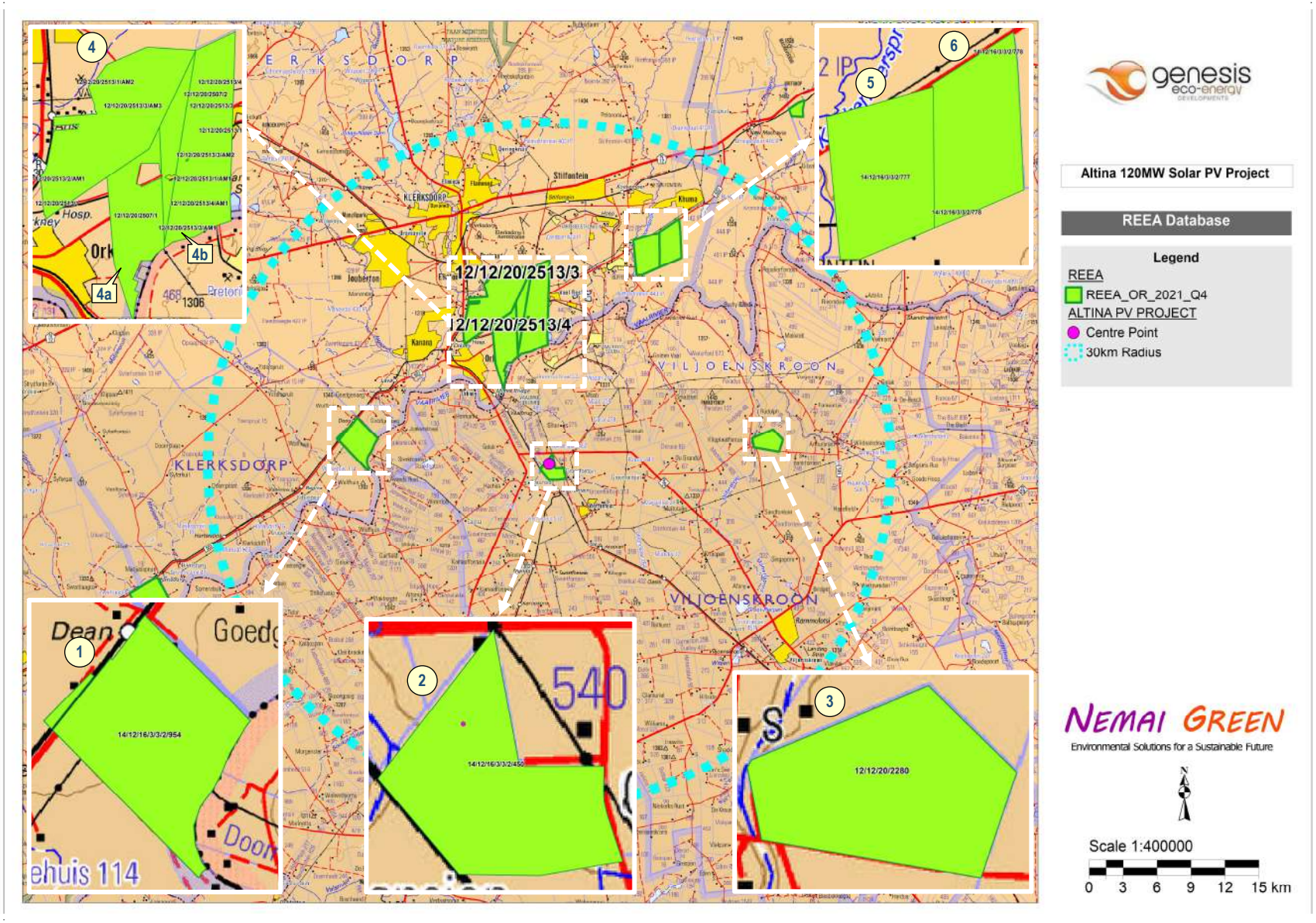


Figure 9: **Renewable energy applications in relation to the Project (within a 30km radius) (REEA, October 2021)**

7 ASSUMPTIONS, GAPS AND LIMITATIONS

The following assumptions and limitations accompany the report:

- In accordance with the purpose of Scoping, the report does not include detailed specialist investigations on the receiving environment, which will only form part of the EIA Phase. The environment in the Project Area was primarily assessed in the Scoping Phase through site visits and appraisals, desktop screening, incorporating information from other studies, and input received from authorities and I&APs. A refinement of all maps will also be undertaken in the EIA Phase, if necessary.
- As the design of the Project's components is still in feasibility stage, and due to the dynamic nature of the planning environment, the dimensions and layout of the infrastructure may change during the detailed design phase. Subsequent project modifications that emanate from discussions with the I&APs, findings from specialist studies and technical considerations will be conveyed during the public participation of the EIA Phase and will be incorporated into the draft EIA Report, which will be lodged in the public domain.
- Assumptions and limitations listed within the Specialist Reports contained within **Appendix E.**

8 PROJECT DESCRIPTION

8.1 Solar Technology Benefits

Solar energy facilities operate by converting solar energy into a useful form (i.e., electricity). The use of solar energy for electricity generation is a non-consumptive use of a natural resource and consumes no fuel for continuing operation. Solar power produces an insignificant quantity of greenhouse gases over its lifecycle as compared to conventional coal-fired power stations. The operational phase of a solar facility does not produce carbon dioxide, sulphur dioxide, mercury or particulates, as fossil fuel power generation technologies do.

8.2 PV Technology Overview

PV technology produces direct current (DC) which is then converted to alternating current (AC) via power electronic inverters. The main technology categories are crystalline modules (mono or poly), thin film, and concentrated photovoltaics (CPV). **Figure 10** below provides an overview of a typical Solar PV Power Plant.

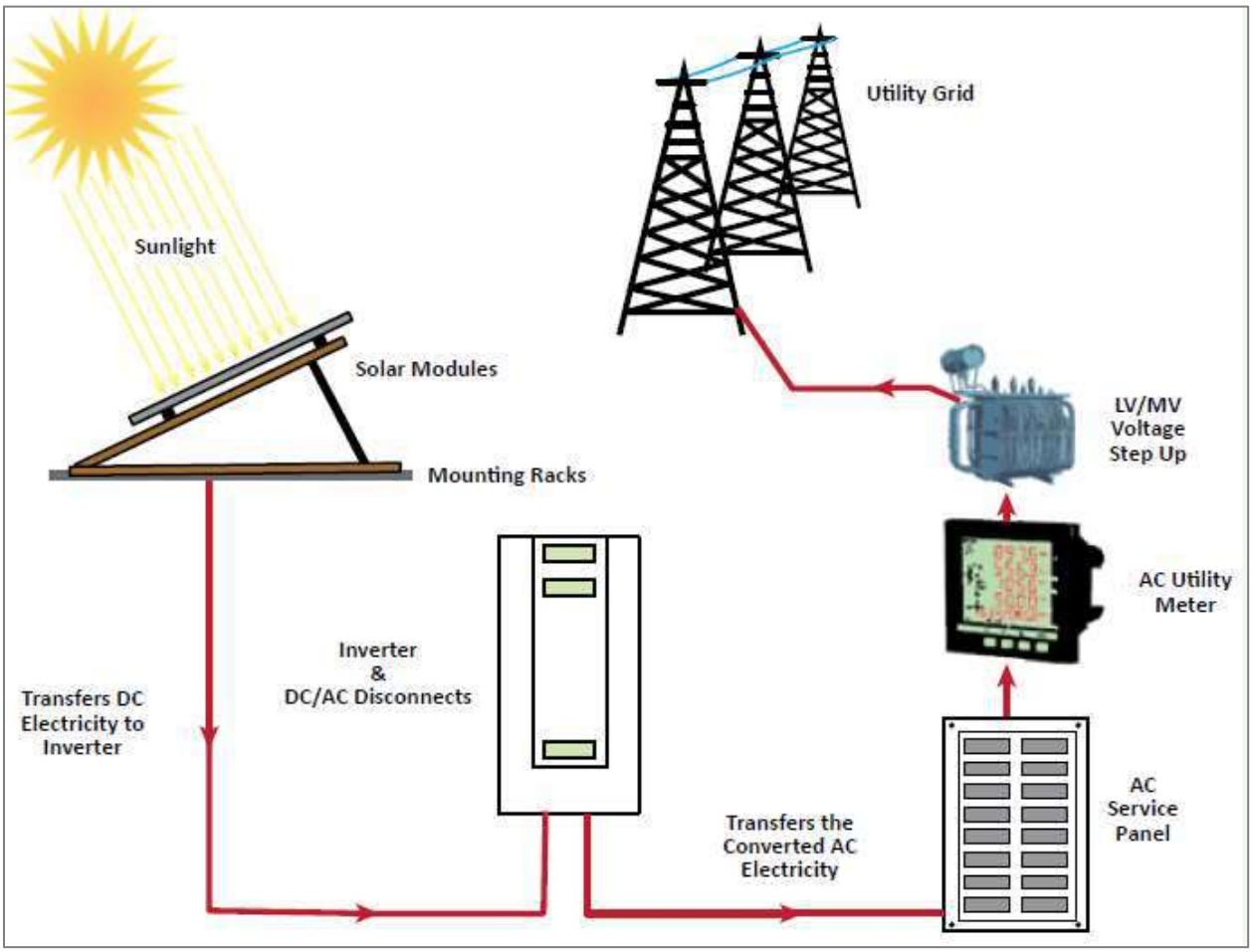


Figure 10: Overview of Solar PV Power Plant (IFC, 2015)

8.3 Energy Yield, Irradiation and Temperature

The Applicant appointed DNV South Africa (Pty) Ltd to undertake a pre-construction energy yield assessment. Various sources of irradiation data for the site were analysed. **Table 7** below presents global horizontal irradiation (GHI), diffuse horizontal irradiation (DHI) and ambient temperature (T) data for the Project location, for a typical meteorological year (TMY).

Table 7: Monthly means of GHI, DHI and temperature datasets for Altina from Solargis (DNV, 2022)

	GHI (kWh/m^2) monthly	DHI (kWh/m^2) monthly	T (°C)
Source	**Satellite derived**		
Period	**TMY**		
Jan	217	75	23.0
Feb	184	63	22.4
Mar	179	59	20.8
Apr	147	44	17.3
May	134	30	13.4
Jun	118	25	10.1
Jul	132	27	9.8
Aug	158	38	13.4
Sep	186	49	17.9
Oct	206	66	20.6
Nov	215	68	21.8
Dec	223	75	22.7
Total	**2098**	**619**	**17.8**

8.4 Infrastructure Overview

8.4.1 Overview of Technical Details

The technical details of the proposed PV Plant are captured in **Table 8** below.

Table 8: Technical details of the proposed PV Plant

No.	Component	Description / Dimensions
14.	Height of PV panels	± 2m
15.	Area of PV Array	± 132 ha
16.	Total area of Project	± 180 ha
17.	Number of inverters required	Approximately 25
18.	Area occupied by inverter / transformer stations / substations	Area occupied by inverters = ± 1 ha Area occupied by on-site substation = ± 1.5 ha
19.	Capacity of on-site substation	160MW, 132 kV/22kV

No.	Component	Description / Dimensions
20.	Area occupied by both permanent and construction laydown areas	Construction Laydown area = ± 2.1 ha Overall hardstanding area (inclusive of laydown area, OSS, O&M area, BESS) = ± 9ha.
21.	Area occupied by buildings	Area occupied by Operation & Maintenance (O & M) infrastructure = ± 1 ha
22.	Length of internal roads	~13 km
23.	Width of internal roads	12m reserve and 4m – 10m road widths
24.	Length of powerline from OSS to Grid Connection	~800 m
25.	Height of fencing	1.8m - 2.4m
26.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing

8.5 Project Layout

The technical suitability of the site for the development of the proposed Solar PV Plant is based on the following key characteristics:

- **Solar Radiation**: The feasibility of a solar facility especially a Solar PV Plant of this magnitude is dependent on the direct solar irradiation levels (refer to **Figure 1** above).
- **Topography**: The suitability of the surface area is an important characteristic for the construction and operation of solar facilities. It was found that the site has a suitable slope.
- **Power and transmission considerations**: The electricity generated by the Solar PV Plant will be injected into the existing Eskom 132 kV distribution system (refer to **Section 8.8** below). The site is located close to the Eskom distribution grid.
- **Extent of site**: The overall extent of the site is sufficient to accommodate the development footprint and allows for the avoidance of site sensitivities.
- **Site access and road infrastructure**: The site is accessible from the R76.
- **Availability of land**: The proposed Project site has been secured through an option to lease.

The following factors were considered in identifying buildable areas on the overall site (amongst others):

- Watercourses;
- Existing infrastructure and associated servitudes;
- Existing structures;
- Requirements of the PV Plant; and
- Shading constraints.

The Project layout is shown in **Figure 11** below and is also contained in **Appendix A.**

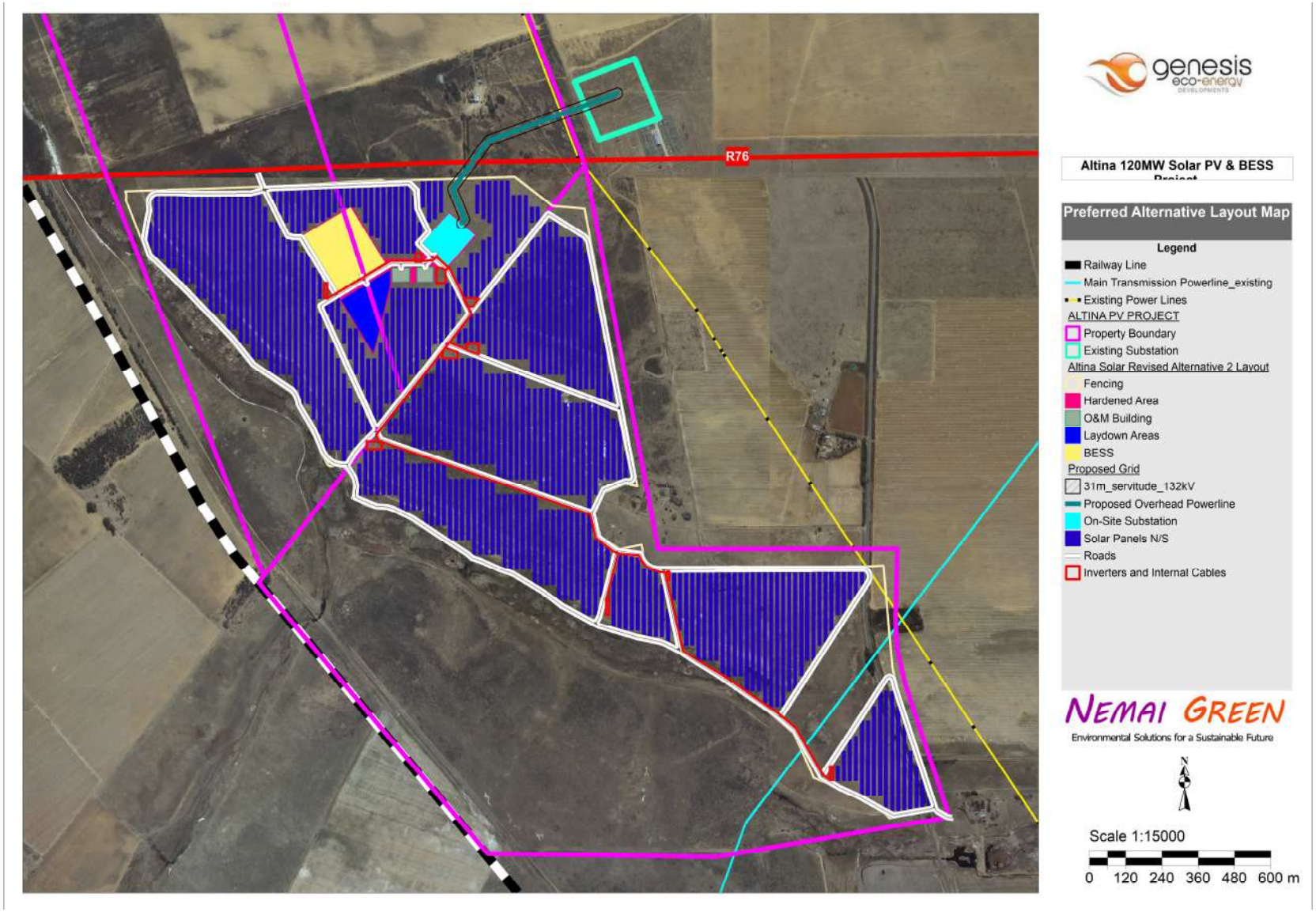


Figure 11: Proposed Project Layout

8.6 Components of the Proposed Solar PV Plant

The Project consists of the following systems, sub-systems or components (amongst others):

- PV panel arrays, which are the subsystems which convert incoming sunlight into electrical energy;
- Mounting structures to support the PV panels;
- On-site inverters to convert DC to facilitate AC connection between the solar energy facility and electricity grid;
- Lithium Ion BESS;
- On-site substation (facility substation)
- New 132 kV power lines between the on-site substation and the grid connection point;
- Cabling between the Project's components, to be laid underground (where practical);
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint;
- High Voltage (HV) Transformers; and
- Security Infrastructure.

The above components are discussed further below.

The components of the proposed Solar PV Facility are discussed below. Reference Source: Solar Power Plant - Types, Components, Layout and Operation (electricaltechnology.org)

8.6.1 Solar PV Panels/Modules

A PV panel is the most important component of a solar power plant. It is made up of small solar cells. This is a device that is used to convert solar photon energy into electrical energy.

Generally, silicon is used as a semiconductor material in solar cells. The typical rating of silicon solar cells is 0.5V and 6Amp. And it is equivalent to 3W power. The number of cells is connected in series or parallel and makes a module. The number of modules forms a solar panel.

According to the capacity of power plants, a number of plates are mounted, and a group of panels is also known as a PV array.

8.6.2 Single Axis Trackers

The following information was sourced from Solar Basics: Single-Axis Tracking (https://www.powerflex.com/).

A solar tracking system adjusts the position of a solar panel along an axis. This is done to ensure a small angle of incidence or the angle that sunlight hits a solar panel. Since the energy output of a solar system increases as the angle of incidence decreases, keeping this angle as small as possible is ideal. Active trackers rely on powered machineries such as gears and motors to move solar panels, whereas passive trackers achieve motion via compressed fluid that shifts sides when heated by the sun, changing the tilt of the panel along with it. Some trackers keep panels aligned with the sun by moving them in the opposite direction of the earth's rotation, and others determine an optimal panel angle based on latitude and longitude data obtained through GPS.

In addition to varying methods of motion, solar trackers differ in terms of the number of axes on which they move. Single axis tracking systems tilt on one axis, tracking the sun as it moves from east to west during the day.

An example of PV modules mounted on a single axis tracker is shown in **Figure 12** below.

Figure 12: Example of PV Module mounted on Single Axis Tracker
(source: Single-ACES – Atlantic Clean Energy Supply – Official Site [https://atlanticces.com/])

The trackers are mounted on steel posts installed in the ground. Concrete bases are sometimes also used. The site would need to be cleared of all trees to prevent shading of the PV modules. The ground between the trackers will be left grassed.

8.6.3 Inverters

The following information was sourced from "A Guide to Solar Inverters: how they work and how to choose them" (https://solarmagazine.com/).

A solar inverter is really a converter. Inverters are installed to convert the DC electrical power into AC electrical power, which is used in the grid. The frequency of the AC electricity is synchronised to the grid, which in South Africa is 50Hz, but varies slightly. The purpose of the inverters is to maximise and control the conversion of power from the DC modules to low voltage AC (i.e., less than 1000V).

String inverters have multiple inputs for connecting the strings from the trackers. String inverters are normally installed on steel structures under the shade of the PV modules.

8.6.4 Low Voltage AC Cabling

AC Cables are installed from the inverters to the distribution box located adjacent to the medium voltage transformers. These cables are installed underground in trenches to a depth of approximately 0.5 m.

8.6.5 Medium Voltage Step-Up Transformers

The purpose of medium voltage transformers is to step-up the low voltage to medium voltage. In order to distribute the combined electrical power from a block of tracker rows the voltage is required to be increased. Transformers will typically be in the order of 2.5MVA capacity and similar in appearance to the type as shown in **Figure 13** below.

Figure 13: Example of Medium Voltage Transformer
(source: https://www.ulaginoli.com/)

Transformers will typically be filled with oil for cooling the transformer windings. The cooling oil is circulated through radiator fins mounted on the side of the transformer. The oil remains in the

transformer. Oil spills from transformers need to be contained by providing drip trays and special care taken to clean up the spill should it occur.

8.6.6 Medium Voltage AC Cabling

Medium voltage AC cabling from the transformers to the high voltage substations is buried in trenches underground at a depth of approximately 1 m. The cables are protected from accidental damage by placing brightly coloured orange danger tape in the trench and sometimes concrete slabs. Cable routes are generally indicated by concrete cables markers on the ground at bend points and road crossings.

8.6.7 High Voltage Substations

The medium voltage cables are connected to a medium voltage switchgear room located in a substation yard on site or in the Collector substation yard. High voltage transformers step the medium voltage up to high voltage.

Figure 14: Example of High Voltage Substation
(source: https://www.protogenenergy.com/)

A typical HV Substation will look like the substation shown in **Figure 14** above, with large ground mounted transformers and outdoor high voltage switchgear with overhead conductors and steel lattice structures. The yard is fenced off and only authorised personnel are allowed inside the high voltage yard (see example shown in **Figure 15** below).

Figure 15: Example of High Voltage Transformers
(source: https://www.electricityforum.com/)

8.6.8 Guardhouses, Operation, Maintenance and Visitor Centre Buildings

Guardhouses, Operation, Maintenance and Visitor Centre Buildings are required for the facility. Buildings will be single story.

The purpose of the buildings is to provide space for staff working on site for the operation and maintenance of the facilities, including storage space for spare parts, and tools, etc. Computers will be installed for monitoring the electricity generation and reporting on the condition of the plant. Toilets, kitchens, water, wastewater and electricity will be required for staff and visitors.

Sustainable building principals will be used including use of rainwater harvesting, energy efficient lighting, insulation, etc.

8.6.9 Roads

The internal roads will have reserve of 12 m and an approximate 4 m width, and will be gravel, with the exception of paving close to the buildings for parking and access into the buildings. The entrance road will be 8m wide with a 14 m reserve.

The basic layout consists of rows of single axis trackers, similar to that shown in **Figure 16** below.

Figure 16: Example of Roads Between Trackers and Medium Voltage Substations
(source: https://ecoinventos.com/)

8.6.10 Fencing, Security and Lighting

Fencing is required to secure the site. Due to the voltage of the DC wiring (up to 1500V) and high value of the plant the site must be secured. Details of the fencing is still to be finalised and may include electric fencing.

CCTV cameras and security lighting may be installed as part of the security for the plant.

8.6.11 Stormwater Infrastructure

The topography of the sites is relatively flat but sloping. The estimated average slope percentage is 4,7%. The stormwater design will be part of the detailed design of the PV scope which must be submitted to the DFFE for approval with the final EMPr.

8.7 Battery Energy Storage System (BESS)

8.7.1 Types of Electrical Energy Storage Systems

Electrical Energy storage systems consist of Mechanical, Chemical, Electrical, Thermal and Electrochemical systems. **Figure 17** below summarizes the various Electrical Energy Storage systems. The Electrochemical/battery storage system was selected as the preferred solution to meet the requirements of the Project.

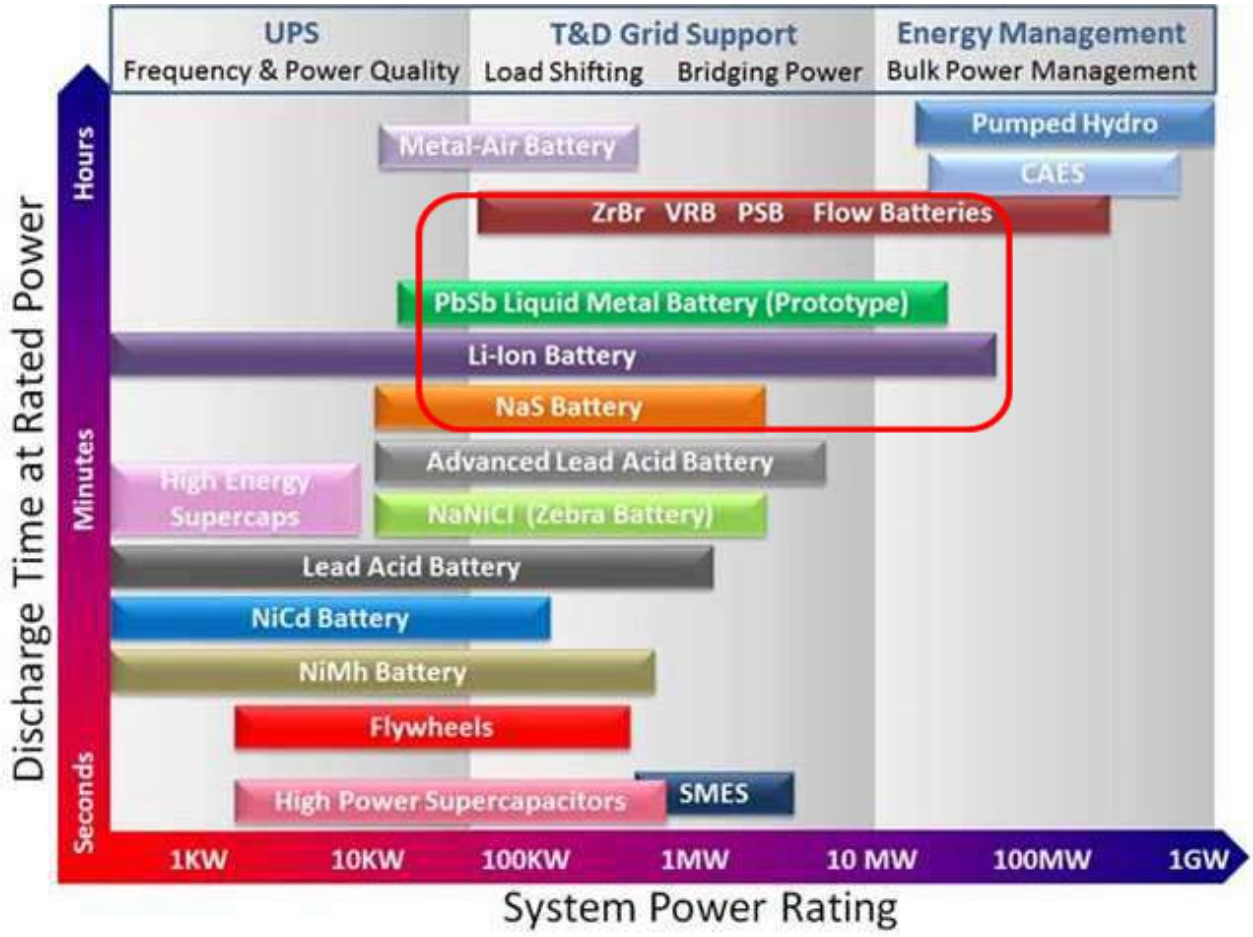


Figure 17: Grid Energy Storage Technologies and Applications
(Adapted from Climate Policy Initiative for the Energy Transitions Committee)

As per https://www.smart-energy.com/, batteries, the oldest, most common and widely accessible form of storage, are an electrochemical technology comprised of one or more cells with a positive terminal named a cathode and negative terminal or anode. *The BESS can be broken into solid state and flow battery systems, as explained below.*

Solid state batteries consist of lithium ion, lead acid etc. lithium ion is used extensively in the Electrical Energy Storage systems. Current estimates indicate that approximately 85% of the electrochemical systems installed use lithium-ion batteries. “Lithium-ion” refers to a wide array of chemistries in which lithium ions are transferred between the electrodes during the charge and discharge reactions. The construction/composition of the lithium-ion battery varies from manufacturer to manufacturer. Lithium ion has the smallest installation footprint when compared to the technologies for the similar energy capacity.

The best known and in widespread use in portable electronic devices and vehicles are lithium-ion and lead acid. Others solid battery types are nickel-cadmium and sodium-sulphur, while zinc-air is emerging.
Another category is flow batteries with liquid electrolyte solutions, including vanadium redox and iron-chromium and zinc-bromine chemistries”. Flow or redox flow battery is where chemical energy

is provided by two chemical components dissolved in liquids contained within the system and separated by a membrane. Typical systems use Vanadium or Zinc Bromine.

8.7.2 The Project's BESS Infrastructure

The total capacity of the BESS is up to a maximum of 40 MW (160 MWh) of BESS. The technology will be the commercially proven solid state battery systems comprising of the Lithium-Ion technology. The main battery suppliers in the world who have a total market share of 85% are Tesla, CATL, Fluence and Samsung.

The batteries will be contained in shipping containers. There will be up to a maximum of 40 shipping containers, each with a battery storage capacity of 1 MW. The approximate dimensions of the containers will be up to a maximum of 20 m long, 3 m wide and 3 m high. Level and fenced off platforms would be created for the battery storage areas. The location of the Battery Energy Storage Systems (BESS) facility is shown for each solar PV footprint area in the technical layout drawing.

The Lithium in this technology is considered hazardous / dangerous goods. Used batteries will be removed by the suppliers for recycling off-site. Batteries containing chemicals that, when charged, are a fire risk and at the end of their life need to be recycled. With regard to the fire risk, the battery storage area will have a non-flammable buffer area of approximately 5m to prevent the spread of fire. The battery energy storage system will have electrical and fire protection measures in the form of battery temperature monitoring, circuit breakers, fire detection and fire suppression as per fire and electrical regulations.

8.8 Grid Connection

The electricity generated by the proposed PV facility will be transferred to the existing Eskom 132 kV distribution system. The Project intends to connect to the existing 88kV/132kV Jersey Distribution Substation (shown in **Figure 18** below), which is located approximately 450m (Alternative 1) and 650m (Alternative 2) to the north-east of the site (see **Figure 19** and **Figure 20** below). The voltage of the energy generated by the Project will be transformed on site by a step-up transformer at the onsite substation (OSS) or facility substation that will be constructed by the Applicant.

Figure 18: Northern view of the Jersey Distribution Substation

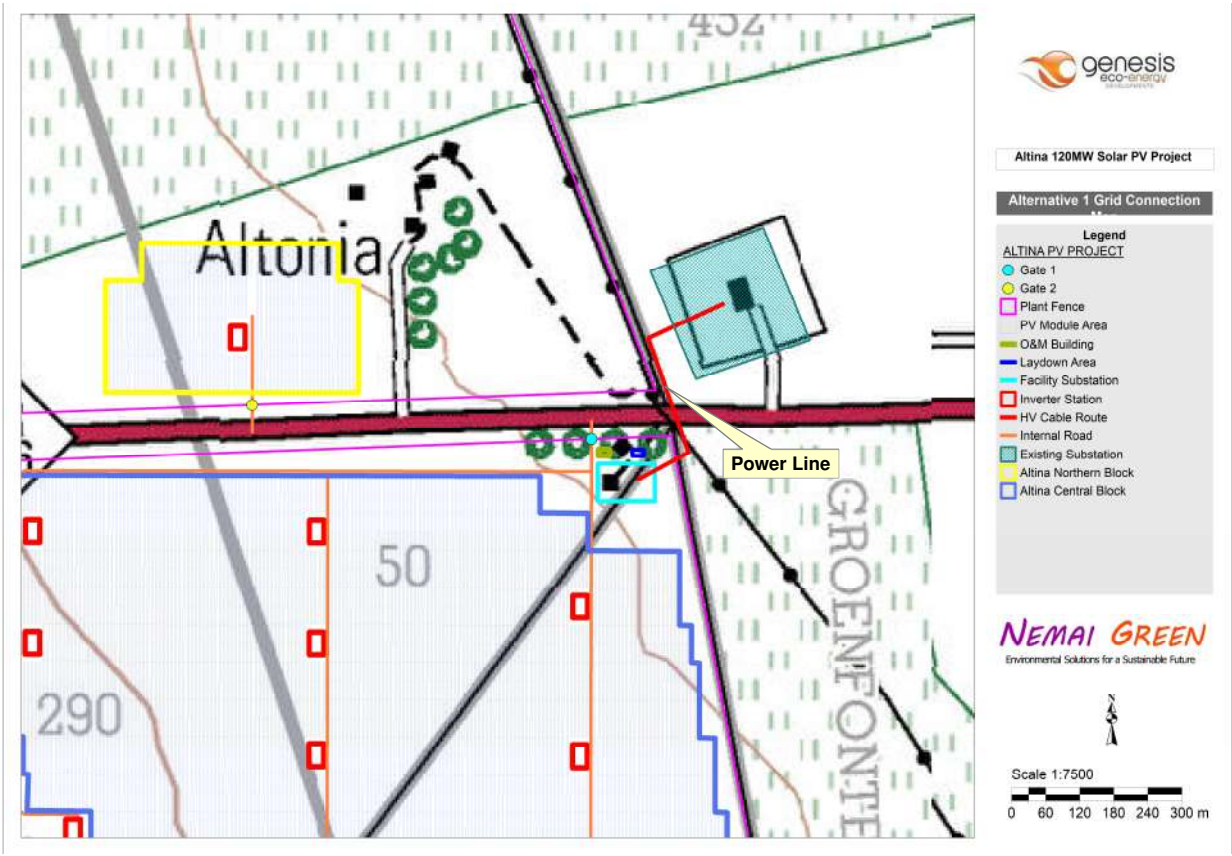


Figure 19: Proposed power line route Alternative 1

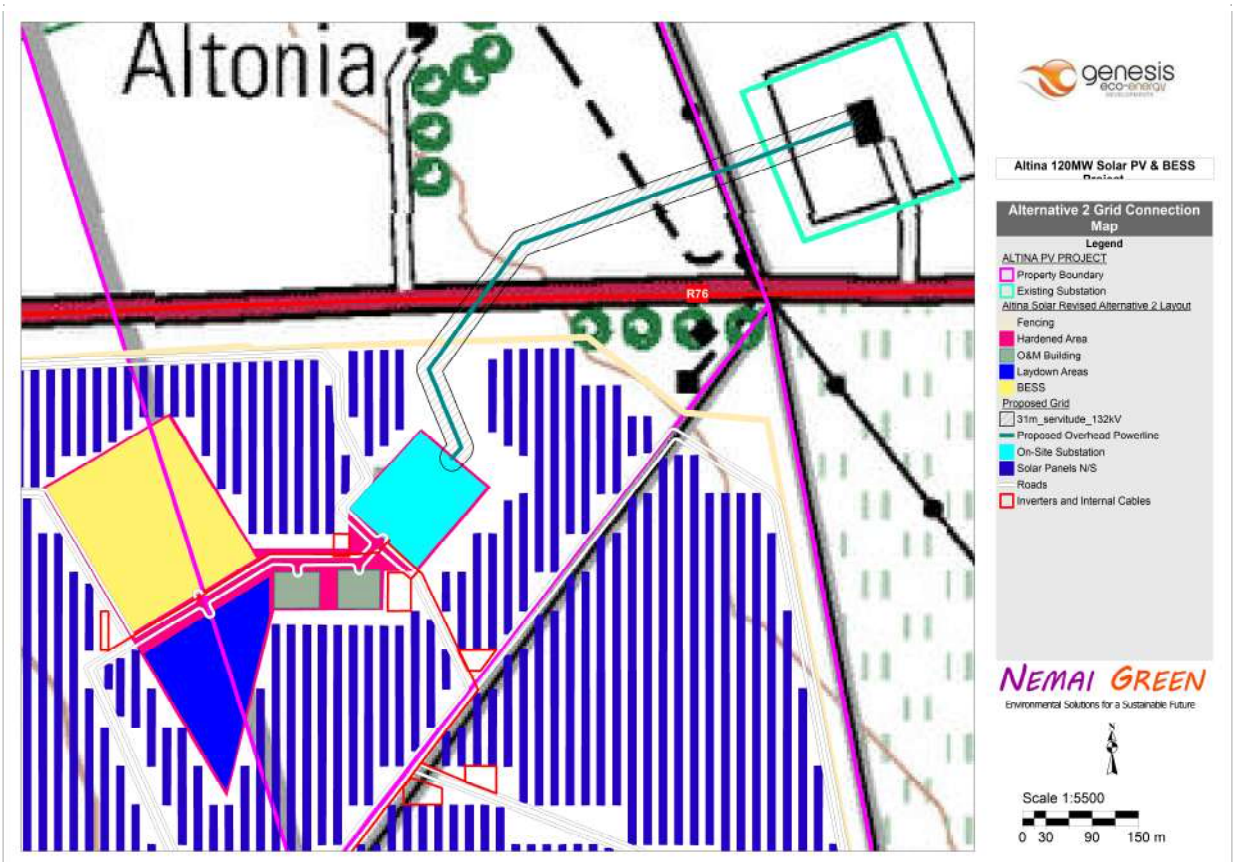


Figure 20: Proposed power line route Alternative 2

Examples of a 132 kV transmission line as well as a high voltage transmission line connecting to a substation are shown in **Figure 21** and **Figure 22** below, respectively.

Figure 21: Example of a 132 kV transmission line (steel monopole structure) (SSI, 2012)

Figure 22: Example of High Voltage Transmission Line Connecting to Substation

8.9 Access Roads and Laydown Areas

The installation of the PV panels requires adequate access to the site by transport / delivery vehicles. A primary access gravel road of length of approximately 583 m and of width of 8 m is deemed to be adequate for the Project.

It is proposed to develop a new access point to the central part of the PV plant from the R76, as shown in **Figure 20** above. From the access point off the R76 (see **Figure 23** below), a main internal road will align to the PV Park facility from which the secondary internal roads branch off to align to the separate PV panel arrays and Control Building / Warehouse.

Figure 23: Proposed access point to the site from the R76 (Google Earth™)

Access will be gained to the south-eastern portion of property via an unclassified public road.

Each PV array requires its own access (internal) road next to it for construction, maintenance (and cleaning) and refurbishment. Although the existing on-site farm roads will be used as far as possible, the exact alignment and design of the required roads will be determined during final design phase.

Each panel array row / groupings will also require a "hard standing" laydown area next to it for temporary placement and storage of the panel mounting structures and the PV panels during construction, as well as for maintenance and refurbishment, during operation.

8.10 Implementation Programme

Key milestones during the Project's implementation programme include the following:

- Financial Close: October 2023.
- Notice to proceed (commencement of construction): November 2024.
- Commercial Operation Date (COD): December 2024.

8.11 Project Life-Cycle

The project life-cycle for a typical Solar PV Plant includes the following primary activities (high level outline only):

- Feasibility phase - This phase includes confirming the feasibility of the Project by evaluating and addressing the following (amongst others) –
  - Solar resource assessment;

- Site selection;
- Project land allocation;
- Project yield assessment;
- Permitting and licensing;
- Legal agreements;
- Socio economic development;
- Industrialisation and localisation;
- Project cost determination;
- Project financing; and
- Risk analysis.

❑ Design phase - This phase includes the following (amongst others) –

- Confirming key design features such as the type of PV module to be used, tilting angle, mounting and tracking systems, inverters, and module arrangement;
- Confirming specifications for the components of the Solar PV Plant and BESS;
- Preparing detailed designs (layout, civil, electrical);
- Preparing construction plans;
- Preparing the Project schedule; and
- Preparing the commissioning plans.

❑ Construction phase – During the implementation of the Project, the following construction activities will be undertaken –

- Pegging the footprint of the development;
- Establishing access roads;
- Preparing the site (fencing, clearing, levelling and grading, etc.);
- Establishing the site office;
- Establishing laydown areas and storage facilities;
- Transporting equipment to site;
- Undertaking civil, mechanical and electrical work; and
- Reinstating and rehabilitating working areas outside of permanent development footprint.

❑ Operational phase - Once the solar park is up and running the facility will be largely self-sufficient. Operational activities associated with the maintenance and control of the Solar PV Plant will include the following (amongst others) –

- Testing and commissioning the facility's components;
- Cleaning of PV modules;
- Controlling vegetation;
- Managing stormwater and waste;
- Conducting preventative and corrective maintenance; and
- Monitoring of the facility's performance.

❑ Decommissioning –

PV panels are guaranteed to produce at least 80% of their rated power for 20 to 30 years. In practice, PV panels will perform satisfactorily well beyond this timeframe. At the end of the 20-30 year lifespan, two scenarios exist for the PV panels:

- The old, redundant panels can be disposed of (at a registered disposal facility designated for this purpose); or
- The panels can be recycled, by either using their components to fix or make new panels, or be donated for use elsewhere (e.g., for the electrification of rural schools and clinics).

It is unlikely that the PV Park will be decommissioned after 30 years. Instead, the facility will continually be reconditioned as the PV panels are recycled and replaced with more advanced technology as it becomes available.

In the event that the Plant must be decommissioned, the decommissioning phase will include measures for complying with the prevailing regulatory requirements, rehabilitation and managing environmental impacts in order to render the affected area suitable for a future desirable use.

8.12 Environmental Authorisation Validity Period & Construction Duration

It is requested that the Environmental Authorisation remain valid for a period of 10 years. It is expected that the construction duration will be approximately 14 months.

8.13 Resources and Services required for Construction and Operation

This section briefly outlines the resources that will be required to execute the proposed Project. Note that provision is made in the EMPr (contained in **Appendix K**) to manage impacts associated with aspects listed below, as relevant.

8.13.1 Raw Materials

Construction

Material required for construction purposes, including fencing and construction material (e.g., cement, sand, aggregate, etc.), will be sourced from suitable suppliers. The PV modules and other components of the facility will also be sourced from accredited suppliers.

Operation

During the operational phase, few raw materials will be required. Material such as consumable spares will be used for the operation of the facility.

8.13.2 Water

Construction

During construction, the Contractor will require water for potable use by construction workers and water will also be used in the construction of the foundations and other components of the Project. The necessary negotiations will be undertaken with the MLM or landowners to obtain water from approved sources.

Operation

Water use requirements for a Solar PV Plant during the operational phase depends on the technology and climate conditions at the site. In general, solar power technologies use relatively low volumes of water for cleaning solar collection and reflection surfaces like PV panels, as well as for domestic consumption by the staff.

Water could potentially be sourced from the Municipality or Landowners with registered boreholes. Other options may be explored as the project progresses in its development stage. The required agreements and/or permits will be concluded and/or applied for as the project progresses.

The Project site Landowner indicated to the Applicant that water could be provided by the landowner to the Project via boreholes. The Landowner said the Applicant would need to test the water, but that there was a good yield. The Landowner has 2 boreholes on site which overflow, and he also has 2 water points from the water pipeline running through the property. The boreholes are registered, so the Project could investigate buying water from the Landowner.

8.13.3 Sanitation

Construction

Sanitation services will be required for construction workers in the form of chemical toilets, which will be serviced at regular intervals by the supplier.

Operation

Sewage from the buildings and toilets across the site will be discharged into various septic tank systems. The soakaway systems will be designed with sufficient spare capacity to accommodate the possibility of excessive usage above the anticipated average. This option is the most cost-effective system for this Project. It is to be considered that a well-constructed and maintained septic tank should be odourless and problem free.

Should the receiving environment be regarded as sensitive, then the use of honey sucker services from an independent contractor will be considered.

8.13.4 Waste

Construction

The types of solid waste to be generated during the construction phase include the following:

- Waste generated from site preparations (e.g. plant material);
- Domestic waste;
- Surplus and used building material; and
- Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags).

Solid waste generated during the construction phase will be temporarily stored at suitable locations (e.g., at the construction camp) and will be removed at regular intervals and disposed of at licenced waste disposal sites.

The following is noted in the municipal IDP (MLM, 2022) in terms of waste disposal sites:

- The Kroonstad landfill site is not meeting the minimum operational requirements due to lack of personnel and equipment;
- The Steynsrus landfill site is operated and managed by a service provided and the conditions have drastically improved; and
- The Viljoenskroon landfill site is operated and managed by a service provider. Though the landfill site is not licensed, the conditions have improved. Application forms for both the new and the closure of the current landfill sites have been submitted to DESTEA. It is further noted that the construction of a new landfill site in Viljoenskroon is underway and as soon as it is operational , the old one will be demolished and rehabilitated.

Hazardous waste will be removed by a waste service provider and will be disposed of at permitted site(s), such as the Holfontein Hazardous Waste Disposal Site, which is in Benoni, Gauteng Province. Holfontein is owned by Enviroserv Waste Management (Pty) Ltd (“Enviroserv”). According to its licence (12/9/11/L975/3), Holfontein is a Class H:H (Class A) landfill.

Wastewater, which refers to any water adversely affected in quality through construction-related activities and human influence, will include the following:

- Sewage;
- Water used for washing purposes (e.g., equipment, staff); and
- Drainage over contaminated areas (e.g., workshop, equipment storage areas).

Suitable measures will be implemented to manage all wastewater generated during the construction period.

Operation

Refuse generated during the operational phase will be removed on a weekly basis and will be disposed of at licenced waste disposal sites.

8.13.5 Roads

Construction

Temporary access roads will be created during the construction phase. The areas affected by temporary roads will be reinstated, as they will not be used permanently in the operational phase.

Operation
The Project site is accessible by the R76 which runs along the northern boundary of the site.

8.13.6 Stormwater

Construction
Best environmental practices will be implemented during construction to manage stormwater.

Operation
The stormwater run-off along the main access road will be controlled by side swales and dispersed in a controlled manner at regular intervals. Stormwater run-off from the buildings will be disposed of through soakaways. A formal piped stormwater system is not envisaged for the wider site. Water will be managed on the surface and dispersed into natural drainage routes. More information will be available once detailed design has been completed.

8.13.7 Electricity

Construction
The EPC Contractor will be responsible for the supply of electricity during construction. The electricity supply will be obtained from diesel generators and / or temporary supply via cables from the site power grid.

Operation
The electricity will be supplied by the plant during daylight hours (off-peak times – 07:00 to 17:00). The BESS will supply electricity during night hours (peak times – 05:00 to 07:00 and 17:00 to 19:00). During other times electricity will be supplied from the power grid.

8.13.8 Laydown Areas

Construction
A laydown area will be required during the construction phase. The proposed laydown area of approximately 1.8 ha will be located next to the on-site substation and BESS site (refer to **Figure 20** above).

8.13.9 Construction Workers

Construction
The appointed Contractor will mostly make use of skilled labour for the construction of the facility and its associated infrastructure. In those instances where casual labour is required, the Applicant will request that such persons are sourced from local communities, as far as possible.

9 ALTERNATIVES

9.1 Introduction

Alternatives are the different ways in which the Project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the Project.

9.2 Site Alternatives

No site alternatives are proposed for this Project. Favourable location factors for the PV Site include suitable solar irradiation levels, short distance to grid connection point, flat topography, suitable site access and availability of land.
According to the Applicant, the site was chosen as follows:

- Easy, cost effective and quick access to the Eskom substation, ensuring competitive tariffs which will enable submission of bids for the REIPPP future bid windows. Also, shorter overall construction duration due to shorter grid lines that are required.
- Excellent topography.
- Well located in an excellent solar resource area.
- Situated in the REDZ area for shorter EIA process duration.
- Well located for ease of construction.

9.3 Layout Alternatives

The space available at the PV Site was adequate to position the facility and its associated infrastructure to avoid areas of sensitive environmental features as far as possible, based on the findings of the specialist studies. The extent of the site allowed for the identification of layout alternatives to manage impacts to environmental sensitivity.

Layout alternative 1 was proposed prior to specialist inputs (**Figure 24**), while layout alternative 2 was proposed after specialist input (**Figure 25a**), with the latter taking into consideration environmental sensitivities on the site as far as possible. In order to address the need for a wetland offset strategy, the Applicant committed to further reduce the residual impacts to the wetlands by revising the preferred alternative layout (alternative 2). The revision of the layout and further information made available included:

- The hardstanding infrastructure was moved to low sensitivity wetland and terrestrial areas within the site footprint;
- Internal site roads follow existing farm roads as far as possible;

- PV module support structure dimensions were clarified in order to determine the expected footprint of the PV modules within high sensitive wetland seeps. It was determined that PV module structure actual footprints would be 0.35% of the dimensions of the module; and
- Areas under the PV modules would remain as natural vegetation.

The revised alternative 2 layout (**Figure 25b**) was assessed by the Specialists and their reports updated. The revised alternative 2 layout further reduces the impacts and the wetland specialist determined that a site rehabilitation strategy would suffice to meet the requirements of an offset strategy based on the changes made. The draft Wetland Rehabilitation Strategy is included in **Appendix E10**.

The following information was provided by the Applicant to describe the reason for revising the layout and some advantages associated with the revised, preferred layout.

Initially, a portion of the plant was located across the non-perennial watercourse that traverses the property area. After reviewing the basic engineering designs and technical layout and in order to avoid the identified environmental sensitivities listed by the specialists, a portion of the PV plant was re-located across the 1:100 floodline so that the affected small PV portion seamlessly integrates with the bigger PV portion.
In addition, we have avoided costly engineering designs and hydrological studies which would have increased the CAPEX of the Project.

By locating the BESS adjacent to the on-site substation, we have adhered to global best practices. In addition, we have avoided lengthy cabling to the substation which would have increased the CAPEX of the plant.

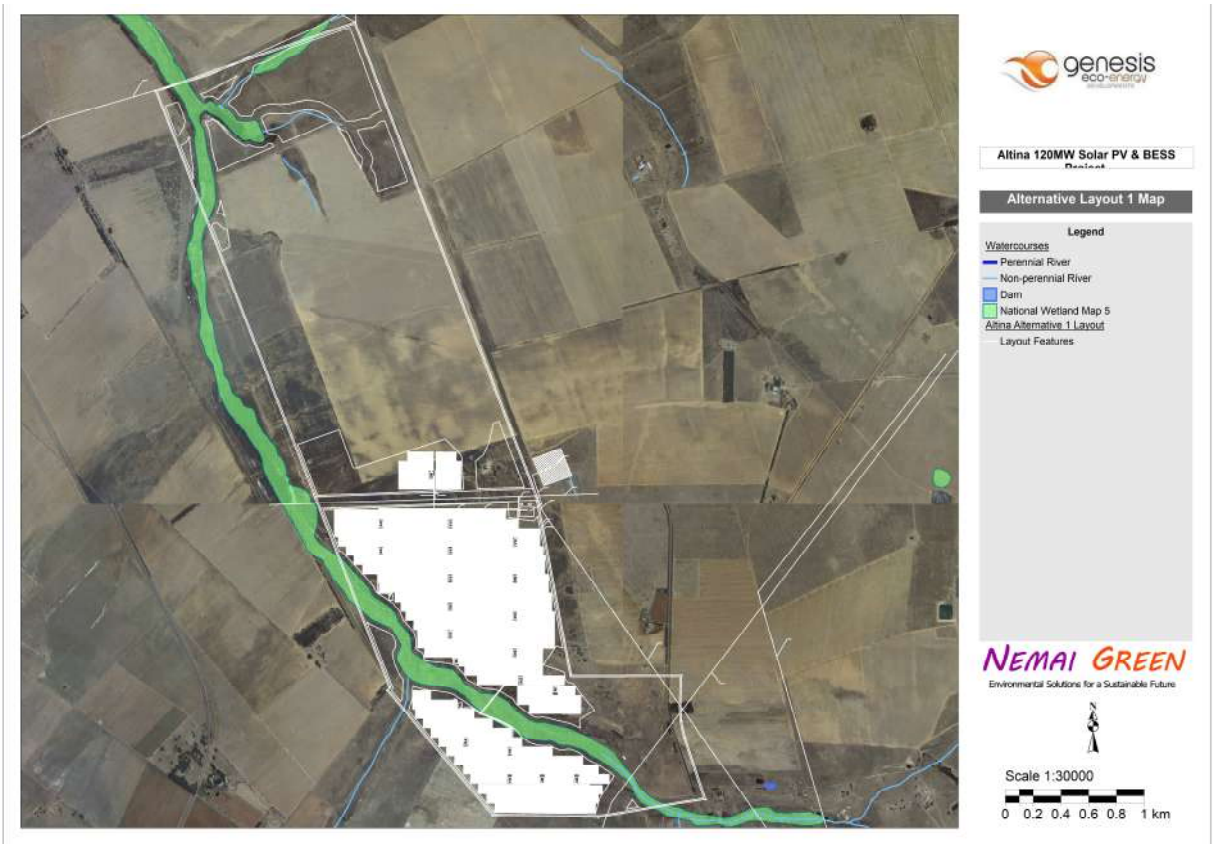


Figure 24: Map of Alternative 1

Figure 25a: Map of the initial Alternative 2

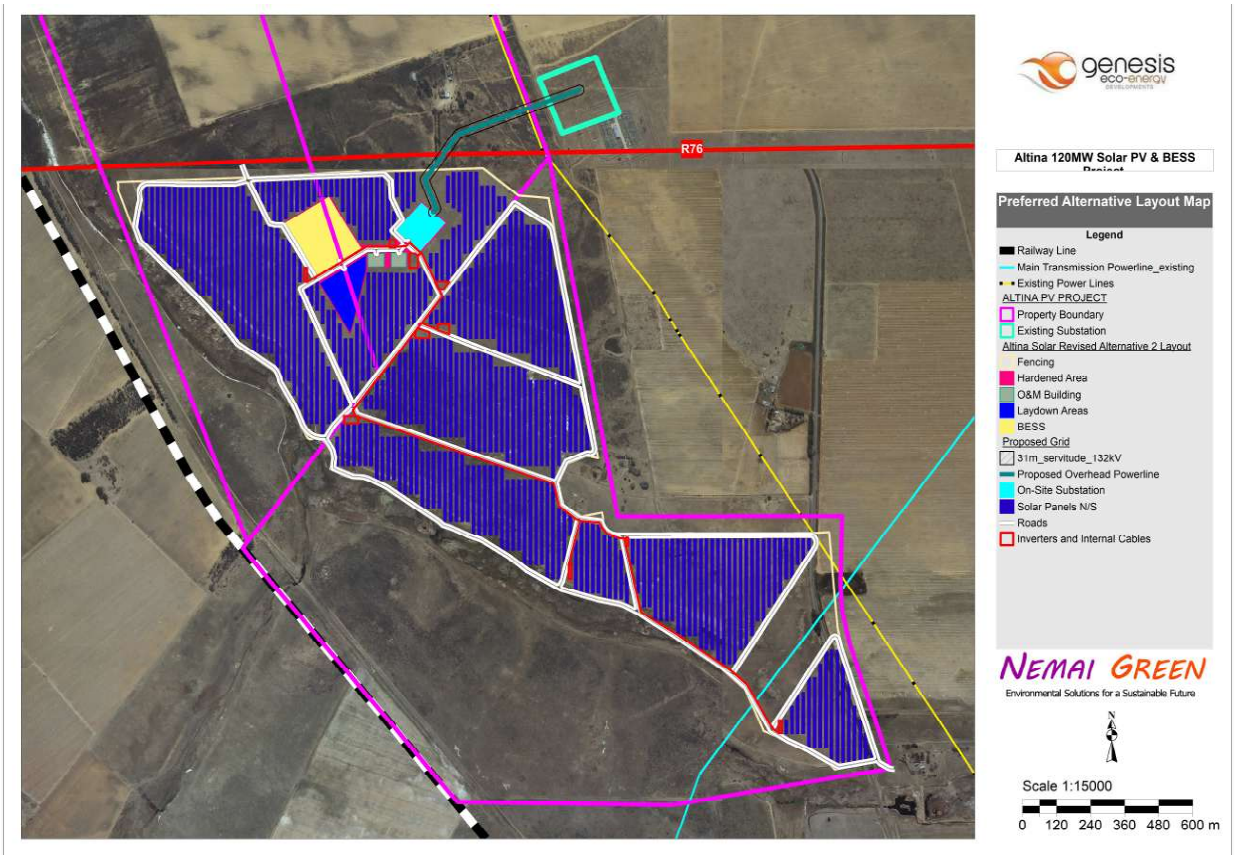


Figure 25b: Map of the Revised Alternative 2 layout

9.4 Technology / Design Alternatives

9.4.1 PV Technology

The proposed solar PV technology will either be monofacial or bifacial solar panels used on either a fixed mounting system or tracking mounting system. The following is noted in this regard:

- Single axis tracker system – this is preferred as it optimises the yield output and is the standard for utility scale solar PV installation.
- Fixed mounted system – this is not the preferred solution as it doesn't allow the solar plant yield to be fully optimised which defeats the purpose of having a fully optimised plant.

