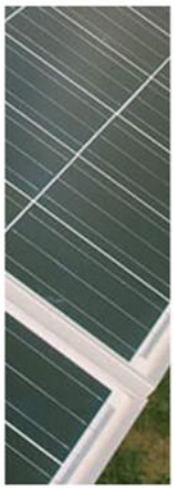
ENVIRONMENTAL IMPACT REPORT

Final – 22 November 2022

THE PROPOSED ORYX SOLAR POWER PLANT NEAR WELKOM/VIRGINIA, FREE STATE PROVINCE



ENVIRONAMICS

PROJECT DETAIL

DFFE Reference No.	:	14/12/16/3/3/2/2163
Project Title	:	Proposed Oryx Solar Power Plant near Welkom/Virginia, Free State Province
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Client	:	Oryx Solar Power Plant (RF) (Pty) Ltd.
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GLOSSARY OF TERMS AND ACRONYMS

BA	Basic Assessment
BAR	Basic Assessment Report
CEA	Cumulative Effects Assessment
DFFE	Department of Forestry, Fisheries and Environmental Affairs
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
GNR	Government Notice Regulation
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
kV	Kilo Volt
LM	Local Municipality

Mitigate	Activities designed to compensate for unavoidable environmental damage.
MW	Megawatt
NEMA	National Environmental Management Act No. 107 of 1998
NERSA	National Energy Regulator of South Africa
NWA	National Water Act No. 36 of 1998
PPP	Public Participation Process
PV	Photovoltaic
REIPPP	Renewable Energy IPP Procurement Process
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SPP	Solar Power Plant
VU	Vegetation Unit

CONTEXT FOR THE DEVELOPMENT

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

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

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

In response to the above, Oryx Solar Power Plant (RF) (Pty) Ltd is proposing the development of a photovoltaic solar facility and associated infrastructure for the purpose of commercial electricity generation on an identified site located on the Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225, Registration Division Theunissen, Free State Province situated within the Matjhabeng Local Municipality area of jurisdiction (refer to Figure A for the locality map). The project entails the generation of up to 150 MW electrical power through photovoltaic (PV) technology. The total

development footprint of the project will approximately be 256 hectares (including supporting infrastructure on site and including the overhead power line) within the 311 hectares identified and assessed as part of the Environmental Impact Assessment process. From a regional site selection perspective, this region is preferred for solar energy development due to its global horizontal irradiation value of around 2118 kwh/m^2.

EXECUTIVE SUMMARY

Like many other small and developing municipalities in the country, the Matjhabeng Local Municipality faces a number of challenges in addressing the needs of sustainable growth and improved quality of life (SDF, 2021). The Matjhabeng Local Municipality Spatial Development Framework (2020/2021- 2024/2025) identifies specific threats and weaknesses experienced in the municipal area which includes lack of proper infrastructure, poor maintenance of infrastructure, lack of financial governance, lack of employment opportunities, lack of bulk services, uncontrolled development, and lack of skills development, to name a few.

The Matjhabeng Local Municipality's Integrated Development Plan (IDP, 2022-23) identifies the goals of the municipality as improved efficiency and effectiveness of the municipal administration, improved provision of basic and environmental services in a sustainable way to our communities, increased economic growth, improve community confidence in the system of local government and enhanced financial viability and improved financial management. The IDP considers the economic structure and performance and how the municipality relies heavily on the agricultural sector and the general decline of the sector. It indicates that alternative sectors to the declining sectors of the area needs to be explored, which includes the renewable energy sector.

Oryx Solar Power Plant (RF) (Pty) Ltd intends to develop a 150MW photovoltaic solar facility and associated infrastructure on the Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225, Registration Division Theunissen, Free State Province situated within the Matjhabeng Local Municipality and Lejweleputswa District Municipality area of jurisdiction. The town of Virginia is located approximately 11km northeast and the town of Welkom is located approximately 20km north of the proposed development (refer to Figure A and B for the locality and regional map). The total footprint of the project will approximately be 256 hectares (including supporting infrastructure on site). The site was identified as being highly desirable due to its suitable climatic conditions, topography (i.e. in terms of slope), environmental conditions (i.e. agricultural potential, ecological sensitivity and archaeology), proximity to a grid connection point (i.e. for the purpose of electricity evacuation), as well as site access via a main road (i.e. to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase).

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

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

- Activity 12(ii)(a)(c) (GN.R. 327): "*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."*

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

- Activity 19 (GN.R. 327): "T*he infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."*

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

- Activity 28(ii) (GN.R. 327): *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."*

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

- Activity 1 (GN.R. 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more..."*

- Activity 15 (GN.R. 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation..."*

- Activity 4 (b)(i)(ee) (GN.R 324): "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."*

- Activity 10 (b)(i)(ee)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

- Activity 12 (b)(i)(ii)(vi) (GN.R 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list,*

within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment of 2004, (ii) within critical biodiversity areas identified in bioregional plans and (vi) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."

- Activity 14(ii)(a)(c)(b)(i)(ff) (GN.R 324): "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."*

- Activity 18 (b)(i)(ee)(hh) (GN.R 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) in the Free State (i) outside urban areas, within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

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

Regulation 21 of the EIA Regulations requires that an Environmental Impact Report (EIR) must contain the information set out in Appendix 3 of the Regulations or comply with a protocol or minimum information requirements relevant to the application as identified and gazetted by the Minister in a government notice. Appendix 3 of GNR326 requires a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred site, the scope of the assessment, and the consultation process undertaken be set out in the EIR report.