A bifacial solar panel receives irradiation on both sides of the panel, which increases the yield. This is preferred over monofacial solar panels that only receive power on one of its sides (see **Figure 26** below). Based on the description provided by the Applicant, a single axis tracker system technology is the preferred alternative for the PV and other technologies will not be considered further.

Figure 26: Monofacial (top) and bifacial (bottom) solar panels ((https://www.bluestemenergysolutions.com/bifacial-versus-monofacial-solar-panels-an-analysis/)

9.4.2 BESS Technology

The BESS can be broken into solid state and flow battery systems, as explained in **Section 8.7**.

From a technical perspective, solid state battery technologies are preferred to flow technology batteries as they are more commercially proven. Hence, they are more economical than flow technologies.

Solid state battery technologies have less environmental hazards as they do not contain electrolytes. Whereas with flow technologies, such as Redox flow batteries, there is a risk of electrolytes, which contain vanadium, a hazardous substance, leaking into the environment.

Solid state battery technologies in the form of Lithium-Ion require less area than flow technologies. Also, flow technology batteries have a tank in the container that contains electrolytes. These are considered to be a storage vessel and hence has more disadvantages to the environment than Li-Ion batteries.

Solid state battery technology is therefore considered the preferred alternative and other alternatives have not been considered further.

9.5 No-Go Option

The no-go alternative can be regarded as the baseline scenario against which the impacts of the Project are evaluated. This implies that the current status and conditions associated with the proposed Project footprint will be used as the benchmark against which to assess the possible changes (impacts) associated with the Project.

In contrast, should the proposed Project not go ahead, any potentially significant environmental issues would be irrelevant, and the status quo of the local receiving environment would not be affected by the project-related activities. The objectives of the Project, including the benefits (such as the exploitation of SA's renewable energy resources, potential economic development and related job creation, and increased security of electricity supply), will not materialise.

The implications of the no-go alternative are discussed in **Section 15.2** below.

10 NEED AND DESIRABILITY

This section serves to expand on the motivation for the proposed development that is provided in **Section 3** above. The format contained in the Guideline on Need and Desirability (DEA, 2017) was used in **Table 9** below.

Table 9: Need for and desirability of the proposed Project

Question No.	Response
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area? *1.1. How were the following ecological integrity considerations taken into account?:* *1.1.1. Threatened Ecosystems.* *1.1.2. Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.* *1.1.3. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs").* *1.1.4. Conservation targets.* *1.1.5. Ecological drivers of the ecosystem.* *1.1.6. Environmental Management Framework.* *1.1.7. Spatial Development Framework.* *1.1.8. Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).*	The following specialist studies will be undertaken to assess the impacts of the Project on the ecological integrity of the area: ▪ Aquatic Assessment; ▪ Terrestrial Ecological Assessment; and ▪ Avifaunal Assessment. The findings of the above studies will be presented in this Report, refer to Section 13. Management objectives are presented and included in the BAR and EMPr to safeguard the sensitive ecological features. The site layout was adjusted to take sensitive environmental features into consideration.
1.2. How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Potential disturbances to ecosystems may include the following: ▪ Clearance of large areas of indigenous vegetation associated with the construction footprint of the PV Site and associated infrastructure; ▪ Potential loss of sensitive environmental features; ▪ Pollution of water resources; ▪ Soil destabilisation and subsequent erosion; and ▪ Proliferation of alien and invasive species. The following specialist studies will be undertaken to assess the impacts of the Project on the ecological integrity of the area: ▪ Aquatic Assessment; ▪ Terrestrial Ecological Assessment; and ▪ Avifaunal Assessment. The findings of the above studies will be presented in this Report, refer to Section 13. Mitigation measures will be included in the BAR under the impact assessment section and EMPr to disturbances to ecosystems, according to the mitigation hierarchy.

Question No.	Response
1.3. How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	The Project may cause surface water, groundwater, soil, air, noise and light pollution during the construction and operational phases. The above impacts will be assessed and mitigation measures have been included in Section 14 and EMPr to manage these impacts.
1.4. What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	The waste to be generated by the Project includes the following: ▪ Construction – o Waste generated from site preparations (e.g. plant material), domestic waste, surplus and used building material, and hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags). Solid waste generated during the construction phase will be temporarily stored at suitable locations (e.g. at the construction camp) and will be removed at regular intervals and disposed of at approved waste disposal sites. All the waste disposed of will be recorded. o Wastewater will include sewage, water used for washing purposes and drainage over contaminated areas. ▪ Operation – o Refuse (domestic waste) generated during the operational phase will be removed on a weekly basis and will be disposed of at a permitted waste disposal facility. Mitigation measures to manage all waste and wastewater generated during the construction and operational are included in the EMPr.
1.5. How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Potential disturbances to cultural heritage may include the following: ▪ Possible direct impacts to graves, heritage resources and on below-ground archaeological deposits and fossils as a result of ground disturbance. ▪ Possible impacts to the cultural landscape as a result of the introduction of incompatible structures and infrastructure to the rural landscape A Heritage Impact Assessment was undertaken and not heritage or cultural sites were identified within the project footprint.
1.6. How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	During the construction phase electricity will be obtained from diesel generators and / or temporary supply via cables from the site power grid. No alternative energy sources were considered. During the operational phase electricity will be sourced from the energy-generation facility itself and/or from the existing electrical infrastructure on the property.
1.7. How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of	The Solar PV Plant proposes to generate electricity from a renewable resource. The total generation capacity of the Project will be 120MW renewable solar energy. Impacts to the receiving environment have been assessed under Section 14 and mitigation measures provided.

Question No.	Response
resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts? *1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life).* *1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)* *1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?*	
1.8. How were a risk-averse and cautious approach applied in terms of ecological impacts? *1.8.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?* *1.8.2. What is the level of risk associated with the limits of current knowledge?* *1.8.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?*	The following specialist studies were undertaken to assess the impacts of the Project on the ecological integrity of the area: ▪ Aquatic Assessment; ▪ Terrestrial Ecological Assessment; and ▪ Avifaunal Assessment. The findings of the above studies are summarised under Section 13 and an impact assessment included under Section 14.
1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following: *1.9.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?* *1.9.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?*	Potential impacts to the social environment include the following: ▪ Construction phase – o Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes) o Safety and security o Use of local road network o Nuisance from dust and noise o Consideration of local labourers and suppliers in area – stimulation of local economy (positive impact) o Transfer of skills (positive impact) ▪ Operational phase – o Direct and indirect economic opportunities as a result of the Project. A Social Impact Assessment was undertaken, and the findings will be presented in Section 13. Mitigation measures to manage impacts to the social environment are included in the EMPr.
1.10. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in	The areas affected by the proposed Project footprint are rural in nature. The Project is located approximately 7km to the southeast of Orkney. The PV Site was previously used for agricultural purposes, which was assessed as part of the

Question No.	Response
socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	Agricultural Impact Assessment (see summary under Section 13).
1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	Refer to the response to question no. 1 above.
1.12. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	There were no site alternatives considered. Two layout alternatives were considered, with the second layout alternative taking into consideration sensitivities identified by specialist surveys of the site. Options under consideration are presented in **Section 9**. The BPEO was identified, taking into consideration of the specialists' findings.
1.13. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Other renewable energy applications that have been made within a 30km radius of the PV Site, according to DFFE's REEA Database, are discussed in **Section 6.6** above. Cumulative impacts are discussed in **Section 14.27.2** below.
2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?: *2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,* *2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),* *2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and* *2.1.4. Municipal Economic Development Strategy ("LED Strategy").*	The socio-economic environment is discussed in **Section 12** below. The following is noted from a planning perspective: ▪ The PV Site and power line are located outside of the urban edge and should not impact on future urban expansion. ▪ The MLM lists the need for electricity under development needs of Ward 22, and overall in the MLM Electricity as a focus area ranks second in terms of prioritisation. ▪ A Key Performance Indicator (KPI) identified in the MLM IDP (2022) was linked to the roll out of solar energy in any identified areas.
2.2. Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area? *2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?*	Refer to the response to question no. 1.9 above.
2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	
2.4. Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	
2.5. In terms of location, describe how the placement of the proposed development will: *2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other,* *2.5.2. reduce the need for transport of people and goods,* *2.5.3. result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),*	2.5.1. The Project will result in increased economic activity, as well as increased opportunities for employment and for SMMEs. 2.5.2. Not deemed to be relevant, due to the nature of the development. 2.5.3. Not deemed to be relevant, due to the nature of the development. 2.5.4. Impacts on surrounding land uses have been assessed as part of the Agricultural Impact Assessment, Social Impact Assessment and Visual Impact Assessment (amongst others).

Question No.	Response
2.5.4. compliment other uses in the area, *2.5.5. be in line with the planning for the area,* *2.5.6. for urban related development, make use of underutilised land available with the urban edge,* *2.5.7. optimise the use of existing resources and infrastructure,* *2.5.8. opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),* *2.5.9. discourage "urban sprawl" and contribute to compaction/densification,* *2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,* *2.5.11. encourage environmentally sustainable land development practices and processes,* *2.5.12. take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),* *2.5.13. the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),* *2.5.14. impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and* *2.5.15. in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?*	2.5.5. Refer to the response to question no. 2.1 regarding planning. 2.5.6. The PV Site and power line are located outside of the urban edge and should not impact on future urban expansion. 2.5.7. The resources and services required for construction and operation are discussed in **Section 8** below. 2.5.8. The Project does not include the expansion of any bulk infrastructure. 2.5.9. Not deemed to be relevant, due to the nature of the development. 2.5.10. Not deemed to be relevant, due to the nature of the development. 2.5.11. Provision has been made in the EMPr to manage the impacts associated with the Project. 2.5.12. Locational factors that favour the proposed site include the favourable solar irradiation levels, short distance to grid connection point, flat topography, suitable site access and availability of land. 2.5.13. The socio-economic benefits associated with the Project will be further identified in the EIA Report. 2.5.14. Refer to the response to question no. 1.5 above. 2.5.15. Refer to the response to question no. 2.1 above regarding planning.
2.6. How were a risk-averse and cautious approach applied in terms of socio-economic impacts? *2.6.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?* *2.6.2. What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?* *2.6.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?*	The findings of the Social Impact Assessment have been included in the BAR under section 13 and impact assessment under Section 14.
2.7. How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following: *2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?* *2.7.2. Positive impacts. What measures were taken to enhance positive impacts?*	Refer to the responses to questions no. 1.9 and 2.1 above. These impacts have been assessed as part of the Social Impact Assessment.
2.8. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to the responses to questions no. 1.7 and 1.10 above.

Question No.	Response
2.9. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	The BPEO was identified, taking into consideration of the specialists' findings, sensitive environmental aspects of the receiving environment, and technical considerations.
2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? *Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?*	
2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	The areas affected by the proposed Project footprint are rural in nature. The PV Site is vacant. Consent has been provided by the landowner for the proposed development.
2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	The findings of the Social Impact Assessment have been included in the under Section 13. Mitigation measures to manage these impacts are included in the EMPr. Also refer to the response to question no. 1.9 above.
2.13. What measures were taken to: *2.13.1. ensure the participation of all interested and affected parties,* *2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,* *2.13.3. ensure participation by vulnerable and disadvantaged persons,* *2.13.4. promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,* *2.13.5. ensure openness and transparency, and access to information in terms of the process,* *2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge, and* *2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted?*	**Section 16** below provides an overview of the public participation process to date, which includes the following: ▪ Compiling the database of I&APs; ▪ Notification provided during the announcement phase; ▪ Notification of review of the draft BAR; ▪ Supplying copies of the draft BAR to authorities; and ▪ Commenting on the draft BAR. Comments received from authorities and I&APs during the announcement phase and draft Review phase will be included in the final BAR.
2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g.. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	The findings of the Social Impact Assessment were included in Section 13 below. Also refer to the responses to questions no. 1.9 and 2.5 above.
2.15. What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Health and safety related risks associated with the Project during the construction and operational phases have been addressed through mitigation measures included in the EMPr. Additional management requirements will be included in the Project's Occupational Health and Safety system.

Question No.	Response
2.16. Describe how the development will impact on job creation in terms of, amongst other aspects: *2.16.1. the number of temporary versus permanent jobs that will be created,* *2.16.2. whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),* *2.16.3. the distance from where labourers will have to travel,* *2.16.4. the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and* *2.16.5. the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).*	The Project will have a beneficial impact on local employment during the construction and operational phases. Further information is included in the summary of the Social Impact Assessment (Section 13) and the impact assessment.
2.17. What measures were taken to ensure: *2.17.1. that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and* *2.17.2. that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?*	SA's commitment to renewable energy is reflected in its ratification of the Paris Agreement and the country's long-term energy planning iterations. Solar power represents a large component of the needed diversification of SA's electricity system. According to the Department of Energy (2017), energy is by nature an intergovernmental issue, cutting across energy security, economic prosperity, employment and environment, among others. In recognising these benefits, clean energy has been incorporated into the broader policy framework. The White Paper on Renewable Energy of 2003 is one of SA's policy documents that laid the foundation for the promotion of renewable energy technologies such as solar, hydro, biomass and wind (http://www.energy.gov.za/files/renewables_frame.html). Through this policy document, a ten year target of how renewable energy technologies could diversify the country's energy mix and secure cleaner energy was set.
2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	The Solar PV Plant proposes to generate electricity from a renewable resource. The total generation capacity of the Project will be 120MW renewable solar energy. Impacts to the receiving environment have been assessed through various specialist studies that are included in the BAR.
2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	The intention is for the mitigation measures included in the BAR and EMPr to be realistic and for the residual risks to be managed to an acceptable level. A rehabilitation fund is setup for the project to provide for any potential remedial work. This is also supported by a sound EMPr to address any foreseeable risks throughout the life cycle of the project.
2.20. What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	
2.21. Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	The BPEO was identified taking into consideration of the specialists' findings, sensitive environmental aspects of the receiving environment, and technical considerations.
2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Other renewable energy applications that have been made within a 30km radius of the PV Site, according to DFFE's REEA Database, are discussed in **Section 6.6** above. Cumulative impacts are discussed in **Section 15.27.2** below.

11 FINANCIAL PROVISIONS

In terms of Section 3(1)(s) of Appendix 1 of GN No. R. 982 of 4 December 2014 (as amended), this section discusses details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.

Due to the sensitive nature of financial provisions, the Applicant cannot provide the exact amounts but can confirm that there will be sufficient funds available to ensure that the Project can be successfully completed and for subsequent operation and maintenance.

Provision will be made in the bill of quantities for the Contractor for the implementation of mitigation measures included in the EMPr (contained in **Appendix K**), including requirements for reinstatement and rehabilitation.

12 PROFILE OF THE RECEIVING ENVIRONMENT

12.1 Introduction

This section provides a general description of the status quo of the receiving environment in the Project area. This serves to provide the context within which the Basic Assessment was conducted. The study area includes the entire footprint of the Project components and related activities.

The reader is referred to **Section 13** below for more elaborate explanations provided through the specialist studies and their findings for specific environmental features.

This section allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed Project. The potential impacts to the receiving environment are discussed further in **Section 14** below.

12.2 Land Use

Status Quo

The Project is located in the northern part of the Free State Province and north-western part of the Fezile Dabi District Municipality (FDDM) and falls within Ward 22 of the Moqhaka Local Municipality (MLM). The site is located approximately 7km to the south of the town of Orkney and is accessed directly from the R76 which runs to the north of the site. The Project footprint is vacant and has been used for agricultural purposes, predominantly grazing and soya and maize cultivation in the south-eastern corner. Evidence of sand mining activities are visible in the north-western corner of the proposed PV footprint.

Agriculture is the dominant land use in the Project area. The following land uses are encountered around the Project's PV Site:

- Cultivated agriculture with annual plantings of crops such as maize, sunflower, sorghum or beans.
- Grazing of land not suitable for cultivation.
- The town of Vierfontein is situated approximately 3 km south-east of the Project, and the town of Orkney approximately 7 km to the north-west of the Project site.
- Existing Eskom Substation north of the Project.

Views of the Project's PV Site are provided in **Figure 27** and **Figure 28** below.

Figure 27: **Existing Eskom substation as viewed from the R76 looking north.**

Figure 28: **View looking south at farmlands on the property.**

Potential Impacts / Implications

- Solar power is regarded as one of the most land-intensive power generation technologies. However, layouts can be flexible as the systems are modular and the PV modules can be arranged to fit within most footprints. The land is suitable for the scale and requirements of the proposed Project.
- The Project has a limited life span. Following decommissioning and rehabilitation, alternative land uses, such as returning the land to agriculture, can be pursued.
- Requirements and restrictions associated with servitudes on the properties need to be adhered to.

12.3 Climate

Status Quo

The climate data for Orkney is presented (https://weatherspark.com/y/92860/Average-Weather-in-Orkney-South-Africa-Year-Round).

Orkney's climate is characterised as having warm, long summers and short, cold, and dry winters. Orkney experiences significant seasonal variation in monthly rainfall. The rainy period of the year lasts for just over 8 months, from September to May. The month with the most rain in Upington is January, with an average rainfall of 75 mm. The dry period of the year lasts for almost 4 months, from May to September. The month with the least rain in Orkney is July, with an average rainfall of 3 mm.

The hot season lasts for just over 4 months, from October to March, with an average daily high temperature above 28°C. The hottest month of the year in Orkney is January, with an average high of 30°C and low of 17°C. The cool season lasts for just under 3 months, from May to August, with an average daily high temperature below 22°C. The coldest month of the year in Orkney is June, with an average low of 3°C and high of 20°C.

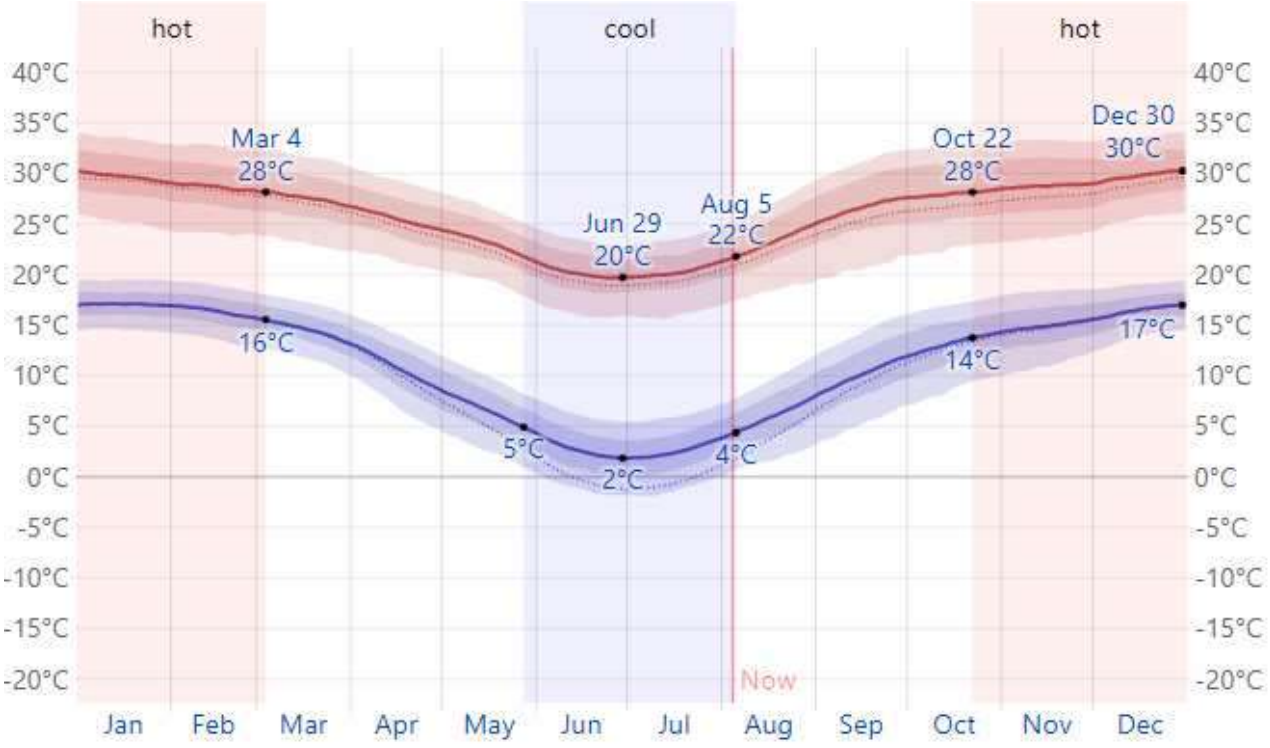


Figure 29: Average minimum and maximum temperatures in Orkney
(Copyright © 2022 https://weatherspark.com/y/92860/Average-Weather-in-Orkney-South-Africa-Year-Round)

The mean monthly precipitation over the year is shown in **Figure 30** below. The average annual precipitation is approximately 450 mm.

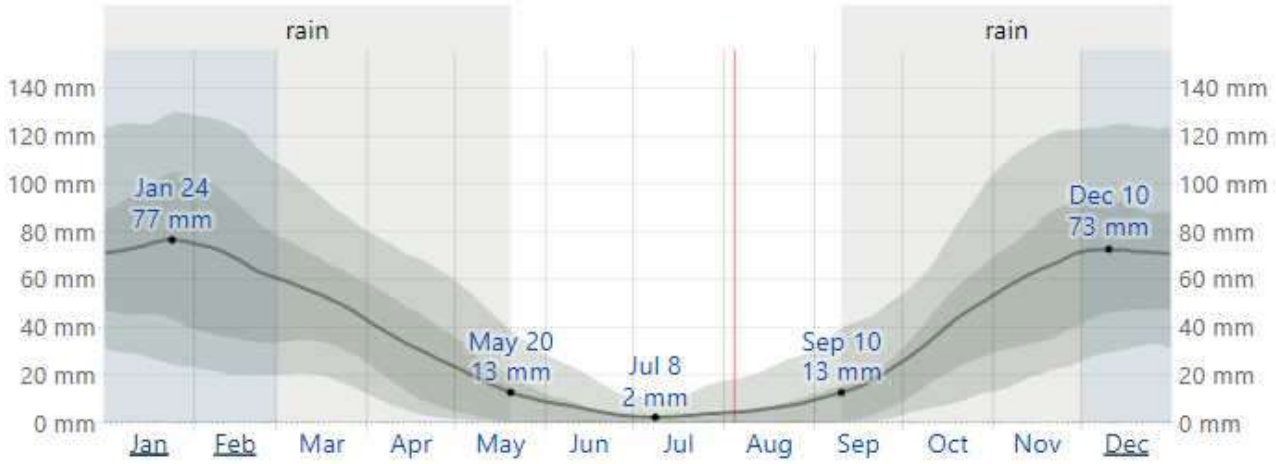


Figure 30: Average monthly precipitation in Orkney
(Copyright © 2022 https://weatherspark.com/y/92860/Average-Weather-in-Orkney-South-Africa-Year-Round)

Potential Impacts / Implications

- The Project proposes to generate energy from a renewable resource, by harnessing solar energy. Renewable energy sources play a role in providing energy services in a sustainable manner and, in particular, in mitigating climate change.
- The proposed site was found to be suitable for the development of the Solar PV Plant due to the local climate and good solar resource (irradiation) (amongst others).
- The efficiency of the facility could be adversely affected if the modules are soiled (covered) by particulates/dust. Soiling of modules will require an appropriate maintenance and cleaning plan.
- Climate change may impact on the Project through extreme floods, which may pose a risk to the facility's infrastructure.

12.4 Geology and Soil

Status Quo

The proposed development is underlain by Quaternary superficial deposits. These superficial sediments mantle sediments of the Ecca and Transvaal Supergroup at depth.

According to the Agricultural Impact Assessment undertaken (**Appendix E4**), The soil derived from the weathering of Vryheid lithology of the Ecca formation. The rock formations are layered arenite and shale. These rocks usually produce sandy loam ferralitic soils of medium depth. Iron and manganese concretions and soft plintite are common. Clay may accumulate in the subsoil to form cutanic blocky or peds. These restrict infiltration. Rainwater then drains laterally and deplete of iron to form a so-called e-horizon. Soils with an e-horizon are important reservoirs for groundwater and contribute to the maintenance of wetlands downslope. In the case of Altina, the concave slopes are normally where these soils occur.

The soil in general has a sandy texture with a clay content of below 18%, and in some places below 10%. This is the reason for the mine in the central western part of the site.

The main soil types found within the Project footprint are listed below and shown in **Figure 31**:

- Exc - This unit is the mine on the western portion of the land, which is adjacent to the river.
- Oa/Lo - Moderately deep yellowish brown soil with a depth that varies over short distances. The subsoil consists of soft ferricrete or cutanic structured deeper subsoil. A bleached e-horizon may occur above the deeper subsoil. This cause lateral water movement in the subsoil, and is often the source of water that feeds the wetlands further downslope.
  The dominant soil forms identified are Oakleaf, Avalon and Longlands.
  These soils may be arable if deep enough. They are, however, not normally cultivated because they can become waterlogged and impassable for farm vehicles during high and prolonged rainfall events.
- Cv600 - Sandy soil with a clay content of 8 - 18% with a total rooting depth of more than 600 mm. The topsoil is light brown with a grain structure. The subsoil is yellowish brown sandy loam with poorly developed blocky or grain structure.
  The dominant soil forms identified are Clovelly, Avalon and Glencoe.
- Lo500 - Moderately deep and shallow greyish brown topsoil on soft plintite or gleyed subsoil. These soils are very erodible and as in the case of Oa/Lo, a store of groundwater to recharge wetlands downslope.
  The dominant soil form found is Longlands. Escort and Kroonstad may also occur.
  They should not be cultivated but left as natural grazing.

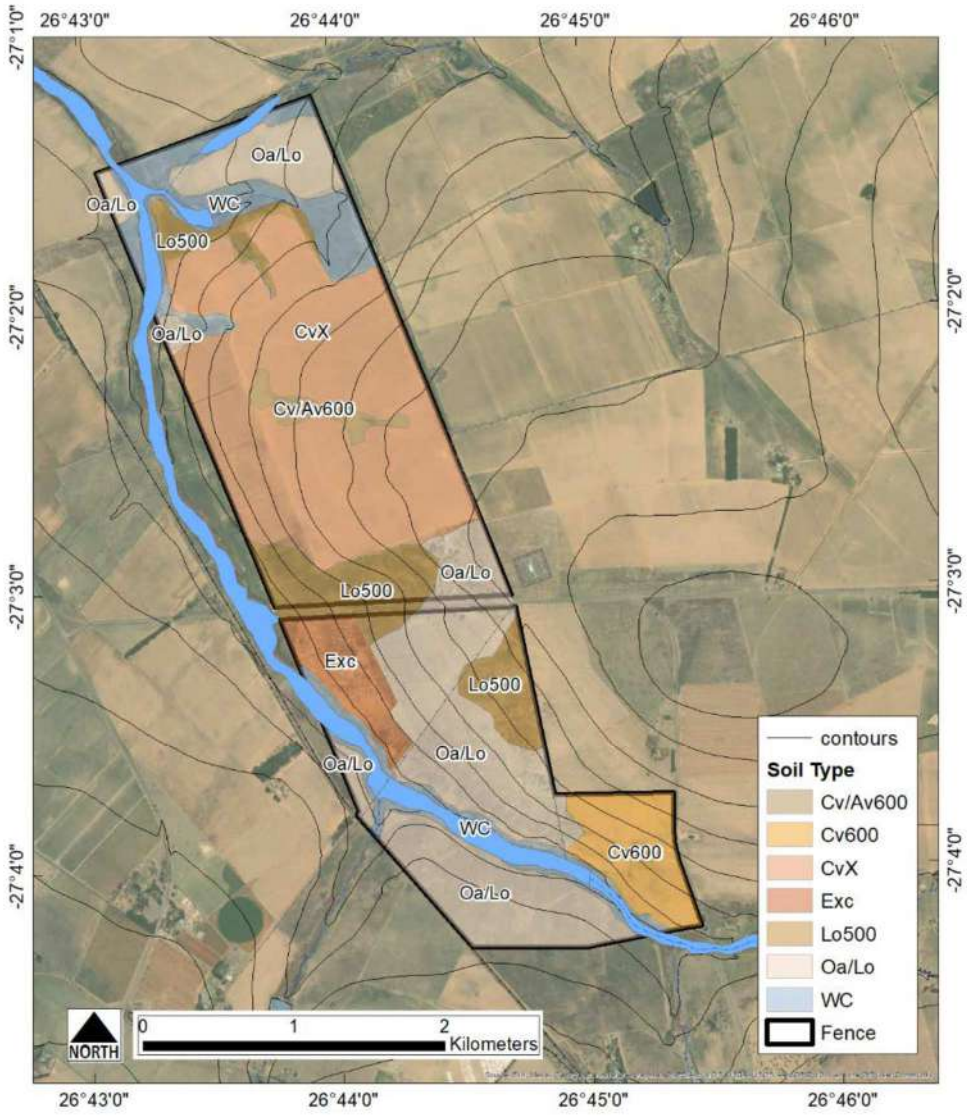


Figure 31: **Soil types within the Project area**

Potential Impacts / Implications

- The geotechnical characteristics determine the suitability of the PV Site in terms of foundations for structures and infrastructure.
- Construction phase:
  - Loss of soil suitable to agriculture.
  - Establish need to rehabilitate eroded areas.
  - Use of heavy equipment during the construction phase could lead to soil compaction.
  - Soil could be contaminated through inadequate storage and handling of hazardous materials, spillages from equipment and plant and poor management of waste, wastewater and cement mixing.
  - Topsoil may be lost if not properly stripped and stockpiled for use during rehabilitation.
  - Erosion may take place if stormwater is not adequately managed.
- Operational phase:

- Erosion may take place if stormwater is not adequately managed.
- Soil could be contaminated through inadequate storage and handling of hazardous materials, leaks from the BESS and poor management of waste and wastewater.

12.5 Topography

Status Quo

In terms of the terrain morphology, the PV Site is characterised by plains with medium relief. In terms of the SOTER database (see **Figure 32** below), the landform encountered over most of the PV Site is characterised as a plain at a medium level.

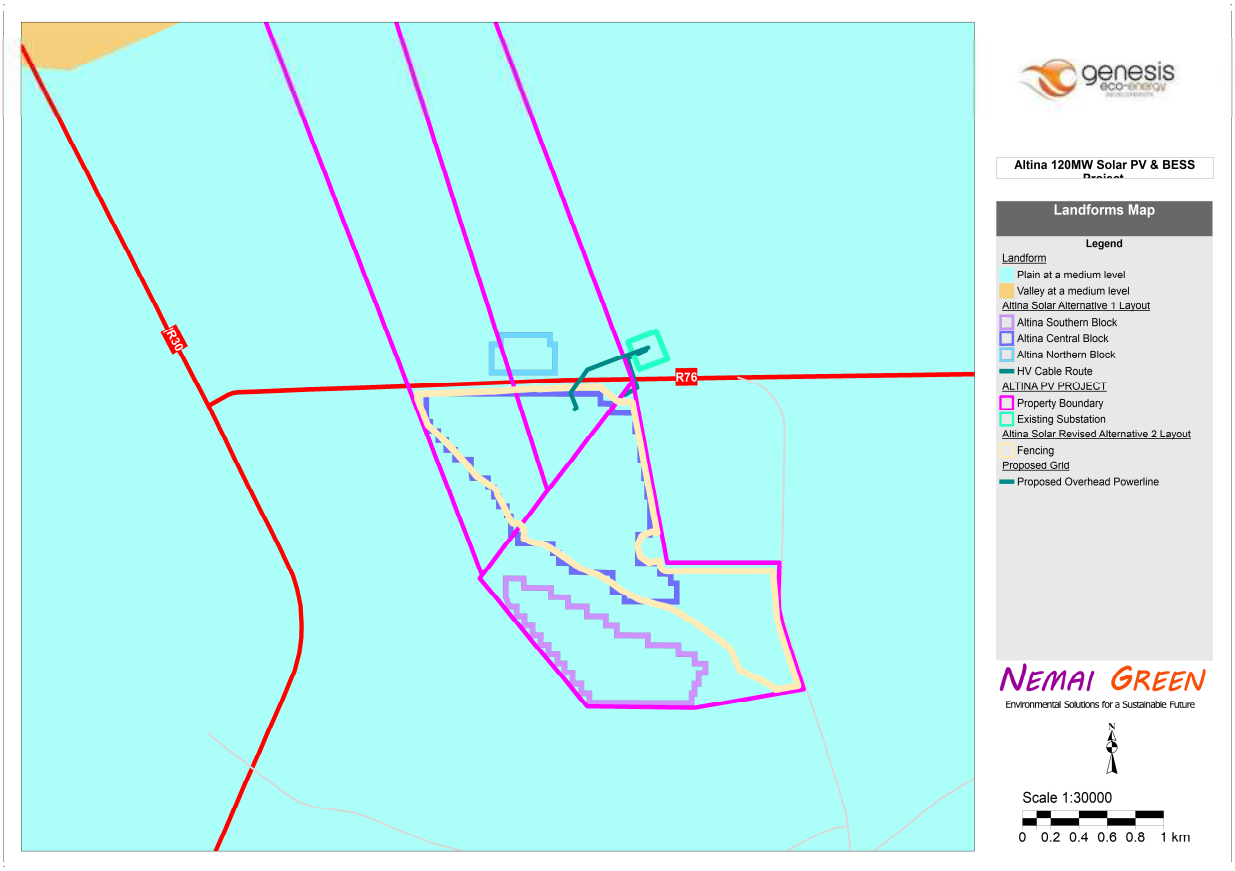


Figure 32: SOTER Landforms

The elevation profiles of the PV Site are as follows (see **Figure 33** below).:

- From west to east the elevation rises from 1298 m to 1319 m above sea level over a distance of approximately 1.07 km, which equates to an approximate slope of 2%; and
- From north to south the elevation drops from 1312 m to 1297 m above sea level over a distance of approximately 1.02 km, which equates to an approximate slope of 1.5%.

The main topographical feature in proximity to the site is a watercourse, the Vierfonteinspruit south of the proposed site, that flows east to west across the property.

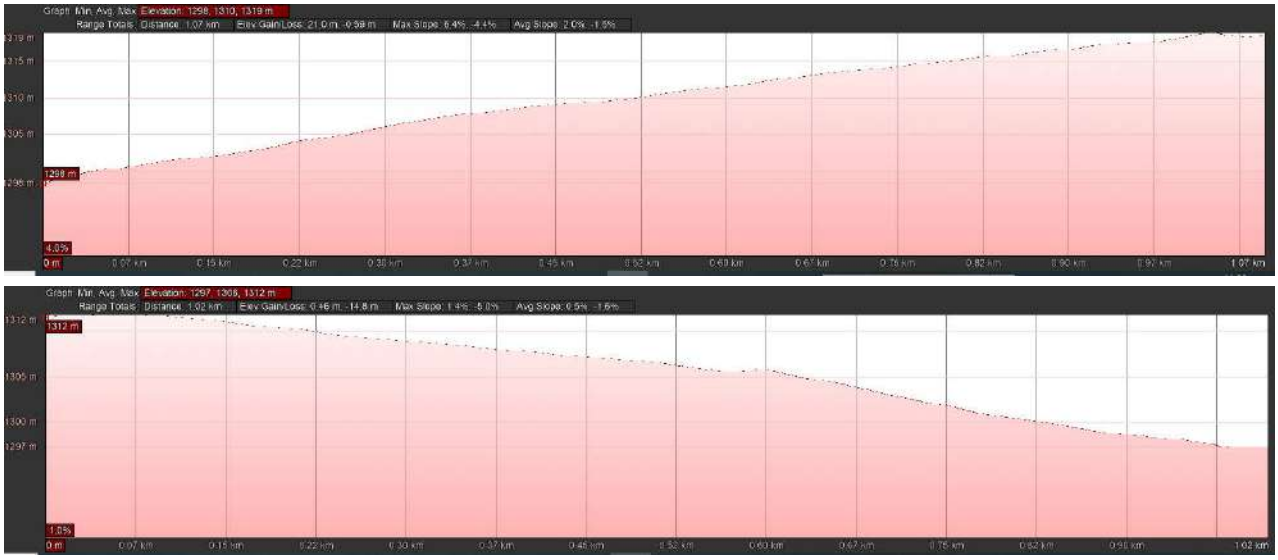


Figure 33: **Map of site profiles – Top: west to east; and Bottom: north to south**

Potential Impacts / Implications

- The topography is relatively flat which makes it suitable for the development of a large scale Solar PV Plant.
- Visual impacts may be caused by the transformation of the landscape.
- Erosion of areas cleared for construction purposes.
- From a glint and glare perspective, it is noted that the solar panels are designed to absorb, not reflect, irradiation.

12.6 Surface Water

Status Quo

The Project Area is situated in the C24B Quaternary Catchment, which falls within the Vaal Water Management Area (WMA). The Project Area drains into the Vierfontein Floodplain. Watercourses in the Project Area are shown in **Figure 34** and **Figure 35** below.

The project area does not overlap with any class 1 Freshwater Ecosystem Priority Area (FEPA) Rivers or wetlands. According to the National Wetland Map 5 spatial data (Van Deventer *et al.*, 2018), the Vierfontein Floodplain occurs on the PV Site, which will be excluded from the development.

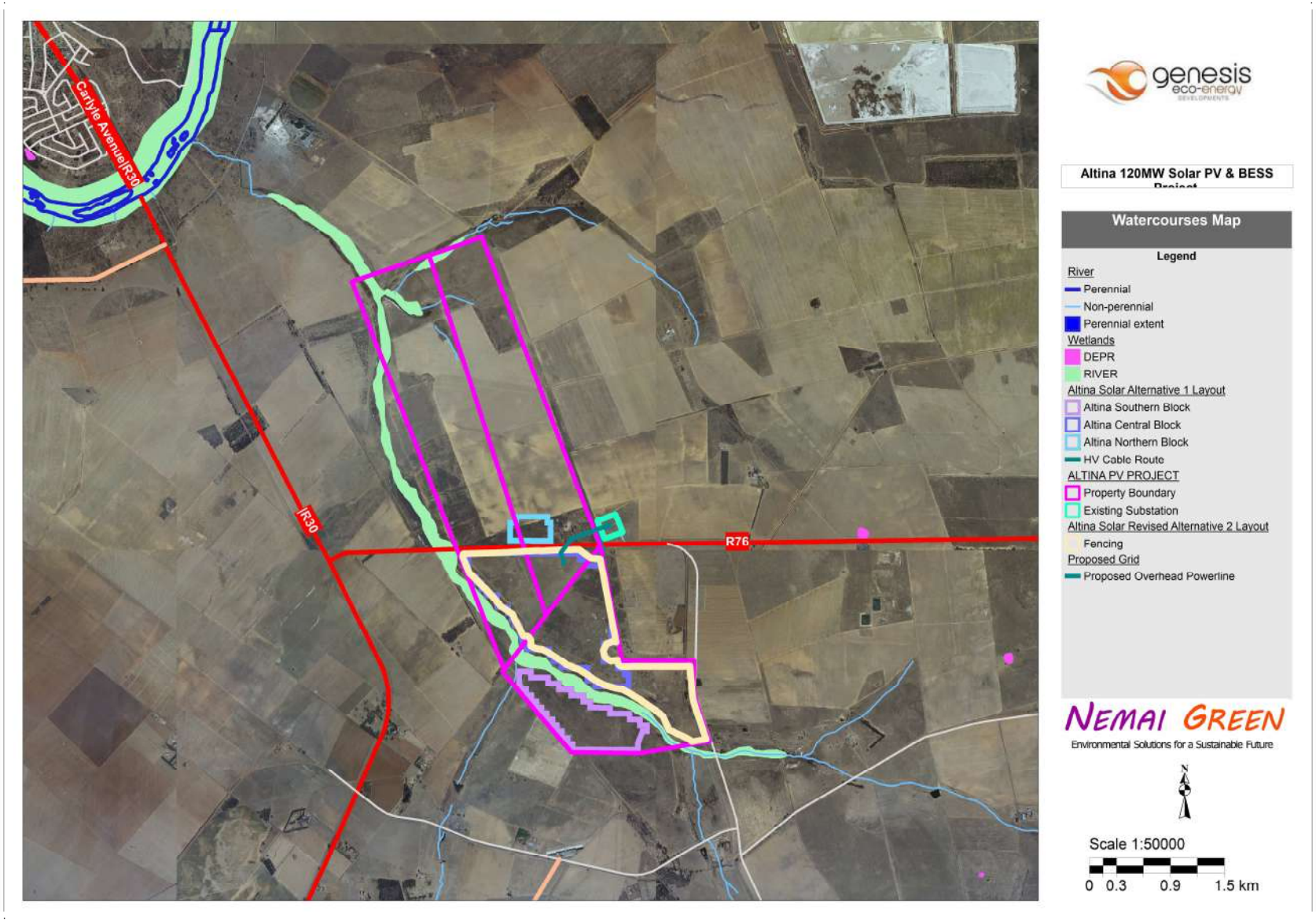


Figure 34: Watercourses associated with the Proposed Project

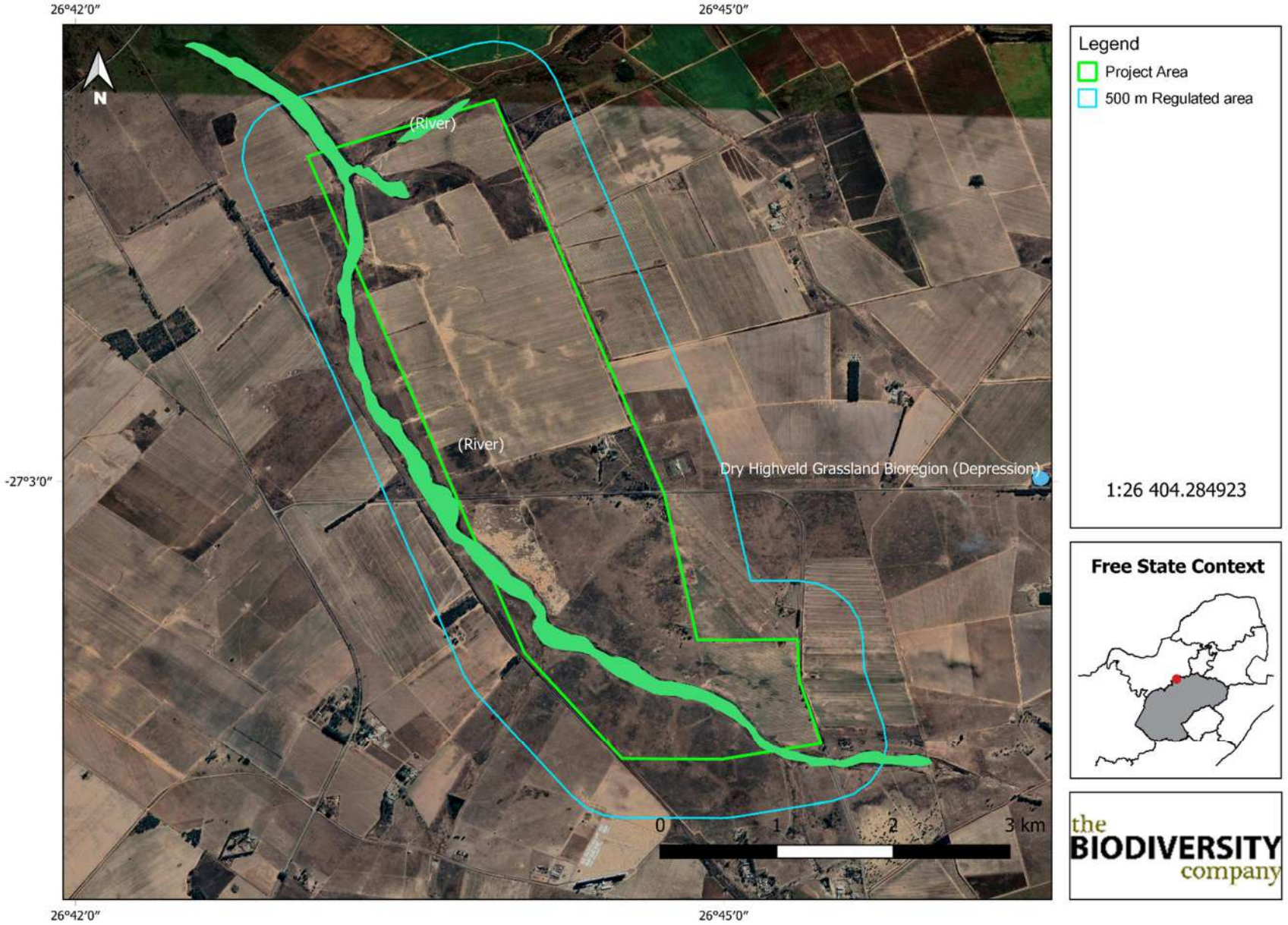


Figure 35: **National Wetland Map 5 (Clark & Husted, 2022)**

According to the findings from the National Web Based Environmental Screening Tool, an area of very high sensitivity in terms of aquatic biodiversity occurs to the south of the PV Site (see **Figure 36** below), which is associated with the wetland. The PV site footprint itself falls within a low aquatic sensitivity. Refer to the wetland specialist sensitivity verification under **Section 13.4**.

Figure 36: **Map of Relative Aquatic Biodiversity Theme Sensitivity**

Potential Impacts / Implications

- Construction phase:
  - Damage to wetland corridors or destabilisation of morphology as a result of construction activities in proximity to the watercourses on the PV Site.
  - Reduction of water quality through sedimentation (e.g., silt from the construction site transported via runoff) and poor construction practices (e.g., improper management of wastewater, incorrect storage of material, spillages, etc.).
  - Temporary alteration of flow and the structure (i.e. bed and banks) of the watercourse on the PV Site as a result of poor management of stormwater.
  - Alteration of site drainage.
  - Reduction in biodiversity of aquatic biota as a result of the abovementioned drivers.
- Operational phase:

- Sedimentation through silt-laden runoff, caused by inadequate stormwater management.
- Damage to the facility from major flood events.
- Water resources could be contaminated through inadequate storage and handling of hazardous materials, leaks from the BESS and poor management of waste and wastewater.
- Alteration of site drainage.

12.7 Flora & Fauna

Status Quo

12.7.1 Biomes and Vegetation Types

The proposed PV Site falls in the Grassland Biome and the vegetation type found in the Project Area is the Vaal-Vet Sandy Grassland (Gh 10) (Mucina and Rutherford, 2006) (see **Figure 37** below). The Vaal-Vet Sandy Grassland listed as an Endangered (EN) vegetation type.

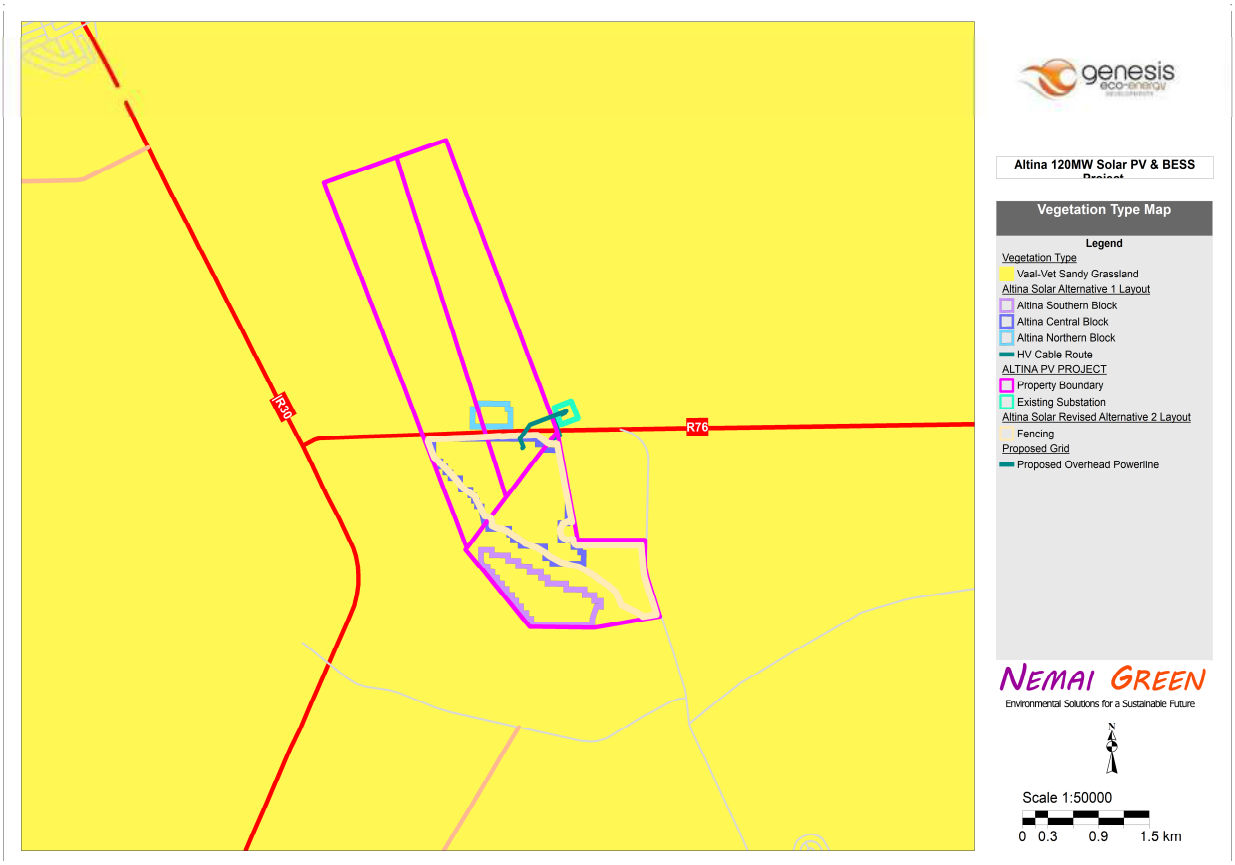


Figure 37: Vegetation types in relation to the Project Area

According to the findings from the National Web Based Environmental Screening Tool, the Project Area has very high sensitivity in terms of the relative terrestrial biodiversity theme, and medium and low sensitivity in terms of the relative plant species theme.

12.7.2 Threatened Terrestrial Ecosystems

In terms of Section 52(1)(a) of NEM:BA, a national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2011. The list classified all threatened or protected ecosystems in South Africa in terms of four categories; Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Protected. The purpose of categorising these ecosystems is to prioritise conservation areas in order to reduce the rates of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems. According to the South African National Biodiversity Institute (SANBI) (2011), the Project Area falls within a threatened ecosystem, which is the Vaal-Vet Sandy Grassland listed as EN.

'Ecosystem protection level' is an indicator of how adequately an ecosystem is protected or not. Ecosystems can be classified as not protected, poorly protected, moderately protected or well protected depending on the proportion of each ecosystem that is under conservation management within a protected area, as recognized in the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA). These protected areas include state or privately-owned protected areas as well a land under biodiversity stewardship agreements. According to the National Biodiversity Assessment (2018), the project area falls within the area listed as **Not Protected** on a national scale.

12.7.3 Protected Areas

The aim of NEM:PAA is to provide for the protection and conservation of ecologically viable areas representative of SA's biological diversity and natural seascapes.

According to the South Africa Protected Areas Database (SAPAD_OR_2021_Q4), the nearest formally protected areas to the Project Area include the following (refer to **Figure 38** below):

- Boskoppie Game Reserve (± 7.5 km to the west);
- Mispah Game Reserve (± 5.8 km to the northeast); and
- Mahemsvlei Private Nature Reserve (± 17.5 km to the southeast).

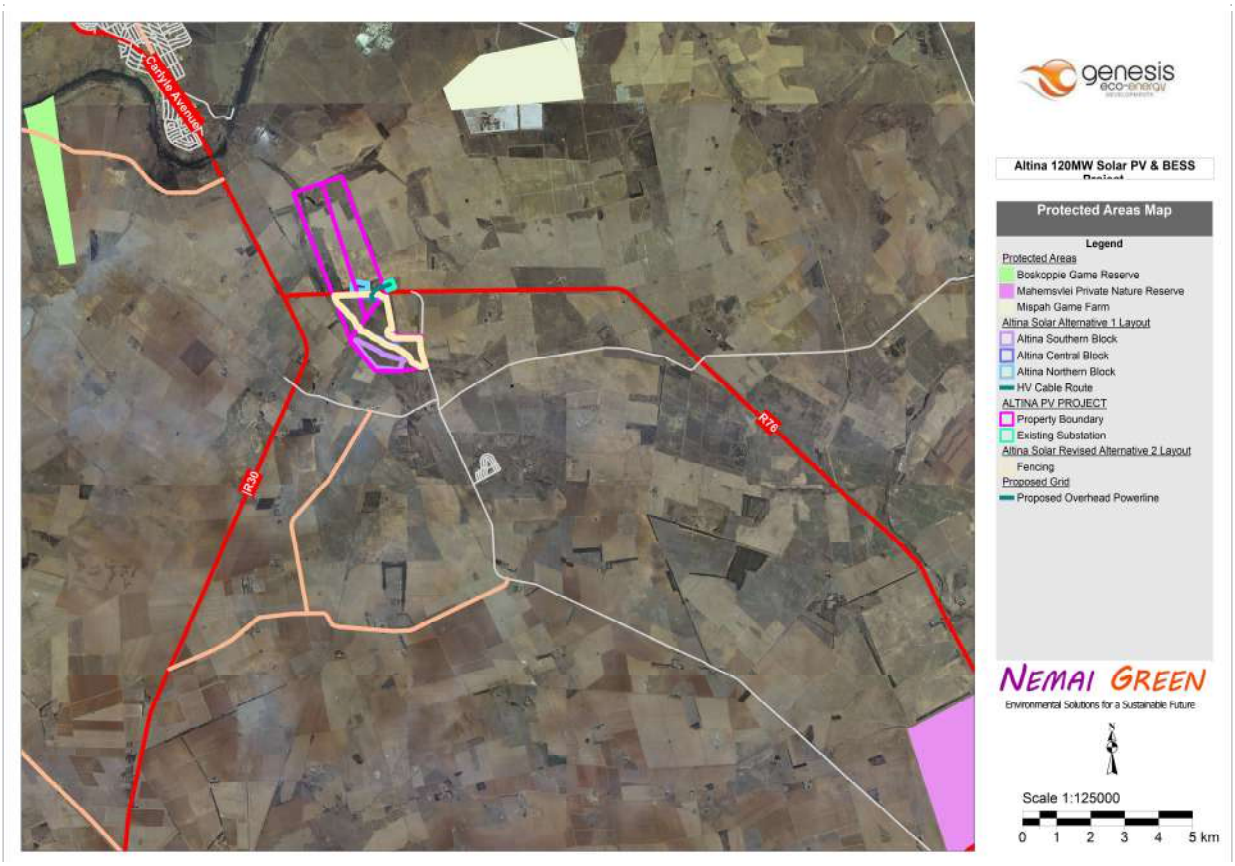


Figure 38: Protected areas in relation to the Project Area

12.7.4 Free State Biodiversity Plan

The Free State Biodiversity Plan (2015) (Collins, 2016) shows Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). CBAs are important for conserving biodiversity while ESAs are important to ensure the long-term persistence of species or functioning of other important ecosystems. Degradation of CBAs or ESAs could potentially result in the loss of important biodiversity features and/or their supporting ecosystems.

The location of the Project Area in relation to the Free State Biodiversity Plan is shown in **Figure 39** below. The Project falls predominately over an area designated as CBA1 and 'other'.

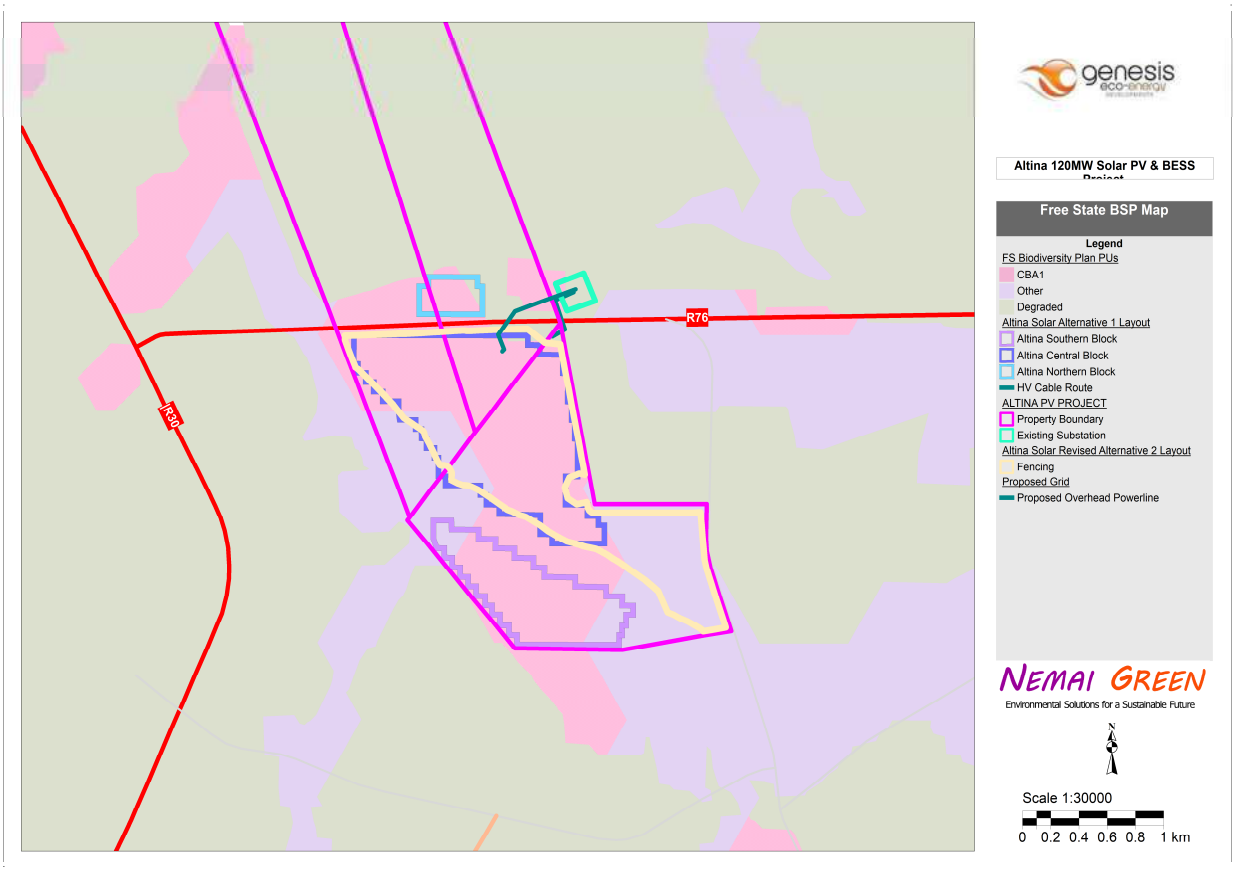


Figure 39: Project Area in relation to the Free State Biodiversity Plan

12.7.5 Important Bird & Biodiversity Area

The Important Bird & Biodiversity Area (IBA) programme of southern Africa (Barnes, 1998) identifies 124 IBAs in South Africa. IBAs are places of international significance for the conservation of birds and other biodiversity and are sites that together form part of a wider, integrated approach to the conservation and sustainable use of the natural environment. There are no IBA's within a 20km radius of the Project Area. The closest IBA are the Sandveld and Bloemhof Dam Nature Reserves, which are approximately 73km southwest of the site.

According to the findings from the National Web Based Environmental Screening Tool, the PV Site has Low sensitivity in terms of the relative avian theme.

Potential Impacts / Implications

- Construction phase –
  - Clearance of vegetation for site preparation, along access roads and other areas to be disturbed. This could result in habitat loss / fragmentation. The significance of habitat loss will need to consider the total area of habitat affected, the uniqueness of the habitat and the sensitivity and conservation status of the habitat and its associated species.
  - Potential loss, disturbance or displacement of protected fauna and flora species.

- Human - animal conflicts.
- Noise and vibration.
- Nights lights may affect nocturnal faunal species.
- Illegal harvesting and poaching of faunal and floral species by construction workers.
- Pollution of the biophysical environment from poor construction practices.
- Proliferation of invasive alien species in disturbed areas.

❑ Operational phase –

- Habitat fragmentation (e.g., barriers to animal movement).
- Reflection of sunlight from the solar panels could adversely affect birds, including those species that use the watercourses on the site and surrounding areas.
- Landscaping, re-seeding and vegetation control is required to remove the risk of vegetation shading modules and reducing performance of the facility.
- Chemical pollution associated with cleaning the PV panels.
- Shading out of plants by solar panels.
- Proliferation of invasive alien species in disturbed areas.

Specialist Study Triggered / Additional Investigations

❑ The compatibility of the project with the Free State Biodiversity Plan and other environmental management and planning tools will be considered further during the EIA Phase.

❑ The Terrestrial Ecological Impact Assessment in the EIA Phase will assess the status of the sensitive ecological features. Suitable mitigation measures will be identified, and recommendations will be made to address potential impacts.

❑ The layout will be refined to incorporate the findings of the Terrestrial Ecological Impact Assessment and will take into consideration sensitive ecological features.

❑ Best practices to mitigate impacts to flora and fauna will be included in the EMPr.

12.8 Socio-Economic Environment

Status Quo

The following information was sourced from the Fezile Dabi DM and Moqhaka LM IDPs.

❑ **Demographic Profile –**

- The population of the Moqhaka LM has decreased by 4.4% from 167 892 in 2001 to 160 532 persons in 2011. The community survey conducted during 2016 indicated that the population once again decreased with 3.61% to 154 732.
- The number of households increased by 10.0% from 41 514 in 2001 to 45 661 and increased again with 17.39% to 53 601 according to the Community Survey results of 2016.
- The population, age structure, dependency and gender ratios between the DM and LM are shown below.

Table 10: population, age structure, dependency and gender ratios

Category	Detail	DC20: Fezile Dabi District Municipality	FS201: Moqhaka Local Municipality
Population	2011	488 036	160 538
	2016	494 777	154 732
Age Structure [2016]	<15	25.5%	27.0%
	15-64	67.5%	66.4%
	65+	7.0%	6.5%
Dependency Ratio [2016]	Per 100 (15-64)	48.1	50.5
Gender Ratio [2016]	Males per 100 females	98.9	-
Population Growth	(% p.a.)	0.31%	-0.73%

- Moqhaka has the second highest GDP contribution in the district.
- The unemployment rate for Moqhaka LM was 39.9% in 2001 and decreased to 35.2% in 2011.
- Approximately 71% of the population aged 5-24 years were recorded in 2011 to be attending an educational institution, this number increased to only 72.3% in 2016.

❑ **Economic and Employment Profile –**

- The economy of Fezile Dabi District Municipality is made up of several sectors which are summarised in the table below.

Table 11: Fezile Dabi Economic Distribution of Sectors 2018

Economic Sector	% Category
Retail and Wholesale Trade	22%
Community Services	20%
Manufacturing	13%
Private Households	13%
Agriculture	12%
Finance and Business Services	7%
Construction	6%
Transport	5%

- During the period of 2020 & 2021, the wholesale and retail trade and community services were the largest sectors of the regional economy. Together than accounted for 42% of the economic output.

- Manufacturing, private household and agriculture comprise the nest 38% of the economy, with a roughly equal split of 13% of the economy.
- The community sector, which includes the government services, is generally a large contributor towards the economic output in smaller and more rural local municipalities. This, combined with the large contributions made by agriculture and from private household economic activity reveal a rural economy with a base found in farming and providing services to its population. Manufacturing does make a significant contribution, and this serves to broaden the base of the economic output of the region.

Potential Impacts / Implications

- Construction phase:
  - Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes).
  - Safety and security.
  - Use of local road network.
  - Nuisance from dust and noise.
  - Consideration of local labourers and suppliers in area – stimulation of local economy (positive impact).
  - Transfer of skills (positive impact).
- Operational phase:
  - Once established, the operation of the Solar PV Plant would result in direct and indirect economic opportunities.
  - Visual impacts to surrounding communities.

12.9 Agriculture

Status Quo

The Project's PV Site is used currently for livestock farming and dryland cultivation; and was historically used for agricultural purposes.

Veld condition is poor. The presence of *Seriphium plumosum* (bankrotbos) is common on most of the rangeland and is indicative of overgrazing or in the case of this site, the presence of an e-horizon just above the clayey subsoil.

The veld's grazing capacity is estimated by the Department as 7ha per LSU. It is the opinion of the Agricultural Specialist (see report under **Appendix E4**). that due to the encroachment; the capacity should be downgraded to around 10 ha/LSU.

According to the findings from the National Web Based Environmental Screening Tool, areas of mostly medium sensitivity with the south-eastern section falling within high sensitivity in terms of the relative agriculture theme occur in the Project Area (see **Figure 40** below).

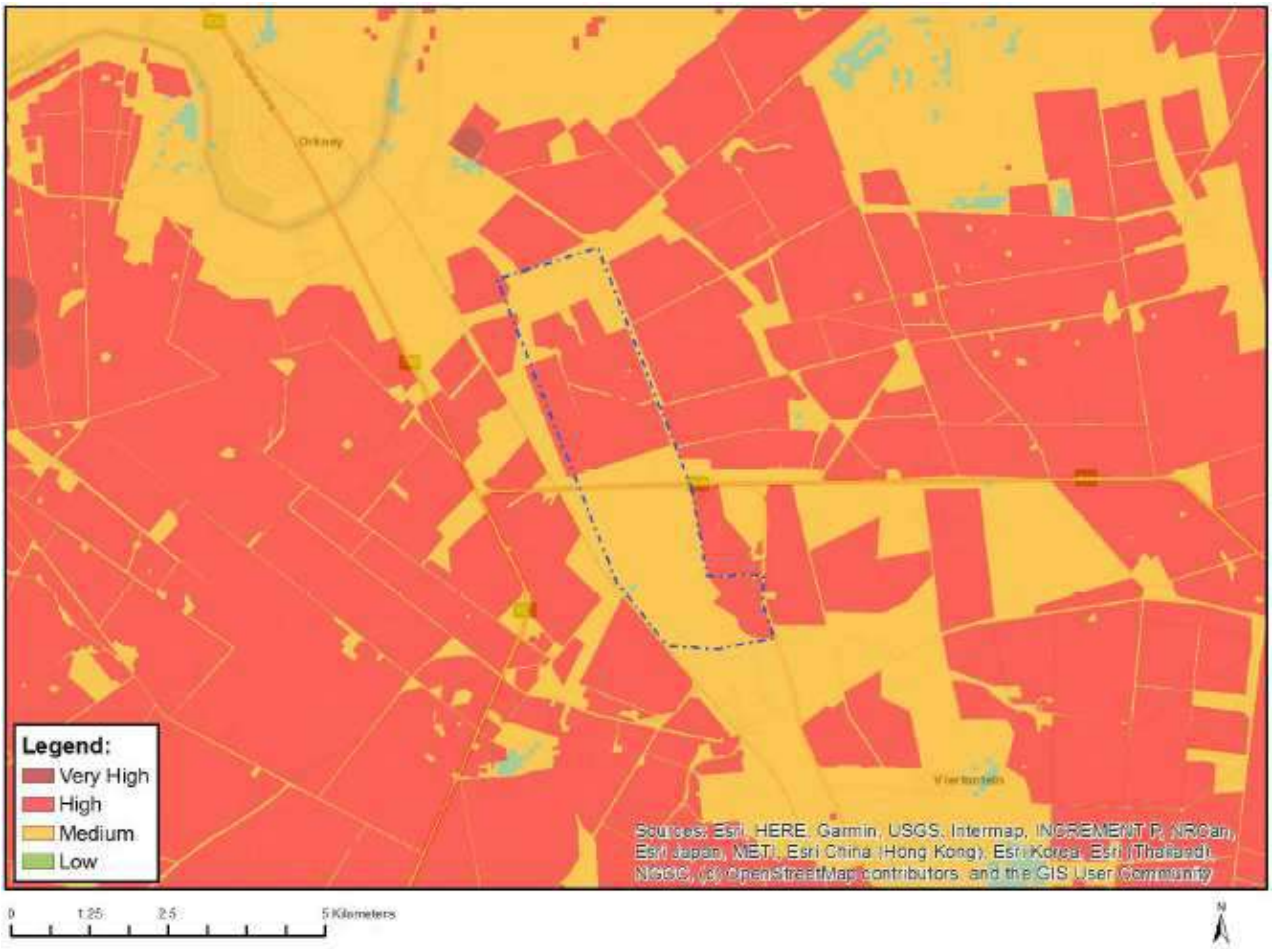


Figure 40: **Map of Relative Agriculture Theme Sensitivity**

Potential Impacts / Implications

- Construction phase:
  - Loss of agricultural land use due to direct occupation by the development footprint. This will take affected portions of land out of agricultural production.
  - Soil erosion by wind or water due to alteration of the land surface characteristics.
  - Alteration of surface characteristics may be caused by construction related land surface disturbance, vegetation removal, panel surfaces and the establishment of hard standing areas, surfaces and roads. Erosion will cause loss and deterioration of soil resources.
  - Loss of topsoil due to poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.) and resultant decrease in that soil's capability for supporting vegetation.
  - Risk of harm to livestock from construction activities (e.g., open excavations).
- Operational phase:

- Loss of agricultural land use due to direct occupation by the development footprint. This will take affected portions of land out of agricultural production.
- Soil erosion by wind or water due to alteration of the land surface characteristics.

12.10 Air quality

Status Quo

Potential sources of air pollution in the region include the following:

- ❑ Fugitive dust emissions from agricultural activities and vehicles travelling on unpaved roads;
- ❑ Vehicle exhaust emissions from vehicles travelling on paved and unpaved roads, including on the R30 and R76;
- ❑ Biomass burning (veld fires);
- ❑ Domestic fuel burning; and
- ❑ Other fugitive dust sources such as wind erosion from exposed areas.

Potential Impacts / Implications

- ❑ The Project proposes the use of a renewable resource (solar), which is a cleaner form of energy generation than using fossil fuels, with environmental benefits.
- ❑ Construction phase:
  - Dust from the use of dirt roads by construction vehicles;
  - Dust from bare areas that have been cleared for construction purposes;
  - Emissions from construction equipment and machinery; and
  - Tailpipe emissions from construction vehicles.
- ❑ Operational phase:
  - The efficiency of the solar plant could be reduced if the modules are soiled (covered) by particulates/dust.
  - Impacts to air quality caused by the operation and maintenance of the facility include dust from the use of dirt roads and tailpipe emissions from vehicles.

12.11 Noise

Status Quo

In terms of the local acoustical environment, the background noise levels are expected to be typical of a rural area. Noise in the greater area emanates primarily from farming operations (e.g., use of farming equipment) and vehicles on the surrounding road network.

Potential Impacts / Implications

- ❑ Construction phase:

- Localised increases in noise may be caused by –
  - Construction equipment, machinery and vehicles;
  - Construction material delivery vehicles; and
  - General activities at the construction camp.

❑ Operational phase:

- Solar PV facilities produce electricity during the daytime hours, when the sun's rays are collected by the panels. When there is little to no irradiance, noise emitted by the equipment is significantly reduced. The main sources of noise from the Project will be the rack mounted inverters and the central step-up transformer, which are only expected to be audible to operational staff who will come in close proximity to these components.
- Localised noise from operation and maintenance vehicles and activities.

12.12 Historical and Cultural Features

Status Quo

As seen in the 1985 aerial view of the PV Site in **Figure 41** below, the land was historically used for agricultural purposes. The presence of any heritage resources will be confirmed as part of the Heritage Impact Assessment.

Figure 41: Aerial view of the PV Site dating to 1985

According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS), the Palaeontological Sensitivity is moderate, and a desktop palaeontological study is required (see **Figure 42** below).

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 42: SAHRIS PalaeoSensitivity Map

According to the findings from the National Web Based Environmental Screening Tool, areas of low sensitivity in terms of the relative archaeological and cultural theme, and medium sensitivity in terms of the relative palaeontology theme occur in the Project Area (see **Figure 43** and **Figure 44** below).

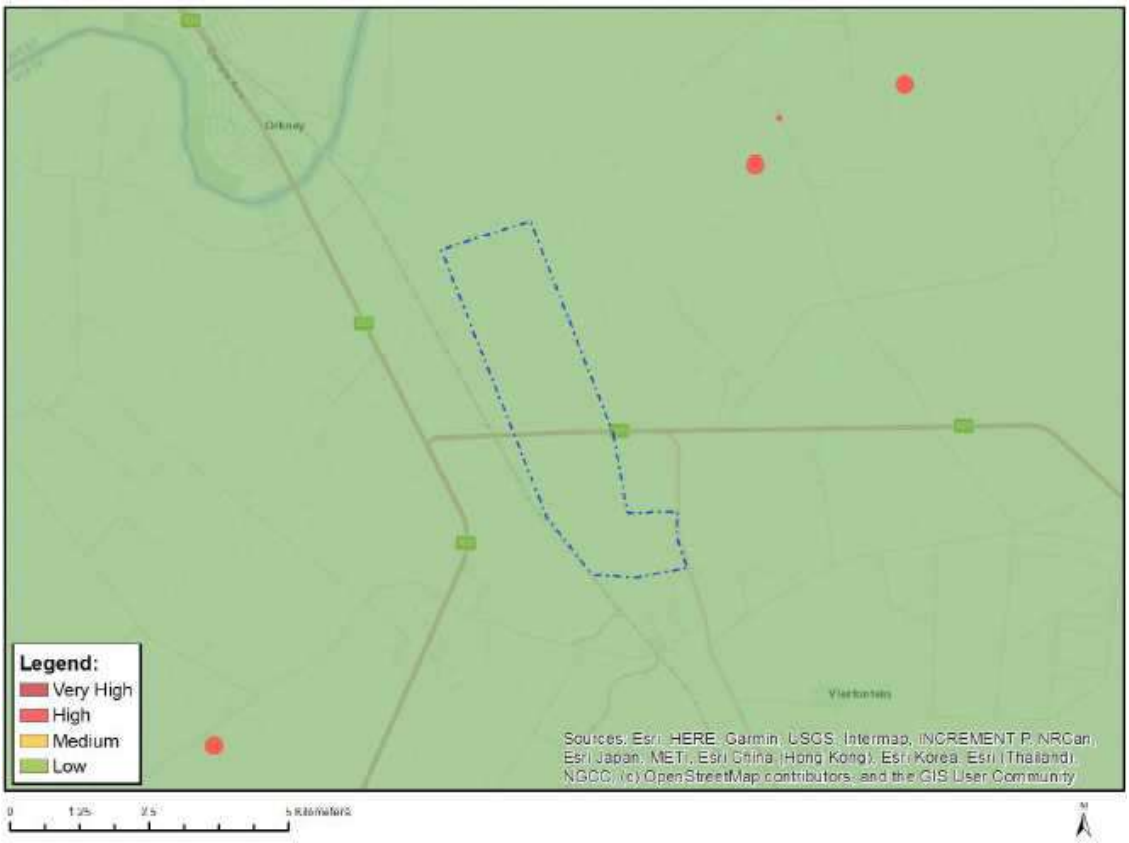


Figure 43: Map of Relative Archaeological and Cultural Theme Sensitivity

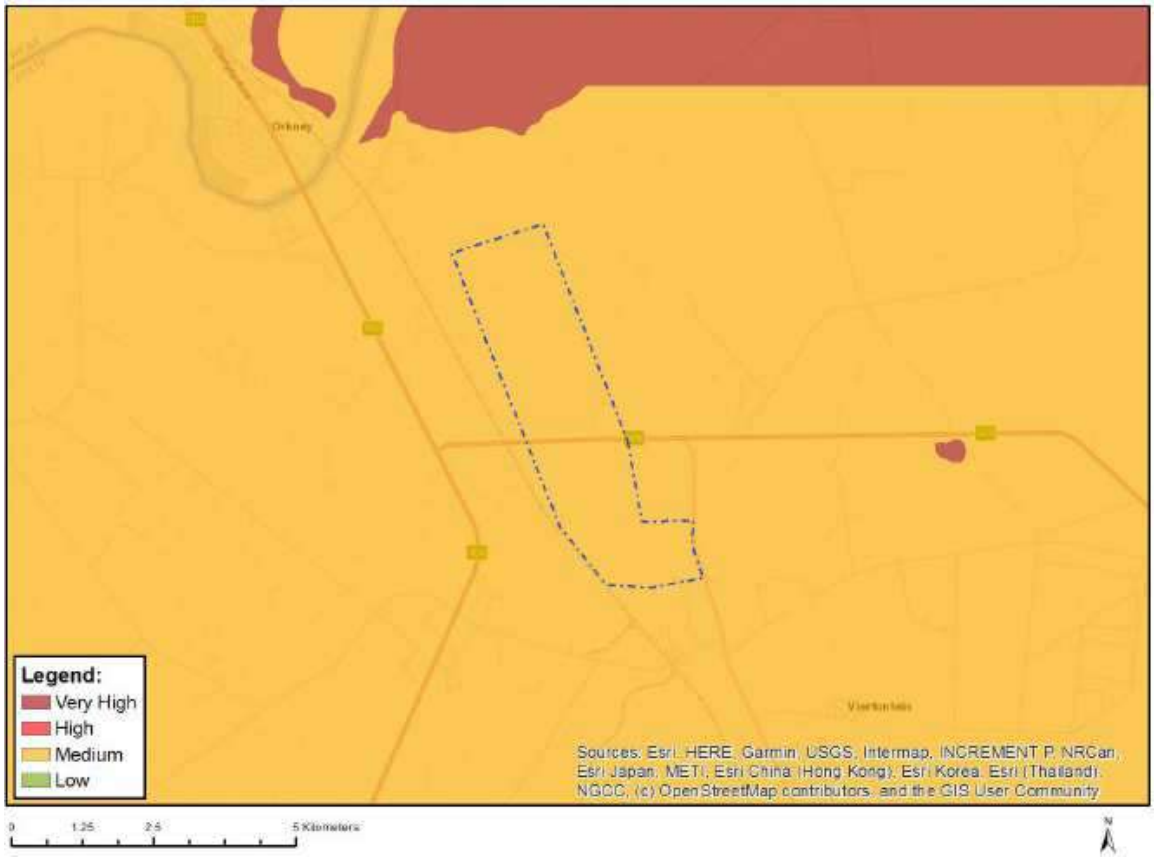


Figure 44: Map of Relative Paleontology Theme Sensitivity

Potential Impacts / Implications

- ❑ Construction phase:
  - Possible, but unlikely impacts on below-ground archaeological deposits and fossils as a result of ground disturbance.
  - Possible impacts to the cultural landscape as a result of the introduction of incompatible structures and infrastructure to the rural landscape.

12.13 Planning

Status Quo

The following is noted from a planning perspective:

- ❑ The proposed PV Site and power line are located outside of the urban edge and should not impact on future urban expansion.
- ❑ In the event that the Solar PV Plant must be decommissioned, the decommissioning phase will include measures for complying with the prevailing regulatory requirements, rehabilitation and managing environmental impacts in order to render the affected area suitable for a future desirable use.
- ❑ Other renewable energy applications have been made within a 30km radius of the PV Site, according to DFFE's REEA Database (refer to **Section 6.6** above). The nearest approved PV plant is located approximately 7 km to the north-west of the Project Area.
- ❑ The proposed PV Site is not located near civil aviation aerodromes. According to the findings from the National Web Based Environmental Screening Tool, the PV Site has low sensitivity in terms of the relative civil aviation theme. The nearest civil aviation aerodrome is more than 10 km north of the site.

Potential Impacts / Implications

- ❑ Potential incompatibility with planning frameworks.

12.14 Existing Structures and Infrastructure

Status Quo

An existing overhead power line runs to the east of the Proposed Project (see **Figure 46** below) in a southwest – northeast direction to the existing Eskom Substation, and further lines run between the substation and Orkney. A railway line runs along the western boundary of the Project area and will not be affected by the Proposed Project. The existing Eskom substation is located to the northeast of the Project site (see **Figure 45** below). The setbacks / conditions required by the custodians of infrastructure on the PV Site and along the power line route will need to be adhered to.

Figure 45: Existing Eskom Substation

Potential Impacts / Implications

- The Project will need to comply with the requirements of the custodians of infrastructure that traverses the PV Site or run along the boundaries of the sites or are crossed by the power line.

12.15 Transportation

Status Quo

The Project area is rural in nature. The transportation network in the Project Area is shown in **Figure 46** below. The R76 runs north of the Site. The R76 connects to the R30 to the west of the site, which if followed northwards arrives in Orkney.

A railway line runs to the west of the site. All other roads in the immediate area are unsurfaced farm roads.

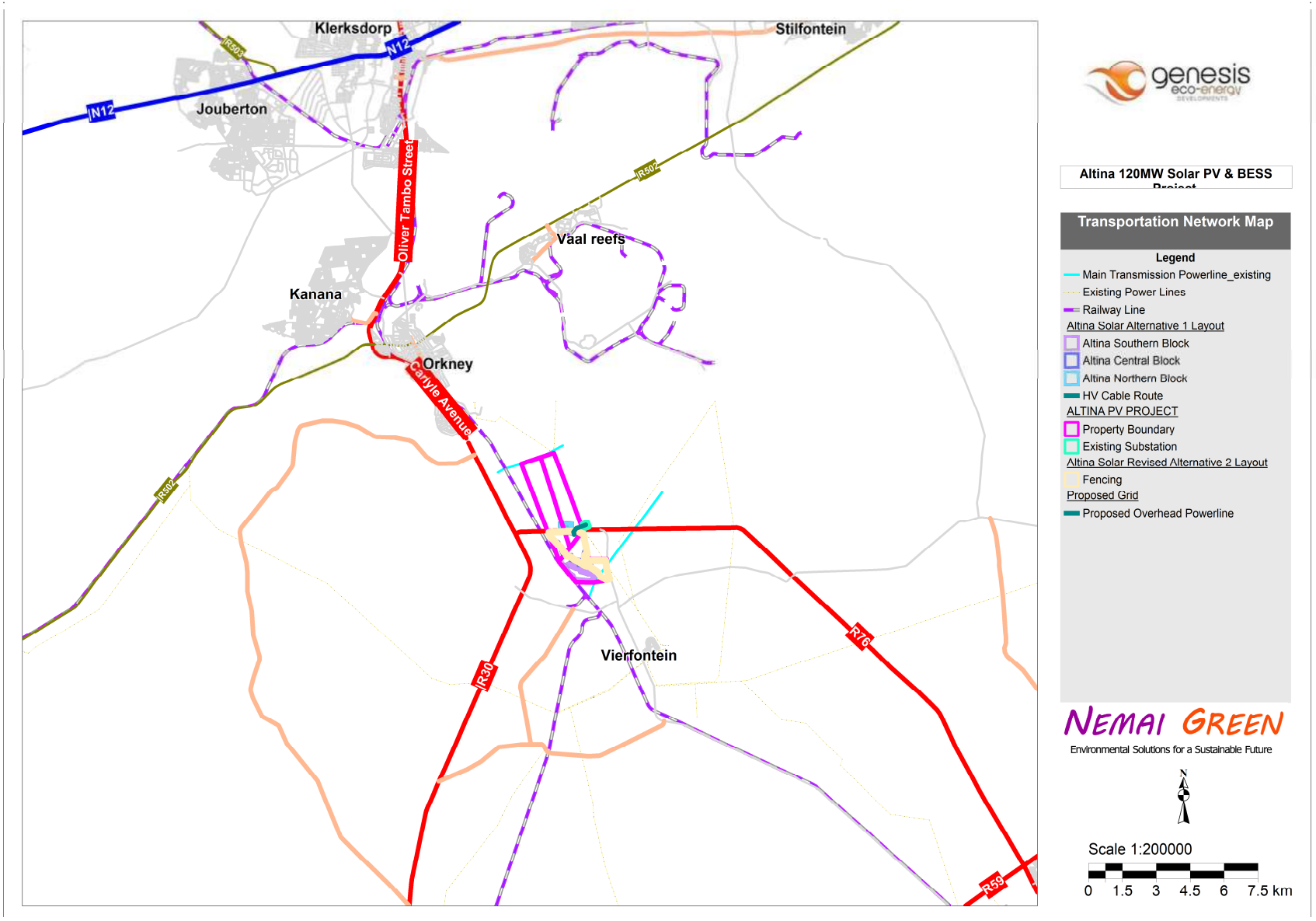


Figure 46: Transportation network

Potential Impacts / Implications

- One of the factors considered in determining the suitability of the Project sites was its accessibility in terms of the existing road network.
- Construction phase:
  - Transportation of materials and construction personnel to site.
  - Impacts to road conditions.
  - Speeding and reckless driving by construction personnel.
  - Construction vehicles accessing and leaving the site via the N6 national road.
  - Use of oversized vehicles/abnormal loads, as required.
- Operational phase:
  - Safe access, taking into consideration the high speed environment along the N6.
  - Transportation of maintenance materials, and operational and maintenance staff, to site.

12.16 Health

Status Quo

All health care services are located within the municipal urban nodes of the surrounding areas, most predominantly in Orkney. The nearest hospital is the West Vaal Hospital to the northwest of the Project Area. The site is largely unserviced, and provision would need to be made for sanitation and water supply.

Potential Impacts / Implications

- Construction phase:
  - Hazards related to construction work.
  - Increased levels of dust and particulate matter.
  - Increased levels of noise.
  - Water (surface and ground) contamination.
  - Poor water and sanitation.
  - Communicable diseases.
  - Psychosocial disorder (e.g. social disruptions).
  - Safety and security.
  - Lack of suitable health services.
- Operational Phase:
  - Hazards related to operation and maintenance work.
  - Fire and explosion risks during BESS operation.

13 SUMMARY OF SPECIALIST STUDIES

13.1 Specialist Studies undertaken as part of the Basic Assessment

According to Münster (2005), a 'trigger' for a specialist study is "*a particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an issue and/or potentially significant impact associated with that proposed development that may require specialist input*".

The specialist studies triggered by the nature of the proposed development and its receiving environment include the following:

1. Wetland Delineation and Risk Assessment;
2. Terrestrial Ecological Assessment;
3. Avifaunal Assessment;
4. Agricultural Potential Impact Assessment
5. Heritage Impact Assessment;
6. Desktop Palaeontological Impact Assessment;
7. Visual Impact Assessment; and
8. Social Impact Assessment.

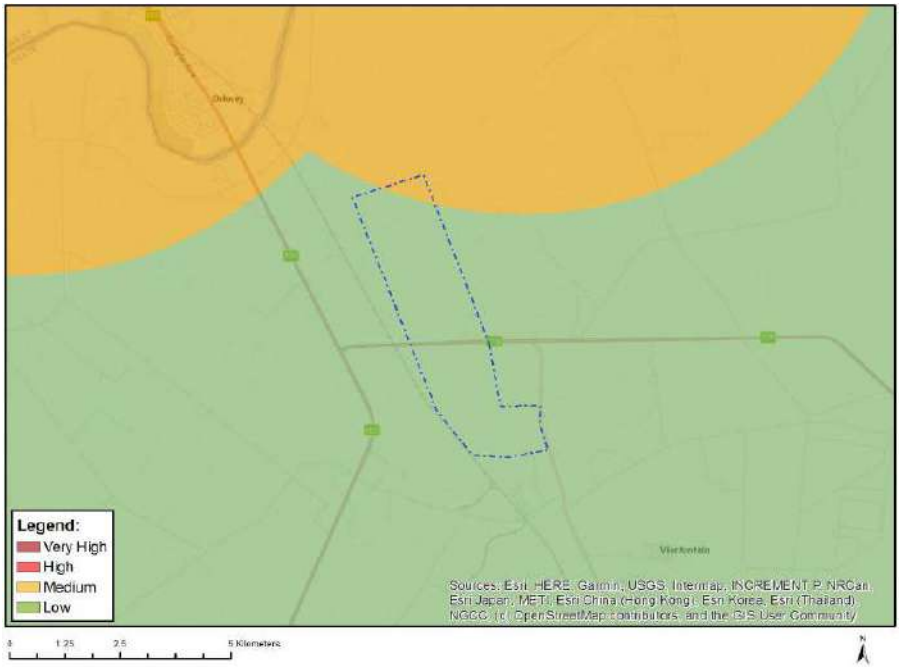
13.2 Excluded Specialist Studies identified during Environmental Screening

As mentioned in **Section 9.4** above, a report was compiled by means of the National Web Based Environmental Screening Tool, which is appended to the Application Form (contained in **Appendix B**). **Table 12** below lists the specialist studies that were identified in the Screening Report, but which were not deemed to be necessary.

Table 12: Specialist studies identified in the Screening Report that were not undertaken

Specialist Study identified in Screening Report	Reason for not undertaking the Specialist Study
Defence Assessment	The map that was created by the Environmental Screening Tool showed the Defence theme to have low sensitivity in the Project area.

Specialist Study identified in Screening Report	Reason for not undertaking the Specialist Study
	 Upon interrogation of the surrounding environment, through the site visit, desktop review and satellite imagery, no evidence was found of any military or defence operations or installations. It was thus not deemed necessary to undertake this study.
Radio Frequency Interference (RFI) Assessment	The map that was created by the Environmental Screening Tool showed the RFI theme to have low sensitivity in the Project area.  Upon interrogation of the surrounding environment, through the site visit, desktop review and satellite imagery, no evidence was found of any radio frequency installations.

Specialist Study identified in Screening Report	Reason for not undertaking the Specialist Study
	In addition, it was not deemed necessary to undertake this study for the following reasons: ❑ The remoteness of the proposed site within a largely rural setting; ❑ Research (e.g. United States Federal Aviation Admiration, 2010) suggests that RFI from PV installations is low risk. PV systems equipment such as step-up transformers and electrical cables are not sources of electromagnetic interference because of their low frequency of operation and PV panels themselves do not emit EMI. The only component of a PV array that may be capable of emitting EMI is the inverter. Inverters, however, produce extremely low frequency EMI similar to electrical appliances and at a distance of 46 m from the inverters the EM field is at or below background levels. Standard engineering mitigations will be implemented to address RFI at the PV site, as necessary.
Civil Aviation Assessment	The map that was created by the Environmental Screening Tool showed the Civil Aviation theme to have low sensitivity in the Project area, which is positioned in the southern section of the overall property boundary. The map that was created by the Environmental Screening Tool showed low civil aviation sensitivity in terms of the PV Site (**See figure below**).  The South African Civil Aviation Authority (SACAA) was included in the Authorities database and notified of the project. It was not deemed necessary to undertake this study since the Project footprint falls outside of any buffer surrounding an aerodrome, airport, or other civil aviation infrastructure.
Socio-Economic Assessment	A Social Impact Assessment has been undertaken.

13.3 Incorporating the Findings from Specialist Studies into the Basic Assessment

The *Guideline for the review of specialist input in EIA processes* (Keatimilwe & Ashton, 2005) was used for including the findings of the specialist studies into the BAR. Key considerations included the following:

- Ensuring that the specialists have adequately addressed I&APs' issues and specific requirements prescribed by environmental authorities;
- Ensuring that the specialists' input is relevant, appropriate and unambiguous; and
- Verifying that information regarding the receiving ecological, social and economic environments has been accurately reflected and considered.

The information obtained from the respective specialist studies was incorporated into the BAR in the following manner:

- The assumptions and limitations identified in each study were included in **Section 10** above;
- The information was used to complete the description of the receiving environment (**Section 13** above) in a more detailed and site-specific manner;
- A summary of each specialist study is contained in the sub-sections to follow (**Sections 14.4 – 14.14** below), focusing on the approach to each study, key findings and conclusions drawn;
- The specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment contained in **Section 15** below;
- Where relevant, the evaluations performed by the specialists on the alternatives of the Project components were included in **Section 16** below to identify the most favourable option;
- Specialist input was obtained to address comments made by I&APs that related to specific environmental features pertaining to each specialist discipline; and
- Salient recommendations made by the specialists were taken forward to the final conclusions (**Section 18** below).

Refer to **Appendix E9** for declarations from the respective specialists.

13.4 Wetland Delineation and Risk Assessment

A summary of the Aquatic Assessment (Clark & Husted, 2022) (contained in **Appendix E1**) follows.

13.4.1 Details of the Specialist

The details of the specialist that undertook the Aquatic Assessment follow.

Organisation:	The Biodiversity Company	
Name:	T. Clark	A. Husted
Qualifications:	MSc Zoology	MSc Aquatic Health
Affiliation (if applicable):	SACNASP Pr Sci Nat (121338)	SACNASP Pr Sci Nat (400213/11)

13.4.2 Objectives of the Study

The following tasks were completed in fulfilment of the terms of reference for this study:

- The identification, delineation and classification of wetlands within the project area;
- Assessment of the Present Ecological State (PES) of the identified wetlands;
- Assessment of the Wetland Ecosystem Services provided by the identified wetlands;
- Assessment of the Ecological Importance and Sensitivity of the identified wetlands
- A risk assessment for the proposed development; and
- The prescription of mitigation measures and recommendations for identified risks.

13.4.3 Methodology

The assessment included the following tasks (amongst others):

- Desktop research using numerous spatial datasets available;
- The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was considered for this assessment. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels. In addition, the method also includes the assessment of structural features at the lower levels of classification (Ollis *et al.,* 2013);
- The wetland areas were delineated in accordance with the DWAF (2005) guidelines;
- Quantify the impacts of human activity or clearly visible impacts on wetland health, and convert the impact scores to a Present Ecological Status (PES) score;
- The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains;
- The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane and Bredin, 2017) was used to determine the appropriate buffer zone for the proposed activity; and
- The risk-based impact assessment was conducted in accordance with the DWS risk-based water use authorisation approach and delegation guidelines.

Please refer to Section 5 of the Specialist Report for a detailed outline of the methodology followed.

Two site visits were conducted on 22 March and 25 April 2022. These constitute late summer and early autumn surveys respectively.

13.4.4 Key Findings of the Study

A description of the surface water features in the Project area is contained in **Section 13.6** above. Key findings from the study follow.

13.4.4.1 Wetland Classification and Extent

In total six wetland hydrogeomorphic (HGM) units belonging to three HGM types (floodplain, unchannelled valley-bottom, and hillslope seeps) were identified both within the 500 m

regulated area and the project area. The most prominent wetland feature with which all of the other identified wetlands are associated (drain into) is the Vierfonteinspruit Floodplain (HGM 1). The level 1-4 classification for these HGM units as per the national wetland classification system (Ollis et al., 2013) is presented in **Table 13** below. A map showing the extent of these wetlands is shown in **Figure 47.**

Table 13: Wetland classification as per SANBI guideline (Ollis et al. 2013). (Clark & Husted, 2022)

Wetland System	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
HGM 1	Inland	Highveld	Dry Highveld Grasslands Group 3	Valley Floor	Floodplain	Flat	N/A
HGM 2	Inland	Highveld	Dry Highveld Grasslands Group 3	Valley Floor	Unchannelled valley-bottom	N/A	N/A
HGM 3	Inland		Dry Highveld Grasslands Group 3	Slope	Seep	Without Channelled Outflow	N/A
HGM 4	Inland		Dry Highveld Grasslands Group 3	Slope	Seep	Without Channelled Outflow	N/A
HGM 5	Inland	Highveld	Dry Highveld Grasslands Group 3	Slope	Seep	Without Channelled Outflow	N/A
HGM 6	Inland	Highveld	Dry Highveld Grasslands Group 3	Slope	Seep	Without Channelled Outflow	N/A

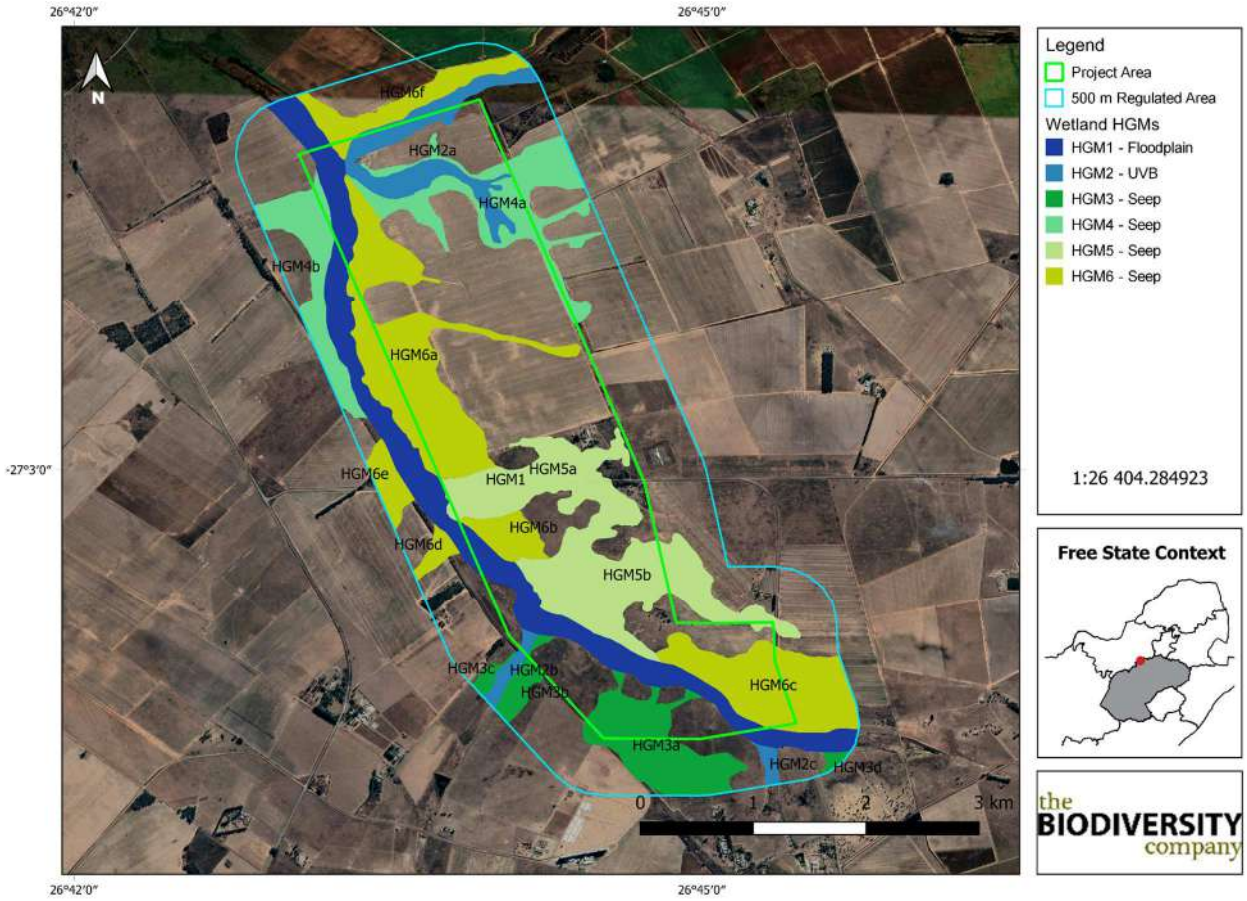


Figure 47: **Wetlands delineated within the 500 m regulation area around the proposed PV footprint (Clark & Husted, 2022)**

13.4.4.2 Present Ecological State (PES)

The present ecological state (PES) of the wetlands identified within the project area is provided in **Table 14**. Overall, HGM 3 was found to be the most intact wetland with a PES of Largely Natural (Class B) while HGM 6 was found to be the most heavily impacted wetland unit with a rating of Seriously Modified (Class E). All remaining wetland HGM units (HGMs 1, 2, 4 and 5) were rated as Moderately Modified (Class C).

Table 14: **Summary of the scores for the wetland PES (Clark & Husted, 2022)**

Wetland	Hydrology	Geomorphology	Vegetation	Overall
HGM 1	C: Moderately Modified (3.5)	C: Moderately Modified (2.5)	B: Largely Natural (1.9)	**C: Moderately Modified**
HGM 2	D: Largely Modified (4)	C: Moderately Modified (2.8)	C: Moderately Modified (2)	**C: Moderately Modified**
HGM 3	B: Largely Natural (1.5)	B: Largely Natural (1.1)	B: Largely Natural (1.8)	**B: Largely Natural (1.5)**
HGM 4	D: Largely Modified (4.5)	C: Moderately Modified (3)	C: Moderately Modified (2.1)	**C: Moderately Modified**
HGM 5	C: Moderately Modified (3.5)	D: Largely Modified (4)	D: Largely Modified (4.2)	**C: Moderately Modified**
HGM 6	E: Seriously Modified (6.5)	E: Seriously Modified (6.2)	E: Seriously Modified (7.5)	**E: Seriously Modified (6**

Although the upper reaches of Vierfonteinspruit floodplain (HGM 1) support small impoundments their effect on the hydrological and sediment regime of the wetland appear negligible. Due to the high saturation levels in this wetland soil disturbances within the wetland itself remain few and consequently the system supports a largely natural vegetation. Sand mining occurs in the project area but is mostly restricted to the seeps and only marginally encroaches on the floodplain. The floodplain likely experiences increased floodpeaks as a result of bare surfaces associated with croplands and certainly shows signs of sediment accumulation as a result.

HGM2 experiences similar catchments impacts relating widespread commercial crop cultivation as well as upstream dams. However, a larger proportion of this wetland type has been subject to soil disturbance as a result of crop cultivation. Additionally these valley-bottom wetlands show signs of increased susceptibility to flow path erosion.

HGM 3, is relatively remote and access to it both in terms of humans and livestock is limited. As such the seep remains in a Largely Natural state with no appreciable adverse catchment effects.

HGM 4 is impacted by commercial crop farming particularly in the eastern portions but otherwise remains in a Moderately Modified State with an abundance of short dense hydromorphic grasses and sedges surrounding the unchanneled valley-bottoms in the north.

Although the soils in HGM 5 are not currently being impacted by active croplands they do show signs of having been previously tilled. Nevertheless, the hydrological regime remains relatively intact. Sand mining has encroached on small portions of this seep closer to the floodplain. These impacts together with intense livestock grazing has altered the natural vegetation assemblage noticeably.

Although small portions remain, most of the HGM 6 seeps have been transformed by active crop cultivation. Vegetation loss and tilling have served to decrease rainslash protevtion of the soil, increase crust formation, alter infiltration rates and decrease the distribution and retention time of water in these seeps while increasing runoff, floodpeaks and erosion. Consequently, the functionality of these wetlands has been seriously compromised however some natural habitat remains and these seeps still contribute to baseflows in the floodplain.

13.4.4.3 Ecological Importance and Sensitivity (EIS)

The results of the ecological and importance (EIS) assessment are shown in **Table 15**. At a regional scale the NFEPA Wetveg database recognises Dry Highveld Grassland Group 3 floodplains as Critically Endangered, Valley-bottoms as Least Threatened and seeps as Endangered (Nel and Driver, 2012). None of the wetlands within the project area or the

500 m regulated surrounding it are recognised as NFEPA wetlands or rivers. However portions of HGMs 1, 2, 3, 4 and 5 are zoned as CBA 1 areas. The National Wetland Map 5 does not list updated conservation statuses for any the wetlands in the project area.

At a more local scale, HGMs 1, 2 and 4 are rated as having a Very High EIS based primarily on account of their high potential to support Threatened species but also due to their larger size, higher saturation levels, Threatened status and their importance from a provincial conservation planning perspective (portions zoned as CBA1). The Vierfonteinspruit floodplain (HGM1) and associated wetlands in the north (HGMs 2 and 4) provide ideal breeding habitat for two regionally occurring Threatened species namely such as African Marsh Harrier and African Grass Owl. The dense tall reedbeds along the Vierfonteinspruit floodplain provide ideal nesting and foraging conditions for African Marsh Harrier and link directly to an area of recognised importance for the species along the Vaal River less than 3 km north. The dense Imperata cylindrica dominated hydromorphic grasslands in the north (HGM2 and 4) provide ideal nesting and foraging habitat for African Grass Owl.

Habitat diversity within HGMs 3 and 5 is relatively low and these wetlands are not considered important in terms of maintaining viable populations of threatened species. These wetlands are ranked as High primarily on account of their intactness and importance from a provincial conservation perspective (portions are CBA 1). Based on the above the CBA 1 designation of these wetlands is warranted from a biodiversity perspective.

Table 15: The Ecological Importance and Sensitivity results for the wetland area (VH=Very High/A; H=High/B; L=low/D) (Clark & Husted, 2022)

Aspect	HGM 1	HGM 2	HGM 3	HGM 4	HGM5	HGM 6
Ecological Importance & Sensitivity	VH (3.5)	VH (3.1)	H (2.8)	VH (3.4)	H (2.5))	L (0.5)

13.4.4.4 Sensitivity and Buffer Analysis

A map was produced to visually represent the sensitivity of the wetlands based on the findings of the wetland assessment (**Figure 48**). Less impacted wetlands (HGMs 1, 2, 3 4 and 5) were classified as having a High sensitivity while more impacted wetlands (HGM 6) were assigned a Moderate-High. All wetland buffers were assigned a Moderate sensitivity. All other non-wetland areas within the 500 m regulated area were assigned a Low sensitivity from a wetland perspective. The site sensitivity verification can be found under Section 6 of the Specialist Report.

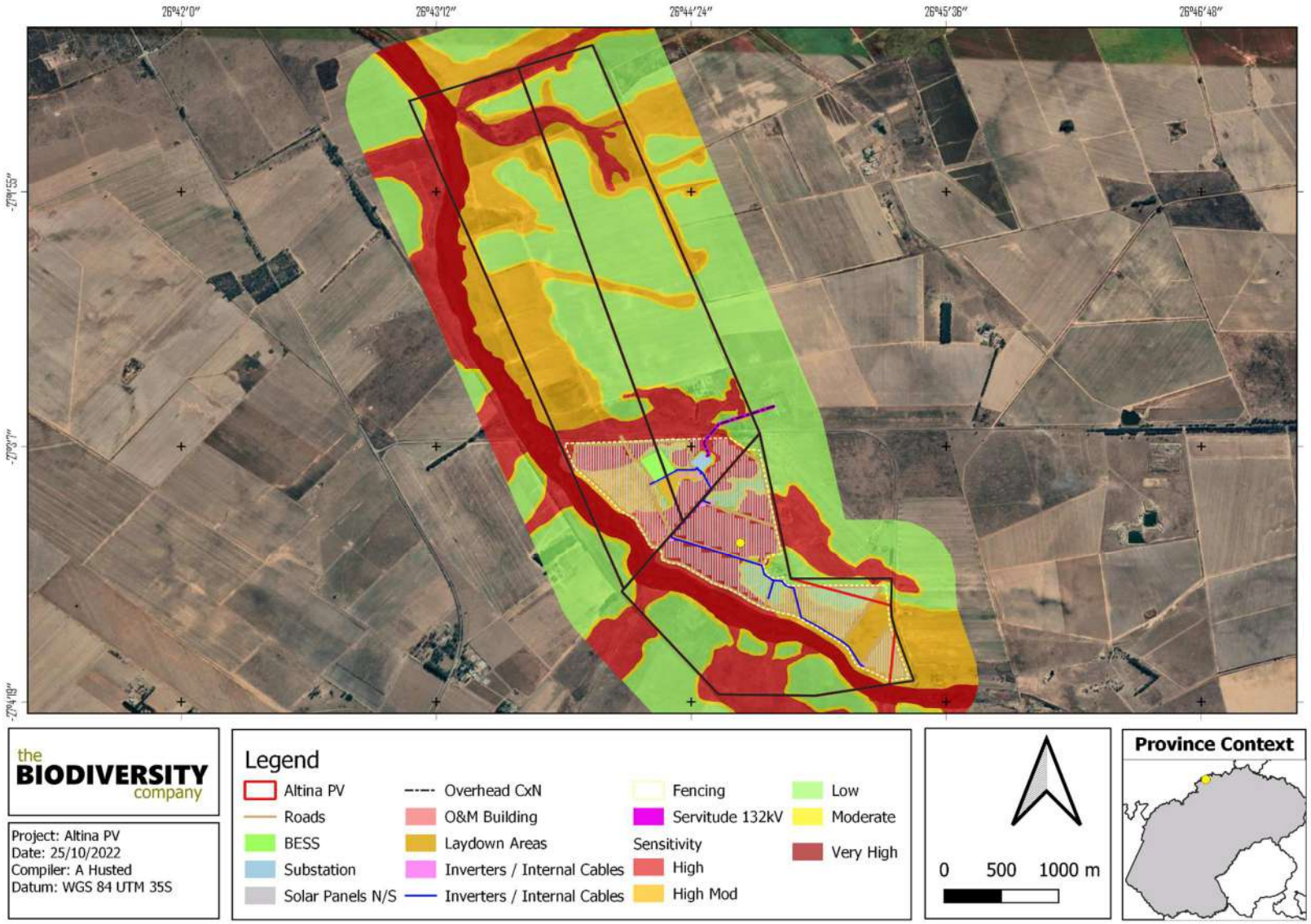


Figure 48: Wetland sensitivity map (Clark & Husted, 2022)

The “Buffer zone guidelines for wetlands, rivers and estuaries” (Macfarlane and Bredin 2017) was used to determine the appropriate wetland buffer zone for the proposed activity, in this case renewable energy. The Vierfonteinspruit floodplain (HGM1) and associated unchanneled valley-bottoms (HGM2) were assigned a minimum development buffer of 41 m. This was based primarily on their Moderately Modified PES and Very High EIS combined with the potential for increased sediments and turbidity as a result of the construction of the PV farm.

Less impacted Seeps belonging to HGMs 3,4 and 5 were assigned a buffer of 29 m while the more impacted and low EIS wetlands of HGM 6 were assigned a buffer of 24 m. The main impacts influencing the buffer determination tool, in all instances, included increase in sediment inputs & turbidity as well alteration of floodpeaks.

13.4.5 Impact Assessment

Refer to **Section 14.12** below for the results from the risk based impact assessment from this study.

13.4.6 Conclusions

The proposed development is situated (for the most part) on the eastern bank of the Vierfonteinspruit floodplain. Some smaller valley-bottom wetlands and seeps are associated with this floodplain. Aside from the valley bottom and floodplain wetlands large portions of the project area particularly south of the tar road are covered by extensive temporary to seasonal hillslope seepage areas.

The hillslope seeps show a strong linkage to the ground water regime which likely exhibits a shallow perched aquifer. Movement of water through this sandy subsurface aquifer was strong as evidenced by prominent gleying of the plinthic horizon and rapid recharge of water in auger holes. Undoubtedly these seeps play an important role in the streamflow regulation and recharge of the large floodplain wetland.

Based on the preferred infrastructure layout (Alternative 2) although the proposed development will avoid the floodplain and associated buffer it will overlap some seepage areas. These seeps are assigned a sensitivity rating of High as they still remain relatively intact and functional. Loss of seep wetland habitat (under infrastructure Alternative 2) equates to 126.3 ha or 26.3% of the total wetland extent in the project area. The developer has stated that the total footprint area would equate to 0.35% per hectare. Based on this, the extent of direct impacts to the wetland area would amount to 44.2 ha or 9.2% of the total wetland extent in the project area.

The loss of wetland area necessitates a Water Use Licence and a Wetland Offset Strategy. Decisions regarding the development of wetland areas and the required compensation have been considered in a preliminary rehabilitation strategy for the development. This approach is motivated by the mitigation hierarchy process. Efforts have been made to avoid (and also minimise) direct

impacts to wetlands and to further mitigate any unavoidable impacts. Due to the loss of wetland area and the inadequacy of the avoidance and mitigation measures to achieve an acceptable level or residual risk, the (on-site) rehabilitation of wetland systems is required. The rehabilitation strategy presents rehabilitation measures to facilitate the recovery of impacted systems, but to also provide adequate compensation for the expected loss of wetland areas.

Although the project area overlaps a number of seeps it is conceivably possible, given the nature of the project, to maintain much of the current base flow to the floodplain and valley-bottom wetlands. Construction of the bifacial arrays on concreted steel mono-pole plinths greatly reduces the actual surface footprint of the development and is thus considered unlikely to drastically alter the hydrological regime of the seeps and therefore the quantity of water delivered to the floodplain and valley-bottom wetlands. The challenge lies in maintaining subsurface flow of water beneath the solar panels without promoting erosion (especially during high rainfall events) of these seep zones and sedimentation and or contamination of the floodplain and valley bottom wetlands. Mitigation provided in this report therefore focuses on maintaining or better yet improving the current sediment regime of the hillslope seeps beneath solar PVs. Although the risk of erosion and sedimentation during the construction phase is likely to be unavoidable and High regardless of mitigation, this impact is likely to be short-lived and can be reduced to a Moderate residual risk (or potentially lower) during operation.

Overall, development of the solar PV is conceivably viable from a wetland perspective. However, if the project is to proceed it recommended that the placement of solar PVs and associated infrastructure within wetland areas is minimised as far as possible. Complete wetland avoidance will not be feasible. Development within the wetlands will require a full water use licence application and decisions regarding the allowed activities and required compensation in terms of the loss of functional hectare equivalents would need to be addressed in the preliminary stages of an offset strategy.

13.5 Terrestrial Ecology Assessment

A summary of the Terrestrial Ecology Assessment (Steyn *et al*., 2021) (contained in **Appendix E2**) follows.

13.5.1 Details of the Specialist

The details of the specialists that undertook the Terrestrial Ecology Assessment follow.

Organisation:	The Biodiversity Company		
Name:	J. Jacobs	A. Husted	C. Burger
Qualifications:	BSc Honours Biodiversity and Conservation Biology	MSc Aquatic Health	BSc Honours Ecology
Affiliation (if applicable):		SACNASP Pr Sci Nat (400213/11)	-

13.5.2 Objectives of the Study

The objectives of this study included the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the project area;
- Desktop assessment to compile an expected species list and possible threatened flora and fauna species that occur within the project area;
- Field survey to ascertain the species composition of the present flora and fauna community within the project area;
- Delineate and map the habitats and their respective sensitivities that occur within the project area;
- Identify the manner that the proposed project impacts the flora and fauna community and evaluate the level of risk of these potential impacts; and
- The prescription of mitigation measures and recommendations for identified risks.

13.5.3 Methodology

The assessment included the following tasks (amongst others):

- Existing data layers were incorporated into GIS software to establish how the proposed Project might interact with any ecologically important features;
- A botanical assessment was undertaken, which encompassed an assessment of all the vegetation units and habitat types within the Project area. This focused on an ecological assessment of habitat types as well as identification of any Red Data species within known distribution of the Project area;
- A faunal assessment was undertaken, which included the following:
    - Compilation of expected species lists;
    - Identification of any Red Data or SCC potentially occurring in the area; and
    - Emphasis was placed on the probability of occurrence of species of provincial, national and international conservation importance.
    - The field survey component of the assessment utilised a variety of sampling techniques including, but not limited to, visual observations, identification of tracks and signs and utilization of local knowledge.
    - Site selection for trapping focussed on the representative habitats within the Project area.
- Herpetofauna (reptiles and amphibians) –
    - A herpetofauna desktop assessment of the possible species in the area was undertaken and attention was paid to the SCCs.
    - A herpetofauna field assessment was conducted in each habitat or vegetation type within the project area, as identified from the desktop assessment, with a focus on those areas which will be most impacted by the proposed development.
- Terrestrial Site Ecological Importance –

- The different habitat types within the assessment area were delineated and identified based on observations during the field assessment as well as available satellite imagery. These habitat types were assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes.
- Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g. SCC, vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts).

Please refer to Section 4 of the Specialist Report for a detailed outline of the methodology.

The survey was undertaken from the 23rd to the 24th May 2022, in the dry season.

13.5.4 Key Findings of the Study

A description of the terrestrial ecological features in the Project area is contained in **Section 13.8** above. Key findings from the study follow.

13.5.4.1 Vegetation Assessment

Indigenous Flora

The vegetation assessment was conducted throughout the extent of the project area. A total of 49 tree, shrub, herbaceous and graminoid plant species were recorded in the project area during the field assessment (**Table 16**). Plants listed as Category 1 alien or invasive species under the NEMBA appear in green text. Plants listed in Category 2 or as ‘not indigenous’ or ‘naturalised’ according to NEMBA, appear in blue text.

The list of plant species recorded to is by no means comprehensive, and repeated surveys during different phenological periods not covered, may likely yield up to 30% additional flora species for the project area. However, floristic analysis conducted to date is however regarded as a sound representation of the local flora for the Project Area.

Table 16: Trees, shrub and herbaceous plant species recorded in the project area (Husted, *et al.*, 2022)

Family	*Scientific Name*	Common Name	Threat Status (SANBI, 2017)	SA Endemic	Alien Category
Acanthaceae	*Barleria macrostegia*	Tongklapper	LC	Not Endemic	
Anacardiaceae	*Searsia lancea*	Karee	LC	Not Endemic	
Apocynaceae	*Gomphocarpus tomentosus subsp. tomentosus*	Woolly Milkweed	LC	Not Endemic	
Asparagaceae	*Asparagus laricinus*	Cluster-leaf asparagus	LC	Not Endemic	
Asparagaceae	*Agave americana*	Sentry plant	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 3 in Western Cape
Asphodelaceae	*Aloe greatheadii*	Spotted Aloe	LC-Sched 6 Protected	Not Endemic	
Asteraceae	*Bidens pilosa*	Blackjack	NE	Not Endemic	
Asteraceae	*Seriphium plumosum*	Bankrupt Bush	LC	Not Endemic	
Asteraceae	*Cirsium vulgare*	Spear Thistle, Scotch Thistle	NE	Not Indigenous; Naturalised; Invasive	NEMBA Category 1b
Asteraceae	*Conyza bonariensis*	Flax-leaf Fleabane	NE	Not Indigenous; Naturalized exotic weed	
Asteraceae	*Tagetes minuta*	Khaki Bush, Khaki Weed, African Marigold	NE	Not Indigenous; Naturalized exotic weed	
Asteraceae	*Hilliardiella oligocephala*	Bicoloured-leaved vernonia	LC	Not Endemic	
Asteraceae	*Berkheya radula*	Boesmanrietjie	LC	Not Endemic	
Asteraceae	*Osteospermum muricatum subsp. muricatum*	Bietou	LC	Not Endemic	
Campanulaceae	*Wahlenbergia undulata*	African Bluebell	LC	Not Endemic	
Casuarinaceae	*Casuarina equisetifolia*	Horsetail Casuarina	NE	Not Indigenous	NEMBA Category 2
Cyperaceae	*Schoenoplectus corymbosus*	Plume sedge	LC	Not Endemic	
Fabaceae	*Vachellia karroo*	Sweet Thorn	LC	Not Endemic	
Fabaceae	*Crotalaria agatiflora*	Canary Bird Bush	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b
Meliaceae	*Melia azedarach*	Chinaberry	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b
Myrtaceae	*Eucalyptus grandis*	Saligna Gum	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b
Poaceae	*Aristida congesta subsp. congesta*	Tassel Three-awned Grass	LC	Not Endemic	

Poaceae	*Chloris gayana*	Rhodes grass	LC	Not Endemic	
Poaceae	*Cymbopogon caesius*	Broad-Leaved Turpentine Grass	LC	Not Endemic	
Poaceae	*Cynodon dactylon*	Couch Grass	LC	Not Endemic	
Poaceae	*Eragrostis chloromelas*	Blue Lovegrass	LC	Not Endemic	
Poaceae	*Eragrostis curvula*	Weeping Love Grass	LC	Not Endemic	
Poaceae	*Eragrostis gummiflua*	Gum grass	LC	Not Endemic	
Poaceae	*Panicum coloratum*	Bamboeskweek	LC	Not Endemic	
Poaceae	*Themeda triandra*	Red Grass	LC	Not Endemic	
Poaceae	*Digitaria eriantha*	Finger Grass	LC	Not Endemic	
Poaceae	*Hyparrhenia hirta*	Common Thatching Grass, Blougras (a)	LC	Not Endemic	
Poaceae	*Melinis repens*	Natal Red Top	LC	Indigenous, Not Endemic	
Poaceae	*Setaria sphacelata var. sphacelata*	Common bristle grass; Golden Timothy Grass	LC	Indigenous, Not Endemic	
Poaceae	*Sporobolus africanus*	Ratstail Dropseed; Rush Grass	LC	Not Endemic	
Poaceae	*Zea mays*	Corn			
Poaceae	*Imperata cylindrica*	Beady Grass, Bedding Grass, Cotton-Wool Grass, Silky Grass	LC	Not Endemic	
Poaceae	*Arundo donax*	Giant Reed	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b
Poaceae	*Eragrostis superba*	Flat-Seed Love Grass	LC	Not Endemic	
Poaceae	*Phragmites australis*	Common Reed	LC	Not Endemic	
Poaceae	*Pogonarthria squarrosa*	Herringbone Grass	LC	Not Endemic	
Poaceae	*Cortaderia selloana*	Pampas grass		Not Indigenous	NEMBA Category 1b
Rhamnaceae	*Ziziphus mucronata subsp. mucronata*	Buffalo Thorn, Wait-a-bit	LC	Indigenous, Not Endemic	
Rosaceae	*Prunus persica*	Peach	NE	Naturalized exotic weed	
Scrophulariaceae	*Selago densiflora*		LC	Not Endemic	
Solanaceae	*Datura ferox*	Large Thorn Apple	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b

Solanaceae	*Solanum sisymbriifolium*	Wild Tomato, Dense; Thorned Bitter Apple	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b
Typhaceae	*Typha capensis*	Bulrush, Common Cattail	LC	Not Endemic	
Verbenaceae	*Verbena bonariensis*	Wild Verbena			NEMBA Category 1b

Alien and Invasive Plants

Twelve (12) IAP species were recorded within the project area. Nine (9) of these species are listed under the Alien and Invasive Species List 2020, Government Gazette No. GN1003 as Category 1b. These IAP species must be controlled by implementing an IAP Management Programme, in compliance of section 75 of the NEMBA, as stated above.

13.5.4.2 Faunal Assessment

One (1) amphibian specie was recorded in the project area during survey period, namely *Amietia fuscigula* (Common River Frog). However, due to the presence of various wetlands across the project area providing suitable habitat there is a possibility of more amphibian species being present. No reptile species were recorded during the survey period observed. However, there is the possibility of several species being present, as certain reptile species are secretive and longer-term surveys are required in order to ensure adequate sampling. None of the herpetofauna species recorded are regarded as threatened.

Ten (10) mammal species were observed during this survey of the project area (**Table 17**) based on either direct observation or the presence of visual tracks and signs. None of the species recorded are regarded as a SCC. Five mammal species are provincially protected.

Table 17: Summary of mammal species recorded within the project area (Husted, *et al.*, 2022)

Species	Common Name	Conservation Status		Free State Nature Conservation Ordinance 8 of 1969
		Regional (SANBI, 2016)	IUCN (2021)	
Antidorcas marsupialis	Springbok	LC	LC	Schedule 2
Canis mesomelas	Black-backed Jackal	LC	LC	
Cryptomys hottentotus	Common Mole-rat	LC	LC	
Cynictis penicillata	Yellow Mongoose	LC	LC	
Damaliscus pygargus	Blesbok	LC	LC	Schedule 2
Hystrix africaeaustralis	Cape Porcupine	LC	LC	
Lepus saxatilis	Scrub Hare	LC	LC	Schedule 2
Raphicerus campestris	Steenbok	LC	LC	Schedule 2
Sylvicapra grimmia	Common Duiker	LC	LC	Schedule 2
Xerus inauris	Cape Ground Squirrel	LC	LC	

13.5.4.3 Habitat Assessment

The habitat assessment identified the following different habitats in the Project area (**Figure 49**):

- **Degraded Vaal-Vet Sandy Grassland**

  Degraded Vaal-Vet Sandy Grassland was identified in scattered patches along the project area. This habitat unit is mainly characterised by graminoid species associated with the Vaal-Vet Sandy Grassland vegetation type such as *Aristida congesta, Cynodon dactylon, Eragrostis chloromelas, Pogonarthria squarrosa* and *Eragrostis curvula*. The invasive species *Seriphium plumosum* was however, proliferated throughout the majority of this habitat unit. Additionally, this habitat unit has been exposed to current and historical anthropogenic activities which has decreased the habitat integrity.

  The condition within this habitat depends on the extent of the disturbance in some areas being more severe, usually related to one being more overgrazed than the other. As a result of the ongoing and historic disturbances the plant community is no longer considered as being fully representative of the reference vegetation.

  The degraded grassland habitat is located adjacent to various seep, channelled valley bottom and floodplain wetlands, and as such still serves as a movement corridor as it creates a link between these systems and its surrounding terrestrial landscape for several faunal species, especially avifauna and mammals.

- **Wetlands**

  This habitat unit represents the wetland areas located across the project area. The wetland assessment where these areas are identified can be found in a separate Wetland Delineation and Impact Assessment Report. Even though somewhat disturbed, the ecological integrity, importance and functioning of these areas play a crucial role as a water resource system and an important habitat for various fauna and flora. The preservation of these systems is an important aspect to consider for the proposed development, even more so due to the high sensitivity of the area according to the various ecological datasets. This habitat needs to be protected and improved due to the role of this habitat as a water resource.

- **Transformed**

  This habitat unit has previously been impacted upon and shows a change from their natural state, with little to no remaining natural vegetation due to land transformation. The transformed habitat predominantly comprised of agricultural fields, roads and residential buildings.

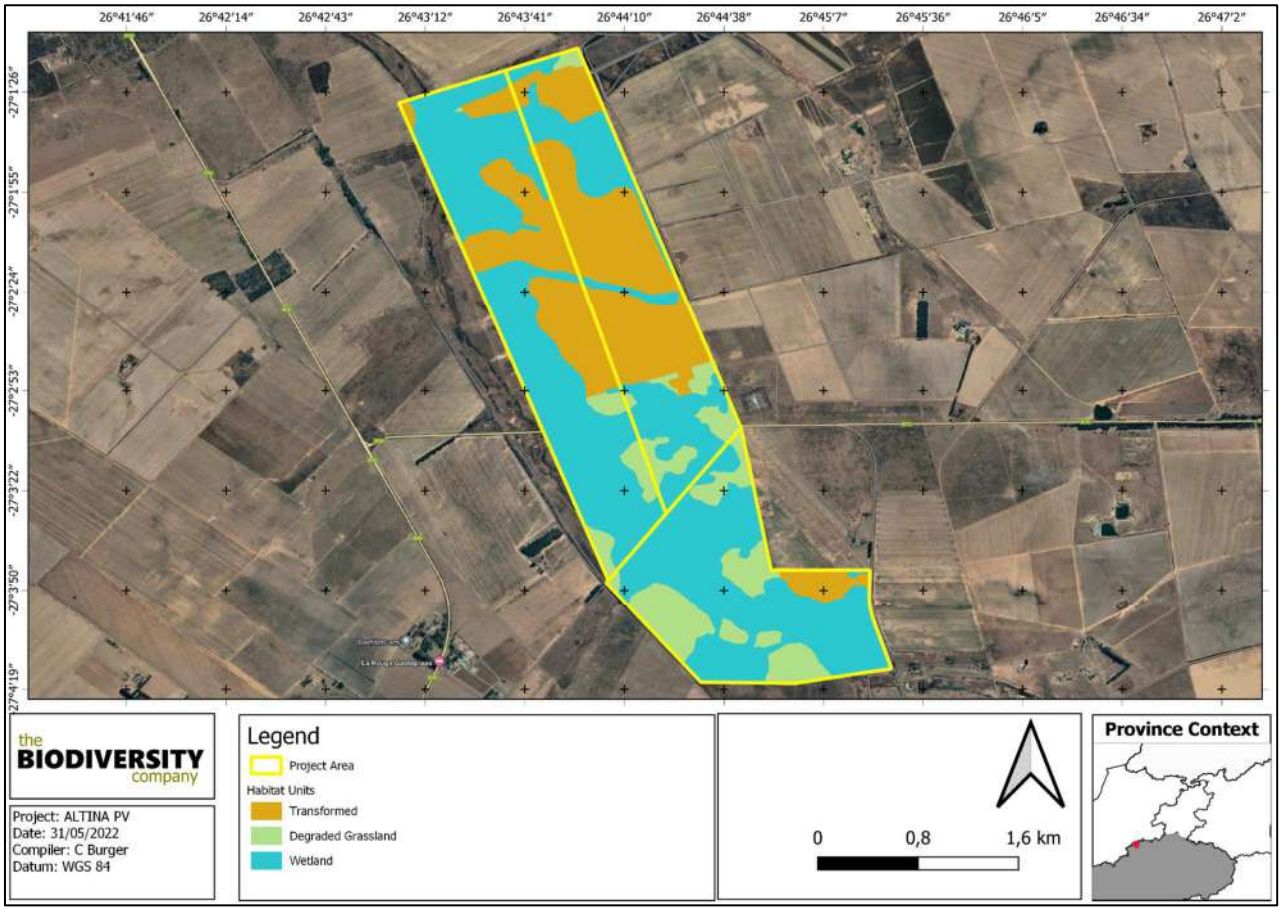


Figure 49: Habitats identified in the project area (Husted *et al.*, 2022)

13.5.4.4 Site Ecological Importance

The biodiversity theme sensitivity, as indicated in the screening report, was derived to be Very High, mainly due to scattered portions in the northern, southern and central portion of the project area being within a CBA 1, a northern portion of the broader property being an ESA 2 and within an EN ecosystem.

The completion of the terrestrial biodiversity assessment found that the Degraded Grassland which overlap with the screening report is of medium sensitivity and thus do not corroborate the screening report in that regard. It was also found that the areas classified as CBA1 has been degraded and the alien and invasive species *Seriphium plumosum* has proliferated in these areas.

As per the terms of reference for the project, GIS sensitivity maps are required in order to identify sensitive features in terms of the relevant specialist discipline/s within the project area. The sensitivity scores identified during the field survey for each terrestrial habitat are mapped.

Three (3) different terrestrial habitat types were delineated within the project area, and one set of wetland habitats as a whole. All habitats within the assessment area of the proposed project were allocated a sensitivity category (**Table 18**). The sensitivity of the wetland habitats ranged from high to medium with some of the wetland areas considered to have a high sensitivity predominantly due to the intact unique habitat provided for biodiversity,

while some wetland areas are considered to be of medium sensitivity due to the severe transformation that occurred across these areas. The sensitivities of the habitat types delineated are illustrated in **Figure 50**. The site sensitivity verification can be found under Section 7.2 of the Specialist Report.

Table 18: SEI Summary of habitat types delineated within field assessment area of project area (Husted *et al.*, 2022)

Habitat (Area)	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Wetlands	Medium > 50% of receptor contains natural habitat with potential to support SCC	High Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches	Medium	Low	High
Wetlands	Low < 50% of receptor contains natural habitat with limited potential to support SCC.	Low Several minor and major current negative ecological impacts.	Low	Low	Medium
Degraded Grassland	Medium > 50% of receptor contains natural habitat with potential to support SCC	Medium Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts, with some major impacts and a few signs of minor past disturbance.	Medium	Medium	Medium
Transformed	Low < 50% of receptor contains natural habitat with limited potential to support SCC.	Low Several minor and major current negative ecological impacts.	Low	Medium	Low

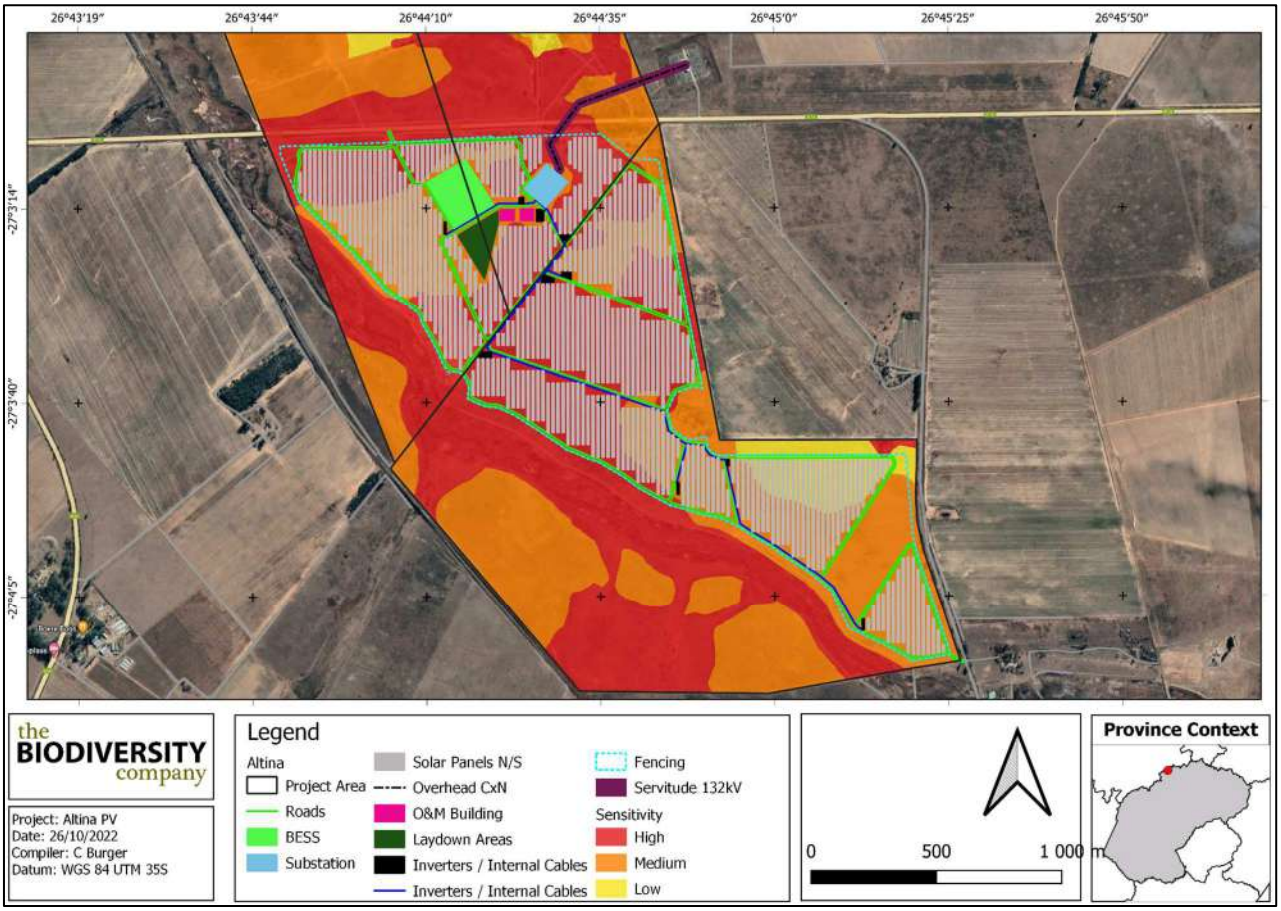


Figure 50: Sensitivity of the project area (Husted *et al.*, 2022)

13.5.5 Impact Assessment

Refer to **Section 14.13** below for the results from the impact assessment from this study.

13.5.6 Conclusions

The completion of a comprehensive desktop study, in conjunction with the results from the field survey, suggest there is a good confidence in the information provided. The survey ensured that there was an extensive ground truth coverage of the assessment area, and most habitats and ecosystems were assessed to obtain a general species (fauna and flora) overview and the major current impacts were observed.

Three habitat units were identified during the assessment and included Wetland, Degraded Grassland and Transformed areas. The sensitivity of the wetland habitats ranged from high to medium with some of the wetland areas considered to have a high sensitivity predominantly due to the intact unique habitat provided for biodiversity, while some wetland areas are considered to be of medium sensitivity due to the severe transformation that occurred across these areas. The degraded grassland habitat is considered to be of medium terrestrial sensitivity, as the area still provides habitat to various fauna and flora species, while the transformed habitat is considered to have a low sensitivity.

Two layout alternatives are considered for the proposed project, (Alternative 1 and Alternative 2). Both alternatives are considered to have a moderate to low negative impact on the terrestrial ecosystem associated with the project area after implementation of mitigation measures;

- The assessment area possesses a moderate diversity and density flora species, which is well represented in the general area. Moreover, fauna is ubiquitous within the assessment area and surrounding landscape.

Alternative 2 is, however, the preferred layout alternative due to the following:

- It excludes more high sensitivity areas than alternative 1; and
- More areas indicated by the database as CBA1 will be excluded from development.

Biodiversity maintenance is one key ecological service provided by the identified terrestrial biodiversity areas through their ecological integrity, importance and functioning. As such the preservation of these systems is an important aspect to consider for the proposed project.

Any development in high sensitivity areas must be avoided, which will occur with the selection of the project area. Development within the high sensitivity areas within the project area will lead the direct destruction and loss of functional habitats; and the faunal species that are expected to utilise this habitat. Thus, if these areas are not maintained in a natural or near natural state, destroyed or fragmented, then meeting targets for biodiversity features will not be achieved. The mitigation measures, management and associated monitoring regarding the expected impacts will be the most important factor of this project and must be considered by the issuing authority.

The main expected impacts of the proposed infrastructure will include the following:

- Habitat loss and fragmentation;
- Degradation of surrounding habitat;
- Disturbance and displacement caused during the construction and maintenance phases; and
- Direct mortality during the construction phase.

Mitigation measures as described in this report must be implemented to reduce the significance of the risk, but there is still a possibility of impacts occurring. Considering that the area that has been identified as being of significance for biodiversity maintenance and ecological processes (Moderate and High sensitivity), development may proceed but with caution and only with the implementation of mitigation measures.

Considering the above-mentioned information, no fatal flaws are evident for the proposed project. It is the opinion of the specialists that the project location, may be favourably considered on condition that all prescribed mitigation measures and supporting recommendations are implemented.

13.6 Avifaunal Assessment

A summary of the Avifaunal Assessment (Clark *et al.*, 2022) (contained in **Appendix E3**) follows.

13.6.1 Details of the Specialist

The details of the specialist that undertook the Avifaunal Assessment follow.

Organisation:	The Biodiversity Company	
Name:	T. Clark	A. Husted
Qualifications:	MSc Zoology	MSc Aquatic Health
Affiliation (if applicable):	SACNASP Pr Sci Nat (121338)	SACNASP Pr Sci Nat (400213/11)

13.6.2 Objectives of the Study

The Biodiversity Company was appointed to undertake an avifaunal baseline and impact assessment for the proposed Altina solar photovoltaic (PV) system. The proposed project area is located 3 km south-east of Orkney near Vierfontein in the Free State province. The project area is bisected by the R76 tar road which divides the project into northern and southern portions. The most significant habitat feature from an avifaunal perspective is the large floodplain which enters the project area in the south-west and again in the north.

The proposed solar panels will be bifacial and thus the complete clearing of vegetation beneath the PV panels is required. The project will tie into the existing substation bordering the project area (27.049034°; 26.746572°). Two infrastructure alternatives have been proposed namely Alternative 1 which represents the original layout and Alternative 2 which represents the preferred layout that takes into account potential sensitivities. This study was conducted in line with relevant national legislation and best practice standards:

- The National Web-Based Environmental Screening Tool DEA website (2022);
- South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna Protocols for environmental impact assessments in South Africa;
- South African National Biodiversity Institute, Pretoria. Version 1.2020;
- Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998; and
- BirdLife South Africa (BLSA). 2017.Best Practice Guidelines. Birds and Solar Energy. Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. A Regime 1 Level Assessment is warranted here based on the position of the PV footprint in an area of low overall avifaunal sensitivity both in terms of the National Environmental Screening Tool as well as the findings from the field verification.

The Terms of Reference (ToR) included the following:

- Description of the baseline avifaunal community;
- Identification of present or potentially occurring SCC;
- Sensitivity assessment and map to identify sensitive areas in the project area;
- Impact assessment, mitigation measures to prevent or reduce the possible impacts.

13.6.3 Methodology

The following resources were consulted during the desktop assessment and for the compilation of the expected species list:

- Hockey *et al*. (2005), Roberts Birds of Southern Africa (seventh end.). Primary source for species identification, geographic range and life history information.
- Sinclair and Ryan (2010), Birds of Africa. Secondary source for identification.
- South African Bird Atlas Project (SABAP 2). Full protocol atlassing data from relevant pentads used to construct expected species list. These included the two pentads covering the site (2700_2640 and 2700_2645) and one from the nearby town of Orkney (2655_2640).
- Taylor *et al*. (2015), Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Used for conservation status, nomenclature and taxonomical ordering.
- The National Web-Based Environmental Screening Tool DEA website (2022), specifically Animal, Avian and Terrestrial Biodiversity Themes.
- BirdLifeSa (2022) website for information on Important Bird and Biodiversity Areas.

Fieldwork was conducted on two occasions on 22 March 2022 and 25 April 2022 constituting late summer and early autumn surveys. Sampling consisted of standardized point counts as well as incidental observations. Standardized point counts were conducted to gather data on the species composition and relative abundance of species within the various habitats within the project area. To supplement the species inventory with cryptic and illusive species that may not have been detected within the rigid point count protocol, incidental observations were included. A search of for signs of African Grass Owl breeding or presence was conducted in the north of the project area.

Point count data was arranged into a matrix with point count samples in rows and species in columns. The table formed the basis of the various subsequent statistical analyses. To distinguish similarities / differences in the species composition between the four identified avifaunal habitats the matrix was converted into a Bray-Curtis dissimilarity matrix and used to generate a two-axis non-metric multidimensional scaling (NMDS) ordination. Thirdly raw count data converted to relative abundance values and used to establish dominant species and calculate the diversity of each habitat. Shannon's Diversity Index H was the metric used to estimate diversity. All statistical analyses were performed in the R statistical environment.

Habitat sensitivity classes and impact assessment methodology are presented under Section 5.4 and 5.5 of the methodology chapter in the specialist report (see **Appendix E3**).

13.6.4 Key Findings of the Study

13.6.4.1 Site Diversity

During the site visit, a total of 71 bird species were recorded within the project area. Of these, 44 were recorded during the standardised point counts (n=20) while the remaining species were detected incidentally (while moving between point counts).

A summary of the point count data for each of the main avifaunal habitats within each area is given together with their respective diversity rankings. The highest avian diversity was observed in the Wetland habitat followed by Grassland and lastly Croplands. The Wetland and Grassland habitats are the most diverse habitat types due to their higher microhabitat diversity, structural complexity, and resource diversity.

The non-metric multidimensional scaling (NMDS) ordination shown in **Figure 51** provides a visual representation of the difference / similarity in the species composition between the three habitat types. Most noticeable is that the Wetland and Grassland species assemblages differed the most from each other and support largely unique avifaunal assemblages with some minor overlap. The Croplands habitat supports a low diversity assemblage that is intermediary in species composition between Wetlands and Grasslands. In other words, the cropland habitat was characterised by habitat generalists.

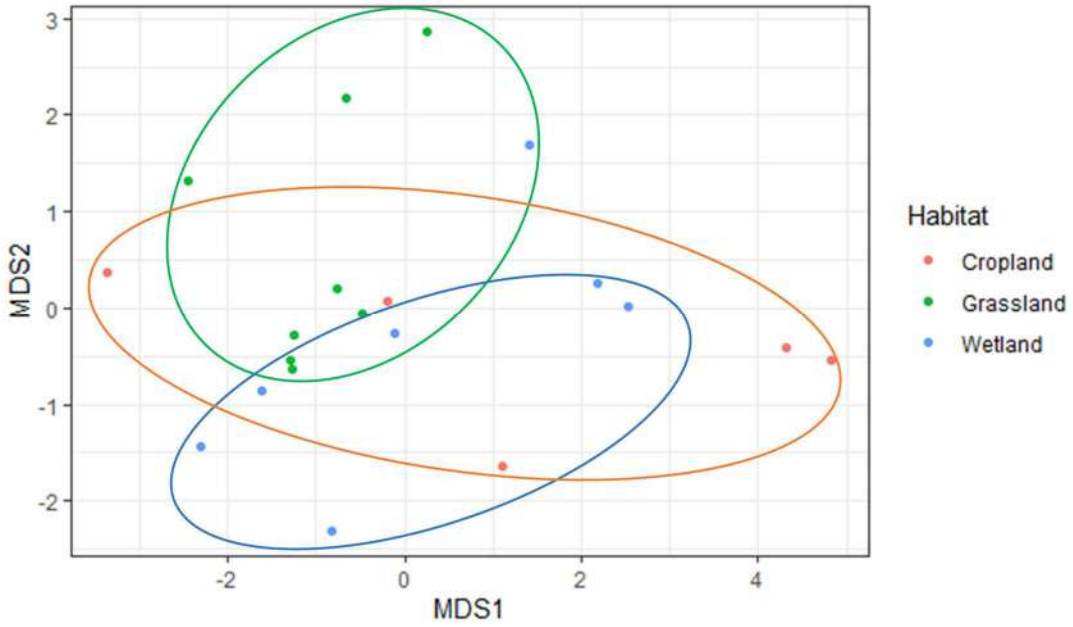


Figure 51: Non-metric multidimensional scaling ordination contrasting the avifaunal species assemblages within the project area (Clark & Husted, 2022)

13.6.4.2 Species of Conservation Concern (SCC)

No SCC were detected within the project area during the site visit. A total of 24 SCC (**Table 19**) are, however, known to occur in the region. Of these, only four have been recorded during SABAP2 surveys within the three pentads relevant to the project area namely

Caspian Tern (*Sterna caspia*), Lanner Falcon (*Falco biarmicus*), Melodious Lark (*Mirafra cheniana*) and Maccoa Duck (*Oxyura maccoa*) (SABAP2, 2022). In the Free State all birds are protected except for generalist species; Mousebirds, Bulbuls, Red-winged Starling, Pied Starling, Common Myna, Cape and House Sparrow, Crows, weavers, Queleas, Widowbirds, Bishops, Rock Pigeon, Cape Turtle Dove, Ostrich, Laughing Dove, Reed Cormorant, and White-breasted Cormorant (Nature Conservation Ordinance 8 of 1969). The provincially protected species are listed in the full list provided in Appendix A of the Specialist's report.

Table 19: Summary of the scores for the wetland PES (Clark & Husted, 2022)

Common Name	Scientific Name	Status				LO	Atlas
		Global	Regional	NEMBA	FS		
White-backed Vulture	*Gyps africanus*	CR	CR	EN	PG	4	
Cape Vulture	*Gyps coprotheres*	EN	EN	EN	PG	4	
African Marsh Harrier	*Circus ranivorus*	LC	EN		PG	2	
Yellow-billed Stork	*Mycteria ibis*	LC	EN		PG	3	
Black Harrier	*Circus maurus*	VU	EN		PG	3	
Martial Eagle	*Polemaetus bellicosus*	VU	EN	EN	PG	3	
African Grass Owl	*Tyto capensis*	LC	VU		PG	2	
Caspian Tern	*Sterna caspia*	LC	VU		PG	3	x
Lanner Falcon	*Falco biarmicus*	LC	VU		PG	3	x
Great White Pelican	*Pelecanus onocrotalus*	LC	VU		PG	3	
Pink-backed Pelican	*Pelecanus rufescens*	LC	VU		PG	3	
Black Stork	*Ciconia nigra*	LC	VU		PG	4	
Secretarybird	*Sagittarius serpentarius*	VU	VU		PG	3	
Blue Crane	*Anthropoides paradiseus*	VU	NT	PS	OG	2	
Melodious Lark	*Mirafra cheniana*	NT	LC		PG	3	x
Greater Flamingo	*Phoenicopterus roseus*	LC	NT		PG	2	
Abdim's Stork	*Ciconia abdimii*	LC	NT		PG	2	
Marabou Stork	*Leptoptilos crumeniferus*	LC	NT		PG	4	
Maccoa Duck	*Oxyura maccoa*	NT	NT		PG	3	x
Chestnut-banded Plover	*Charadrius pallidus*	NT	NT		PG	3	
Black-winged Pratincole	*Glareola nordmanni*	NT	NT		PG	2	
Pallid Harrier	*Circus macrourus*	NT	NT		PG	3	
Red-footed Falcon	*Falco vespertinus*	NT	NT		PG	3	
Lesser Flamingo	*Phoeniconaias minor*	NT	NT		PG	2	

Key: Status: CR = Critically Endangered; DD = Data Deficient; EN = Endangered; LC = Least Concern; NA = Not Assessed; NT = Near Threatened; OG = Ordinary Game; PG = Protected Game; PS = Protected Species; VU = Vulnerable. Likelihood of Occurrence (LO): 1 = Present; 2 = High; 3 = Moderate. Sources: Taylor et al. (2015); BirdLife South Africa (2016); SABAP 2 (2022).

Seven SCC are considered highly likely to occur within the project area based on habitat availability and suitability. These include African Marsh Harrier (*Circus ranivorus*), African Grass Owl (*Tyto capensis*), Blue Crane (*Anthropoides paradiseus*), Greater Flamingo (*Phoenicopterus roseus*), Lesser Flamingo (*Phoeniconaias minor*), Abdim's Stork (*Ciconia abdimii*) and Black-winged Pratincole (*Glareola nordmanni*). Of these, suitable breeding habitat exists only for African Marsh Harrier (*Circus ranivorus*), African Grass Owl (*Tyto capensis*) and Melodious Lark (*Mirafra cheniana*).

African Marsh Harrier (*Circus ranivorus*) – Endangered

This species is considered highly likely to occur along the floodplain wetland. This wetland provides ideal breeding habitat for the species in the form tall reedbeds. Although not observed on site, an area of High sensitivity is identified for this species along the Vaal River (2.5 km north of the project area) and may have easily been overlooked. This species forages primarily over wetlands. Although the species has an extremely large distributional range in sub-equatorial Africa, South African populations are declining due to the degradation of wetland habitats, loss of habitat through over-grazing and human disturbance and possibly, poisoning owing to over-use of pesticides (IUCN, 2017). The floodplain system is considered important for this species.

African Grass Owl (*Tyto capensis*) – Vulnerable

An uncommon and illusive resident. In these areas, nests and re sites is most frequently associated with large, dense stands of *Imperata cylindrica*. Constructs a network of tunnels in this grass referred to as runs. The species is a habitat specialist and wetlands appear to be important for hunting and breeding. African Grass Owl is primarily threatened by widespread loss of grassland and wetland habitat. Additional threats include anthropogenically altered burn regimes, livestock (trampling of runs and nest) as well as roadkill's. Ideal breeding and foraging habitat occur in the wetland complex associated with the floodplain in the far north of the project area. Although no signs of the species were detected during the survey it is possible that this cryptic and illusive species was overlooked or may be temporarily absent as nesting suitability and prey availability (considerable amount of *Otomys* spp. droppings) is high. The species has not been recorded in the pentad during SABAP2 surveys. Together this suggests a low prevalence in the area or perhaps even localised extirpation. However, species presence cannot be conclusively ruled out and this area should be avoided in terms of solar PV and farming activities (remain uncultivated and fenced off from livestock).

13.6.4.3 Species Congregations and Flyways

The project area was not found to support any globally significant congregations of water birds or other birdlife. The floodplain wetland was, however, found to support significant flocks of Red-billed Quelea (*Quelea quelea*), Yellow-crowned Bishop (*Euplectes afer*) and Southern Red Bishop (*Euplectes orix*) as well as numerous waterbirds. These breeding

congregations should be considered important on a regional scale. The project area is not situated in any globally recognised avifaunal flyway

13.6.4.4 Collision Prone Species

Mixed views have been presented on the significance of collisions as an impact, with a definitive answer precluded by a lack of long-term data. Currently the consensus is that collisions due to the lake effect is unlikely and that other impacts associated with the construction and operation of solar facilities (e.g., habitat loss, collision with fences, electrocution on transmission lines, increased predation pressure as birds attempt to forage beneath solar panels and struggle to escape) may be of greater overall consequence to avifauna (Birdlife, 2012). Nevertheless, given the paucity of empirical research on this topic, the precautionary principle is adopted here, and the potential for collision and (to a lesser intensity electrocution) considered possible.

For the purposes of this project a subset of collision prone species has been identified. Based on these data six species emerge with a high probability of collision having been seen on more 50% of the time during SABAP surveys. These include Hadeda Ibis (*Bostrychia hagedash*), Egyptian Goose (*Alopochen aegyptiaca*), Helmeted Guineafowl (*Numida meleagris*), Yellow-billed Duck (*Anas undulata*), Reed Cormorant (*Phalacrocorax africanus*) and Western Cattle Egret (*Bubulcus ibis*).Species considered particularly prone and likely to collision based on in-field count data, and flight patterns include Red-billed Quelea (*Quelea quelea*), Hadeda Ibis (*Bostrychia hagedash*), Blacksmith Lapwing (*Vanellus armatus*), Black-headed Heron (*Ardea melanocephala*), Western Cattle Egret (*Bubulcus ibis*) and Spur-winged Goose (*Plectropterus gambensis*).

13.6.4.5 Sensitivity Assessment

Areas of avifaunal sensitivity within the project area is presented in **Figure 52**. Overall, floodplains and valley-bottom wetlands were designated High sensitivity, remaining less disturbed moist grassland as Medium and active croplands as Low sensitivity. These areas were based on a combination of selected wetland delineation data as deemed important for avifauna and count data gathered in-field. The floodplain and valley-bottom areas are assigned a High importance and sensitivity. This was based primarily on account of their capacity to support SCC. These wetlands, particularly the floodplain supports ideal breeding habitat for two Threatened species namely African Marsh Harrier (*Circus ranivorus*) and African Grass Owl (*Tyto capensis*). Similar habitat along the Vaal River 2.5 km north of the project area has been highlighted as an important area for African Marsh Harrier and is afforded a High Avifaunal sensitivity rating in the Environmental Screening Tool. This habitat also provides suitable foraging habitat for additional five potentially occurring SCC. Furthermore, these wetlands support exceptionally large flocks of roosting seed-eaters and waterbirds which are widely accepted in the literature as being most susceptible to collision with solar panels. These wetlands also supported by far the highest species richness and abundance of avifauna within the entire project area as well as the

highest abundances of collision prone species. This habitat has been excluded from the development footprint and adherence to the prescribed wetland buffers on floodplains and valley-bottom wetlands important for roosting seed-eaters is assumed based on infrastructure Alternative 2 (preferred). Based on this layout the proposed infrastructure does not overlap any areas of High avifaunal sensitivity but instead only roughly equal amounts of Moderate and Low sensitivity areas

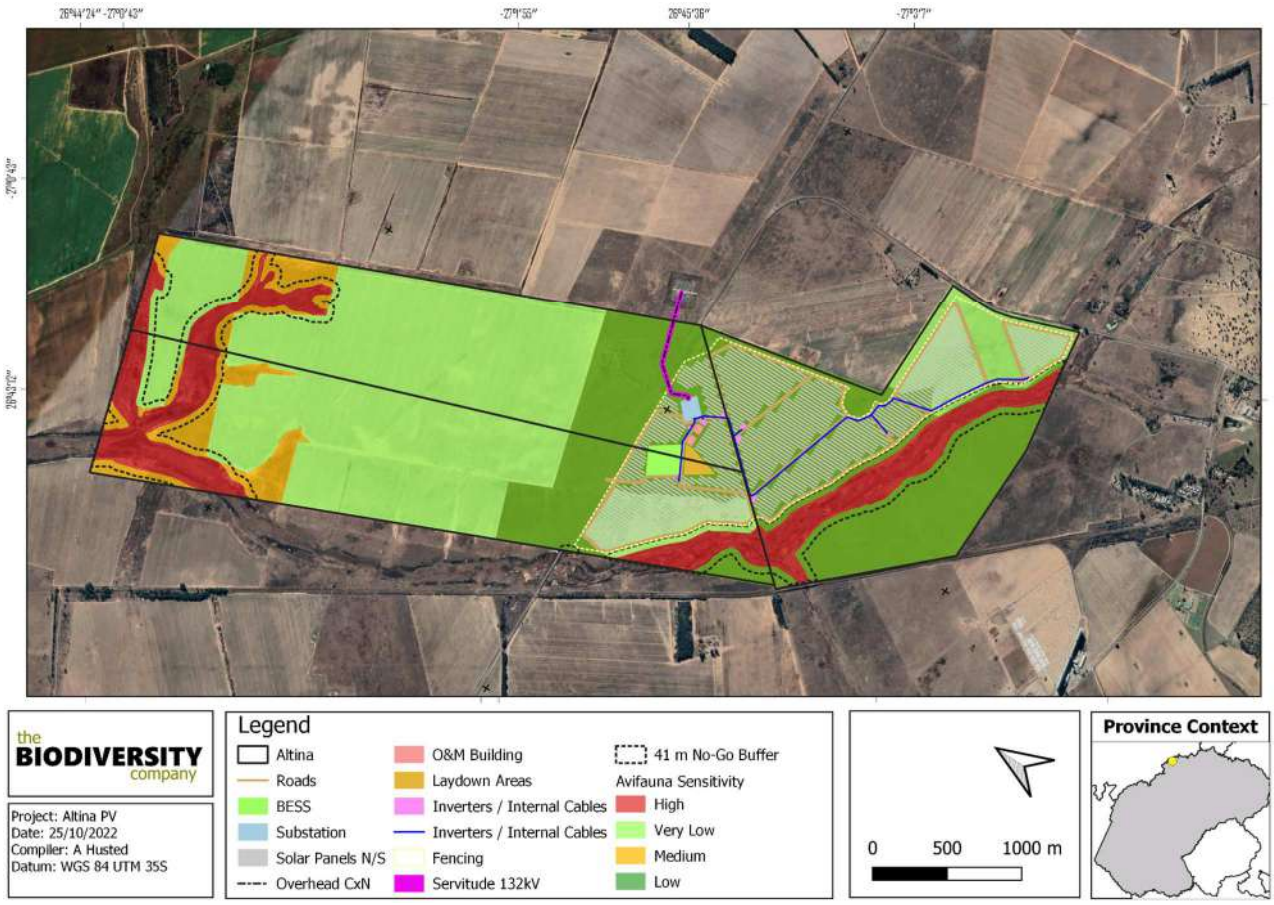


Figure 52: Site-based avifaunal sensitivity map showing overlaid preferred infrastructure layout Alternative 2 (Clark & Husted, 2022)

The zones designated as 'very high' and 'high' will require mitigation measures to increase the visibility of the earth wire in these areas. It was noted during the field survey that the existing power lines were also provided with visibility devices within these zones, reiterating the need for this strategy for a new line development. It should be noted that the tie-in line associated with the Droërivier Substation crosses a watercourse. Although this area is designated as a medium risk zone, it is recommended that visibility devices be fitted within this section as well.

Refer to Section 6 of the Specialist Report for the site sensitivity verification.

13.6.5 Impact Assessment

Refer to **Section 14.14** below for the results from the impact assessment from this study.

13.6.6 Conclusions

Two infrastructure alternatives have been proposed namely Alternative 1 which represents the original layout and Alternative 2 which represents the preferred layout that takes into account potential sensitivities. Both infrastructure Alternatives 1 and 2 were rated in terms of their respective impact significance.

During the site visits a total of 71 species were observed within the project area through a combination of point counts and incidental observations. Of the three habitats the highest avian diversity was observed in the Wetland habitat followed by the Grassland and lastly Croplands Habitat. The Wetland habitat also supports the most diverse and unique avifaunal assemblage due to the presence of waterfowl and its overall higher microhabitat diversity, structural complexity and resource availability.

Although no SCC were observed during the site visit, ideal breeding habitat was identified along the floodplain wetland particularly in the far north of the project area for two threatened species namely the Endangered African Marsh Harrier (*Circus ranivorus*) and African Grass Owl (*Tyto capensis*).

In terms of avifaunal sensitivity, the floodplains and valley-bottom wetlands were designated High sensitivity. The Grasslands surrounding the northern floodplain and valley-bottom wetlands are assigned a Medium sensitivity. All remaining less disturbed moist grassland is rated as Low sensitivity while active croplands were afforded a Very Low sensitivity.

Five impacts to avifauna are anticipated as a result of the establishment PV plant. These included (1) Habitat loss, degradation and fragmentation including loss of important bird congregations (2) Collision, electrocution and entrapment with PV infrastructure, (3) Direct loss of SCC nests or suitable nesting habitat, (4) Sensory disturbance and extirpation of SCC or large roosting flocks and (5) Cumulative effect on regional birdlife. Habitat loss was assigned a residual risk of Medium (under infrastructure Alternative 1) on account of the high likelihood of the development and long-term nature of the project which will lead to the probable encroachment on the High sensitivity wetland habitat. It is, however, assumed that the High sensitivity floodplains and valley-bottoms will be excluded from the PV footprint under the preferred infrastructure Alternative 2 which will reduce the residual impact to Low. Collision and electrocution were assigned a Medium significance under Alternative 1. However, this impact can be reduced to a Low significance under Alternative 2 by avoiding the floodplain habitat and its associated buffers both in terms of PV placement as well as associated above-ground electrical transmission lines. In this respect, avoid spanning fences and above-ground powerlines in the northern quarter of the project area and within the buffer of the floodplain wetland or across the small dam (-27.057851°; 26.746390°). Additionally, all power cables within the PV area should be thoroughly insulated and buried wherever practically feasible. Flappers and coils can help to increase the visibility of transmission lines especially the thinner earth line with which most collisions tend to be associated. Install Eskom-approved flappers or coils

on new transmission lines (particularly the earth wire). Although not planned, it must be kept in mind for future activities that crossing the floodplain wetland with overhead electrical transmission lines, is considered undesirable from an avifaunal perspective. If there remains budget and scope for flappers or coils then they would be best placed on the portion of the line that crosses the road. Otherwise the existing lines which cross the wetland near the north-eastern corner of the project area would benefit greatly from the use of bird diverters such as these. White strips placed along the edges of the panels appear to help to increase visibility and deter birds and are recommended as far as practically feasible.

The remaining impacts are deemed to have a Low residual risk under infrastructure Alternative 2, on account of the general lack of SCC nests and individuals on site and the effective actions which are planned to be implemented to reduce disturbances to any potentially occurring SCC (avoiding the placement of PV infrastructure in High and Medium sensitivity habitat).

It is recommended that the floodplain wetland habitat and surrounding grassland particularly in the north continues to be excluded from all future PV and agricultural activities beyond this application. The northern wetland and surrounding grassland should remain fenced off to protect this ideal breeding habitat for harriers, grass owls and waterbirds. Overall, it is the opinion of the specialist that the project should be considered favourably from an avifaunal perspective, provided infrastructure Alternative 2 is taken and the suggested mitigation effectively applied.

13.7 Agricultural Potential Impact Assessment

A summary of the Agricultural Potential Impact Assessment (Gouws, 2022) (contained in **Appendix E4**) follows.

13.7.1 Details of the Specialist

The details of the specialist that undertook the Agricultural Impact Assessment follow.

Organisation:	Index
Name:	Dr A. Gouws
Qualifications:	PhD Integrated Land Use Modelling
Affiliation (if applicable):	▪ SACNASP (No:400140/06). ▪ Member of the Soil Science Society of South Africa

13.7.2 Objectives of the Study

The key issues that were considered in the agricultural assessment include the following:

- ❑ Map the present land uses and farming infrastructure;
- ❑ Indicate land capability (potential);
- ❑ Determine the farming patterns of farmers in the region;

- Indicate the impact of the Project on the agricultural potential of the land where it will be constructed; and
- Indicate the impact of the Project on agriculture.

13.7.3 Methodology

The approach to the assessment included the following (amongst others):

- The present land uses of the Project area were identified from various satellite images;
- The soils were classified according to the binomial soil classification system for Southern Africa;
- Soil capability is described according to the system used by the DALRRD; and
- The agricultural sensitivity description is according to the screening tool, published by the DFFE in GN 320 of Government Notice 43310 on 20 March 2020 (Screening Tool).

Please refer to Section 2 of the Specialist's report (**Appendix E4**) for further details on the methods and procedures followed.

The results of this study followed a site visit on 19 April 2022.

13.7.4 Key Findings of the Study

13.7.4.1 Present Land Use

Altina is a mixed enterprise farm with both cultivated and grazing land. The lands are rented out. Soya and maize were planted in the 2021/2 season. The maize yield was estimated at 5,0 t/ha, and that of the soya, at 2,4 t/ha. Sand is being mined on a portion of the farm, but according to the farm owner, the licence will expire by end 2022/3.

The total area assessed was 850,4 ha. Of this 179 ha comprise the land where the infrastructure will be placed. Present land uses are mapped in **Figure 53** below.

In terms of regional land uses, most of the arable land is annually planted to summer crops like maize, sunflower, sorghum, or beans. Five centre pivot irrigation machines were found within 10 km of the farm's centroid.

Most of the deeper soils are cultivated. Soils that are shallow or waterlogged are the only land that is used as grazing. Most of the farmers have mixed farms where livestock is reared in conjunction with cropping. Stover is used for fodder in the late winter.

The town of Orkney and some mines are also located in the region.

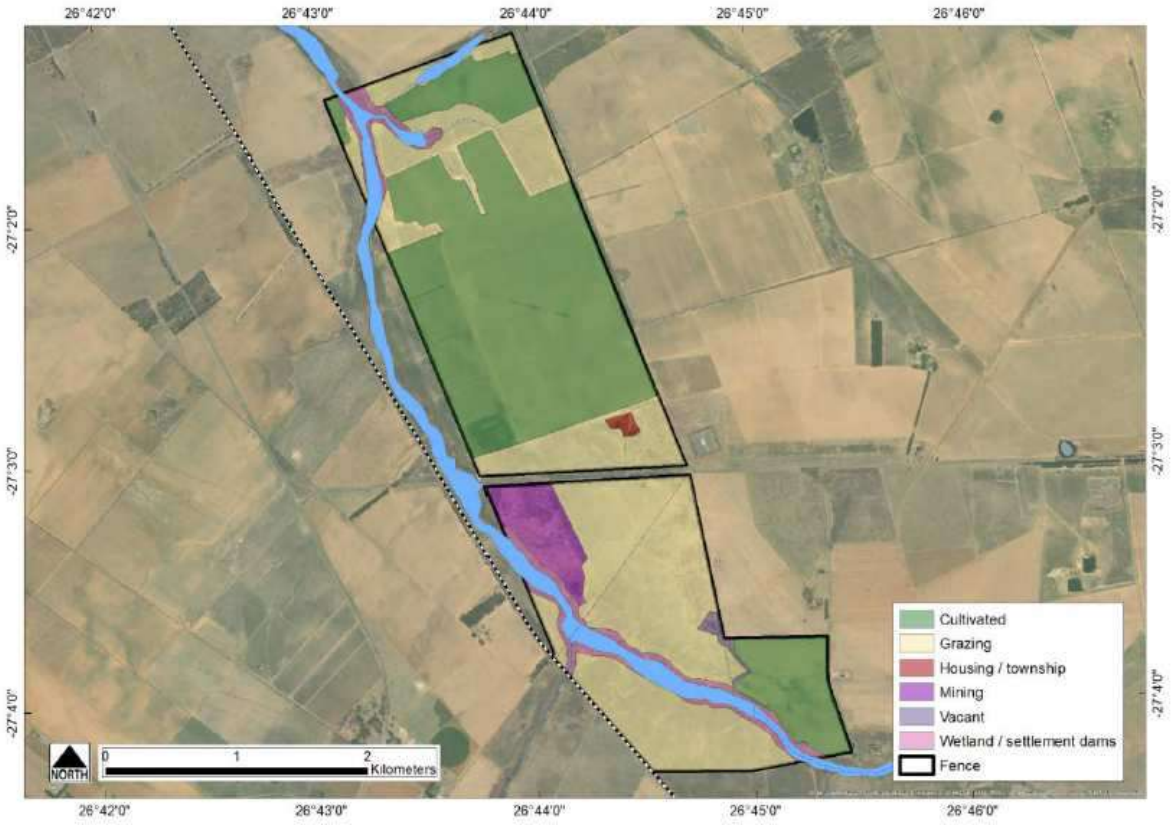


Figure 53: Present land uses (Gouws, 2022)

13.7.4.2 Climate

The long term average rainfall is 618 mm per year that falls mainly in the summer months. The summers are long, warm and mostly clear and the winters are short, cold, dry, and clear. Over the course of the year, the temperature typically varies from 2°C to 30°C and is rarely below -2°C or above 34°C. The hot season lasts for 4.4 months, from October 22 to March 4, with an average daily high temperature above 28°C. The hottest month of the year in Orkney is January, with an average high of 30°C and low of 17°C. The cool season lasts for 2.3 months, from May 27 to August 5, with an average daily high temperature below 22°C. The coldest month of the year in Orkney is June, with an average low of 3°C and high of 20°C.

The climate is suitable for rainfed crop production.

13.7.4.3 Grazing Capacity

Veld condition is poor. The presence of *Seriphium plumosum* (bankrotbos) is common on most of the rangeland and is indicative of overgrazing or in the case of this site, the presence of an e-horizon.

The veld's grazing capacity is estimated by the Department of Agriculture as 7ha per LSU. It is our opinion that due to the encroachment; the capacity should be downgraded to around 10 ha/LSU.

The footprint is 179 ha, which can accommodate approximately 17 LSU.

13.7.4.4 Soil

The soil derived from the weathering of Vryheid lithology of the Ecca formation. The rock formations are layered arenite and shale. These rocks usually produce sandy loam ferralitic soils of medium depth. Iron and manganese concretions and soft plintite are common. Clay may accumulate in the subsoil to form cutanic blocky or peds. These restrict infiltration. Rainwater then drains laterally and deplete of iron to form a so-called e-horizon. Watercourses are often wide and saturated with water for prolonged periods of the year. Soils with an e-horizon are important reservoirs for groundwater and contribute to the maintenance of wetlands downslope. In the case of Altina, the concave slopes are normally where these soils occur.

The soil in general has a sandy texture with a clay content of below 18%, and in some places below 10%. This is the reason for the mine in the central western part of the site. The soil map and description of the dominant soils are provided below.

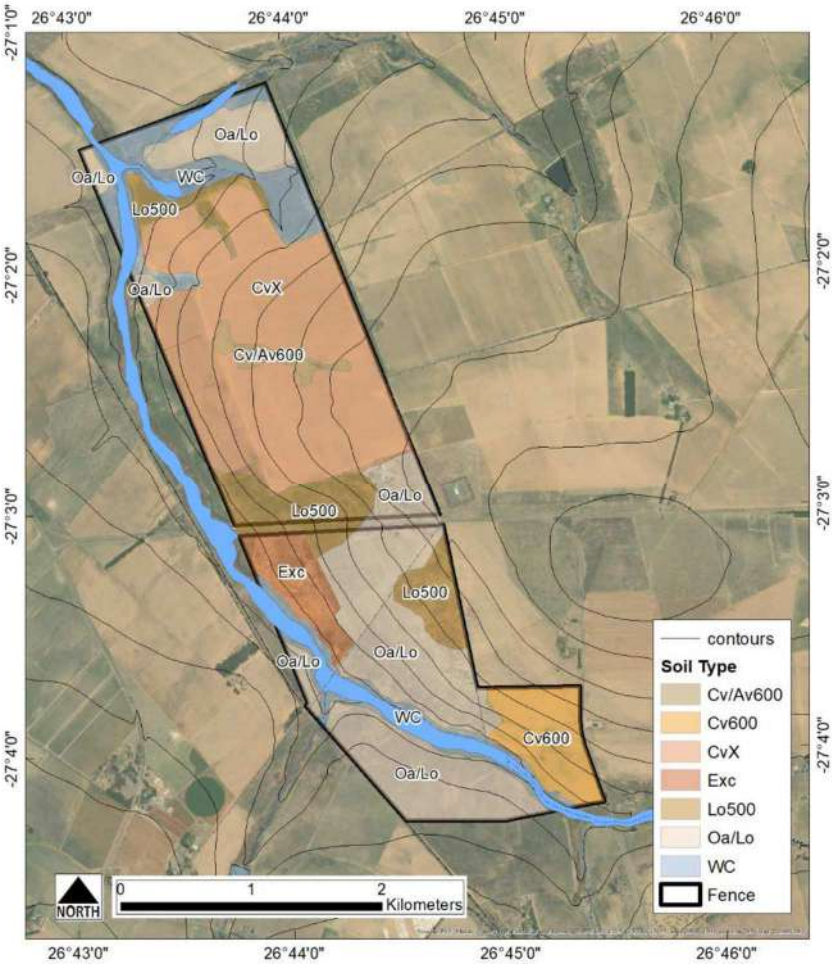


Figure 54: Soil types on the development areas (Gouws, 2022)

The soil types associated with the Project footprint are as follows:

- Exc - This unit is the mine on the western portion of the land, which is adjacent to the river.
- Oa/Lo - Moderately deep yellowish brown soil with a depth that varies over short distances. The subsoil consists of soft ferricrete or cutanic structured deeper subsoil. A bleached e-horizon may occur above the deeper subsoil. This cause lateral water movement in the subsoil, and is often the source of water that feeds the wetlands further downslope.
  The dominant soil forms identified are Oakleaf, Avalon and Longlands.
  These soils may be arable if deep enough. They are, however, not normally cultivated because they can become waterlogged and impassable for farm vehicles during high and prolonged rainfall events.
- Cv600 - Sandy soil with a clay content of 8 - 18% with a total rooting depth of more than 600 mm. The topsoil is light brown with a grain structure. The subsoil is yellowish brown sandy loam with poorly developed blocky or grain structure.
  The dominant soil forms identified are Clovelly, Avalon and Glencoe.
- Lo500 - Moderately deep and shallow greyish brown topsoil on soft plintite or gleyed subsoil. These soils are very erodible and as in the case of Oa/Lo, a store of groundwater to recharge wetlands downslope.
  The dominant soil form found is Longlands. Escort and Kroonstad may also occur. They should not be cultivated but left as natural grazing.

13.7.4.5 Sensitivity Analysis

Refer to section 5 of the Specialist Report for the site sensitivity verification. Soil capability is a factor of soil properties like depth to restrictive layers, texture, presence of stones and rocks, etc.

The cultivated portion north of the tarred road that was under soya beans in 2021/2 has a depth of around 500 – 800 mm and has few rocks and stones. These soils have high to moderate arable potential.

The cultivated land in the south eastern part of the site that was planted with maize. Because the cultivated land has portions that are waterlogged or underlain by hard plinthite, the soil is only moderately sensitive. It consists of Clovelly, Avalon, Longlands or Dresden soils. This portion is shallow and moderately deep soils and are moderately sensitive and is contrary to that which was indicated by the screening tool.

Placement of the panels and other infrastructure for Alternative 2 is in indicated in **Figure 55**. The yellow shaded area is medium sensitive land while the hatched portion indicates where the panels will be placed.

According to the guidelines of the protocol, for the assessment and minimum report content for EIA impacts on agricultural resources, the following applies:

- The development is on medium sensitive land, which status was also indicated in the screening tool, and also confirmed by the site visit. Provision 1.1.3 in the Protocol applies, which requires the specialist to submit an Agricultural Compliance Statement. This statement is provided in Section 5.3 of the Specialist's report.

Grazing land, although important, is not a criterion in determining if land is high potential. Potential of land in the guidelines used in the Screening Tool is based on rainfed crop production. This is also the criteria in other legislation. Wetlands in the Wetland Report include deep sand that contributes to the river through lateral flow deep in the profile. These upland soils are hydropedologically important because they maintain the streamflow of the river. The soils, however, have a clay content usually below 12% with a low water holding capacity. This makes the land medium to low potential for both cropping and animal grazing. The presence of Seriphium plumosum (bankrotbos) on these soils, and in most of the footprint is common and is indicative of overgrazing and/or, the presence of an e-horizon just above the clayey subsoil.

The grazing density of the veld is 7 ha /LSE for the region, but was estimated at more than 10 ha/LSU because of the poor state of the veld.

Vleis provide valuable grazing in the late winter and early autumn, especially when the livestock numbers are close to the grazing capacity. Most mixed enterprise farmers utilise stover from crops like maize as supplementary fodder. The vleis along the river were delineated and assigned Class vii and is low sensitivity land.
These are all outside the footprint of the development.

The following will evaluate the land of the footprint for the development. As indicated earlier in the report, all *highly sensitive* land is excluded from the development through micro placement of infrastructure.

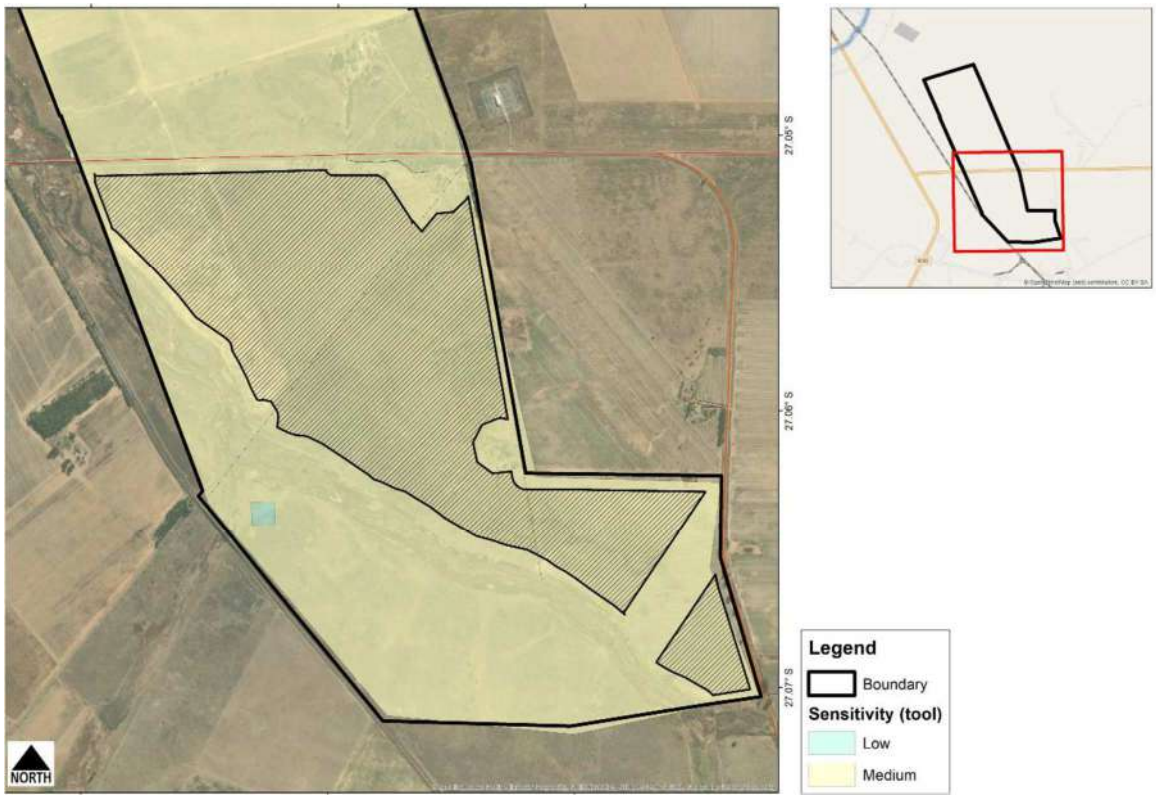


Figure 55: Micro placement of infrastructure (Gouws, 2022)

The soil on the property is arable but no water is available for irrigation. According to the agricultural potential map of NDA, the land is arable (Department of Agriculture, 2019).
Land capability classes are interpretive groupings of land with similar potential and limitations or similar hazards. Land capability involves consideration of difficulties in land use owing to physical land characteristics, climate and the risks of land damage from erosion and other causes.

The classic eight-class land capability system (Klingebiel & Montgomery, 1961) was adapted for use by the South African Department of Agriculture in their Agriculture Geographic Information System (AGIS).

Land capability is classified according to guidelines published by the National Department of Agriculture in AGIS.

Land Capability is determined by the collective effects of soil, terrain and climate features and shows the most intensive long-term use of land. At the same time, it indicates the permanent limitations associated with the different land-use classes.

Figure 56 and **Figure 57** indicate the Land use capability as per the criteria in AGIS of DALRRD.

DALRRD (2016)	Klingebiel	Capability	Arability
1-2	viii	Very low	Not arable
3-4	vii	Very low to low	
5-6	vi	Low	
7	v	Low to moderate	
8	iv	Moderate	Arable
9-10	iii	Moderate to high	
11-12	ii	High	
13-14	i	High to very high	
15	i	very high	

Figure 56: Relationship between grading of the Screening tool and that of Klingebiel et al. (Gouws, 2022)

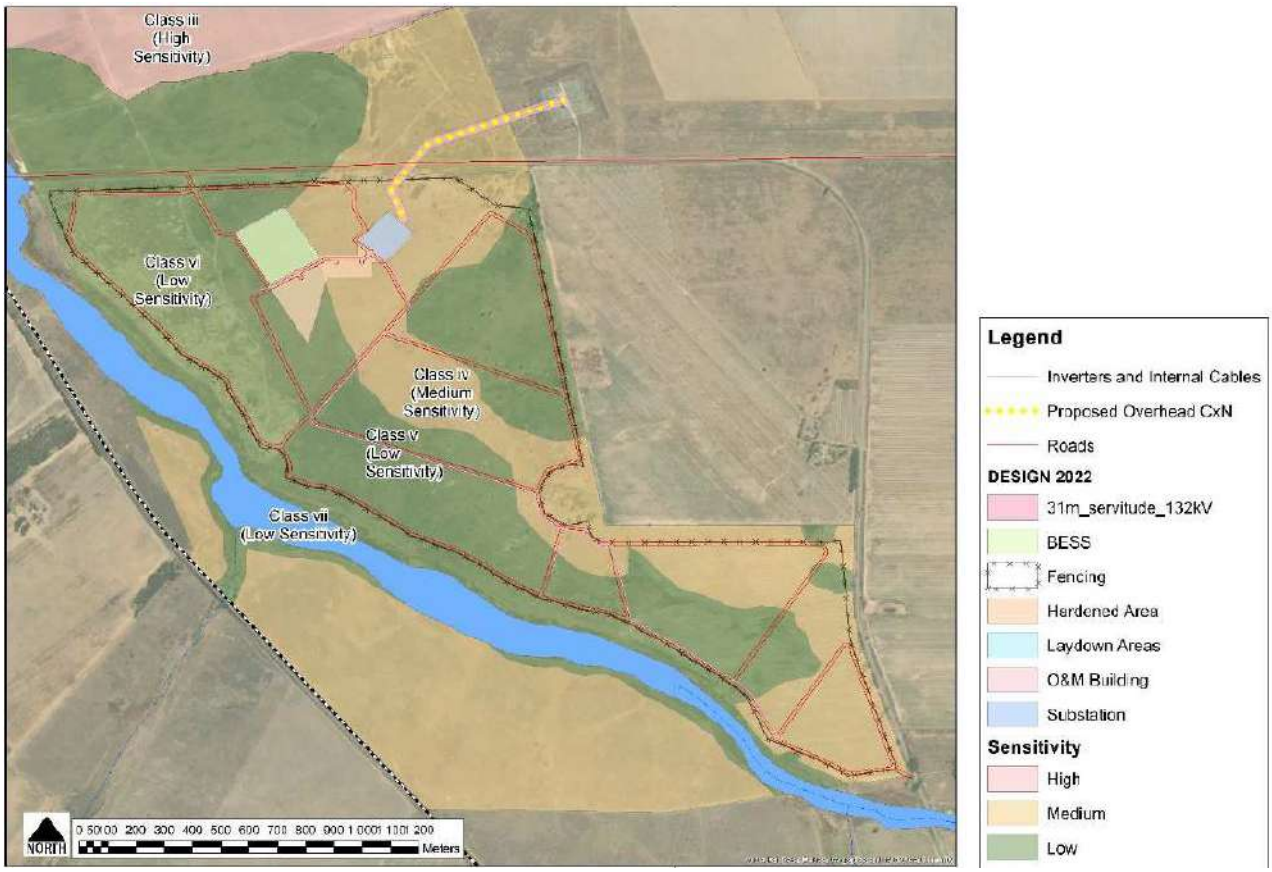


Figure 57: Land sensitivity description (Gouws, 2022)

The following was found:

- High capability land for crop production (Class ii and iii) occurs in the central portion of the land, north of the tarred road. The far eastern portion of the property is also high capability land. The balance is medium to low capability (Classes iv and lower).
- The land capability was then used as input to determine agricultural sensitivity (refer to the previous section where the two classification systems are compared).

There are portions of land that has developed shallow ferricrete which have medium sensitivity for agriculture, and which was included as highly sensitive in the screening tool. These have, however, low or medium sensitivity.

- All highly sensitive land was retained for cropping and will not be impacted on by the development.

13.7.5 Impact Assessment

Refer to **Section 14.15** below for the results from the impact assessment from this study.

13.7.6 Conclusions

The buildable area was confined to the low and medium sensitive portion of the farm. It consists mainly of shallower uneven and mined land that has medium sensitivity according to the screening tool. It further excludes watercourses and riparian vegetation.

All highly sensitive land was retained for cropping and will not be impacted on by the development. The placement of the development will avoided any high potential and cultivated land. The site survey also found that the grazing land is severely encroached that has degraded the livestock carrying capacity, in our view, to unsustainable levels.

There will be no loss of high potential land. No impact and no mitigation required.

121 ha of poor-quality grazing will be lost for the duration of the project. The impact is low. The present poor state of the veld can be rectified at the end of the project life.

No farming infrastructure will be lost.

It is estimated that less than one labourer is required to tend the livestock. If implemented he can easily be absorbed in the present farming activities or at the PV Site.

No reason can be found not to allow the development. It is our recommendation that the project be implemented.

13.8 Heritage Impact Assessment

A summary of the Heritage Impact Assessment (van Schalkwyk, 2022) (contained in **Appendix E5**) follows.

13.8.1 Details of the Specialist

The details of the specialist that undertook the Heritage Impact Assessment follow.

Organisation:	J. A. van Schalkwyk
Name:	J. A. van Schalkwyk
Qualifications:	D Litt et Phil
Affiliation (if applicable):	▪ Association of Southern African Professional Archaeologists (ASAPA) (No. 164) ▪ Principal Investigator: Iron Age, Colonial Period, Industrial Heritage.

13.8.2 Objectives of the Study

The aim of this study is to determine the cultural heritage significance of the area where the solar power plant, associated infrastructure will be located, is to take place. This included:

- Conducting a desk-top investigation of the total project area; and
- A visit to the proposed project area.
- The project area includes the following properties:
- Portions of the farms Batsfontein 290, Altona 50 and Rietvlei 539

The objectives were to:

- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance; and
- Provide guideline measures to manage any impacts that might occur during the proposed project's construction and implementation phases.

13.8.3 Methodology

The methodology employed for this study consisted of the following:

- A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. In this regard, various anthropological, archaeological and historical sources were consulted.
- A survey of HIAs done for projects in the region by various heritage consultants was conducted with the aim of determining the heritage potential of the area.
- The Heritage Atlas Database, various SAHRA databases, the Environmental Potential Atlas, the Chief Surveyor General and the National Archives of South Africa were consulted.
- Aerial photographs and topocadastral and other maps were also studied.
- The field survey was done according to generally accepted archaeological practices, and was aimed at locating all possible heritage sites, objects and structures.

Please refer to Section 5 of the Specialist's report for further detail on the approach and methodology followed (**Appendix E5**).

The project area was visited on 25 May 2022 and was investigated by accessing it by means of the various farm tracks and then walking transects.

13.8.4 Key Findings of the Study

13.8.4.1 Survey Results

From a review of the available old maps and aerial photographs the project area has always been open space, with the main activity being agricultural fields. The only built structure development visible is the farm dam located on the north-western corner of the project area.

This situation carries on until recent times, with the only structures added are the current Altona farmstead.

One feature that is depicted on the latest topographic map but is not present on the older maps and aerial photographs, is the Groenfontein farmstead (**Figure 58**). These buildings have been reviewed and the following can be said: they are younger than sixty years, are all in ruins and shows no signs of unique or interesting architectural features. They have therefore been rated as having very low significance.

Figure 58: Remains of the "Groenfontein" farmstead (Gouws, 2022)

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

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

A site sensitivity verification can be found under Section 6.4 of the Specialist Report. The results of the Screening Tool were confirmed by the Specialist, namely that the site has a low sensitivity.

13.8.5 Impact Assessment

Refer to **Section 14.16** below for the results from the impact assessment from this study.

13.8.6 Conclusions

The cultural landscape qualities of the region are made up of a pre-colonial element consisting of very limited Stone Age and Iron Age occupation, as well as a much later colonial (farmer) component, which also gave rise to an urban component.

During the survey no sites, features or objects of cultural significance were identified.

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, impact of the proposed develop is determined to be very low and no mitigation measures are proposed.

Based on the outcome of the heritage survey, the two alternatives, i.e., Alternative 1 (original layout) vs. Alternative 2 (new layout) are rated as 'no preference' given that neither will impact on any known sites of cultural heritage significance.

The legal requirements related to heritage specifically are specified in Section 3 of this report.

For this proposed project, the assessment has determined that no sites, features or objects of cultural heritage significance occur in the project area, therefore no permits are required from SAHRA or the PHRA.

If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

From a heritage point of view, it is recommended that the Proposed Project be allowed to continue on acceptance of the mitigation measures presented and the following conditions:

- The Palaeontological Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo) indicate that the project area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological assessment is required.
- 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 appropriate steps to take are indicated in Section 9 of the

report, as well as in the Management Plan: Burial Grounds and Graves, with reference to general heritage sites, in the Addendum attached to the Specialist's report.

13.9 Desktop Paleontological Impact Assessment

A summary of the Desktop Palaeontological Impact Assessment (Butler, 2022) (contained in **Appendix E6**) follows.

13.9.1 Details of the Specialist

The details of the specialist that undertook the Desktop Palaeontological Impact Assessment follow.

Name:	Elize Butler
Qualifications:	M.Sc. Zoology
Affiliation (if applicable):	Palaeontological Society of South Africa (PSSA) 2006-currently

13.9.2 Objectives of the Study

The Terms of Reference for this study were to undertake a Palaeontological Impact Assessment and provide feasible management measures to comply with the requirements of SAHRA.

13.9.3 Methodology

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This includes all trace fossils and fossils. All available information is consulted to compile a desktop study and includes Palaeontological impact assessment reports in the same area, aerial photos, and Google Earth images, topographical as well as geological maps.

Please refer to Section 4 of the Specialist's Report for more details on the methodology and terms of reference (**Appendix E6**).

13.9.4 Key Findings of the Study

The geology of the Altina 120MW Solar Photovoltaic (PV) Project near Orkney in the Free State is indicated on the 1:250 000 Kroonstad 2726 (Schutte, 2000) Geological Map (Council for Geosciences, Pretoria). According to this map the proposed development is underlain by the Quaternary deposits comprising of aeolian sand. Recent Shape files produced by the Council of Geosciences (Pretoria) indicates that the proposed Altina PV Project is underlain by alluvium, colluvium, and eluvium. The PalaeoMap of the South African Heritage Resources Information System indicates that the Palaeontological Sensitivity of the Quaternary deposits is moderate (Almond and Pether, 2009; Almond et al., 2013)

The Quaternary Era is also known as the “Age of the Mammals” and is preserved on coastal plains (Langebaanweg), cave systems (Makapan), and river gravel terraces (Cornelia), as well as other basins. These deposits have been subdivided in six African Land Mammal Ages, namely Recent, Florisian, Cornelian, Makapanian, Langebaanian, and Namibian (MacRae 1999). Quaternary deposits best known in the Free State is the Florisbad and Cornelia localities. Fossils recovered from these sites include teeth and bones of mammals, fish, reptiles, freshwater mollusks, trace fossils, wood, rhizoliths and diatom floras (Groenewald and Groenewald 2014). Quaternary fossils are usually very rare but may also include mammalian teeth and bone, ostrich eggshells, tortoise remains, ostracods, diatoms, and reptilian skeletons, trace fossils include burrows, vertebrate tracks, rhizoliths as well as calcretised termitaria (termite heaps). Plant remains include foliage, pear, wood, pollens. Microfossils and vertebrate remains are often found in Quaternary deposits near water courses and drainage lines.

The superficial deposits are the youngest geological deposits formed during the most recent geological period (approximately 2.6 million years ago to present). Most of the superficial deposits are unconsolidated sediments and consist of clay, gravel, sand, silt, that form relatively thin, discontinuous patches of sediments or larger spreads onshore. These sediments comprise of channel, floodplain and stream deposits, talus gravels and glacial drift sediments. Quaternary deposits are very important because palaeoclimatic changes are reflected in the different geological formations (Hunter et al., 2006). During the climate fluctuations in the Quaternary Era most geomorphologic features in southern Africa where formed (Maud, 2012). Barnosky (2005) indicated that various warming and cooling events occurred in the Quaternary but states that climatic changes during the Quaternary, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past. Climate variations that occurred in the Quaternary were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth et al., 2004).

Underlaying these superficial sediments at depth are sediments of the Ecca Group (Vryheid Formation) as well as sediments of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup).

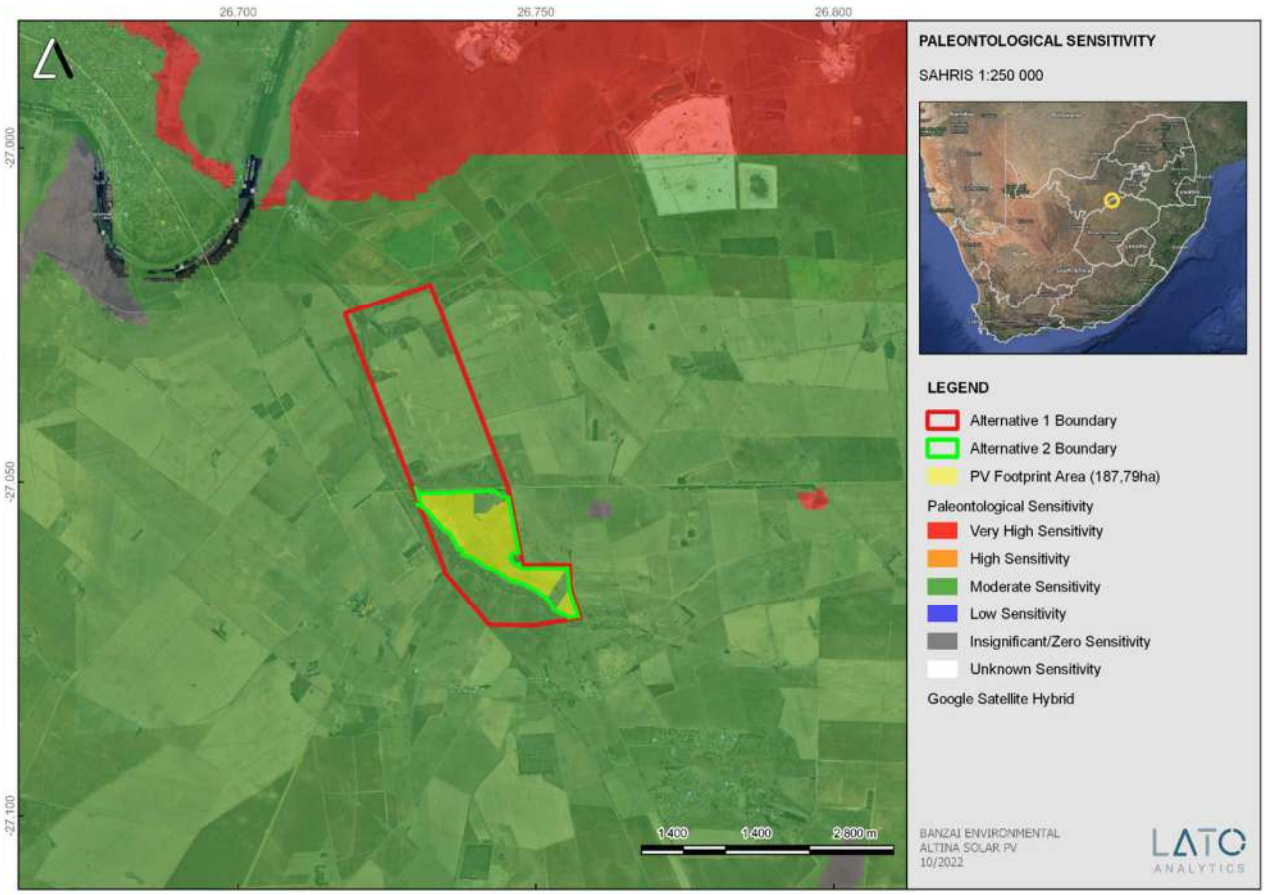


Figure 59: SAHRIS palaeosensitivity map for the proposed Project (yellow rectangle). Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero (Butler, 2022)

13.9.5 Impact Assessment

Refer to **Section 14.17** below for the results from the impact assessment from this study.

13.9.6 Conclusions

The proposed development is underlain by Quaternary superficial deposits. The PalaeoMap of the South African Heritage Resources Information System indicates that the Palaeontological Sensitivity of the Quaternary deposits is moderate (Almond and Pether, 2009; Almond et al., 2013). These superficial sediments mantle sediments of the Ecca and Transvaal Supergroup at depth. These underlaying sediments will not be impacted on by the development as the structures of the Altina PV Project will not penetrate that deep.

Two layout alternatives are considered for the proposed PV development. As both alternatives have the same geology, the impact of the proposed Altina PV Project on fossil heritage of the area, will be the same. From a Palaeontological view no alternative is more preferred above the other. A Moderate Palaeontological Significance has been allocated to the development footprint. It is therefore considered that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area. The construction and operation of the project may be

authorised, as the whole extent of the development footprint is not considered sensitive in terms of palaeontological heritage. If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments must report to SAHRA (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) so that mitigation can be carry out by a palaeontologist.

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.

13.10 Visual Impact Assessment

A summary of the Visual Impact Assessment (Breitenbach, 2022) (contained in **Appendix E7**) follows.

13.10.1 Details of the Specialist

The details of the specialist that undertook the Visual Impact Assessment follow.

Organisation:	Eco Elementum (Pty) Ltd
Name:	N. Breitenbach
Qualifications:	B.Sc. Geography
Affiliation (if applicable):	-

13.10.2 Objectives of the Study

The broad terms of reference for the study are as follows:

- Describe the existing visual characteristics of the proposed sites and its environs.
- Viewshed and viewing distance using GIS analysis up to 15 km from the proposed structures.
- Visual Exposure Analysis comprising the following aspects:
  - Terrain Slope;
  - Slope angle is determined from the Digital Terrain Model (DTM) and the location of the proposed structures given a ranking depending on the steepness of the slope.
  - Aspect of structure location;
  - Aspect of the slope where the structures are to be built, are calculated from the DTM and given a ranking determined by the Sun angle.
  - Landforms;
  - Landform of the location of the proposed structures are determined from the DTM and ranked according to the type of landform. Structures built on certain landforms, e.g. ridges, will be more visible than structures built in valleys.

- Slope Position of structure;
- Using GIS analysis, the position of the proposed structure is determined and ranked according to the position on the slope the structure is to be built.
- Relative elevation of structure;
- Using the DEM the elevation of the proposed structure relative to the surrounding elevation is determined and ranked according to the difference in height of the surrounding areas.
- Terrain Ruggedness;
- The terrain ruggedness is determined from the DEM and given a ranking based on the homogeneousness of the terrain.
- Viewer Sensitivity;
- The Viewer sensitivity ranking of the surrounding areas is determined using various land cover and land use datasets and ranked according to the sensitivity of the related structures to the environment.
- Overall Visual Impact;
- Combing all the above dataset a final visual impact of the proposed structures is calculated.

❑ Compare both alternatives and recommend an alternative with the least predicted impact on the receiving environment.

13.10.3 Methodology

The following sequence was employed in this Visual Assessment Report:

❑ Viewshed and viewing distance using GIS analysis up to 15 km from the proposed structures utilizing ArcGIS Pro and Spatial Analyst extension.

❑ In order to model the decreasing visual impact of the structures, concentric radii zones of 1 km to 15 km from the activities were superimposed on the viewshed to determine the level of visual exposure. The closest zone to the proposed structures indicates the area of most significant impact, and the zone further than 10 km from the structures indicates the area of least impact. The visual ratings of the zones have been defined as follows:

- <1 km (very high);
- 1 - 2 km (high);
- 2 - 5 km (moderate);
- 5 -10 km (moderate-low);
- 10 - 15 km (low) and
- >15 km (insignificant).

❑ A Visual Exposure Analysis were conducted that included the following parameters:

- Terrain Slope
  - Slope angle is determined from the Digital Terrain Model (DTM) and the location of the proposed structures given a ranking depending on the steepness of the slope;
  - Structures built on steep slopes are assumed to be more visible and exposed than those on flat surfaces.
- Aspect of structure location

  - Aspect of the slope where the structures are to be built, are calculated from the DTM and given a ranking determined by the Sun angle.
  - Structures on flat surface are illuminated by the sun the whole day and thus visible from all directions. In the southern hemisphere structures on North facing slopes are less visible from the south, structures on East and West facing slopes are only illuminated during half of the day thus less visible where structures on the southern slopes are mostly in the shade.
- Landforms
  - Landform of the location of the proposed structures are determined from the DTM and ranked according to the type of landform. Structures built on certain landforms, e.g. ridges, will be more visible than structures built in valleys.
- Slope Position of structure
  - Using GIS analysis, the position of the proposed structure is determined and ranked according to the position on the slope the structure is to be built.
- Relative elevation of structure
  - Using the DEM the elevation of the proposed structure relative to the surrounding elevation is determined and ranked according to the difference in height of the surrounding areas. Structures built on higher ground are more visible than those built in low lying areas.
- Terrain Ruggedness
  - The terrain ruggedness is determined from the DEM and given a ranking based on the homogeneousness of the terrain. Rugged terrain has a tendency to increase the visual absorption characteristics of the terrain.
- Visual Absorption Capacity
  - To simulate the Visual Absorption Capacity (VAC) of the landscape, land cover data of the area were assigned a VAC ranking. The Visual Exposure results and VAC rankings of the landscape were use in an algorithm to determine a quantitative visual exposure for each sensitive receptor.
- Overall Visual Impact
  - Combing all the above dataset a final visual exposure ranking was determined for each of the identified sensitive receptor areas.
- Compare the Visual Exposure Ratings for all the sensitive receptors
  - Comparison of the two alternatives

13.10.4 Key Findings of the Study

13.10.4.1 Receptors Identified

From a desktop study of satellite imagery various sensitive receptors in the form of human habitation areas, consisting of the town of Orkney to the north and various dispersed homesteads surrounding the proposed Altina Solar PV project area can be seen in **Figure**

60. It should be noted that the sensitive receptors in the area may differ from those identified as not all areas may have been identified from the imagery successfully.

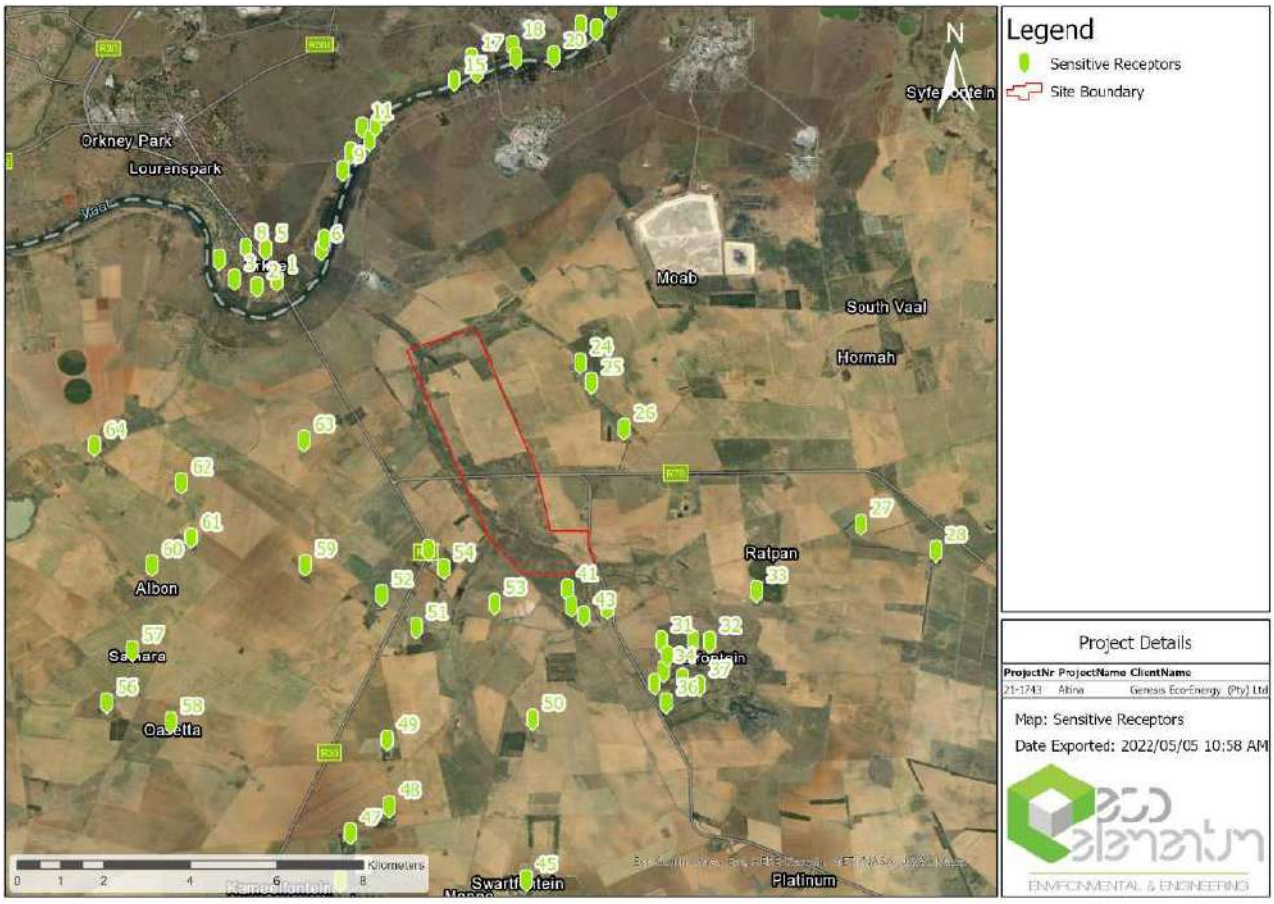


Figure 60: Sensitive Receptors Identified (Breitenbach, 2022)

13.10.4.2 Viewshed Analysis

For the assessment of the visibility of the area, the viewshed has been calculated from where the surface infrastructure can be seen from any point on the map. The View from the visibility area is then further ranked based on distance from the centre of the proposed infrastructure. The visible infrastructure count is combined with the distance from the source ranking together with the Visual Absorption Capacity (VAC) of the land cover types, the slope, aspect, ruggedness, relative elevation, landforms and slope position to get a quantitative Visual Exposure ranking of all the areas where it may be possible to see the proposed development. Each identified sensitive receptor is then overlaid on the Visual Exposure Ranking and the value extracted to that pixel to give a quantitative ranking for each of the identified sensitive receptors. Ranking is done from 1 to 5, 1 being very low and 5 very high (**Table 20**).

Table 20: Visual Exposure Ranking – Distance from Proposed Infrastructure Development (Breitenbach, 2022)

1	Very Low
2	Low
3	Medium
4	High
5	Very High

Due to fact that topographic modification can take place by agricultural, vegetation and other activities in the area, the viewshed is only a theoretical study. The viewpoints have been identified based on the sensitivity of the areas to visual disturbance and areas that can be negatively impacted by the related structures (**Figure 61** and **Figure 62**).

The Visual Exposure Rating (VER) at each of the identified sensitive receptors for both the alternative 1 and 2 scenarios was determined. Ratings are ranked 1 - 10, 1 being very low and 10 very high. The system only takes into account the variables as described in this report and the amount of infrastructure that would be visible. Factors like real time and micro scale vegetation are not taken into account, thus the actual rating may be lower or higher depending on the updated land use in the vicinity or latest vegetation growth or height on a micro and macro scale.

The VER ranged from 0 to 3.8 (Alternative 1) and 0 to 7.9 (Alternative 2) over approximately 64 identified receptors, while the average was 1.2 and 1.5 respectively.
The VER are by no means a rating of visual quality; it is rather used to determine the likelihood that the proposed infrastructure will be seen from the viewpoint receptors. It is also used to quantitively determine the best option in terms of visual impact.

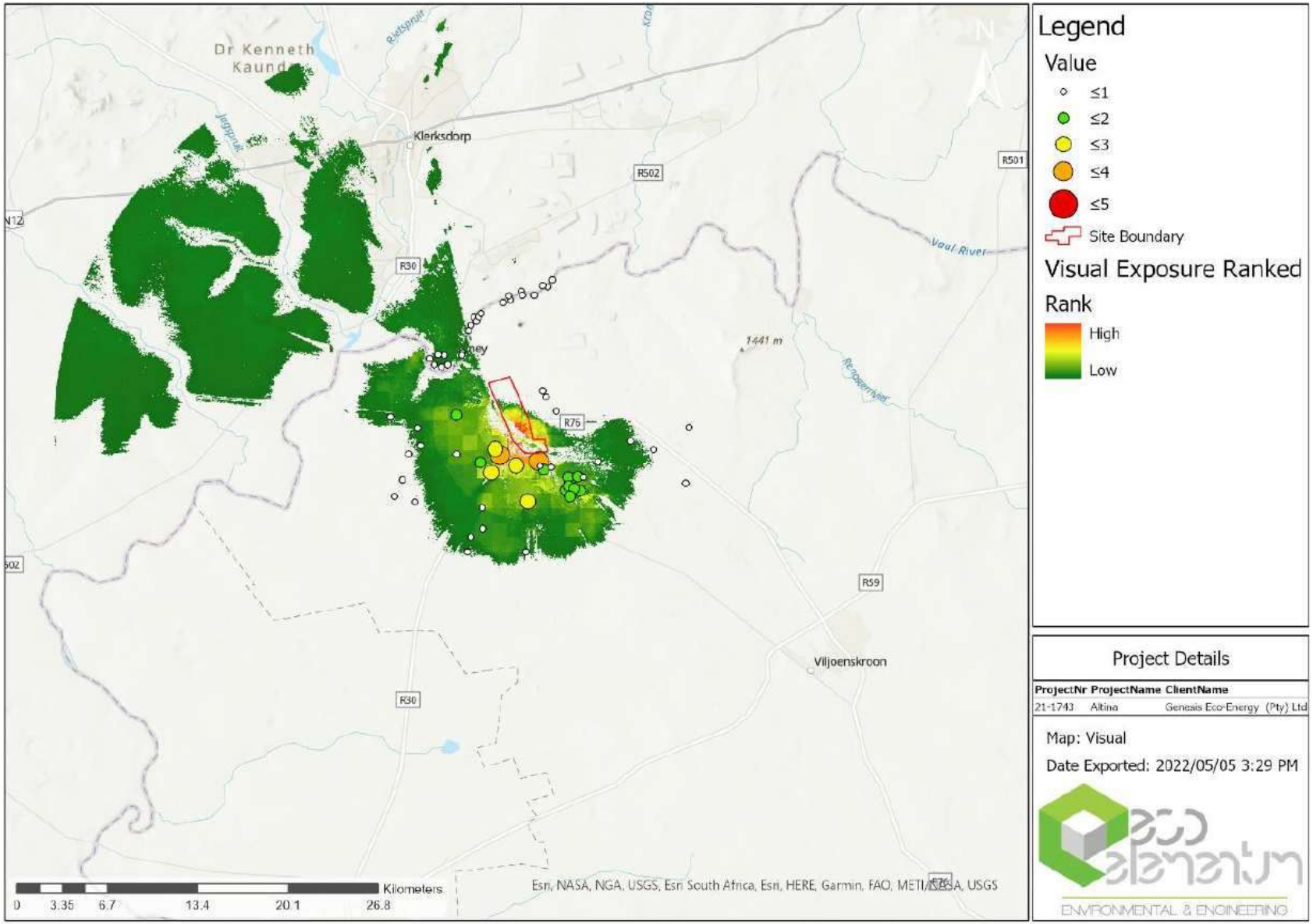


Figure 61: **Viewpoint Sensitive Receptors overlaid on the Visual Exposure Ranking for Alternative 1 (Breitenbach, 2022)**

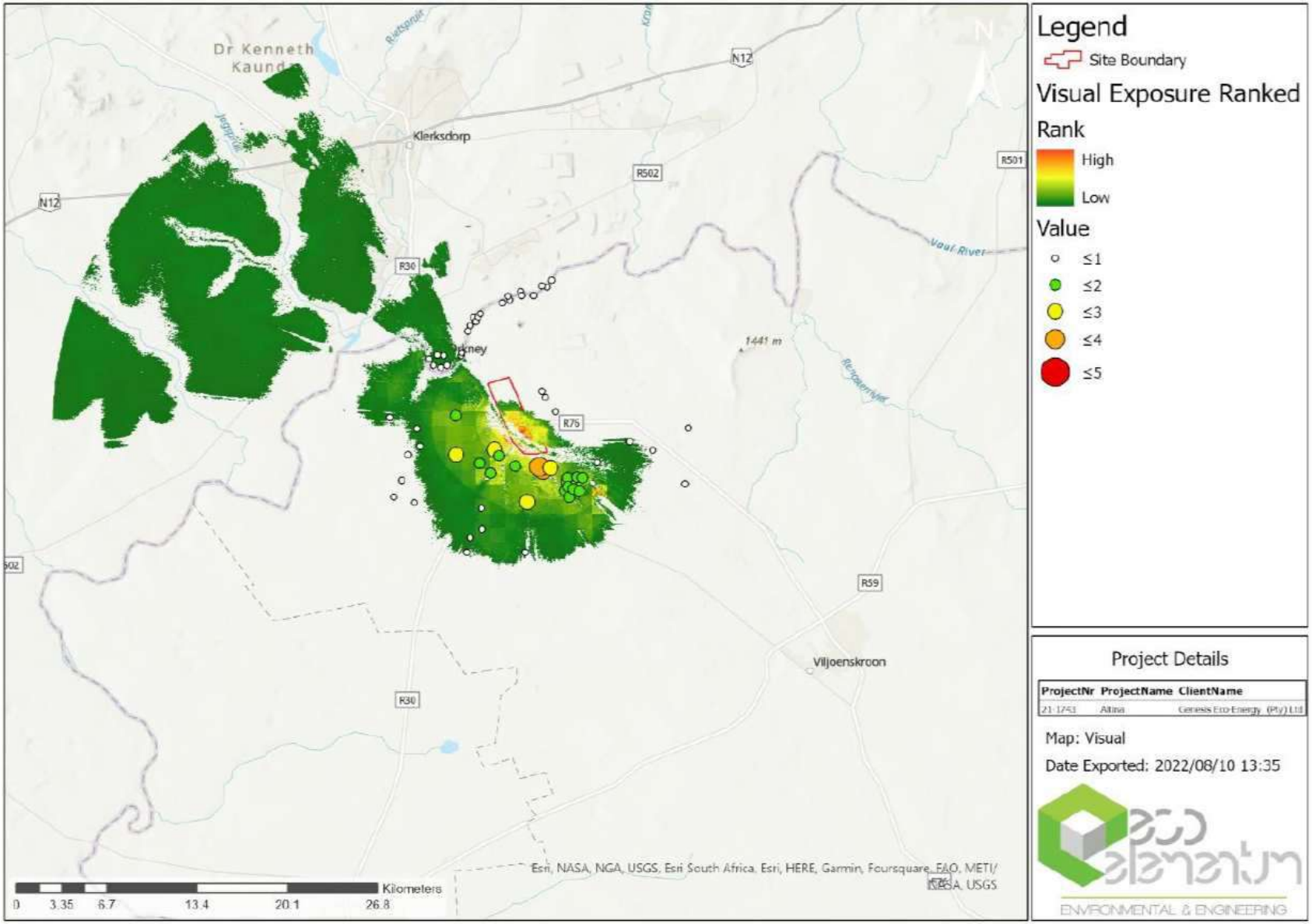


Figure 62: **Viewpoint Sensitive Receptors overlaid on the Visual Exposure Ranking for Alternative 1 (Breitenbach, 2022)**

When comparing the two alternatives from a visual impact perspective alternative 1 is predicted to have the least impact on the receiving environment. The number of receptors predicted to be impacted are 33 for alternative 1 compared to 34 for alternative 2. The average rating for all the predicted receptors is also higher for alternative 2. The predicted maximum rating is also higher in alternative 2.

13.10.5 Impact Assessment

Refer to **Section 14.18** below for the results from the impact assessment from this study.

13.10.6 Conclusions

The construction and operation phase of the proposed Altina Solar PV project related activities and its associated infrastructure will have a MODERATE visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact might decrease to a point where the visual impact can be seen as less significant. The moderating factors of the visual impact of the proposed solar PV plant in close range are the following:

- Number of human inhabitants and mining operations located in the area.
- Natural topography and vegetation.
- Mitigation measures that will be implemented.

In light of the above-mentioned factors that reduce the impact of the facility, the visual impact is assessed as MODERATE VISUAL IMPACT after mitigation measures have been implemented.

When comparing the two alternatives from a visual impact perspective alternative 1 is predicted to have the least impact on the receiving environment. The amount of receptors predicted to be impacted are 33 for alternative 1 compared to 34 for alternative 2. The average rating for all the predicted receptors are also higher for alternative 2. The predicted maximum rating for all the receptors are also higher in alternative 2.

From a visual impact perspective Alternative 1 is predicted to have the least impact on the receiving environment.

The Visual Impact due to the activities and associated infrastructure can be seen as having a MODERATE impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation, the visual impact can be seen as MODERATE. Although visual impacts of Solar PV plants cannot be mitigated effectively, it is important to reduce the visual impact to acceptable levels. The mitigation measures described in this report are best practice for the Burau of Land Management in the United States of America and considered effective to reduce the visual impact as reasonably possible for the project to go ahead.

13.11 Socio-Economic Impact Assessment

A summary of the Socio-Economic Impact Assessment (Chidley & Tanhuke, 2022) (contained in **Appendix E8**) follows.

13.11.1 Details of the Specialist

The details of the specialists that undertook the Socio-Economic Impact Assessment follow.

Organisation:	Nemai Consulting	
Name:	C. Chidley	C. Tanhuke
Qualifications:	BA (Economics); BSc Eng (Civil); MBA	BA Environmental Management

13.11.2 Objectives of the Study

The terms of reference for the study are as follows:

- Describe the Social baseline conditions that may be affected by the project;
- Describe the approach proposed for assessing the potentially significant issues that should be addressed by the SIA during the EIA phase;
- Determine the specific local social impacts of the project;
- Identify the potential social issues associated with the project;
- Suggest suitable mitigation measures to address the identified impacts; and
- Make recommendations on preferred options from a social perspective.

13.11.3 Methodology

The approach to the study was based on the DEA&DP's Guidelines for Socio-Economic Impact Assessment (Barbour, 2007). These guidelines are based on accepted international best practice guidelines and principles which include the Guidelines and Principles for Socio-Economic Impact Assessment (Inter-organizational Committee on Guidelines and Principles for Social Impact Assessment, May 1994). Accordingly, the study includes a review of the following:

- Relevant social data;
- Relevant planning and policy frameworks for the area;
- Information gathered while undertaking similar studies; and
- Social issues associated with similar projects.

Refer to Section 4 of the Specialist's report for further detail on the methodology followed in terms of sourcing of information (**Appendix E8**).

13.11.4 Key Findings of the Study

It is estimated that the peak number of workers during the construction phase would be 700 for a period of about 6 months. The construction duration is likely to be 18 months.

The potential for creating value within the regional study area and into the broader Free State economy is depends on the level of development of the renewable energy sector. The major cost items for a solar park are the modules, the transformers and the inverters – these will be imported items. The cabling and electrical systems can be manufactured in South Africa. The economic value created through installation and grid connection can be created within South Africa, with much of the labour and semi-skilled workers being available within the regional study area.

An estimate of the number of jobs to be created by the proposed project can be derived from the Department of Energy Report using the figures to date for the Limpopo Province. A provincial breakdown is provided for 3 projects (all completed) which all use Solar PV technology. It was reported that 118MW of energy was generated, creating 1 240 job years to date (which have included all of the construction jobs) and estimated at 2 917 job years over the 20-year life of the projects (Department of Energy, 2019). Applying these proportions to the proposed project yields the total job years of 2 966 job years and a construction job phase year estimate of 1 261. These figures do not include the contribution from the BESS segment of the project, which has not been studied in the literature.

The table below summarises the job creation estimates for the proposed project. Readers should bear in mind the various sources for this information, the assumptions made and the dates of the data – together these factors combine to set the degree of accuracy for these estimates at 20%.

Table 21: Job Creation Estimate Summary (Chidley & Tanhuke, 2022)

Description	No.
Total Job Years Created (Direct)	2 966
Planning and Construction Phase	1 261
Operation and Maintenance Phase, 20 years	1 705

The regional study area is the Fezile Dabi District Municipality, formerly known as the Northern Free State District Municipality, situated in the north of the Free State. It is surrounded by the Northwest, Gauteng and Mpumalanga Provinces to the north, Thabo Mofutsanyana District Municipality to the south, and Lejweleputswa District Municipality to the west. Refer to Section 5 of the Specialist report for the detail of the regional study.

The local study area comprises the project boundary and its close neighbours. The proposed project is located on agricultural land to the south of the town of Orkney in the Free State Province. Orkney and the surrounding region to the south is home to agricultural production and gold mining. Well known mines in the immediate vicinity of the proposed project are the Kopanang Mine / Vaal Reefs Mine and Harmony Moab. Larger towns in the region include Klerksdorp and Potchefstroom.

The dominant land use in the within five kilometres of the proposed project is crop based agriculture and the infrastructure supporting agriculture. Social infrastructure was identified within 5km of the Project site.

13.11.5 Impact Assessment

Refer to **Section 14.25** below for the results from the impact assessment from this study.

13.11.6 Conclusions

Based on the impact assessment and the suggested mitigation measures, the proposed technical alterative detailed for the proposed solar park and transmission line do not have an impact upon the social impact of the project.

Having taken into consideration the project aims of electricity generation using renewable power sources, and considering the assessment above which does not indicate any fatal social flaws. The “No-go” option is not supported by this study.

The benefits from the project going ahead, from a social perspective, will be larger than the project not proceeding.

The regional study area is a rural economy with a narrow base, population growth is lower than in surrounding areas and the per capita economic performance is lower than in surrounding local jurisdictions. The project site has few social receptors surrounding the site, and the project has a low footprint on the social environment. The social and economic impacts of the project are expected to be mainly positive in the sense that the local economy will be stimulated and broadened. The negative impacts are limited in nature and scope and can be successfully mitigated by management rules and practises. It is therefore found that the project, once the recommended mitigation measures have been implemented, has a nett positive impact on the social environment of the regional study area.

14 IMPACT ASSESSMENT

14.1 General

This section focuses on the pertinent environmental impacts that could potentially be caused during the pre-construction, construction and operational phases of the proposed Project.

Note that an 'impact' refers to the change to the environment resulting from an environmental aspect (or activity), whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity.

Impacts were identified as follows:

- Impacts associated with listed activities contained in GN No. R. 983, R. 984 and R. 985 of 4 December 2014, as amended, for which Environmental Authorisation have been applied for;
- An appraisal of the Project's activities and components;
- An assessment of the receiving biophysical, social, economic and built environments;
- Findings from specialist studies;
- Issues highlighted by environmental authorities; and
- Comments received during public participation from I&APs.

14.2 Impacts associated with Listed Activities

As mentioned, the Project requires Environmental Authorisation for certain activities listed in the EIA Regulations of 2014 (as amended), which serve as triggers for the Basic Assessment. The potential impacts associated with the key listed activities are broadly stated in **Table 22** below. The potential impacts were elaborated on in the specialist studies that were undertaken as part of the Basic Assessment.

Table 22: Potential Impacts associated with the key listed activities

Listed Activities	Potential Impact Overview
GN No. R. 983 of 4 December 2014 (as amended) (Listing Notice 1)	
GN No. R.983 – Activity no. 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; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;* *excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is —* *(a) temporarily required to allow for maintenance of existing infrastructure;* *(b) 2 kilometres or shorter in length;* *(c) within an existing transmission line servitude; and*	• Impacts associated with the footprint of the physical infrastructure (proposed power line). • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species, ecosystems) along the proposed power line. • Visual impacts associated with the proposed power line. • Impacts to land use.

Listed Activities	Potential Impact Overview
(d) will be removed within 18 months of the commencement of development.	
GN No. R.983 – Activity no. 12(ii)(a & c): *The development of -* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs -* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -* *excluding -* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area;* *(ee) where such development occurs within existing roads, road reserves or railway line reserves; or* *(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.*	• Impacts associated with the footprint of the physical infrastructure within 32 m of a watercourse (e.g. wetlands). • Adverse effects to resource quality associated with working in-stream and alongside watercourses. • Loss of instream vegetation within construction domain. • Destabilisation of affected watercourses. • Reduction in water quality of receiving watercourses due to improper management of storm water, hazardous material and sanitation. • Altering the drainage of the site.
GN No. R.983 – Activity no. 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;* *but excluding where such infilling, depositing, dredging, excavation, removal or moving -* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.*	• Construction activities (including bulk earthworks) to be undertaken within watercourses for physical infrastructure. • Adverse effects to resource quality associated with working in-stream and alongside the watercourse. • Destabilisation of affected watercourses.
GN No. R.983 – Activity 24(ii): *The development of a road -* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road -* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	• Impacts associated with access roads. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species, ecosystems). • Traffic disruptions during construction. • Impacts to watercourses (wetlands).
GN No. R.983 – Activity no. 27: *The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	• Clearance of areas consisting of indigenous vegetation associated with the construction footprint. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species, ecosystems). • Visual impacts.

Listed Activities	Potential Impact Overview
	• Soil destabilisation and subsequent erosion. • Proliferation of alien and invasive species.
GN No. R.983 – Activity no. 28(ii): *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	• Clearance of large areas associated with the construction footprint on land used for agricultural purposes, outside of an urban area. • Loss of agricultural land. • Social impacts associated with construction activities.
GN No. R.983 – Activity 56 (i & ii) *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre-* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.*	• Impacts associated with access roads. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species, ecosystems). • Traffic disruptions during construction. • Impacts to watercourses (wetlands).
GN No. R. 984 of 4 December 2014 (as amended) (Listing Notice 2)	
GN No. R.984 – Activity 1: *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, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs -* *(a) within an urban area; or* *(b) on existing infrastructure.*	• Impacts associated with generating electricity by the Solar PV Plant. • Impacts associated with the footprint of the physical infrastructure. • Impacts to land use. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species, ecosystems). • Visual impacts. • Soil destabilisation and subsequent erosion. • Proliferation of alien and invasive species. • Socio-economic impacts. • Traffic impacts.
GN No. R.984 – Activity 15: *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	• Clearance of large areas of indigenous vegetation associated with the construction footprint of the PV Site and associated infrastructure. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Visual impacts. • Soil destabilisation and subsequent erosion. • Proliferation of alien and invasive species.
GN No. R. 985 of 4 December 2014 (as amended) (Listing Notice 3)	
GN No. R.985 – Activity 4 - (b)(i)(cc) & (ee): *The development of a road wider than 4 metres with a reserve less than 13,5 metres.*	Impacts associated with building access roads in areas containing indigenous vegetation, including the loss of biodiversity.
GN No. R.985 – Activity no. 12(b)(i), (ii) & (iv): *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is*	The clearance of large tracts of indigenous vegetation and potential loss of sensitive fauna and flora species within areas

Listed Activities	Potential Impact Overview
required for maintenance purposes undertaken in accordance with a maintenance management plan.	consisting of endangered ecosystems, or within CBAs.
GN No. R.985 – Activity no. 14(ii) - (b)(i)(dd) & (ff): *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.*	• Impacts to biodiversity within CBAs as a result of the development of infrastructure within watercourses (wetlands) • Effects to resource quality associated with working in-stream and alongside the watercourses.
GN No. R.985 – Activity no. 18(b)(i)(ee) & (hh) *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *b. Free State* *i. Outside urban areas:* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(hh) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.*	• Impacts associated with access roads. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species, ecosystems). • Traffic disruptions during construction. • Impacts to watercourses (wetlands).

14.3 Issues raised by Environmental Authorities and IAPs

The Comments and Responses Report (CRR) (contained in **Appendix J**) includes comments received from authorities and I&APs on the during the Announcement Phase (31 March to 5 May 2022) and the draft BAR Review Phase of the Basic Assessment Process undertaken from 16 September to 17 October 2022.

The comments previously received have been succinctly grouped into the following main categories (please refer to the CRR in **Appendix J** for a comprehensive and accurate representation of the issues raised):

- Existing Infrastructure –
  - Requirements from custodians of existing infrastructure.
  - Wayleave application information.
- Pollution potential –
  - Impacts resulting from construction activities
- EIA process –
  - Relevant listed activities to be applied for, and to be explained in relation to the Project.

The CRR will be updated to include all comments received during the public review of the amended draft BAR.

14.4 Project Activities

In order to understand the impacts related to the Project it is necessary to unpack the activities associated with the project life-cycle, which is done in the sub-sections to follow.

14.4.1 Project Phase: Pre-construction

Some of the main Project activities, as well as high-level environmental activities, to be undertaken in the pre-construction phase are listed in **Table 23** below.

Table 23: Simplified List of Activities associated with Pre-construction Phase

Project Phase: Pre-construction
Project Activities
• Negotiations and agreements with the affected landowners, custodians of existing infrastructure, stakeholders and authorities (as relevant).
• Registration of power line servitude.
• Detailed engineering design.
• Detailed geotechnical investigations.
• Survey and mark development.
• Survey and map topography for determination of post-construction landscape, rehabilitation and shaping (where necessary).
• Procurement process for Contractor.
• Review Contractor's method statements (as relevant).
• Establish new access roads and undertake selective improvements to existing access roads to facilitate the delivery of construction plant and materials.
• The building of a site office and ablution facilities.
• Confirmation of the location and condition of all structures and infrastructure.
• Determining and documenting the conditions of the roads to be used during construction.
• Fencing off PV site.
High Level Environmental Activities
• Diligent compliance monitoring of the EMPr, Environmental Authorisation and other relevant environmental legislation
• Pre-construction environmental survey
• Develop Environmental Monitoring Programme (e.g. air quality, water quality, noise, traffic, social)
• Barricading of sensitive environmental features (e.g. watercourses)
• Obtain permits for impacts to Species of Conservation Concern (SCC), if avoidance is not possible
• On-going consultation with I&APs
• Other activities as per EMPr

14.4.2 Project Phase: Construction

Some of the main Project activities, as well as high-level environmental activities, to be undertaken in the construction phase are listed in **Table 24** below.

Table 24: Simplified List of Activities associated with Construction Phase

Project Phase: Construction
Project Activities
• Site establishment.
• Prepare access roads.
• Relocation of existing structures and infrastructure, as relevant.
• Establish construction laydown areas.
• Bulk fuel storage.
• Delivery of construction material.
• Transportation of equipment, materials and personnel.
• Storage and handling of material.
• Construction employment.
• Site clearing (as necessary).
• Construction of PV Plant infrastructure.
• Construction of substation components.
• Construction of associated infrastructure.
• Concrete Works.
• Erection of steel structures.
• Mechanical and Electrical Works.
• Electrical supply.
• Material delivery and offloading.
• Stringing of transmission lines.
• Stockpiling.
• Waste and wastewater management.
High Level Environmental Activities
• Diligent compliance monitoring of the EMPr, Environmental Authorisation and other relevant environmental legislation.
• Implement Environmental Monitoring Programme
• Reinstatement and rehabilitation of construction domain.
• On-going consultation with IAPs.
• Other activities as per EMPr.

14.4.3 Project Phase: Operation

Some of the main Project activities, as well as high-level environmental activities, to be undertaken in the operational phase are listed in **Table 25** below.

Table 25: Simplified List of Activities associated with Operational Phase

Project Phase: Operation
Project Activities
• Testing and commissioning the Project's components.
• Cleaning of PV modules
• Servitude access arrangements and requirements.
• Routine maintenance inspections of power lines and servitudes.
• Controlling vegetation.

Project Phase: Operation
• Managing stormwater and waste.
• Conducting preventative and corrective maintenance.
• Monitoring of the PV facility's performance.
• On-going consultation with directly affected parties.
High Level Environmental Activities
• On-going consultation with I&APs.
• Other activities as per EMPr for Operational Phase.

14.5 Environmental Aspects

Environmental aspects are regarded as those components of the Project's activities that are likely to interact with the environment and cause an impact.

The environmental aspects that have been identified for the Project, which are linked to the project activities (refer to **Section 14.4** above), are provided in **Table 26** below. Note that only high level aspects are provided.

Table 26: Environmental Aspects associated with Project Life-Cycle

Project Phase: Pre-construction
Environmental Aspects
• Inadequate consultation with landowners, affected parties, stakeholders and authorities.
• Inadequate environmental and compliance monitoring.
• Poor construction site planning and layout.
• Site-specific environmental issues not fully understood.
• Land occupancy by temporary buildings, provisional on-site facilities and storage areas.
• Inaccurate pre-construction environmental survey.
• Absence of relevant permits (if required).
• Lack of barricading of sensitive environmental features.
• Poor waste management.
• Absence of ablution facilities.

Project Phase: Construction
Environmental Aspects
• Inadequate consultation with landowners.
• Inadequate environmental and compliance monitoring.
• Lack of environmental awareness creation.
• Indiscriminate site clearing.
• Poor site establishment.
• Poor management of access and use of access roads.
• Disruptions to traffic.
• Poor transportation practices.
• Poor fencing arrangements.

Project Phase: Construction
• Erosion.
• Disruptions to existing services.
• Disturbance of topsoil.
• Poor management of excavations.
• Inadequate storage and handling of material.
• Inadequate storage and handling of hazardous material.
• Poor maintenance of equipment and plant.
• Poor management of labour force.
• Pollution from ablution facilities.
• Inadequate management of construction camp.
• Poor waste management practices – hazardous and general solid, liquid.
• Wastage of water.
• Disturbance to land use along power line route.
• Poor management of pollution generation potential.
• Damage to significant flora (if encountered).
• Damage to significant fauna (if encountered).
• Environmental damage where watercourses are crossed.
• Inadequate stormwater management.
• Damage to environmentally sensitive areas.
• Damage to cultural heritage and palaeontological features (if encountered).
• Poor reinstatement and rehabilitation.

Project Phase: Operation
Environmental Aspects
• Inadequate environmental and compliance monitoring.
• Inadequate management of routine maintenance and maintenance works.
• Inadequate management of vegetation.
• Inadequate stormwater management.
• Pollution caused by cleaning of panels.
• Pollution caused by dangerous good (e.g. transformer oils) associated with the onsite substation.
• Inadequate management of light pollution.
• Failure to comply with health, safety and environmental specifications.

14.6 Potentially Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable.

Note that it is not the intention of the impact assessment to evaluate all potential environmental impacts associated by the Project's environmental aspects, but rather to focus on the potentially **significant** direct and indirect impacts.

The potentially significant environmental impacts associated with the Project, as listed in **Table 27** below, were identified through an appraisal of the following:

- Project-related components and infrastructure (see **Section 5.4**) as well as the resources and services required (see **Section 5.6**);
- Activities (see **Section 14.4**) and aspects (see **Section 14.5**) associated with the project life-cycle (i.e. pre-construction, construction and operation);
- Nature and profile of the receiving environment and potential sensitive environmental features and attributes (see **Section 12**);
- Findings from specialist studies (see **Section 13**);
- Understanding of direct and indirect effects of the Project as a whole (see **Section 14**);
- Comments received during public participation from authorities and I&APs; and
- Legal and policy context (see **Section 8**).

Note that the list of impacts in **Table 27** below is elaborated on in the impact assessments that follow in **Sections 15.9 – 15.26** below.

Table 27: Potentially Significant Environmental Issues

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
Land Use	▪ Permanent change in land use at PV site and along power line route. ▪ Setbacks / conditions associated with surrounding land and infrastructure. ▪ Sterilisation of land. ▪ Servitude restrictions. ▪ Impacts to land use along power line.	▪ Sterilisation of land for other land use types up to the decommissioning of the Project (if applicable). ▪ Servitude restrictions.
Geology	▪ Suitability of geological conditions to support the proposed infrastructure.	▪ Suitability of geological conditions to support the infrastructure.
Geohydrology	▪ Groundwater pollution due to spillages and poor construction practices. ▪ Utilisation of the on-site boreholes (if applicable).	▪ Groundwater pollution due to poor operation and maintenance practices. ▪ Utilisation of the on-site boreholes (as applicable).
Topography	▪ Visual impact. ▪ Erosion of areas cleared for construction purposes.	▪ Visual impact caused by proposed Project infrastructure and landscape transformation. ▪ Erosion due to inadequate stormwater management.
Soil	▪ Soil erosion due to clearance and inadequate stormwater management. ▪ Soil compaction. ▪ Soil contamination due to spillages and poor construction practices. ▪ Loss of topsoil.	▪ Soil erosion due to inadequate stormwater management. ▪ Soil contamination due to poor operation and maintenance practices.
Surface Water	▪ Alteration of drainage over site. ▪ Surface water pollution due to spillages, sedimentation and poor construction practices. ▪ Encroachment of construction activities into riparian zones and 1:100 year floodlines.	▪ Sedimentation through silt-laden runoff, caused by inadequate stormwater management. ▪ Water resources could be contaminated through inadequate storage and handling of hazardous materials and poor management of waste and wastewater. ▪ Water use requirements of the Project need to be satisfied.

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
Flora & Fauna	▪ Habitat loss / fragmentation. ▪ Potential loss, disturbance or displacement of fauna and flora species. ▪ Human - animal conflicts. ▪ Noise and vibration impacts to fauna. ▪ Night lights may affect nocturnal faunal species. ▪ Illegal harvesting and poaching of faunal and floral species by construction workers. ▪ Pollution of the biophysical environment from poor construction practices. ▪ Proliferation of invasive alien species in disturbed areas.	▪ Habitat fragmentation (e.g. barriers to animal movement). ▪ Shading out of plants by solar panels. ▪ Reflection of sunlight from the solar panels could adversely affect birds. ▪ Risk to birds from collision with infrastructure and from electrocution. ▪ Electrical faulting from birds. ▪ Chemical pollution associated with cleaning the PV panels. ▪ Proliferation of invasive alien species in disturbed areas. ▪ Pollution from use of herbicides.
Socio-economic Environment	▪ Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes). ▪ Safety and security. ▪ Use of local road network. ▪ Nuisance from dust and noise. ▪ Consideration of local labourers and suppliers in area – stimulation of local economy (positive impact). ▪ Transfer of skills (positive impact).	▪ Direct and indirect economic opportunities as a result of the Project.
Air Quality	▪ Dust from the use of dirt roads by construction vehicles. ▪ Dust from bare areas that have been cleared for construction purposes. ▪ Emissions from construction equipment and machinery. ▪ Tailpipe emissions from construction vehicles.	▪ The efficiency of the solar plant could be reduced if the modules are soiled (covered) by particulates/dust. ▪ Impacts to air quality caused by the operation and maintenance of the facility include dust from the use of dirt roads and tailpipe emissions from vehicles.
Noise	▪ Localised increases in noise may be caused by construction activities.	N/A
Agriculture	▪ Loss of fertile soil through land clearance. ▪ Soil erosion. ▪ Loss of topsoil. ▪ Risk of harm to livestock from construction activities if site not secured.	▪ Loss of possible future agricultural land use due to direct occupation by the development footprint. ▪ Soil erosion due to inadequate stormwater management.
Historical and Cultural Features	▪ Possible direct impacts on below-ground archaeological deposits and fossils as a result of ground disturbance.	▪ Possible impacts to the cultural landscape as a result of the introduction of incompatible structures and infrastructure to the rural landscape.
Existing Structures & Infrastructure	▪ Setbacks / conditions associated with surrounding land and infrastructure. ▪ Crossing of existing infrastructure by power line.	▪ Setbacks / conditions associated with surrounding land and infrastructure. ▪ Disturbances to infrastructure traversed by power line during maintenance activities.
Transportation	▪ Increase in traffic on the local road network. ▪ Transportation of materials and construction personnel to site. ▪ Impacts to road conditions. ▪ Speeding and reckless driving by construction personnel. ▪ Construction vehicles accessing and leaving the sites via national and/or provincial roads. ▪ Use of oversized vehicles / abnormal loads, as required.	▪ Transportation of maintenance materials, as well as operational and maintenance personnel, to site.

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
	▪ Risks to other road users.	
Civil Aviation	▪ Impact on Air Traffic Navigation and Communication. ▪ Sun glare off PV panels blinding aircraft pilots. ▪ Risks posed to aviation by obstacles (power lines).	
Aesthetics	▪ Landscape transformation. ▪ Visual impacts associated with construction activities.	▪ Landscape transformation. ▪ Inadequate reinstatement and rehabilitation of construction footprint. ▪ Light pollution. ▪ Glint and glare from PV facility. ▪ Visual impacts.
Health	▪ Hazards related to construction work. ▪ Increased levels of dust and particulate matter. ▪ Increased levels of noise. ▪ Water (surface and ground) contamination. ▪ Poor water and sanitation. ▪ Communicable diseases. ▪ Psychosocial disorder (e.g. social disruptions). ▪ Safety and security.	▪ Hazards related to operation and maintenance work.

The findings of the specialists are of particular importance in terms of understanding the impacts of the Project and managing these during the project life-cycle, as these studies focused on the significant environmental issues. As can be seen from the various impact assessments performed by the specialists, there are a cross-cutting impacts that are addressed in a number of these studies, with particular reference to the land use, terrestrial ecology and socio-economic effects of the Project. The mitigation measures proposed by the specialists for these similar types of impacts are regarded as complementary and they are aligned with best practices and principles.

14.7 Impact Assessment Methodology

The impacts and the proposed management thereof are first discussed in **Section 14.9** to **Section 14.26** below on a qualitative level and thereafter quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance of the impacts (refer to methodology provided in **Table 28** below). Where applicable, the impact assessments and significance ratings provided by the respective specialists are included.

In the case of the specialist studies, some of the impact assessment methodologies deviated from the approach shown in **Table 28** below. However, the quantitative basis for these specialist evaluations of the impacts to specific environmental features still satisfied the intention of the EIA.

The assessment considers impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

Table 28: Quantitative Impact Assessment Methodology

Nature (/Status)	The project could have the following impacts to the environment: • Positive; • Negative; or • Neutral.
Extent	• Local - extend to the site and its immediate surroundings. • Regional - impact on the region but within the province. • National - impact on an interprovincial scale. • International - impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources. • Low - natural and social functions and processes are not affected or minimally affected. • Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way. • High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	• Short term - 0-5 years. • Medium term - 5-11 years. • Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. • Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	• Almost certain - the event is expected to occur in most circumstances. • Likely - the event will probably occur in most circumstances. • Moderate - the event should occur at some time. • Unlikely - the event could occur at some time. • Rare/Remote - the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- 0 - Impact will not affect the environment. No mitigation necessary. 1 - No impact after mitigation. 2 - Residual impact after mitigation / some loss of populations and habitats of non-threatened species. 3 - Impact cannot be mitigated / exceeds legal or regulatory standard / increases level of risk to public health / extinction of biological species, loss of genetic diversity, rare or endangered species, critical habitat.

14.8 Impact Mitigation

14.8.1 Mitigation Hierarchy

Impacts are to be managed by assigning suitable mitigation measures. According to DEAT (2006), the objectives of mitigation are to:

- ❑ Find more environmentally sound ways of executing an activity;
- ❑ Enhance the environmental benefits of a proposed activity;
- ❑ Avoid, minimise or remedy negative impacts; and
- ❑ Ensure that residual negative impacts are within acceptable levels.

Mitigation should strive to abide by the following hierarchy – (1) prevent; (2) reduce; (3) rehabilitate (or remediate); and/or (4) compensate for the environmental impacts.

The proposed mitigation of the impacts associated with the Project includes specific measures identified by the environmental specialists and the technical team (including engineering solutions), stipulations of environmental authorities and environmental best practices.

Note that the mitigation measures in the subsequent sections are not intended to be exhaustive, but rather focus on the potentially significant impacts identified.

The EMPrs (contained in **Appendix K**) provide a comprehensive list of mitigation measures for specific elements of the Project and the receiving environment, which extends beyond the impacts evaluated in the body of the BAR.

14.8.2 EMPr Framework

An EMPr represents a detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the life-cycle of a project.

The content of an EMPr must either contain the information set out in Appendix 4 of GN No. R. 982 of 4 December 2014, as amended, or must be a generic EMPr relevant to an application as identified and gazetted by the Minister in a Government Notice. Once the Minister has identified, through a Government Notice, that a generic EMPr is relevant to an application for Environmental Authorisation, that generic EMPr must be applied by all parties involved in the EA process, including, but not limited to, the Applicant and the Competent Authority.

In accordance with the above, the following EMPr's were developed for the Project:

- Normal EMPr for the Project (contained in **Appendix K1**); and
- Generic EMPr for the power line (contained in **Appendix K2**); and
- Generic EMPr for the on-site substation (contained in **Appendix K3**)

All liability for the implementation of the EMPr (as well as the EIA findings and Environmental Authorisation, if granted) lies with the Project Proponent.

14.9 Land Use

14.9.1 Impact Description

Land is required for constructing the proposed infrastructure associated with the Project. In addition, a servitude will be required for the power line.

The dominant land use and land cover in the areas earmarked for the project infrastructure is presented in **Section 12.2** above. The proposed PV site is located on private, which has historically

been used for agricultural purposes. The proposed site has been secured and the landowner has entered into a Long-Term Land Lease Agreement with the Applicant.

14.9.2 Impact Assessment

Environmental Feature	**Land Use**
Relevant Alternatives & Activities	**All physical infrastructure that forms part of the Project**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Power line servitude restrictions. • Disruptions to existing land use along power line.	• Process to be undertaken to compensate landowners along power line route. • Power line route to follow existing transmission line servitudes. • Rehabilitation post operation.

Alternative 1	**+/- Impacts**	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	long-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	long-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1

14.10 Soils

14.10.1 Impact Description

During the construction phase areas will be cleared of vegetation, which may lead to soil erosion. Erosion could also take place in the absence of suitable stormwater management. The EMPr includes storm water management measures to prevent the occurrence of erosion.

Soil may be polluted by poor storage or handling of material, spillages and inadequate housekeeping practices. Specific mitigation measures are contained in the EMPr, where the primary objective is the effective and safe management of materials on site, in order to minimise the impact of these materials on the biophysical environment. The same objective applies to the correct management and handling of hazardous substances (e.g. fuel, transformer oil).

14.10.2 Impact Assessment

Environmental Feature	**Soils**
Relevant Alternatives & Activities	**Construction and operational activities**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**

• Soil erosion • Soil compaction • Soil contamination	• Consider findings from geotechnical investigations during Project design phase and incorporate mitigation measures (as relevant). • Stabilisation of cleared areas to prevent and control erosion. • Manage drainage from sites to minimise erosion. • Reinstate and rehabilitate disturbed areas within development footprint to prevent future erosion. • See mitigation measures regarding hazardous substances & waste.

Alternative 1	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	long-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	long-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1

14.11 Geohydrology

14.11.1 Impact Description

Groundwater may be impacted by the Project as follows:

- ❑ Possible influence on groundwater flow as a result of earthworks and building of infrastructure and structures associated with the development footprint during construction.
- ❑ Use of groundwater during construction and operational phases; and
- ❑ Potential contamination of groundwater during construction and operational phases as a result of inadequate management of wastewater and spillages of dangerous goods.

14.11.2 Impact Assessment

Environmental Feature	**Geohydrology**
Relevant Alternatives & Activities	**Construction and operational activities**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Groundwater pollution. • Groundwater use. • Impacts to groundwater flow.	• Consider findings from geotechnical investigations during Project design phase and incorporate mitigation measures (as relevant). • Suitable protection of groundwater during excavations. • All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. • Provide sufficient and suitable sanitation facilities during construction and operational phases, which shall conform to all relevant health and safety standards and codes. • Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales). • The intention is that water that is required for construction and operation will be sourced from the on-site registered boreholes. All

	water use from the boreholes must be in accordance with the registered volume that can be abstracted and must comply with the provisions of the NWA.

Alternative 1	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium-high	long-term	likely	3
After Mitigation	-	local	low	long-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium-high	long-term	likely	3
After Mitigation	-	local	low	long-term	unlikely	1

14.12 Surface Water

The findings from the Wetland Assessment (contained in **Appendix E1**) follow.

14.12.1 Impact Description

Based on the preferred infrastructure layout (Alternative 2) although the proposed development will avoid the floodplain and associated buffer it will overlap some seepage areas. These seeps are assigned a sensitivity rating of High as they still remain relatively intact and functional. Loss of seep wetland habitat (under infrastructure Alternative 2) equates to 126.3 ha or 26.3% of the total wetland extent in the project area. This necessitates a Water Use Licence and a Wetland Offset Strategy. Decisions regarding the development of wetland areas and the required compensation lies beyond the scope of this study and would need to be addressed in the preliminary stages of an offset strategy (separate study to be commissioned if the developers wish to proceed with the development in wetland areas).

Considering the size of these seeps and the volumes of water delivered by them (during the height of the rainy season), the primary objective should be to avoid trying to drain them or divert flows around them but instead to allow for the diffuse subsurface flow of water beneath the solar panels. However, it is mentioned that the solar PV panels will be bifacial and that, as a consequence, the ground beneath the PV grid will be completely cleared. Although the vegetation in most of the seeps is short, sparse, heavily overgrazed and in most places devoid of obligate hydrophytes (if not completely cleared by agriculture), the clearing of what little vegetation exists beneath the PV grids introduces a number of challenges. This is because vegetation plays an important role in the maintenance of hydrological and sediment regimes in wetlands. Removal of vegetation, particularly in the seep zones has the potential to decrease infiltration and increase surface runoff. It also has the potential to result in erosion of the seep zones while at the same time increasing sediment loads and potentially toxicants delivered to the valley-bottom and floodplain wetlands.

The challenge is how to allow the subsurface flow of water beneath the solar panels without promoting erosion (especially during high rainfall events) of these seep zones and sedimentation and or contamination of the floodplain and valley bottom wetlands. Mitigation should therefore focus

on maintaining or, better still, improving on the current sediment regime of the hillslope seeps. However construction on concreted steel mono-pole plinths greatly reduces the actual surface footprint of the development and is considered unlikely to drastically alter the hydrological regime of the system and therefore the quantity of water delivered to the floodplain and valley-bottom wetlands.

14.12.2 Impact Assessment

Table 29: DWS Risk Impact Matrix for the PV Site (Clark & Husted, 2022)

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Activity	Aspect	Impact	Wetland Type	Severity: Flow Regime	Severity: Water Quality	Severity: Habitat	Severity: Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
Construction																			
Clearing and preparation of PV footprint and access roads	Disturbance of wetland habitat.	Loss or degradation of wetland vegetation.	Without	4	4	4	5	5	2	5	12	4	4	5	3	16	192	H	• Use the wetland shapefiles provided by TBC to clearly demarcate (on the ground) the edge of the buffer on the floodplain and valley-bottom wetlands (41 m buffer). Regard these as strict no-go areas and sign post as environmentally sensitive. • All activities (including driving and equipment storage) must remain outside of the floodplain and valley-bottom wetlands identified on site that will be conserved. • Attempt to avoid development and activities within the seeps as far as possible. Apply for a water use licence and start to initiate the development of an offset strategy for all wetlands to be developed. Incorporate the wetland offset strategy and any remedial activities associated with this strategy in the master plan for the development and implement in tandem with construction. • Towards this offset consider rehabilitating a 100 m stretch from the eastern outer boundary of the floodplain wetland wherever this intersects disturbed ground (either the sand mining activities or croplands both active or fallow). • While clearing keep a nursery of plant sods (prioritise wetland plants such as sedges, rushes and grasses such as *Imperata cylindrica*) in an on-site nursery (consider a spot in or close to the sand mining area) for use in wetland restoration efforts as part of the offsets. • Use existing access roads wherever possible.
			With	3	3	3	4	5	2	5	12	2	2	5	1	10	120	M	

Activity	Aspect	Impact	Severity														Risk Rating	Control Measures
			Wetland Type	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance		
		Increased bare surfaces, floodpeaks and potential for erosion	Without	4	5	4	4	5	2	5	12	4	4	5	1	14	168	H	• Hold off on the clearing of vegetation as long as possible, ensuring that all environmental and water use authorisations are in place, the site construction materials are in place and the PV infrastructure is sourced and ready prior to clearing. • Take every measure to ensure that the bulk of the site clearing and earth moving activities take place in winter when rainfall is lowest (and the grass sward is thinnest) to minimize environmental damage, erosion, sedimentation and contamination.
			With	3	3	3	3	5	2	2	9	3	3	1	1	8	72	M	• Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. • Scrape the area where mixing and storage of sand and concrete occurred to clean and re-grass once finished. • Revegetate all denuded areas beyond the buildings as soon as possible
		Introduction and spread of alien and invasive vegetation	Without	2	2	4	4	3	2	5	10	3	3	5	1	12	120	M	• Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) . • Appropriately stockpile topsoil cleared from the site.
			With	1	1	1	1	1	1	2	4	2	1	5	1	9	36	L	• Minimize unnecessary clearing of vegetation beyond the infrastructure footprints. • Lightly till any disturbed soil around the development to avoid compaction.
Excavation and installation of PV infrastructure.	Alteration of Hydrological Regime	Decreased flow inputs to the Vierfontein spruit floodplain (HGM1)	Without	5	5	4	4	5	2	5	12	4	4	5	1	14	168	H	• Aim to maximise infiltration of rain water and maintain diffuse subsurface drainage below PVs in seeps. • Develop a sound stormwater management plan that is engineered to promote rainfall infiltration, maintain diffuse subsurface flows in seep areas, minimise the development of preferential flow paths. The

Activity	Aspect	Impact		Severity													Risk Rating	Control Measures
				Wetland Type	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	
			With	4	3	3	3	5	2	5	12	3	3	1	1	8	96	M	stormwater plan would also benefit from Lidar based topography maps and / or site-specific contours that allow for the identification of flow paths. • All low points, flow paths or clean water drains should be engineered to minimize erosion through the installation of small drop downs and flow attenuation structures especially out outlets into the floodplain. • Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in). • Minimise the extent of concreted / paved / gravel areas. • Avoid excessively compacting the ground beneath the solar panels. • Introduce coarse, preferably washed, gravel beneath PV arrays.
	Soil disturbance	Increased sediment loads to downstream reaches	Without	4	5	4	4	5	2	5	12	4	4	5	1	14	168	H	• See mitigation for increased bare surfaces, runoff and potential for erosion • Introduce coarse, preferably washed, gravel beneath PV arrays.
			With	3	3	3	3	5	2	2	9	3	3	5	1	12	108	M	
Operation																			
Routine operation and maintenance of PV farm	Residual vegetation disturbance	Proliferation of alien and invasive species	Without	1	1	2	2	5	2	5	12	2	2	5	1	10	120	M	• Continue to remove all alien and invasive plant species as they arise (i.e. weedy annuals and other alien forbs) . • Attempt to plant only locally indigenous plant species within the gardens. • Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. • Do not store any construction materials or equipment within any of the identified wetlands or their buffers. • Mixing of concrete must under no circumstances take place within any wetland. • Release only clean water into the environment.
			With	1	1	1	1	1	2	5	8	2	2	1	1	6	48	L	
	Increased contamination	Nutrient enrichment of wetlands	Without	1	5	4	4	5	2	5	12	4	4	5	2	15	180	H	
			With	1	1	1	1	1	1	2	4	2	1	5	1	9	36	L	

Activity	Aspect	Impact	Severity									Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
			Wetland Type	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence								
	Altered sediment regime	Increased sedimentation from cleared ground beneath solar PV areas	Without	1	1	4	4	2.5	2	5	9.5	3	3	5	1	12	114	M	• Develop a sound stormwater management plan that is engineered to promote rainfall infiltration, maintain diffuse subsurface flows in seep areas, minimise the development of preferential flow paths. The stormwater plan would also benefit from Lidar based topography maps and / or site-specific contours that allow for the identification of flow paths. • Consider the use of a coarse heavy metal-free gravel beneath the solar panels to promote infiltration and minimize surface run-off and erosion during high rainfall events. The gravel should be free of heavy metal contaminants.
			With	1	1	4	4	2.5	2	5	9.5	3	3	5	1	12	114	M	
Decommissioning																			
Demolition	Vehicle access	Degradation of vegetation and proliferation of alien and invasive species	Without	1	4	4	4	3.3	5	3	11	3	1	1	1	6	68	M	• Decommissioning is unlikely for the foreseeable future, however, if the water supply infrastructure ever needs upgrading and needs to be moved the following is recommended: • See mitigation for the impacts on degradation of downslope wetlands and spread of alien and Invasive plants. • Alien and invasive species control should continue for a minimum of three years following decommissioning.
			With	1	1	1	1	1	1	2	4	2	1	1	1	5	20	L	
	Soil and vegetation disturbances	Increased bare surfaces, runoff and potential for erosion	Without	4	5	4	4	5	2	5	12	4	4	5	1	14	168	H	• See mitigation for increased bare surfaces, runoff and potential for erosion and increased sediment loads during construction • Landscape and rehabilitate project area.
			With	1	1	1	1	1	2	2	5	3	1	1	1	6	30	L	

Mitigation

The mitigation measures identified include the following:

- Use the wetland shapefiles to clearly demarcate (on the ground) the edge of the buffer on the floodplain and valley-bottom wetlands (41 m buffer). Regard these as strict no-go areas and sign post as environmentally sensitive.
- All activities (including driving and equipment storage) must remain outside of the floodplain and valley-bottom wetlands identified on site that will be conserved.
- Apply for a water use licence and start to initiate the development of an offset strategy for all wetlands to be developed. Incorporate the wetland offset strategy and any remedial activities associated with this strategy in the master plan for the development and implement in tandem with construction.
- Towards this offset consider rehabilitating a 100 m stretch from the eastern outer boundary of the floodplain wetland wherever this intersects disturbed ground (either the sand mining activities or croplands both active or fallow).
- Hold off on the clearing of vegetation as long as possible, ensuring that all environmental and water use authorisations are in place, the site construction materials are in place and the PV infrastructure is sourced and ready prior to clearing.
- Take every measure to ensure that the bulk of the site clearing and earth moving activities take place in winter when rainfall is lowest (and the grass sward is thinnest) to minimize environmental damage, erosion, sedimentation and contamination.
- While clearing keep a nursery of plant sods (prioritise wetland plants such as sedges, rushes and grasses such as *Imperata cylindrica*) in an on-site nursery (consider a spot in or close to the sand mining area) for use in wetland restoration efforts as part of the offsets.
- Minimize the disturbance footprint and the unnecessary clearing of vegetation outside of this area.
- Develop a sound stormwater management plan that is engineered to promote rainfall infiltration, maintain diffuse subsurface flows in seep areas, minimise the development of preferential flow paths. The stormwater plan would also benefit from Lidar based topography maps and / or site-specific contours that allow for the identification of flow paths.
- All low points, flow paths or clean water drains should be engineered to minimize erosion through the installation of small drop downs and flow attenuation structures especially out outlets into the floodplain.
- Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in).
- Consider the use of a coarse gravel beneath the solar panels to promote infiltration and minimize surface run-off and erosion during high rainfall events. The gravel should be free of heavy metal contaminants.
- Educate staff and relevant contractors on the location and importance of the identified wetlands through toolbox talks and by including them in site inductions as well as the overall master plan.
- Promptly remove / control all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed.

- Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash.

14.13 Terrestrial Ecology

The findings from the Terrestrial Ecology Assessment (contained in **Appendix E2**) follow.

14.13.1 Impact Description

Two layout alternatives were provided and considered within the project area. As mentioned above sections below will only be duplicated where the impact between the two layouts were considered different. Limited/degraded CBA 1 will be lost. The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios. The mitigation actions required to lower the risk of the impact are provided.

The following potential main impacts on the biodiversity (based on the framework above) were considered for the construction phase of the proposed development. This phase refers to the period during construction when the proposed features are constructed; and is considered to have the largest direct impact on biodiversity. The main anticipated impact includes the clearing of vegetation, proliferation of alien plant species along the roads and cleared areas as well as the severing of movement corridors for fauna, and the fragmentation of habitat. The following potential impacts to terrestrial biodiversity were considered:

- Destruction, further loss and fragmentation of the of habitats, ecosystems and vegetation community;
- Introduction of alien species, especially plants;
- Destruction of protected plant species;
- Displacement of faunal community due to habitat loss, direct mortalities, and disturbance (road collisions, noise, dust, vibration and poaching); and
- Chemical pollution associated with dust suppressants.

The operational phase of the impact of daily activities is anticipated to further spread the IAP, as well as the deterioration of the habitats due to the increase of dust and edge effect impacts. Dust reduces the ability of plants to photosynthesize and thus leads to degradation/retrogression of the veld. Moving maintenance vehicles do not only cause sensory disturbances to fauna, affecting their life cycles and movement, but will lead to direct mortalities due to collisions. The use of non-environmentally friendly chemical for the cleaning of the PV panels can lead to the pollution of water sources and ultimately death of fauna and flora.

The following potential impacts were considered:

- Continued fragmentation and degradation of habitats and ecosystems ;
- Spread of alien and/or invasive species;
- Ongoing displacement and direct mortalities of faunal community due to disturbance (road collisions, collisions with substation, noise, light, dust, vibration);

- Reduced dispersal of fauna;
- Chemical pollution associated with measures to keep PV clean; and
- Fencing of PV site.

Table 30 summarises the significance of potential impacts associated project on fauna and flora before and after implementation of mitigation measures. The loss of habitat and the degradation of habitat were rated as 'High' prior to mitigations being implemented for Alternative 1 and as 'Moderately High' prior to mitigations being implemented for Alternative 2. Through the implementation of mitigations such as the restriction and demarcation of the project footprint this can only be lowered to 'Moderate' for both Alternatives 1 and 2, it can however not be mitigated completely as habitat will still be lost. The habitat and vegetation type recorded are not restricted and is well represented in the general area.

Table 31 summarises the significance of the operational phase impacts on biodiversity before and after implementation of mitigation measures. The continued loss of habitat and the degradation of habitats within the area were rated as 'Moderately High' prior to mitigations being implemented for Alternative 1 and as 'Moderately High' prior to mitigations being implemented for Alternative 2. Through the implementation of mitigations this can be reduced to a 'Moderate' level for both Alternatives 1 and 2. The impact significance of displacement and direct mortalities of fauna were rated as 'Moderate' prior to mitigation for the project. Implementation of mitigation measures reduced the significance of the impact to a 'Low' level.

14.13.2 Impact Assessment

Table 30: Assessment of significance of potential impacts on terrestrial ecology associated with the construction phase (Clark & Husted, 2022)

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Destruction, fragmentation and degradation of habitats, and ecosystems (ALTERNATIVE 1)	5	3	4	4	5		4	2	3	4	4	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Definite	**High**	Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderate**
Destruction, fragmentation and degradation of habitats, and ecosystems (ALTERNATIVE 2)	5	3	4	3	5		4	2	3	3	4	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology moderately sensitive/ /important	Definite	**Moderately High**	Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Highly likely	**Moderate**
Spread and/or establishment of alien and/or invasive species	4	3	3	3	4		3	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted /	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Highly likely	**Moderate**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha	Small / ecosystem structure and function	Ecology with limited sensitivity/importance	Likely	**Low**

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
		Linear features affected < 1000m						impacted / Linear features affected < 100m	largely unchanged			
Destruction of protected plant species.	4	3	3	3	4		2	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Highly likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**
Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration).	4	3	3	3	5		2	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Definite	**Moderately High**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Chemical pollution associated with dust suppressants	4	4	4	3	4		3	2	2	2	2	
	Life of operation or less than 20 years: Long Term	Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	Great / harmful/ ecosystem structure and function largely altered	Ecology moderately sensitive/ /important	Highly likely	**Moderately High**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Possible	**Low**

Table 31: Assessment of significance of potential impacts on terrestrial ecology associated with the operational phase (Clark & Husted, 2022)

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Continued fragmentation and degradation of habitats and ecosystems (ALTERNATIVE 1)	5	3	4	4	5		4	3	3	4	3	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Definite	**High**	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**
Continued fragmentation and degradation of habitats and ecosystems (ALTERNATIVE 2)	5	3	4	3	4		4	3	3	3	3	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology moderately sensitive/ /important	Highly likely	**Moderately High**	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**
Spread and/or establishment of alien and/or invasive species	4	3	3	4	3		2	2	2	3	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology moderately sensitive/ /important	Likely	**Low**

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Ongoing displacement and direct mortalities of faunal community due to disturbance (road collisions, collisions with substation, noise, light, dust, vibration)	4	3	3	3	3		3	2	2	2	2	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Possible	**Low**
Reduced dispersal of fauna	4	3	3	3	3		2	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**
Chemical pollution associated with measures to keep PV clean	4	3	3	3	3		3	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Fencing of PV site	4	3	3	3	3		3	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

Table 32: Mitigation Measures – Terrestrial Ecology (Clark & Husted, 2022)

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Management outcome: Vegetation and Habitats				
Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. All activities must be restricted within the low/medium sensitivity areas. No further loss of high sensitivity areas should be permitted. It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon.	Life of operation	Project manager, Environmental Officer	Areas of indigenous vegetation	Ongoing
Existing access routes, especially roads must be made use of.	Construction/Operational Phase	Environmental Officer & Design Engineer	Roads and paths used	Ongoing
All laydown, chemical toilets etc. should be restricted to medium/low sensitivity areas. Any materials may not be stored for extended periods of time and must be removed from the project area once the construction phase has been concluded. No permanent construction phase structures should be permitted. Construction buildings should preferably be prefabricated or constructed of re-usable/recyclable materials. No storage of vehicles or equipment will be allowed outside of the designated project areas.	Construction/Operational Phase	Environmental Officer & Design Engineer	Laydown areas	Ongoing
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood and wind events. This will also reduce the likelihood of encroachment by alien invasive plant species. All livestock must always be kept out of the project area, especially areas that have been recently revegetated.	Operational phase	Environmental Officer & Contractor	Assess the state of rehabilitation and encroachment of alien vegetation	Quarterly for up to two years after the closure
A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment. Construction activities and vehicles could cause spillages of lubricants, fuels and waste material potentially negatively affecting the functioning of the ecosystem. All vehicles and	Life of operation	Environmental Officer & Contractor	Spill events, Vehicles dripping.	Ongoing

equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas outside of the project area.				
It should be made an offence for any staff to take/ bring any plant species into/out of any portion of the project area. No plant species whether indigenous or exotic should be brought into/taken from the project area, to prevent the spread of exotic or invasive species or the illegal collection of plants.	Life of operation	Project manager, Environmental Officer	Any instances	Ongoing
A fire management plan needs to be complied and implemented to restrict the impact fire might have on the surrounding areas.	Life of operation	Environmental Officer & Contractor	Fire Management	During Phase
Any individual of the protected plants that are present needs a relocation or destruction permit in order for any individual that may be removed or destroyed due to the development. Hi visibility flags must be placed near any threatened/protected plants in order to avoid any damage or destruction of the species. If left undisturbed the sensitivity and importance of these species needs to be part of the environmental awareness program. Infrastructure, development areas and routes where protected plants cannot be avoided, these plants mainly being succulents should be removed from the soil and relocated/ re-planted in similar habitats where they should be able to resprout and flourish again.	Life of operation	Project manager, Environmental Officer	Protected Tree/Plant species	Ongoing
Management outcome: Fauna				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency
A qualified environmental control officer must be on site when construction begins. A site walk through is recommended by a suitably qualified ecologist prior to any construction activities, preferably during the wet season. Should animals not move out of the area on their own relevant specialists must be contacted to advise on how the species can be relocated. In situations where the threatened and protected plants must be removed, the proponent may only do so after the required permission/permits have been obtained in accordance with national and provincial legislation. In the abovementioned situation the development of a search, rescue and recovery program is suggested for the protection of these species.	Construction Phase	Environmental Officer, Contractor	Presence of any floral or faunal species.	During phase
The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments, • Signs must be put up to enforce this.	Construction/Operational Phase	Project manager, Environmental Officer	Infringement into these areas	Ongoing
The duration of the construction should be minimized to as short term as possible, to reduce the period of disturbance on fauna.	Construction	Project manager, Environmental Officer & Design Engineer	Construction/Closure Phase	Ongoing
Noise must be kept to an absolute minimum during the evenings and at night to minimize all possible disturbances to amphibian species and nocturnal mammals.	Construction/Operational Phase	Environmental Officer	Noise levels	Ongoing

No trapping, killing, or poisoning of any wildlife is to be allowed • Signs must be put up to enforce this;	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing
Outside lighting should be designed and limited to minimize impacts on fauna. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (green/red) lights should be used wherever possible.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Light pollution and period of light.	Ongoing
Try incorporating motion detection lights as much as possible to reduce the duration of illumination. Heights of light columns to be minimised to reduce light spill. Baffles, hoods or louvres to also be used to reduce light spill.	Construction Phase	Environmental Officer & Design Engineer	Light pollution	Ongoing
All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife. Speed limits (30km/h) must still be enforced to ensure that road killings and erosion is limited.	Life of operation	Health and Safety Officer	Compliance to the training.	Ongoing
Schedule activities and operations during least sensitive periods (winter months), to avoid migration, nesting and breeding seasons.	Life of operation	Project manager, Environmental Officer & Design Engineer	Activities should take place during the day in the case.	Ongoing
All areas to be developed must be walked through prior to any activity to ensure no nests or fauna species are found in the area. Should any Species of Conservation Concern not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Construction and Operational phase	Project manager, Environmental Officer	Presence of Nests and faunal species	Planning, Construction and Rehabilitation
Any holes/deep excavations must be dug and planted in a progressive manner and shouldn't be left open overnight; • Should the holes be left open overnight they must be covered temporarily to ensure no small fauna species fall in.	Planning and Construction	Environmental Officer & Contractor, Engineer	Presence of trapped animals and open holes	Ongoing
Ensure that cables and connections are insulated successfully to reduce electrocution risk.	Life of project	Environmental Officer & Contractor, Engineer	Presence of electrocuted fauna	Ongoing
Any exposed parts must be covered (insulated) to reduce electrocution risk.	Life of project	Environmental Officer & Contractor, Engineer	Presence of electrocuted fauna	Ongoing
Heat generated from the substations must be monitored to ensure it does not negatively affect the local fauna	Life of operation	Environmental Officer & Contractor	Heat generated by substations	Ongoing
Use environmentally friendly cleaning and dust suppressant products	Construction and operation	Environmental Officer & Contractor, Engineer	Presence of chemicals in and around the project area	Ongoing
Fencing mitigations: • The fence must have holes of 30*30cm to allow for free movement of wildlife.	Planning, construction and operation	Environmental Officer & Contractor, Engineer	Monitor fences for slack wires	Ongoing
Management outcome: Alien species				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency

Compilation of and implementation of an alien vegetation management plan.	Life of operation	Project manager, Environmental Officer & Contractor	Assess presence and encroachment of alien vegetation	Twice a year
The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprint of the roads must be kept to prescribed widths.	Construction/Operational Phase	Project manager, Environmental Officer & Contractor	Footprint Area	Life of operation
Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.	Life of operation	Environmental Officer & Health and Safety Officer	Presence of waste	Life of operation
A pest control plan must be put in place and implemented; it is imperative that poisons not be used.	Life of operation	Environmental Officer & Health and Safety Officer	Evidence or presence of pests	Life of operation
Management outcome: Dust				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency
Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces. • No non environmentally friendly suppressants may be used as this could result in pollution of water sources	Life of operation	Contractor	Dustfall	Dust monitoring program.
Management outcome: Waste Management				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency
Waste management must be a priority and all waste must be collected and stored effectively.	Life of operation	Environmental Officer & Contractor	Waste Removal	Weekly
Litter, spills, fuels, chemicals and human waste in and around the project area.	Construction/Closure Phase	Environmental Officer & Health and Safety Officer	Presence of Waste	Daily
A minimum of one toilet must be provided per 10 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area.	Life of operation	Environmental Officer & Health and Safety Officer	Number of toilets per staff member. Waste levels	Daily
The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility	Life of operation	Environmental Officer & Health and Safety Officer	Availability of bins and the collection of the waste.	Ongoing
Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site.	Life of operation	Environmental Officer, Contractor & Health and Safety Officer	Collection/handling of the waste.	Ongoing
Refuse bins will be emptied and secured. Temporary storage of domestic waste shall be in covered waste skips. Maximum domestic waste storage period will be 10 days.	Life of operation	Environmental Officer, Contractor & Health and Safety Officer	Management of bins and collection of waste	Ongoing, every 10 days

Management outcome: Environmental Awareness Training				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency
All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area to inform contractors and site staff of the presence of protected species, their identification, conservation status and importance, biology, habitat requirements and management requirements as within the Environmental Authorisation and EMPr. The avoidance and protection of the wetland areas must be included into a site induction. Contractors and employees must all undergo the induction and made aware of the "no-go" to be avoided.	Life of operation	Health and Safety Officer	Compliance to the training.	Ongoing
Management outcome: Erosion				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency
Speed limits must be put in place to reduce erosion. • Reducing the dust generated by the listed activities above, especially the earth moving machinery, through wetting the soil surface and putting up signs to enforce speed limit as well as speed bumps built to force slow speeds; • Signs must be put up to enforce this.	Life of operation	Project manager, Environmental Officer	Water Runoff from road surfaces	Ongoing
Where possible, existing access routes and walking paths must be made use of.	Life of operation	Project manager, Environmental Officer	Routes used within the area	Ongoing
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events and strong winds.	Life of operation	Project manager, Environmental Officer	Re-establishment of indigenous vegetation	Progressively
A stormwater management plan must be compiled and implemented.	Life of operation	Project manager, Environmental Officer	Management plan	Before construction phase: Ongoing

14.14 Avifauna

A separate Avifaunal Assessment (contained in **Appendix E3**) was undertaken and the findings from this study are presented below.

14.14.1 Impact Description

Development of the PV plant within the project area and its associated infrastructure will invariably result in the loss of a significant area of avifaunal habitat. However, it must be noted that this habitat is of low to very low sensitivity as much of it has either been completely transformed by crop agriculture or otherwise altered by intense livestock grazing and past soil disturbances. Therefore, considering that the wetlands identified as highly sensitive for avifauna will be avoided (Assuming preferred Alternative 2) is only likely to have a Low residual effect on regional avifaunal assemblages as it does not host any breeding pairs of SCC. However, if loss or degradation of the highly sensitive wetland habitat as identified for avifauna occurs, particularly in the far north, then a High residual impact applies as it would impact upon potentially suitable habitat for a number of water-associated SCC (e.g. African Marsh Harrier) and affect large regionally to nationally significant congregations of roosting waterfowl and seed-eaters.

There remains, as ever, a collision and electrocution risk associated with the solar PV plant. This is likely to be highest in situations where infrastructure is placed closer to the floodplain (Alternative 1) because its rank wetland vegetation and open water bodies attracts high concentrations of waterfowl and roosting seed-eaters. However, this impact can be reduced to a Low significance by avoiding the floodplain habitat and its associated buffers both in terms of PV placement as well as associated above-ground electrical transmission lines (as has been done with Alternative 2). The above-ground electrical transmission infrastructure is not anticipated to cross the floodplain wetland but will instead travel a relatively short distance to the nearby substation (-27.049034°; 26.746572°), greatly reducing the potential for collision. This is a preferable situation as it avoids crossing busy local wetland flight paths (mainly small passerines). If, however, the developers needs to establish a powerline that crosses the floodplain this would represent a significant hazard to birds (High residual impact). If this is required then bird diverters must be installed at the crossing point and the powerlines should cross at a point which parallels existing powerline infrastructure or otherwise along the main access tar road. From an electrocution point of view, few, potentially occurring SCC or priority species are likely to occur in the project area that have a wingspan large enough (>1.5 m) to bridge gaps between live and earthed components or between phases of powerlines. However electrocution of birds within the substations/switching areas cannot be ruled out. Although this is unlikely to involve SCC.

No SCC nests were encountered within the project area. However, suitable breeding habitat for African Grass Owl and African Marsh Harrier was identified, particularly in the northern parts of the floodplain wetland (-27.027538°;26.726753°). Nesting habitat along the floodplain wetland decreases in suitability in a southerly direction for both species, particularly African Grass Owl as

the wetland and its surrounding hydromorphic grassland narrows. Alternative 1 would encroach on potential but suboptimal breeding habitat for African Marsh Harrier and would thus constitute a Medium residual impact significance. If, however, the preferred Alternative 2 is opted for risk of destroying nests or nesting habitat for these species is effectively eliminated.

Sensory disturbances to avifauna are inevitable, but are unlikely to negatively impact upon nesting SCC and is mainly likely to be restricted to the construction phase. Although dust, noise and human activity during construction is unavoidable, much can be done to reduce the effect of these sensory disturbance impacts on avifauna by adopting temporal avoidance strategies by simply avoiding or lowering the intensity of construction activities during spring and summer. During operation, the residual impacts associated with sensory disturbance should drop to a Low significance.

14.14.2 Impact Assessment

Table 33: Loss, degradation and fragmentation of sensitive avifaunal habitat (Clark & Husted, 2022)

Alternative 1		
Criteria	**Without mitigation**	**With mitigation**
Extent	High (4)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Alternative 2		
Criteria	**Without mitigation**	**With mitigation**
Extent	High (4)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Low (4)
Probability	Definite (5)	Improbable (2)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- Continue to use the sensitivity spatial layers provided by TBC to appropriately position all surface infrastructure so as to avoid sensitive avifaunal habitat.
- Avoid placing solar panels and associated infrastructure within the areas demarcated as being of High avifaunal sensitivity.

- Demarcate these areas on the ground during construction and sign post them as environmentally sensitive areas keep out.
- Ensure that the BESS and non-solar panel infrastructure occur in Low sensitivity portions of the project area.
- Rehabilitate all areas that may have been redundantly disturbed immediately after construction.
- Develop and implement an Alien and Invasive Plant Control Plan.

Table 34: Collision, electrocution and entrapment with PV infrastructure (Clark & Husted, 2022)

Alternative 1		
Criteria	**Without mitigation**	**With mitigation**
Extent	Moderate (3)	Moderate (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Highly probable (4)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Alternative 2		
Criteria	**Without mitigation**	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Moderate term (3)
Magnitude	High (8)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- Keep to current preferred infrastructure Alternative 2. Avoid spanning above-ground powerlines in the northern quarter of the project area. Here a network of good avifaunal wetland habitat occurs. Collision and electrocution risk is highest in this area and along the floodplain in the south-western corner of the project area. Bird activity is highest in these areas and should be avoided. This eventuality is unlikely given Alternative 2.
- Avoid spanning fences and above-ground powerlines within the buffer of the floodplain wetland or across the small dam (-27.057851°; 26.746390°). This eventuality is unlikely given Alternative 2.
- All power cables within the project area should be thoroughly insulated and preferably buried in demarcated corridors.
- Install Eskom-approved flappers or coils on new transmission lines (particularly the earth wire). This can help to increase the visibility of transmission lines especially the thinner earth line with

which most collisions tend to be associated. If there remains budget and scope for such interventions then they would be best placed on the portion of the line that crosses the road. Otherwise the existing lines which cross the wetland near the north-eastern corner of the project area would benefit greatly from the use of bird diverters such as these.

- White strips placed along the edges of the panels appear to help to increase visibility and deter birds based on work done by Horvath et al. (2010) and are recommended as far as practically feasible.
- Install bird deterrent devices around panels and on transmission line poles, pylons and / or monopoles to limit collision risk.
- The BESS must be covered in non-reflective surfaces and protected against thermal discharge and the risk of veld fires as a result.

Table 35: Direct loss of SCC nests or suitable nesting habitat (Clark & Husted, 2022)

Alternative 1		
Criteria	**Without mitigation**	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Permanent (5)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Alternative 2		
Criteria	**Without mitigation**	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Permanent (5)	Short term (2)
Magnitude	High (8)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- If African Grass Owl and African Marsh Harrier (or their nests) are found during construction halt construction activities and call an avifaunal specialist immediately for advice on the way forward.
- It should be noted, however, that neither of these species have been recorded during SABAP2 surveys in the pentad and no signs of their recent present were detected during the survey. Consequently the presence in the area is likely sporadic and of low abundance. Still the presence of these illusive birds cannot be ruled out.

- Avoid all areas of Very High and High avifaunal sensitivity.

Table 36: Sensory disturbance and extirpation of SCC or large roosting flocks (Clark & Husted, 2022)

Alternative 1		
Criteria	**Without mitigation**	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Alternative 2		
Criteria	**Without mitigation**	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Attempt as far as possible to conduct the majority of the high intensity construction activities during winter to minimize disturbance of avifauna during sensitive life stages such as lekking, courting, nesting and fledging).
- Keep lighting to a minimum and fit external lighting with downward facing hoods.
- Demarcate natural areas beyond the surface infrastructure footprint and restrict access of personnel into these areas through education and signposting.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.
- Schedule activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons (July-September).

14.15 Agricultural

The findings from the Agricultural Potential Impact Assessment (contained in **Appendix E4**) follow.

14.15.1 Impact Description

The impact assessment is done for a land use change from agriculture to PV generation. The total area assessed was 850,4 ha. Of this, 189 ha comprise the land where the infrastructure will be placed. The impact description will be only for the Footprint area.

High potential land is defined as follows: “Land best suited to, and capable of consistently producing acceptable levels of goods and services for a wide range of agricultural enterprises in a sustainable manner, taking into consideration expenditure of energy and economic resources. It includes Land Capability Classes ii and iii, which are applicable to the Project”.

There will be no loss of high potential land. No impact and no mitigation required.

- 121 ha of poor-quality grazing will be lost for the duration of the project. The impact is low. The present poor state of the veld can be rectified at the end of the project life.
- No farming infrastructure will be lost.
- It is estimated that less than one labourer is required to tend the livestock. If implemented he can easily be absorbed in the present farming activities or at the PV Site.

14.15.2 Impact Assessment

Table 37: Assessment of agricultural impacts (Gouws, 2022)

POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	Before mitigation								MITIGATION
	Extent	Probability	Reversibility	Irreplaceable	Duration	Magnitude	TOTAL (SP)	Significance	
LOSS OF HIGH POTENTIAL LAND									
Loss of land	0	0	0	0	0	0	0	L	There will be no loss of high potential land. No impact. No mitigation required.
LOSS OF GRAZING LAND									
Loss of grazing land	1	5	1	1	3	1	11	L	137 ha of poor quality grazing will be lost for the duration of the project. The impact is low. The present poor state of the veld can be rectified at the end of the project life.
LOSS OF AGRICULTURAL PRODUCTION									
Loss of crop production	0	0	0	0	0	0	0	L	Nine hectares cultivated land will be lost. At an average annual yield of 5t/ha and a gross\ margin of R9 500 per ha, then the loss of farming income from maize will be R85 500. The loss is temporary and will last for the duration of the project. No mitigation required.
Loss of animal production	1	5	1	1	3	1	11	L	The 137 ha that will be under PV can accommodate 14 LSU. The gross margin of livestock is R8 500/LSU. The loss in income is R119 000.
LOSS OF AGRICULTURAL INFRASTRUCTURE									
Direct loss	0	0	0	0	0	0	0	L	No farming infrastructure will be lost. No impact.
LOSS OF JOBS FROM FARMING									
Direct loss	1	5	1	1	3	1	11	L	It is estimated that approximately one labourer is required per 400 hectares of grazing land. At most, one labourer will be required.

14.16 Heritage Impact Assessment

The findings from the Heritage Impact Assessment (contained in **Appendix E5**) follow.

14.16.1 Impact Description

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

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 Altina project is located in an area with a very low presence of heritage sites and features.

- The cultural heritage profile of the larger region is very low. Most frequently found are stone artefacts, mostly dating 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. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016). In addition to the Stone Age profile, there is also the Iron Age element. However, this is located well outside the 30km radius, in the Vredefort Dome area and north of Klerksdorp. 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 the purpose of this review, heritage sites located in urban areas have been excluded.

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

For the project area, the impacts to heritage sites are expected to be of low significance. Impacts 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.

- The potential impact that the proposed development might have, has been calculated and is presented for each individual site in **Table 38** below (this also include the cumulative impact assessment).

14.16.2 Impact Assessment

Based on the outcome of the heritage survey, the two alternatives, i.e. Alternative 1 (original layout) vs. Alternative 2 (new layout) are rated as being of no preference and neither will impact on any known sites of cultural heritage significance.

Table 38: Impact Assessment (van Schalkwyk, 2022)

Altina Solar PV Project		
Impact assessment		
As no sites, features or objects of cultural heritage significance were identified on the project area, there would be no impact as a result of the proposed development		
	Without mitigation	With mitigation
Extent	Site (1)	Site (1)
Duration	Permanent (5)	Permanent (5)
Intensity	Minor (2)	Minor (2)
Probability	Very improbable (1)	Very improbable (1)
Significance	Low (8)	Low (8)
Status (positive or negative)	Neutral	Neutral
Reversibility	n/a	n/a
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	n/a	
Mitigation: None		
Cumulative impact: None		

Mitigation

For the current study, as no sites, features or objects of cultural heritage significance were identified in the project area, no mitigation measures are proposed, however the following will apply:

- Known sites should be clearly marked, so that they can be avoided during construction activities;
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities;
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer (ECO) shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the ECO will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the NHRA, Section 51(1).
- A person or entity, e.g. the ECO, should be tasked to take responsibility for the maintenance heritage sites.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

The following management measures are proposed:

Table 39: Construction Phase: Environmental Management Programme for the project (van Schalkwyk, 2022)

Action required	Protection of heritage sites, features and objects		
Potential Impact	The identified risk is damage or changes to resources that are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the Project Area.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer and the Contractor	During construction only

Table 40: Operational Phase: Environmental Management Programme for the project (van Schalkwyk, 2022)

Action required	Protection of heritage sites, features and objects		
Potential Impact	It is unlikely that the negative impacts identified for pre-mitigation will occur if the recommendations are followed.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Additional construction / development of required infrastructure, e.g. access roads, water pipelines, etc.	See discussion in Section 9.1 above	Environmental Control Officer	During construction only

14.17 Palaeontology

The findings from the Desktop Palaeontological Impact Assessment (contained in **Appendix E6**) follow.

14.17.1 Impact Description

Loss of fossil heritage will be a negative impact. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur and are regarded as having a medium probability. As fossil heritage will be destroyed the impact is irreversible. The significance of the impact occurring will be moderate

Both alternatives of the Altina PV Project are located in the development footprint. As such, these alternatives have the same impact as they have the same geology. From a Palaeontological view no alternative is more preferred above the other.

14.17.2 Impact Assessment

Table 41: Summary of impacts to possible palaeontological resources (Butler, 2022)

	Site	Probability	Duration	Magnitude	Reversibility	Irreplicable Loss	Cumulative Effect	Significance
Alternative 1	1	2	4	2	4	4	2	32
Alternative 2	1	2	4	2	4	4	2	32

14.18 Visual Impact Assessment

The findings from the Visual Impact Assessment (contained in **Appendix E7**) follow.

14.18.1 Impact Description

The impact on the surrounding farmers and land users will be more significant but can still be seen as MODERATE because of the short time the proposed activity will be undertaken. Although the construction activities will be highly visible, the time of exposure is short and thus the impact on the users will be low after mitigation measures have been implemented.

Visibility is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words “how much” of it can be seen. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total.

Potential permanent visual impact on the Viewpoints is expected to have a MODERATE impact before mitigation and MODERATE significance after mitigation, as indicated in the table below. The structures will be MODERATE visible from the Viewpoints, the time of exposure is permanent and thus the impact on the users will still remain MODERATE.

The modelling of visibility is merely conceptual. Being based on DEM and Land cover data, it does not take into account the real-world effect of buildings, trees etc. that could shield the structures from being visible or could have changed over time.

The viewshed analysis therefore signifies a worst-case scenario. The immediate landscape surrounding the observer has a determining influence on long distance views. It is expected that different land cover may offer some degree of visual screening, especially where tall trees occur around farmsteads. This influence was quantified using the land cover data, it must however be noted that this can change on a micro scale or land cover may have changed over time.

14.18.2 Impact Assessment

Table 42: Visual Impact Summary Table for Construction (Breitenbach, 2022)

Nature of impact: Potential visual impact on the viewpoints that had a visual exposure rating for the construction phase.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	2	2
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5 km to 50 km) (4); National (5)]	1	1
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	2	2
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	4	4
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	4	3
	Legal Issues [No legislation(1); Fully covered by legislation (5)]	1	1
	Detection [Immediately(1); Without much effort (2); Need some effort (3); Remote and difficult to observe (4); Covered (5)]	3	3
Consequence	Severity + Spatial Scale + Duration	5	5
Likelihood	Frequency of Activity + Frequency of impact + Legal issues + Detection	12	11
Risk	Consequence * Likelihood	**MODERATE (60)**	**LOW (55)**
Mitigation:	The visual impact can be minimized by not clearing the full surface below the solar PV module. Clear only the areas that is necessary.		
Cumulative Impact:	The construction of the proposed Altina Solar PV project with its associated infrastructure will increase the cumulative visual impact of Solar PV type infrastructure within the region. In context of the existing agriculture, mine, and town border, the construction phase of Altina Solar PV structures will contribute to a regional increase in heavy vehicles on the roads in the region, with construction activity noticeable.		

Table 43: Visual Impact Summary Table for Construction (Breitenbach, 2022)

Nature of impact: Potential visual impact on the viewpoints that had a visual exposure rating.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	2	2
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5 km to 50 km) (4); National (5)]	4	2
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	4	4
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	5	5
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	4	3
	Legal Issues [No legislation(1); Fully covered by legislation (5)]	1	1
	Detection [Immediately(1); Without much effort (2); Need some effort (3); Remote and difficult to observe (4); Covered (5)]	3	3
Consequence	Severity + Spatial Scale + Duration	10	8
Likelihood	Frequency of Activity + Frequency of impact + Legal issues + Detection	13	12
Risk	Consequence * Likelihood	MODERATE (130)	MODERATE (96)
Mitigation:	The visual impact can be reduced by revegetating the surface below the solar PV modules. Paint any supporting structures dark colours to match the Solar PV modules to reduce the contrast between the structures and solar PV modules.		
Cumulative Impact:	The construction of the proposed Altina Solar PV structures with its associated infrastructure will increase the cumulative visual impact of Solar PV type infrastructure within the region. In context of the existing agriculture, mine and town, the added structures will contribute to a slight regional increase in small vehicles on the roads.		

Mitigation

Mitigation measures can be considered in two categories:

- Primary measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered.
- Secondary measures designed to specifically address the remaining negative effects of the final development proposals.

Primary measures that will be implemented will mainly be measures that will minimise the visual impact by softening the visibility of the structures by “blending” with the surrounding areas. Such measures will include the following:

- Revegetate the surface below the solar PV modules.

- Paint any supporting structures the same dark colours as the solar PV modules to reduce the contrast.

Secondary measures will include final rehabilitation, after care and maintenance of the vegetation and to ensure that the final landform is maintained.

14.19 Air Quality

14.19.1 Impact Description

Sensitive receptors to dust and other air quality impacts in the study area include people residing in the surrounding rural areas, ecological features (fauna and flora) and agricultural features (livestock and crops).

The overall Project proposes the use of a renewable resource (solar), which is a cleaner form of energy generation than using fossil fuels, with associated environmental benefits.

Sources of air quality impacts associated with the Project may include:

- Construction phase –
  - Dust from the use of dirt roads by construction vehicles;
  - Dust from bare areas that have been cleared for construction purposes; and
  - Emissions from construction equipment and machinery.
- Operational phase –
  - Impacts to air quality caused by the operation and maintenance of the facility include dust from the use of dirt roads and tailpipe emissions from vehicles.

Mitigation measures are included in the EMPr to ensure that the air quality impacts during the construction phase are suitably managed. The EMPr also includes measures to control and minimize greenhouse gas emissions by optimising the utilisation of construction resources, as well as preventing fires related to construction activities.

During the operational phase of the PV Plant, local atmospheric pollution may reduce the irradiation received or contain airborne corrosive substances. The efficiency of the solar plant can be reduced if the modules are soiled (covered) by particulates/dust.

14.19.2 Impact Assessment

Environmental Feature	**Air Quality**
Relevant Alternatives & Activities	**Construction domain of development footprint**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**

• Excessive dust levels as a result of construction activities • Emissions from construction equipment and machinery	• Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable, particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area and access roads. Note that all dust suppression requirements should be based on the results from the dust monitoring and the proximity of sensitive receptors. • Speed limits to be strictly adhered to. • Incremental site clearance to prevent significant wind erosion of large bare surfaces. • Air quality to be monitored (baseline and during construction) for dust fallout. Sampling locations to consider major sources of dust and sensitive receptors. • Reinstate and rehabilitate disturbed areas within development footprint. • All vehicles and machinery used at the site are to be in good working condition and fitted with appropriate emission controls • Plant to be operated efficiently and turned off when not in use.

Alternative 1	**+/- Impacts**	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	short-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1

Environmental Feature	**Air Quality**
Relevant Alternatives & Activities	**Operation of the Solar PV Plant**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Influence of air quality and soiling on operational efficiency of Solar PV Plant	• An appropriate maintenance and cleaning plan is to be developed for the PV panels.

Alternative 1	**+/- Impacts**	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	long-term	likely	2
After Mitigation	-	local	low	long-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	long-term	likely	2
After Mitigation	-	local	low	long-term	unlikely	1

14.20 Noise

14.20.1 Impact Description

Sensitive receptors to noise impacts in the study area include people residing in the surrounding rural areas, as well as ecological receptors (fauna).

During construction, localised increases in noise will be caused by earthworks, establishment and operating of site construction laydown area, construction of proposed infrastructure, transportation of construction workers and material, activities at the construction camp, and general construction noise.

Solar PV facilities produce electricity during the daytime hours, when the sun's rays are collected by the panels. When there is little to no irradiance, noise emitted by the equipment is significantly reduced. The main sources of noise from the Project will be the rack mounted inverters and the central step-up transformer, which are only expected to be audible to operational staff who will come in close proximity to these components. Other sources of noise include operation and maintenance vehicles and activities.

During the operational phase, power lines produce an audible sound or buzz because they are producing something called a corona discharge that is interacting with the surrounding air. The corona discharge is a side-effect of the electric field the power line generates by carrying electricity. The discharge can be greater, and the buzzing louder if there is increased moisture or pollutants in the air. Under normal conditions, corona-generated noise is not audible. The noise may be audible under certain wet conditions. Conductors are selected based on factors such as audible noise, corona, and electromagnetic field mitigation. In addition, corona rings can be fitted if deemed necessary. Corona is not associated with any adverse health effects in humans or livestock.

Noise that emanates from construction and operational activities are addressed through targeted best practices in the EMPr. The associated regulated standards need to be adhered to.

Project personnel working on the construction site will experience the greatest potential exposure to the highest levels of noise and vibration. Workplace noise and vibration issues will be managed as part of the Occupational Health and Safety Management System to be employed on site, which will include specific measures aimed at preventing hearing loss and other deleterious health impacts.

14.20.2 Impact Assessment

Environmental Feature	Noise
Relevant Alternatives & Activities	Construction domain of development footprint
Project life-cycle	Construction phase

Potential Aspects & Impacts	Proposed Management Objectives / Mitigation Measures
• Noise as a result of construction activities	• The provisions of SANS 10103:2008 will apply to all areas within audible distance of residents. • Construction work should take place during working hours – defined as 07h00 to 17h00 on weekdays and 07h00 to 14h00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place. • Construction activities generating output levels of 85 dB or more will be confined to normal working hours. • Noise preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to be employed.

Alternative 1	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	Almost certain	2
After Mitigation	-	local	low	short-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	Almost certain	2
After Mitigation	-	local	low	short-term	unlikely	1

14.21 Hazardous Substances & Waste

14.21.1 Impact Description

Improper management of hazardous substances and waste may pollute the biophysical environment (air, water and soil), and pose risks to humans, flora and fauna. It may also cause visual impacts.

Hazardous substances to be stored and used during the construction and operational phases of the Project include oil, fuel, solvents and pesticides (amongst others).

General construction waste will comprise of surplus or off-specification materials (e.g. concrete, wooden pallets, packaging paper or plastic, wood, metals, etc.) and construction debris. Domestic waste will include food waste, plastic, glass, aluminum cans and waste paper. A small proportion of the waste generated during construction phase will be hazardous and may include used oil, hydraulic fluids, waste fuel, grease and waste oil containing rags. Wastewater, including water adversely affected in quality through construction-related activities and human influence, will include sewage, water used for washing purposes (e.g. equipment, staff) and drainage over contaminated areas (e.g. workshop, equipment storage areas).

Waste types likely to be generated during routine operation and maintenance activities include dielectric fluids, clearing agents, oils, solvents, wastewater, defunct / damaged PV cells and domestic waste.

Provision is made in the EMPr to manage impacts associated with hazardous substances and waste.

14.21.2 Impact Assessment

Environmental Feature	**Hazardous Substances & Waste**
Relevant Alternatives & Activities	**Storage and use of hazardous substances & generation of waste**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Environmental pollution caused by improper management of hazardous substances and waste	• Hazardous substances shall be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), Occupational Health and Safety Act (No. 85 of 1993), relevant associated Regulations and applicable SANS and international standards. • Prevent environmental contamination from insulating oils used in the substations' transformers. • Drip trays should be placed under construction vehicles and machinery to collect ad hoc leaks. Machinery and vehicles should be serviced and in good working condition to prevent leaks. • Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination and will adhere to the requirements stipulated on the Material Safety Data Sheets. • In the event of spillages of hazardous substances the appropriate clean up and disposal measures shall be implemented. • Waste to be disposed of at a licenced waste disposal facility. • Water used for cleaning of PV panels will not contain any harmful chemicals or additives. • Wastewater to be properly disposed of Contaminated water will not be discharged to the environment. • Used PV panels are to be removed by the suppliers and suitably disposed of or recycled.

Alternative 1	**+/- Impacts**	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium-high	long-term	likely	3
After Mitigation	-	local	low	long-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium-high	long-term	likely	3
After Mitigation	-	local	low	long-term	unlikely	1

14.22 Traffic

14.22.1 Impact Description

One of the factors considered in determining the suitability of the Project sites was its accessibility in terms of the existing road network.

Potential impacts during the construction phase include the following:

- Transportation of materials and construction personnel to site.
- Impacts to road conditions.
- Speeding and reckless driving by construction personnel.
- Construction vehicles accessing and leaving the site via the N6 national road.
- Use of oversized vehicles/abnormal loads, as required.

Potential impacts during the operational phase include the following

- Safe access, taking into consideration the high speed environment along the N6.
- Transportation of maintenance materials, and operational and maintenance staff, to site.

Provision is made in the EMPr to manage impacts associated with traffic.

14.22.2 Impact Assessment

Environmental Feature	**Traffic and Access**
Relevant Alternatives & Activities	**All construction activities that may affect existing road networks**
Project life-cycle	**Construction**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Disruptions to existing road users. • Safety risks. • Crossing of main roads during construction. • Increase in dust levels. • Use of road network by construction vehicles.	• Clearly demarcate all construction access roads. • Proper access control is to be maintained to prevent livestock from accessing construction areas, as well as for any other unauthorised access. • Strict adherence to speed limits by construction vehicles on public roads and access roads. Appropriate speed limits need to be posted on all access roads according to the geometric design and limitations of heavy vehicles. • Ensure adequate maintenance of construction vehicles. • When construction vehicles are required to cross national, provincial and district roads (as relevant) appropriate safety and traffic calming measures need to be in place. This will include flag men, speed reductions and warning signage. • Implement measures to manage dust caused by site traffic on unpaved roads.

Alternative 1	**+/- Impacts**	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	short-term	moderate	2
After Mitigation	-	local	low	short-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	moderate	2
After Mitigation	-	local	low	short-term	unlikely	1

14.23 Existing Structures and Infrastructure

14.23.1 Impact Description

Potential impacts of the Project to existing structures and infrastructure include:

- Disruptions to services or damage caused as a result of construction activities;
- Disruptions to traffic on roads to be used by construction vehicles (see **Section 14.22** above);
- Construction-related disturbances (e.g. noise, dust).

A detailed survey will be conducted to identify all physical features that are located within the final project footprint. Optimisation of the layout during the design phase will seek to avoid existing service infrastructure, where possible. Where avoidance is not possible, suitable compensation measures need to be established, and wayleave applications undertaken, as necessary.

14.23.2 Impact Assessment

Environmental Feature	**Existing Structures and Infrastructure**
Relevant Alternatives & Activities	**All activities that affect existing structures and infrastructure**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Disruption of existing services • Damage to existing structures and infrastructure	• Identify and record existing services and infrastructure. • Conform to requirements of relevant service providers and infrastructure custodians (e.g. Eskom. Transnet, Telkom, etc.). • Ensure access to infrastructure is available to service providers at all times. • Immediately notify service providers of disturbance to services. Rectify disturbance to services, in consultation with service providers. Maintain a record of all disturbances and remedial actions on site. • Adequate reinstatement and rehabilitation of affected environment.

Alternative 1	**+/- Impacts**	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	short-term	moderate	2
After Mitigation	-	local	low	short-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	moderate	2
After Mitigation	-	local	low	short-term	unlikely	1

14.24 Health and Safety

14.24.1 Impact Description

Construction Phase

Health and safety related risks associated with the Project during the construction phase include the following:

- Hazards related to construction work;
- Increased levels of dust and particulate matter, as well as noise;
- Water (surface and ground) contamination;
- Poor water and sanitation services to construction workers;
- Communicable diseases; and
- Safety and security to the local community.

These risks are addressed through mitigation measures identified under other environmental features, such as socio-economic environment, surface water, air quality, noise, as well as best practices included in the EMPr. Additional management requirements will be included in the Project's Occupational Health and Safety system.

Operational phase

An Electromagnetic field (EMF) is produced whenever electricity is used. For a transmission line, the strength of the electric field varies generally with the operating voltage of the line (measured in volts) while the magnetic field strength is related to the current flowing in the line (measured in amps) (Parsons Brinckerhoff, 2013). EMF strengths dependent on *inter alia* the height of the electrical wires above the ground and their geometric arrangements, which are supported by the transmission structures.

Even though the EMF inside a substation is high (but less than occupational limits), the fields outside the substation decrease with distance, as is the case with power lines (Wolhuter & Holtzhausen, 2015). It is documented in literature that EMF levels reduce rapidly with distance from the source. The proposed substation at the PV Plant, which contains high voltage transformers, will be enclosed by security fencing to prevent unauthorised access and the exposure to high voltage electricity. This will also provide safe distance between electrical equipment and the general public.

Other health and safety related associated with the Project during the operational phase include the following:

- Leaching of materials from broken or fire damaged PV modules;
- Injuries to workers from operation and maintenance activities (vehicle accidents, replacement of components/parts, etc.);
- Emergency fire hazards; and
- Electrocution of workers.

14.24.2 Impact Assessment

Environmental Feature	Health and Safety
Relevant Alternatives & Activities	**Construction activities**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Health and safety risks during construction	• Dedicated Occupational Health and Safety system to be implemented by the Contractor. • Undertake a hazard identification and risk assessment and identify preventive and protective measures. • Conduct basic safety awareness training with construction workers. • Provide all workers with the necessary Personal Protective Equipment (PPE). • Prevent environmental contamination. • Provide potable water and sanitation services to workers. • All workers shall be clearly identifiable and to remain within construction domain during working hours. • Prepare an Emergency Response Plan. • Ensure adequate control of communicable diseases. • Maintain access control to construction domain.

Alternative 1	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	short-term to permanent	likely	3
After Mitigation	-	local	low	short-term	unlikely	1
Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	short-term to permanent	likely	3
After Mitigation	-	local	low	short-term	unlikely	1

Environmental Feature	Health and Safety
Relevant Alternatives & Activities	**Operation and maintenance activities**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Health and safety risks posed by operation and maintenance activities	• Dedicated Occupational Health and Safety system to be implemented by the Operator of the PV Plant. • Conduct basic safety awareness training with all operational staff. • Temporary Contractors to adhere to Occupational Health and Safety requirements. • Provide potable water and sanitation services to operational staff. • Prepare an Emergency Response Plan. • Maintain servitude. • Ensure EMF remain less that occupational limits within substation. • Control access to the substation.

Alternative 1	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	long-term	likely	3
After Mitigation	-	local	low	long-term	unlikely	1

Alternative 2	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	long-term	likely	3
After Mitigation	-	local	low	long-term	unlikely	1

14.25 Socio-Economic Environment

The findings from the Social Impact Assessment (contained in **Appendix E8**) follow.

14.25.1 Impact Description

A well-designed, well implemented, well managed solar park can bring significant social benefits to the communities that it serves. If configured or operated in a way that ignores significant social needs or potential impacts, the proposed project may have significant social costs or liabilities for the stakeholders and affected communities.

Table 44: Activities, aspects & impacts of the Project (Chidley & Tanhuke, 2022)

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Land and Servitude Rights Acquisition			Loss of agricultural production
	Land Acquisition		Loss of land (including
			through project infrastructure
	Servitude Rights		Some restrictions on use of productive land
Scheme Operations	Electricity generation	Economic growth and induced impacts.	
	Presence of operational solar park adjacent to active farming activities	Additive to the local economy	
		Increased economic activity	Increased traffic
			Competition for support resources such as housing by solar park staff
		New skills brought into the area	
	Supply of goods and services to the project	Opportunity for local business	
		Opportunity for local labour force	
	Administration and Technical Input	Employment of staff locally	
		Skills development	
	Access into properties		Security Concerns

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Constructio nPhase	Solar Park Construction – piling, frame erection and solar panel mounting, electrical installation and rehabilitation	Employment of people locally	
		Sourcing of equipment, machinery and services locally	
			Noise
			Dust
		Employment of local people	
			Influx of people seeking employment and associated impacts (e.g. cultural conflicts, squatting, demographic changes, anti-social behaviour, and incidence of HIV/AIDS)
		Sourcing of equipment, machinery and services locally	
	Transport of goods to site and employment of staff		Increased traffic
	Transmission Line – limited in scope owing to its short length		Noise
		Employment of people locally	
			Security concerns when contractor's access private property
		Sourcing of equipment, machinery and services locally	

14.25.2 Impact Assessment

Environmental Feature	Institutional, Legal, Political and Equity
Project life-cycle	All Phases
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Attitude formation towards project	• Promptly deal with any raised expectations amongst communities regarding perceived benefits associated with the project, through a process of communication and consultation.
	• Promptly address any concerns raised by the public in a transparent manner.
	• Where necessary always provide prompt and clear feedback to communities.
	• Include all relevant community members in decisions affecting them.
Compliance with municipal by-laws	• Ensure that all municipal by-laws are complied with.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Short term	High	2

After Mitigation	Negative	Site	Low	Short term	High	1
Significance of Impact and Preferred Alternatives	The impact on project progress could be significant if grievances are not addressed. This can be effectively mitigated through the establishment of a grievance procedure and adherence to local by-laws. The impact has no impact on project alternatives.					

Environmental Feature	Gender Relations
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Cultural resistance towards women	• Sensitise staff in respect of gender sensitive issues that are pertinent to the workplace.
Division of labour	• Ensure gender inclusivity and equity with respect to all compensation. • Prioritise gender inclusivity and equity in access to resources, goods, services and decision making with the aim of empowering women. • Promote equal job opportunities for women and men during the construction and operational processes. • Prioritise and articulate gender inclusivity and equity in the project documents by including specific strategies and guidelines for implementation. • The project documents should also include clear mechanisms through which the actual implementation of the activities and the impact on the ground can be monitored and evaluated. • Develop a grievance procedure to specifically address gender matters. • Factors such as culture should be considered when planning for gender activities since they play a great role in influencing gender relations.

	Nature	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	Negative	Site	Moderate	Short term	High	2
After Mitigation	Negative	Site	Low	Short term	High	1
Significance of Impact and Preferred Alternatives	The impact on project equity promotion would be moderate if this impact were not addressed. This can be effectively mitigated through policy and implementation of policy. The impact has no impact on alternative route selection.					

Environmental Feature	Economic opportunities arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
SMME Participation	• Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.
Job Creation and Skills Development	• The main contractor should employ non-core labour from the regional study area as far as possible during the construction phase.
Indirect Employment Impacts	• Spaza/informal trader shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the Moqhaka Local Municipality's By-law Relating to Streets are complied with.

	Nature	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**

Environmental Feature		Economic opportunities arising from the construction phase				
Project life-cycle		Construction phase				
Potential Impact		**Proposed Management Objectives / Mitigation Measures**				
Before Mitigation	Positive	Regional	Medium	Short Term	Likely	1
After Mitigation	Positive	Regional	Large	Short Term	Likely	3
Significance of Impact and Preferred Alternatives	Individuals who will benefit during the construction are limited to those who actively participate in the construction activity through employment, sub-contracting or other economic opportunities. Active participation should be encouraged. The benefits on such a construction will take place irrespective of which routing alternative is preferred.					

Environmental Feature	Disturbance arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Increase in Dust	• Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms. • Adherence to road signage can be added as an advantage and a measure to manage the increase in dust levels. • Mitigation measures management should be adhered to according to the relevant specialist studies.
Influx of workers	• All employment of locally sourced labour should be controlled on a contractual basis. If possible, and if the relevant Ward Councillors deem it necessary, the employment process should include the affected Ward Councillors. • People in search of work may move into the area, however, the project will create a limited number of job opportunities. Locally based people should be given opportunities and preferences over others. • No staff accommodation should be allowed on site. • Influx of workers could may lead to increased diseases and HIV/AIDSs & STI as well as STD infections, therefore awareness programmes should be implemented through the local educational institutions and for the workers as well.
Worker Health and Safety	• The provisions of the OHS Act 85 of 1993 and the Construction Regulations of 2014 should be implemented on all sites; • Account should be taken of the safety impacts on the local community when carrying out the longitudinal aspects of the project, such as the pipelines. • Contractors should establish HIV/AIDS awareness programmes at their site camps. • The site should have a COVID-19 risk assessment, policy and plan. The COVID protocols recommended by this process, and those stipulated as the legal minimum should be enforced on site • Gender sensitive workplace practises should be planned for and adopted on site. Employment practises should be demonstrated free of coercion or harassment.
Security	• The camp site for the project and the longitudinal construction sub-site laydown areas should be fenced for the duration of construction. • All contractors' staff should be easily identifiable through their respective uniforms.

Environmental Feature	Disturbance arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
	• A project policy on management of workers should be developed. This would include education and awareness to be conducted with regards crime, trespassing, and not gathering outside the site could be conducted. • Only security staff should be allowed to reside at contractor camps and no other employees.
Noise impacts	• Prior notice should be given to surrounding communities of noisy event such as blasting. • Construction work should take place during working hours – defined as 07h00 to 17h00 on weekdays and 07h00 to 14h00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place.
Damage to property	• If a risk existing of damage taking place on a property as a result of construction, a condition survey should be undertaken prior to construction; • The contractor is to make good and acknowledge any damage that occurs on any property as a result of construction work; • Where crops and agricultural machinery are damaged, compensation is to be paid to the farmer for the proven loss of these crops; • The farmer should be compensated for any loss of income experienced at the account of the contractor.

	Nature	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	Negative	Local	Medium	Short Term	Likely	2
After Mitigation	Negative	Local	Low	Short Term	Moderate	1
Significance of Impact and Preferred Alternatives	Disturbances and irritation during construction is to be expected. These can then be successfully mitigated through contractor specifications that are issued at a tender stage and through the continuous monitoring of contractor proceedings and performance during construction phase. Negative impacts owing to the construction will unfortunately be experienced irrespective of the alternatives.					

Environmental Feature	Economic Impacts (positive)
Project life-cycle	Operational Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Economic	• The solar park will stimulate the local economy through the provision of jobs and through local procurement • It will contribute to the improvement of the national electricity supply at a price that has been set by a competitive bidding process
Local Procurement	• Local SMMEs should be given an opportunity to participate in the operation of the project through the supply of services, material or equipment.
	• A procurement policy promoting the use of local business where possible, should be put in place and applied throughout the operational phases of the project.
Job Creation and Skills Development	• Women should be given equal employment opportunities and encouraged to apply for positions.

	• A skills transfer plan should be put in place at an early stage and workers should be given the opportunity to develop skills whilst in employment.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	High	Long Term	Likely	3
After Mitigation	Positive	Regional	High	Long Term	Likely	3
Significance of Impact and Preferred Alternatives	The solar park in the regional study area will provide economic stimulus to the regional study area for the long-term. The solar park should adopt policies that are supportive of local procurement and support for local enterprises.					

14.26 "No-Go" Impacts

The "no-go option" is the alternative of not implementing the activity. The "no-go option" also provides the baseline against which the impacts of other alternatives are compared.

The "no go option" needs to be considered in view of the motivation (see **Section 3** above) as well as the need and desirability of the Project (see **Section 7** above). A key consideration in this regard includes:

- South Africa has identified the need to supply a diversified power generation that includes renewable energy technologies, such as proposed by the Project. This is in light of the country's endeavour and commitment to reduce the carbon footprint created by the current heavy reliance on coal to produce electricity. In this regard, the Applicant intends to bid for the current REIPPPP Bid Windows, launched by the DMRE.

In contrast, should the proposed Project not go ahead, any potentially significant environmental issues associated with the Project would be irrelevant and the status quo of the local receiving environment would not be affected by the Project-related activities. The prerogative will lie with the landowner to determine an alternative future desired use of the land. The objectives of the Project would, however, not be met. This will *inter alia* mean that the Project's intended benefits will not materialise. The "no go option" is thus not preferred.

14.27 Cumulative Impacts

14.27.1 Introduction

A cumulative impact, 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.

14.27.2 Other Renewable Energy Projects in Proximity to the Proposed PV Sites

Cumulative impacts can be identified by combining the potential environmental implications of the Project with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the Project area.

Other renewable energy applications in relation to the Project are discussed in **Section 6.6** above. According to the REEA Database, renewable energy applications have been made for properties that are located approximately 15km to the south-west; 7km to the north-west; 10km to the north-west; 18km to the north-east; and approximately 20km to the north-east of the Project's PV site. To note is that lapsed and withdrawn applications have been excluded from the above list.

From a desktop scan it can be seen that these other renewable energy project sites are similar in nature to the proposed PV site. Cumulative impacts may be caused by these various developments, including loss of biodiversity and habitat fragmentation, visual and landscape character impacts, noise, reduction in air quality, traffic disruptions, impacts to water resources, as well as pressures on local facilities, goods and services. The aforementioned impacts in relation to the Project have been assessed individually in **Section 14.9** to **Section 14.25** above and mitigation measures have been developed for each of the impact areas.

The Terrestrial Ecological Impact Assessment (Husted, 2022) notes the following:

- Long-term cumulative impacts due to extensive solar farm footprint, powerlines and substations can lead to the loss of endemic species and threatened species, loss of habitat and vegetation types and even degradation of well conserved areas, this however needs to be quantified by monitoring. The PV panels and associated infrastructure are expected to have a moderate cumulative impact when considering the project in isolation, while the cumulative impacts associated with the proposed project as well as other project in the area are considered to be moderately high due to several existing and planned applications for renewable developments in the vicinity of the project area. Cumulatively these developments will be responsible for the destruction of a large portion of grasslands in the area.
- From the table below it can be seen that in isolation the proposed project will contribute to a loss of approximately 0.35% of the vegetation type, while collectively with other solar projects in the area approximately 2.92% of the vegetation type will be lost.

Vegetation Type	Proposed project area in isolation	Collective approved solar projects in area (REEA, 2021)
245493 ha	871 ha	7173 ha
% Contribution	0,35%	2,92%

Note: According to Mucina and Rutherford (2006) more than 63% of the vegetation type has been transformed for cultivation (ploughed for commercial crops) and the rest is under strong grazing pressure from cattle and sheep.

An assessment of the cumulative impacts of the project on biodiversity is shown in **Table 45** below.

Table 45: Assessment of the cumulative impacts to biodiversity associated with the proposed project (Husted, 2022)

Impact	Overall impact of the proposed project considered in isolation						Cumulative impact of the project and other projects in the area					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Contribution to cumulative habitat loss, especially in the ecological corridors such as the wetland which will also have an impact on the water resource and ecological processes in the region	3	3	3	3	3		4	4	4	4	3	
	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**	Life of operation or less than 20 years: Long Term	Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderately High**

In terms of the Avifauna Impact Assessment (Clark & Husted, 2022), the following is noted:

Many solar developments are planned for the Free State. At least eight other renewable solar development farm parcels applications occur within a 30 km radius of the project area. This project has the potential to add to the cumulative loss of wetland habitat for African Grass Owl and African Marsh Harrier (under infrastructure Alternative 1). This impact is, however, likely to be minimised (under Alternative 2) by avoiding all areas identified as being of wetlands of High avifaunal sensitivity. This impact is considered to have a Low residual impact, on the premise that African Marsh Harrier and African Grass Owl have not been recorded in the pentad nor were they recorded during the survey (nor signs thereof) suggesting low prevalence or even localised extirpation in the area. Habitat is, however, ideal for breeding for both species and their presence should not be completely ruled out.

Table 46: Cumulative effect on regional birdlife (Clark & Husted, 2022)

Alternative 1		
Criteria	**Without mitigation**	**With mitigation**
Extent	Low (2)	Very low (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Alternative 2		
Criteria	**Without mitigation**	**With mitigation**
Extent	Low (2)	Very low (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Avoid all areas rated as High avifaunal sensitivity
- Minimise above-ground electrical infrastructure and avoid transmission line crossing of the large floodplain.
- Rehabilitate all non-developed areas.
- Rehabilitated following decommissioning to re-instate moist grassland.

14.27.3 The Proposed Project's contribution towards Cumulative Impacts

The following is noted in terms of the Project's contribution towards cumulative impacts:

- The construction period may cause traffic-related impacts in terms of the local road network, which will be associated with heavy vehicle construction traffic for the delivery of material, transportation of construction workers and general construction-related traffic. This may compound traffic impacts if other large scale projects are planned during the same period. The EMPr includes mitigation measures to manage traffic-related impacts.
- The clearance of vegetative cover for the Project's development footprint will exacerbate erosion, loss of biodiversity, and impact on the functioning of wetlands. Mitigation measures to control erosion are included in the EMPr.
- There will be an increase in the dust levels during the construction phase, as a result of earthworks, use of haul roads and other gravel roads, stockpiles, vegetation removal, etc. Measures to manage dust are included in the EMPr.
- Any developments that may be enabled by the proposed Project may place a strain on the infrastructure of Orkney. The future growth of the town and interventions to ensure that the infrastructure can cater for this growth forms part of municipal planning.
- Changes in demographics in the region due to the influx of employment seekers may cause problems such as crime, STDs, conflicts with local communities, etc. This was assessed as part of the Social Impact Assessment and mitigation measures are included in the EMPr.
- Cumulative effects in terms of the electromagnetic fields may occur as a result of aligning the proposed Project's power lines alongside existing high-voltage power lines. Although it is anticipated that the electromagnetic fields are mainly associated with localised influences within the servitude width, the cumulative impact is not quantified within this report.
- There is a potential for positive cumulative economic effects from the construction of multiple developments in the area. The increased creation of jobs and economic input into local businesses would provide a benefit to local communities.

15 ANALYSIS OF ALTERNATIVES

15.1 Introduction

Alternatives are the different ways in which the Project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for a project.

The sub-sections to follow discuss the Project's alternatives considered during the Basic Assessment. By conducting the comparative analysis, the BPEO can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "*provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term*".

The 'no-go' option and two layout alternatives assessed are discussed further below.

15.2 "No-Go" Option

The implications of the "no-go" option are discussed in **Section 14.26** above.

The "no go option" is not preferred, as the objectives of the Project will not be met, and the associated benefits will not materialise. Although not proceeding with the Project would avoid the adverse environmental impacts, these impacts are considered to be manageable through the measures contained in the BAR and EMPr.

15.3 Layout Alternatives

The space available at the PV Site was adequate to position the facility and its associated infrastructure to avoid areas of sensitive environmental features as far as possible, based on the findings of the specialist studies. The extent of the site allowed for the identification of layout alternatives to manage impacts to environmental sensitivity.

15.3.1 Technical considerations

The following information was provided by the Applicant to describe the reason for revising the layout and some advantages associated with the revised, preferred layout (revised Alternative 2).

Initially, a portion of the plant was located across the non-perennial feature that traverses the Project area. After reviewing the basic engineering designs and technical layout and in line with global best practices, the Applicant had re-located a portion of the PV plant to across the

1:100 floodline so that the affected small PV portion seamlessly integrated with the bigger PV portion.
In addition, the applicant had avoided costly engineering designs and hydrological studies which would have increased the CAPEX of the Project.

The location of the BESS: BESS power plants can either be charged by the electrical grid or by the solar PV power plant via the on-site substation. By locating the BESS adjacent to the on-site substation, the Applicant had adhered to global best practices. In addition, the Applicant had avoided lengthy cabling to the substation which would have increased the CAPEX of the plant.

15.3.2 Environmental Sensitivity considerations

After specialist studies were undertaken, environmental sensitivities were highlighted, and an alternative site layout (Alternative 2) was selected for inclusion in the assessment. The environmental sensitivities of each alternative site are outlined below:

- Biophysical –
  - Both Alternative 1 and 2 fall over seep wetlands (of high, moderate and low sensitivity);
  - The revised Alternative 2 layout further reduces the impacts to the seep wetlands through the relocation of the hardstanding infrastructure to low wetland sensitive areas.
  - Alternative 1 encroaches upon and crosses a floodplain wetland of very high sensitivity, while Alternative 2 is sited to avoid the floodplain wetland and delineated wetland buffer.
  - Alternative 1 overlaps with a CBA1, and while Alternative 2 overlaps with the same CBA1, less of the CBA1 is impacted on when compared to Alternative 1;
  - One LC-Sched 6 Protected plant species (*Aloe greatheadii*) was identified to occur in the Project area during the field assessment survey;
  - Both Alternatives overlap with an Endangered Ecosystem, which has been degraded.
- Paleontological –
  - The proposed development is underlain by Quaternary superficial deposits., which has a desktop sensitivity of moderate on the PalaeoMap of SAHRIS. These superficial sediments mantle sediments of the Ecca and Transvaal Supergroup at depth. These underlaying sediments will not be impacted on by the development as the structures of the Altina PV Project will not penetrate that deep.
  - As both alternatives have the same geology, the impact of the proposed Altina PV Project on fossil heritage of the area, will be the same. From a Palaeontological view no alternative is more preferred above the other. A Moderate Palaeontological Significance has been allocated to the development footprint. It was concluded in the Palaeontological Impact Assessment that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.
- Heritage –
  - During the Heritage Impact Assessment survey, no sites, features or objects of cultural significance were identified.

- Visual –
  - When comparing the two alternatives from a visual impact perspective alternative 1 is predicted to have the least impact on the receiving environment. The amount of receptors predicted to be impacted are 33 for alternative 1 compared to 34 for alternative 2. The average rating for all the predicted receptors are also higher for alternative 2. The predicted maximum rating for all the receptors are also higher in alternative 2.
  - From a visual impact perspective Alternative 1 is predicted to have the least impact on the receiving environment.

15.4 BPEO

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, the following alternative was identified as the BPEO:

- Alternative 2 (revised layout).

The BPEO also includes the revised layout, which avoids the sensitive areas identified through the specialist studies as far as possible. Only the Visual Impact Assessment specialist concluded that Alternative 1 would be preferred over Alternative 2. This was based on the comparison of the visibility ratings generated through the analysis undertaken. However, although the maximum visual rating for Alternative 2 greatly exceeds that of Alternative 1, this represents one sensitive receptor. Based on the average values of the visibility ratings between Alternative 1 (1.2, n=33) and Alternative 2 (1.5, n=34) very little difference is demonstrated. It can therefore be argued that the difference may be insignificant over the broader sensitive receptors. In addition, given that for the remaining environmental features Alternative 2 was preferred, the opinion of the EAP is that Alternative 2 remains the BPEO.

The BPEO provides a balance between technological, energy and environmental aspects, while retaining the flexibility required in the final design stage of the Project.

16 PUBLIC PARTICIPATION

16.1 General

The purpose of public participation includes the following:

1. To provide I&APs with an opportunity to obtain information about the Project;
2. To allow I&APs to express their views, issues and concerns with regard to the Project;
3. To grant I&APs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the Project; and
4. To enable the Applicant to incorporate the needs, concerns and recommendations of I&APs into the Project, where feasible.

The public participation process for the proposed Project is governed by NEMA and GN No. R 982 of 4 December 2014 (as amended). **Figure 63** below outlines the public participation process for the Basic Assessment undertaken thus far, which illustrates the notifications that were undertaken for the project. During the draft BAR review phase (**16 September 2022** – **17 October 2022**), IAPs and Authorities were invited to indicate their interest in attending a public meeting. A public meeting was held to present the draft BAR and provide a platform for project related discussions on the 10 October 2022. Proof of consultation is provided in **Appendix G**.

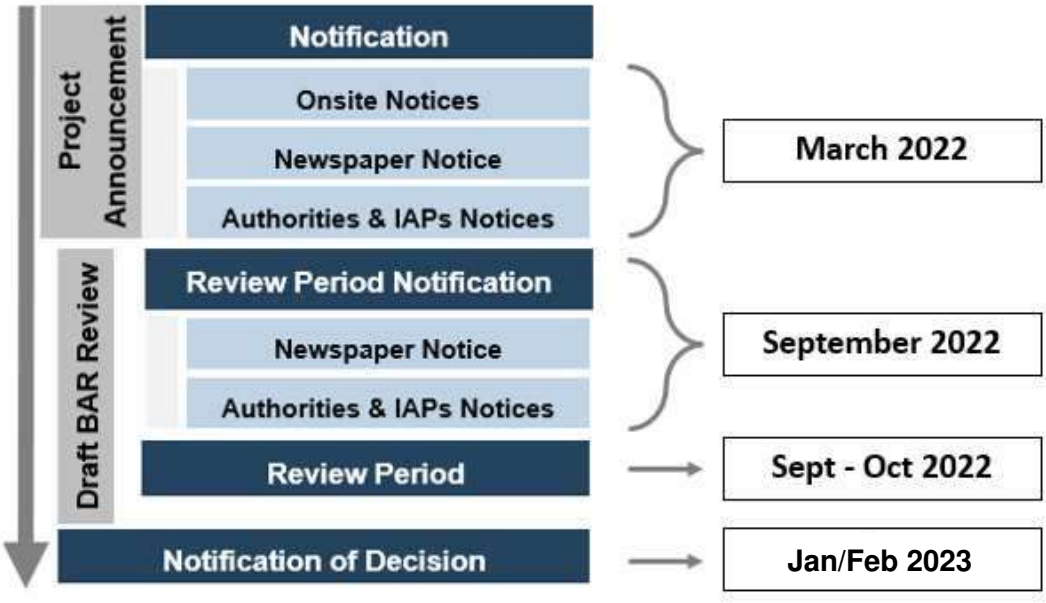

Figure 63: Outline of Public Participation Process undertaken

Comments on the Draft BAR can be submitted in writing to Nemai Consulting by the **17 October 2022**.

Given that new information has been included in the BAR in the form of an amended Alternative 2 layout, and the appended draft Rehabilitation Strategy, a second public review will be undertaken from **04 November to 05 December 2022**.

16.2 Adherence to the National State of Disaster declared for the COVID-19 Pandemic

The Minister of Environment, Forestry and Fisheries published the Directions regarding measures to address, prevent and combat the spread of COVID-19 relating to National Environmental Management Permits and Licences in GN No. 650 of 5 June 2020.

Although now no longer a requirement, a Public Participation Plan for the Basic Assessment for the proposed Project was compiled in terms of the abovementioned Directions, which was submitted to DFFE and subsequently approved by the Department.

16.3 Database of I&APs

A database of I&APs, which includes authorities, different spheres of government (national, provincial and local), parastatals, ward councillors, stakeholders, landowners (where information was available), interest groups and members of the general public, was prepared for the Project and is contained in **Appendix H**.

16.4 Landowner Consent

According to Regulation 39(1) of GN No. R 982 of 4 December 2014 (as amended), if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an Environmental Authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land. This requirement does not apply *inter alia* for linear developments (e.g. pipelines, power lines, roads, etc.) or if it is a SIP as contemplated in the Infrastructure Development Act, 2014.

Landowner consent is included in the Application Form (**Appendix B**).

16.5 Notification of DFFE's Decision

Registered I&APs will be notified after having received written notice from DFFE (in terms of NEMA) on the final decision for the Project. The notification will include the appeal procedure to the decision and key reasons for the decision.

17 CONCLUSIONS & RECOMMENDATIONS

17.1 Outcomes of the EIA Phase

The following key tasks were undertaken during the Basic Assessment Process to date for the proposed Project:

- Specialist studies were undertaken and the findings were incorporated into the BAR in terms of understanding the environmental status quo and sensitive features, assessing the potential impacts and establishing concomitant mitigation measures;
- Potentially significant impacts pertaining to the pre-construction, construction and operational phases of the Project were identified and assessed, and mitigation measures were provided;
- Alternatives for achieving the objectives of the proposed activity were considered; and
- Authorities and I&APs were identified and notified of the review of the Draft BAR.

The outcomes of these tasks are captured below.

17.2 Sensitive Environmental Features

Some of the sensitive and significant environmental features and aspects that are associated with the Project's receiving environment are highlighted, for which mitigation measures are included in the BAR and EMPr (as relevant):

- The proposed Project Alternative 1 and 2 overlap with a CBA1, with the encroachment into the CBA1 less for Alternative 2.
- Both Alternatives overlap with an Endangered Ecosystem, which has been degraded.
- Both Alternatives overlap with areas of high and medium sensitivity as delineated by the Ecological Specialist. However, Alternative 2 impacts on less high sensitive areas.
- One LC-Sched 6 Protected protected flora species was identified to occur in the Project area during the field assessment survey.
- Alternative 1 encroaches on high avifauna sensitive areas, while Alternative 2 encroaches on areas of low and very low avifauna sensitivity.
- Faunal and floral SCC have the potential to occur in the Project area.
- Both Alternative 1 and 2 fall over seep wetlands (of high, moderate and low sensitivity);
- Alternative 1 encroaches upon and crosses a floodplain wetland of very high sensitivity, while Alternative 2 is sited to avoid the floodplain wetland and delineated wetland buffer.
- No sites, features or objects of heritage or cultural significance were identified.
- There will be no loss of high potential agricultural land.
- The impact on the surrounding farmers and land users will be more significant from a visual perspective but can still be seen as MODERATE because of the short time the proposed construction activity will be undertaken.

- Potential permanent visual impact on the sensitive receptors is expected to have a MODERATE impact before mitigation and MODERATE significance after mitigation.
- A Moderate Palaeontological Significance has been allocated to the development footprint. It was concluded in the Palaeontological Impact Assessment that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.
- The R76 road runs east-west to the north of the proposed Project, which forms the access road to the proposed Project. This road joins with the R30 to the west.
- The nearest town is Orkney, located 7km to the northwest (direct distance).

The sensitivity maps are provided in **Figure 64** to **Figure 71** below. Note that multiple maps are provided in order to show the various sensitivities clearly. A cumulative sensitivity map and combined sensitivity maps are included under **Appendix A**.

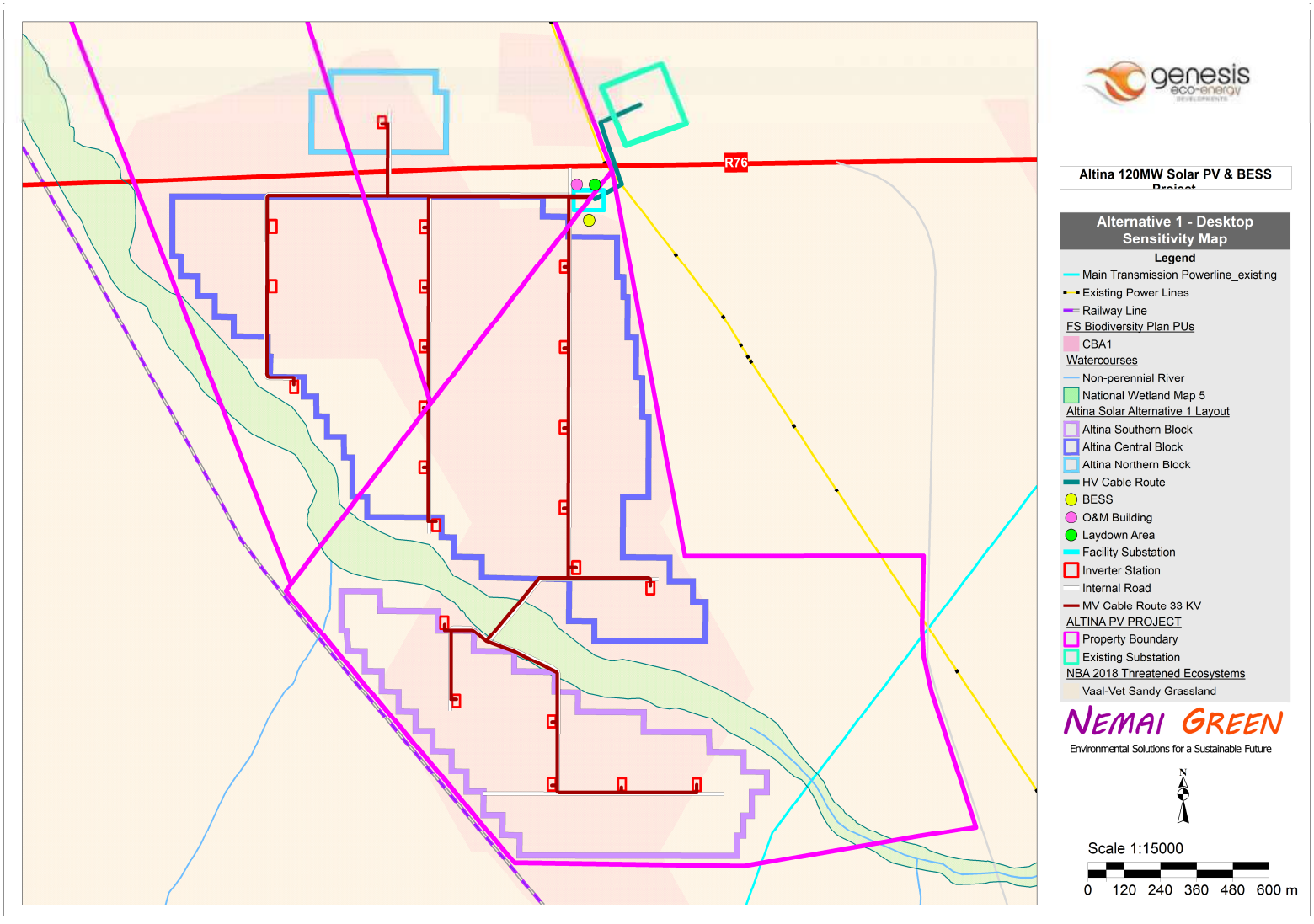

Figure 64: Desktop Sensitivity map for Alternative 1

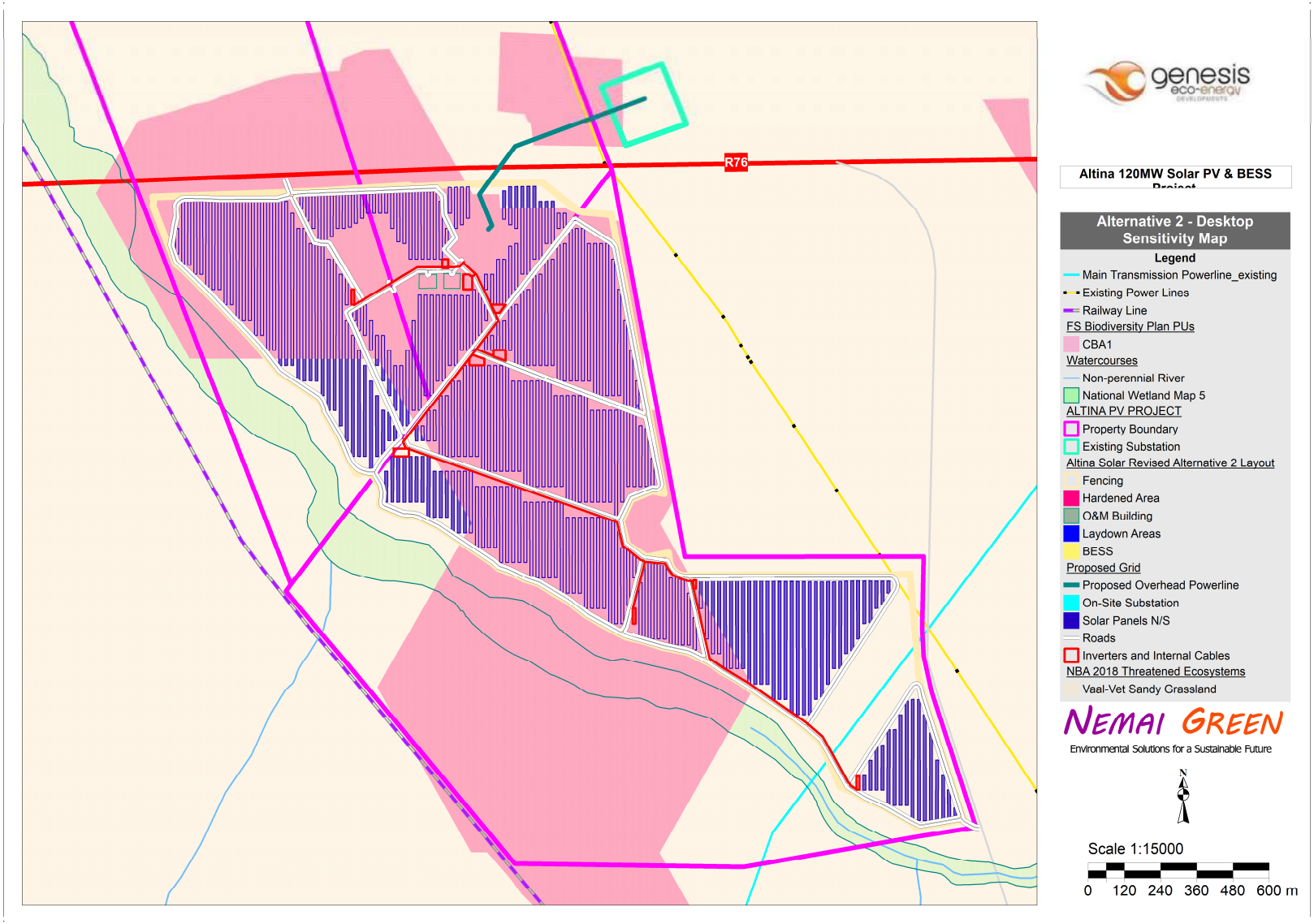

Figure 65: Desktop Sensitivity map for Alternative 2

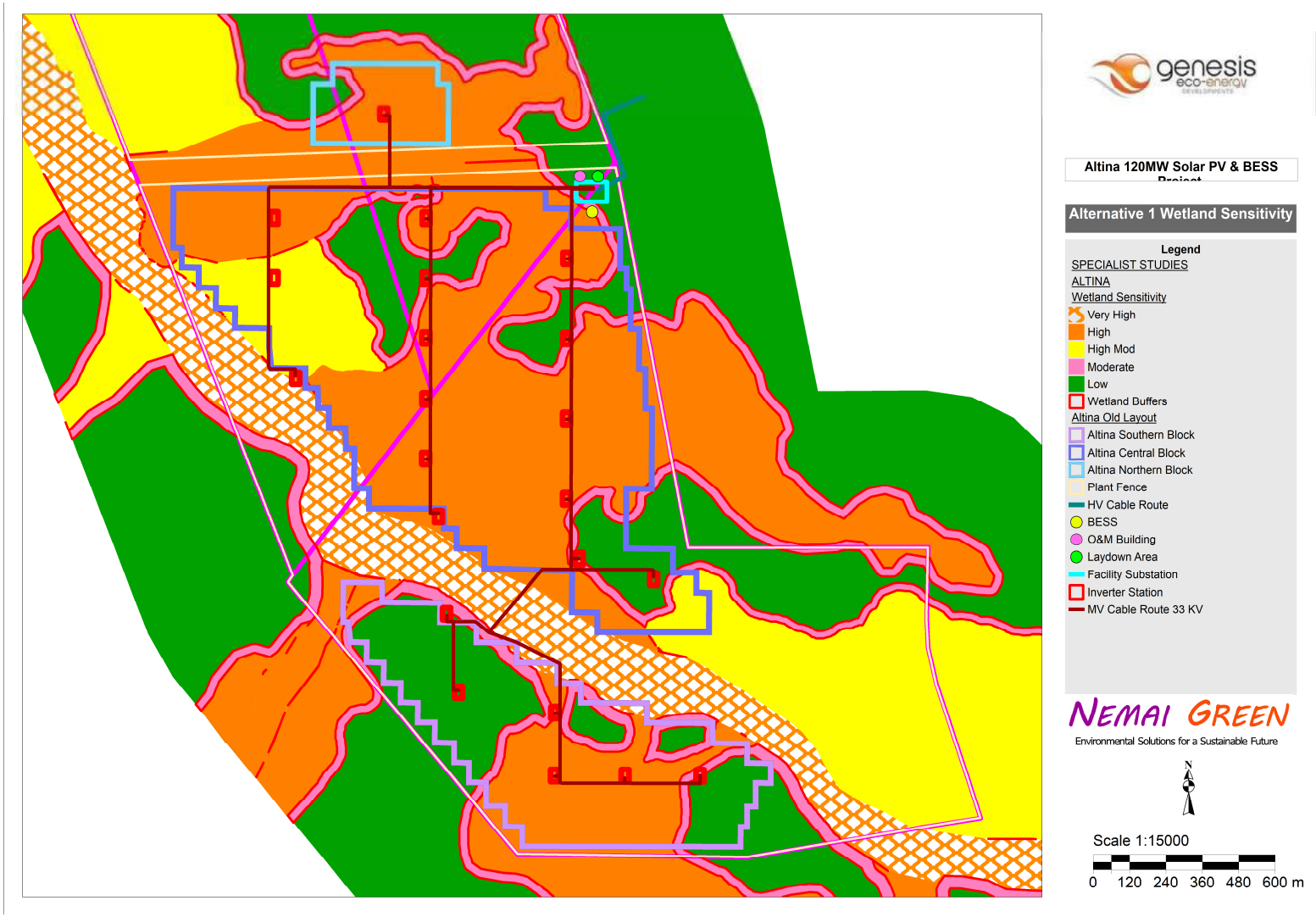

Figure 66: Wetland Sensitivity map for Alternative 1

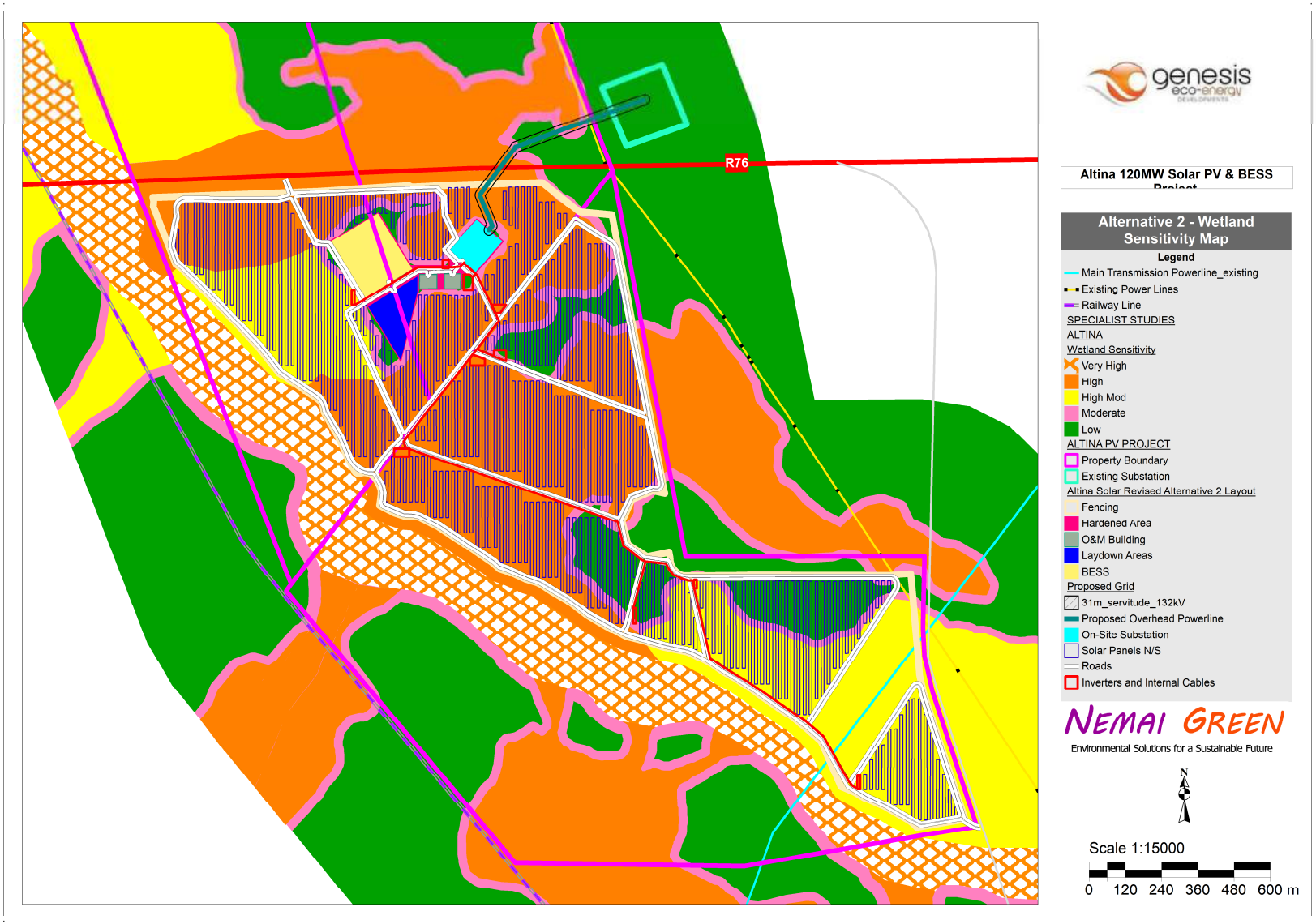

Figure 67: Wetland Sensitivity map for Alternative 2

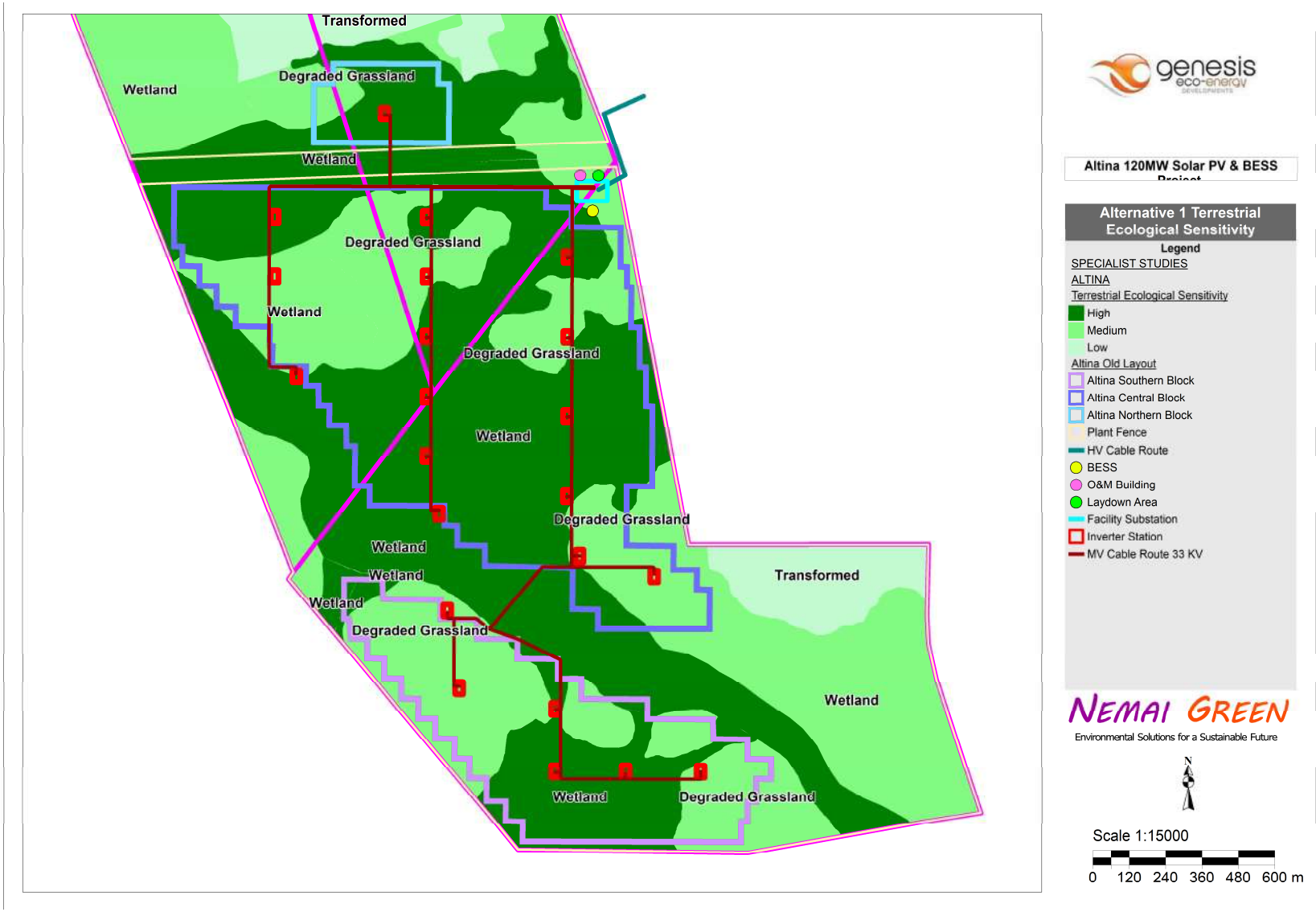

Figure 68: Terrestrial Ecological Sensitivity map for Alternative 1

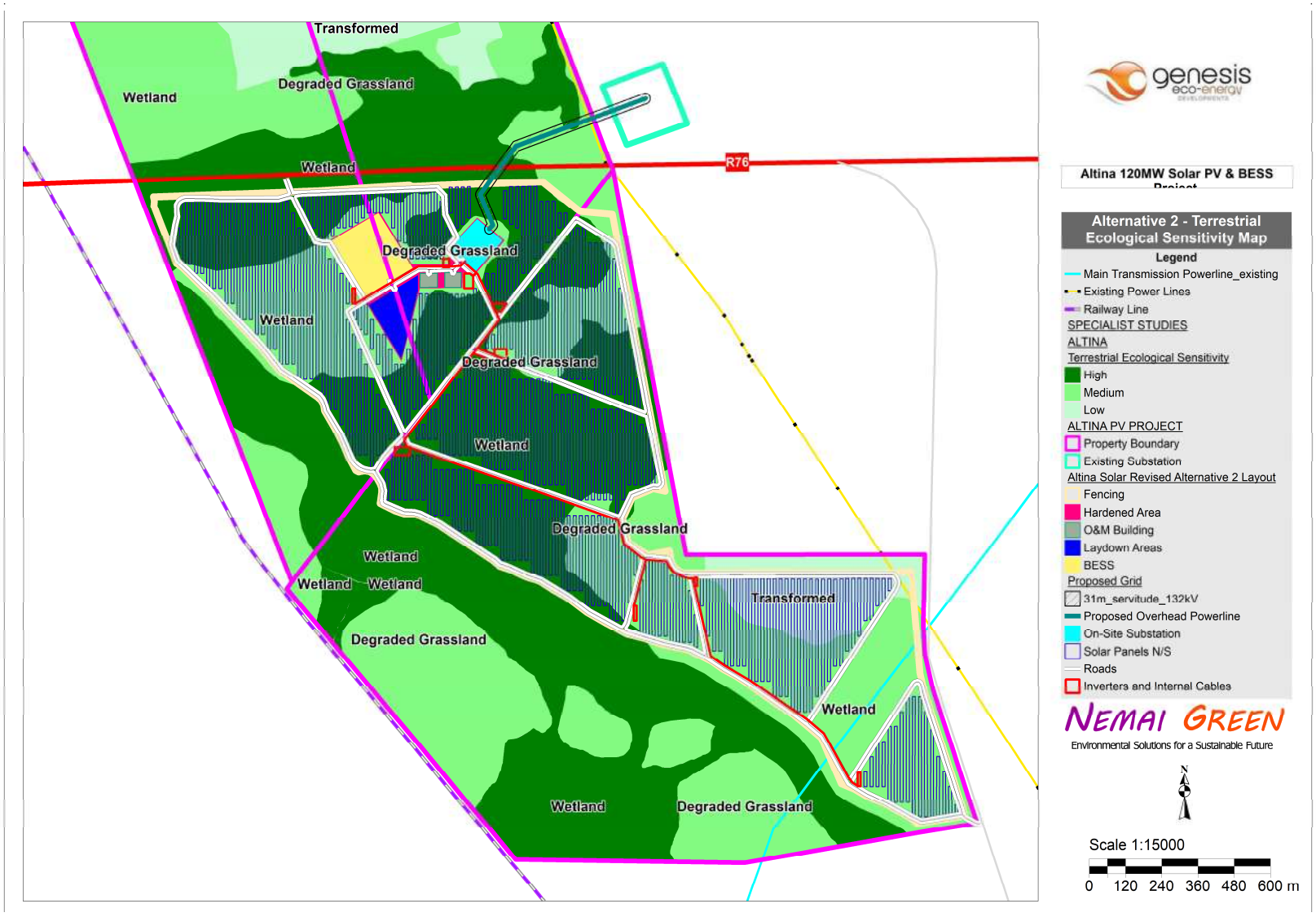

Figure 69: Terrestrial Ecological Sensitivity map for Alternative 2

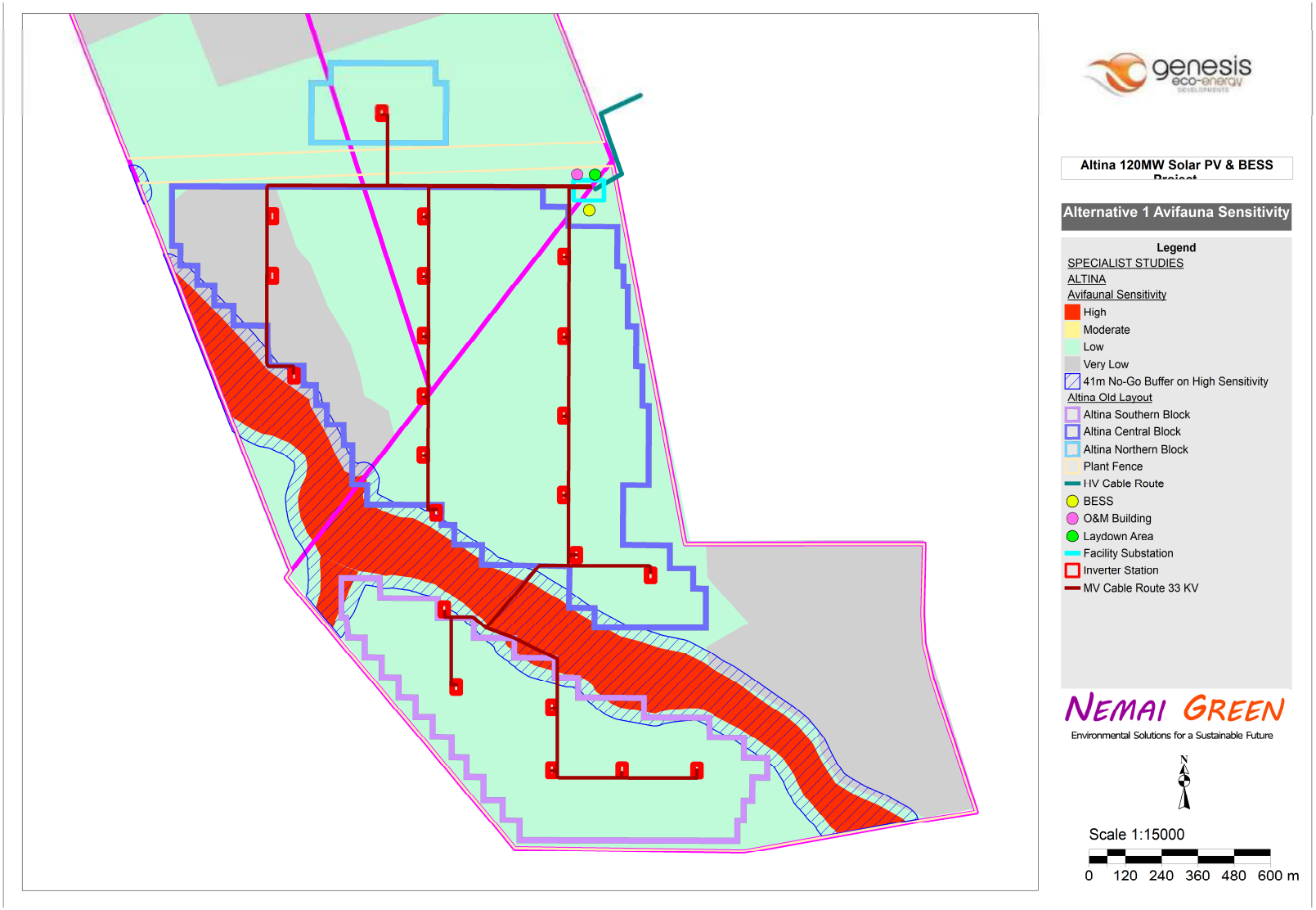

Figure 70: Avifauna Sensitivity map for Alternative 1

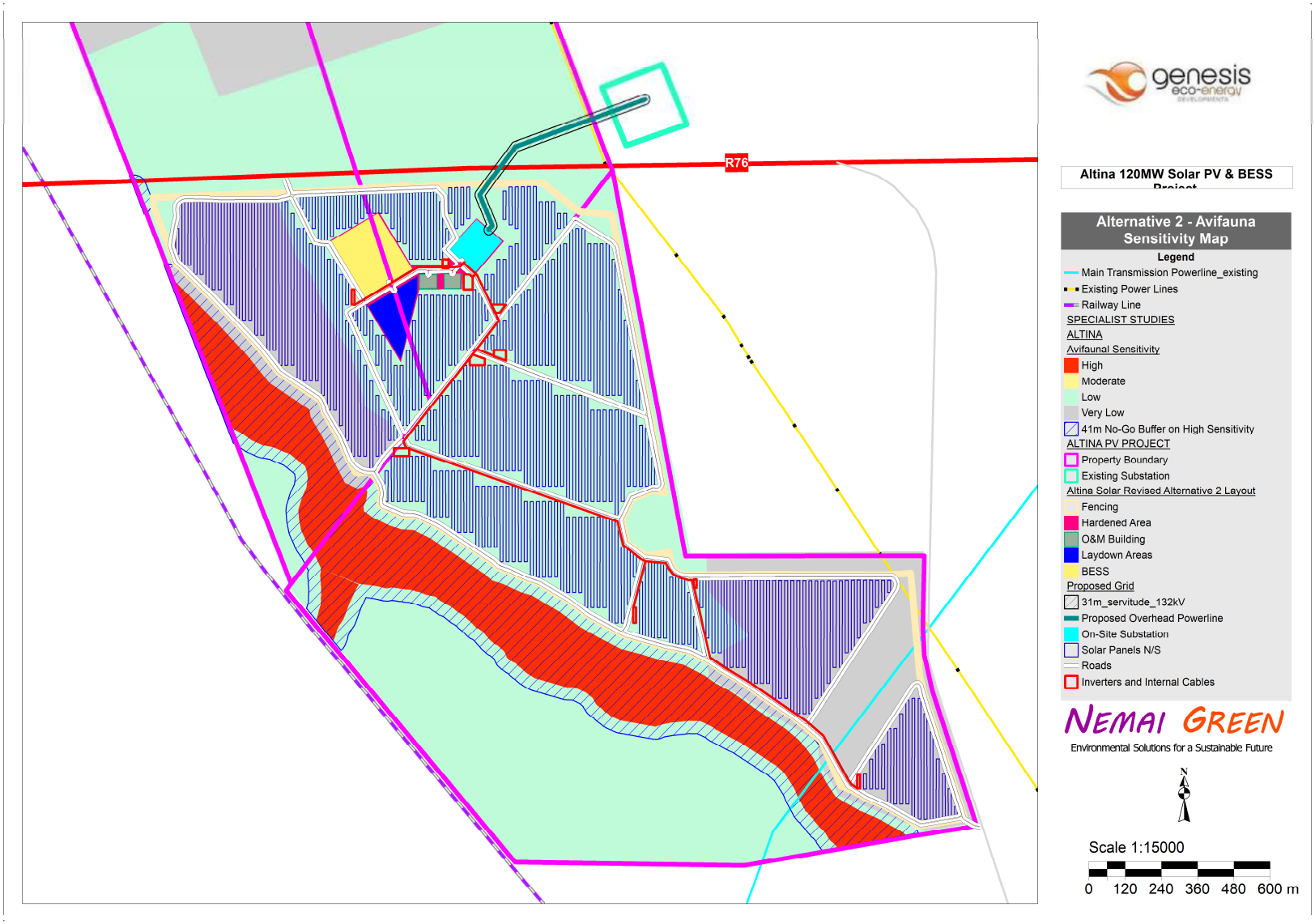

Figure 71: Avifauna Sensitivity map for Alternative 2

17.3 Environmental Impact Statement

The rationale for the siting of the overall Project is based on its suitable geographic location, including the area's high solar yield area, relatively flat topography, sparsely populated land, and proximity to an existing grid connection.

The PV site alternatives that were assessed as part of the Basic Assessment were based on the layouts that were compiled through incorporation of specialist input to avoid the environmentally sensitive features, including visual, palaeontology, heritage, biophysical and social, as far as possible.

Based on the recommendations of the specialists, technical considerations, and the comparison of the impacts, Alternative 2 was identified as the BPEO.

The potentially significant environmental impacts were investigated through the relevant specialist studies. Key findings from the Basic Assessment, which may also influence the conditions of the Environmental Authorisation (if granted), include the following:

- A site walk through is recommended by a suitably qualified ecologist prior to any construction activities, preferably during the wet season and any SSC should be noted. In situations where the threatened and protected plants must be removed, the proponent may only do so after the required permission/permits have been obtained in accordance with national and provincial legislation. In the abovementioned situation the development of a search, rescue and recovery program is suggested for the protection of these species.
- Install Eskom-approved flappers or coils on new transmission lines (particularly the earth wire). This can help to increase the visibility of transmission lines especially the thinner earth line with which most collisions tend to be associated.
- If African Grass Owl and African Marsh Harrier (or their nests) are found during construction halt construction activities and call an avifaunal specialist immediately for advice on the way forward.
- It is recommended that standardised seasonal carcass searches are carried out by the ECO or trained staff (Jenkins et al. 2017 for details on search protocol) for at least the first-year post-construction). If no carcasses are found discontinue searches after a year. Document any avifauna (or other biodiversity) carcasses or incidents in an annual environmental ops report. Additionally detail suspected cause of death and any actions taken to reduce mortalities.
- Institute a Dust monitoring program - air quality to be monitored (baseline and during construction) for dust fallout. Sampling locations to consider major sources of dust and sensitive receptors.
- Apply for a water use licence and start to initiate the development of an offset strategy for all wetlands to be developed. Incorporate the wetland offset strategy and any remedial activities associated with this strategy in the master plan for the development and implement in tandem with construction.

- All activities (including driving and equipment storage) must remain outside of the floodplain and valley-bottom wetlands identified on site that will be conserved.
- In accordance with good practice (in the event that tracking technology is used), the tracking panels must remain at the full 60° tilt to the west for 15 minutes after the sun has set in order to mitigate the yellow glare that could impact receptors.
- Suitable measures need to be implemented to prevent erosion, manage site drainage and rehabilitate cleared areas during the project life-cycle.
- A wetland offset strategy was recommended to address the impacts to wetlands within the Project footprint. The offset strategy was proposed by the Wetland Specialist to take the form of an on-site Wetland Rehabilitation Strategy. The draft strategy is included under Appendix E 10. It is recommended that the strategy be finalised during detailed design prior to construction commencement and submitted to DFFE for approval.

The impacts and risks assessed as part of the Basic Assessment process that was undertaken for the Project are considered manageable with the effective implementation of the measures stipulated in this BAR and EMPr.
With the selection of the BPEO, the adoption of the mitigation measures included in the BAR and the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this Project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the Project and that Environmental Authorisation can be issued for Alternative 2, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

It is further the opinion of the EAP and EIA team that the Basic Assessment was executed in an objective manner and that the process and BAR conform to the requirements stipulated in the EIA Regulations of 2014 (as amended).

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APPENDICES