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

Impacts during the construction phase:

During the construction phase minor negative impacts are foreseen over the short term. The latter refers to a period of 12-18 months. The potentially most significant impacts relate to habitat destruction caused by clearance of vegetation and socio-economic impacts such as the creation of direct and indirect employment opportunities, economic multiplier effects from the use of local goods and services and temporary increase in traffic disruptions and movement patterns.

Impacts during the operational phase:

During the operational phase the site will serve as a solar PV energy facility and the potential impacts will take place over a period of 20 – 25 years. The negative impacts are generally associated with habitat destruction caused by clearance of vegetation, displacement of priority avian species from important habitats, collision and electrocutions of avifauna and visual impact of sensitive visual receptors located within a 500m radius of the proposed power line. The provision of sustainable services delivery also needs to be confirmed. The operational phase will have a direct positive impact through the creation of employment opportunities and skills development, development of non-polluting, renewable energy infrastructure and contribution to economic development and social upliftment.

Impacts during the decommissioning phase:

The negative impacts generally associated with the decommissioning phase include: habitat destruction caused by clearance of vegetation, increased soil erosion and sedimentation, spread and establishment of alien invasive species, continued loss of indigenous vegetation owing to poor recovery of vegetation, contamination of soil by leaving rubble/waste or spilling petroleum fuels or any pollutants on soil which could infiltrate the soil during rehabilitation and the loss of permanent employment. However, skilled staff will be eminently employable, and a number of temporary jobs will also be created in the process. It is not expected that the facility will be decommissioned, but rather that the technology used will be upgraded.

Cumulative impacts:

Cumulative impacts could arise as other similar projects are constructed in the area. According to the Department of forestry, Fisheries and Environment database thirteen (13) other solar plants have been proposed in relatively close proximity to the proposed activity.

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

intrusion. The cumulative effect of the generation of waste was identified as being potentially significant during the decommissioning phase.

Regulation 23 of the EIA Regulations determine that an EIA report must be prepared and submitted for the proposed activity after the competent authority accepts the final Scoping Report, including the Plan of Study for the EIA phase. The EIA report will evaluate and rate each identified impact and identify mitigation measures that may be required. The EIA report will contain information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Appendix 3 of the EIA Regulations. This is the Final EIA Report submitted to the competent authority (Department of Forestry, Fisheries and the Environment (DFFE)) for decision making on the Application for Environmental Authorisation.

1 INTRODUCTION

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

Appendix 3. (3) An environmental impact assessment report contains the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-(a) details of: (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae.

1.1 LEGAL MANDATE AND PURPOSE OF THE REPORT

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

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

Table 1.1: Listed activities[1]

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(ii)	• *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* • Activity 11(i) is triggered since the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area. The

[1] Please refer to Table 6.2 for detailed description of the relevant aspects of the development that will apply to each specific activity.

		infrastructure for the distribution of electricity will include a power line (132kV), an on-site HV/MV substation and switching station (132kV). It is expected that generation from the facility will tie in with either the Oryx 2 - Theseus 132kV Overhead Power Line or the Oryx 1 - Theseus 132kV Overhead Power Line or the Beatrix - Theseus 132kV Overhead Power Line via a loop-in loop-out connection.
GNR. 327 (as amended in 2017)	Activity 12(ii)(a)(c)	• "*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."* • Activity 12(ii)(a)(c) is triggered based on the presence of wetlands (including a valleybottom wetland and a hill slope seep wetland) located within the development footprint proposed for the Oryx solar Power Plant. Should the development footprint be optimized to avoid the wetlands, this listed activity will no longer be relevant.
GNR. 327 (as amended in 2017)	Activity 14	• *"The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres."* • Activity 14 is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel) in containers with combined capacity of 80 cubic metres. The capacity will not exceed 500 cubic metres.
GNR. 327 (as amended in 2017)	Activity 19	• "T*he infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."* • Activity 19 is triggered based on the presence of wetlands (including a valleybottom wetland and a hill slope seep wetland) located within the development footprint proposed for the Oryx solar Power Plant. The development footprint of the SPP includes these surface

		water features and will result in the removal of more than 10 cubic meters of rock from the watercourse. Should the development footprint be optimized to avoid the wetlands, this listed activity will no longer be relevant.
GNR. 327 (as amended in 2017)	Activity 24(ii)	• *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters.* • Activity 24(ii) is triggered as the internal roads will vary between 6 and 12 meters in width. The internal roads will be 6m in width and the perimeter road will be up to 12m in width.
GNR. 327 (as amended in 2017)	Activity 28(ii)	• *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."* • Activity 28(ii) is triggered as portions of the affected property have been used for grazing and the property will be re-zoned to "special" use for the proposed development. The development footprint of the solar power plant will be 256 hectares.
GNR. 327 (as amended in 2017)	Activity 56(ii)	• *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* • Activity 56 (ii) is triggered since the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres.
GNR. 325 (as amended in 2017)	Activity 1	• *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."* • Activity 1 is triggered since the proposed photovoltaic solar facility will generate up to 150 megawatts electricity through the use of a renewable resource.

GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • In terms of vegetation type the site falls within the Vaal-Vet Sandy Grassland and the Highveld Alluvial Vegetation which is described by Mucina and Rutherford (2006) as Endangered and least threatened. Activity 15 is triggered since portions of the site has not been lawfully disturbed during the preceding ten years; therefore, more than 20 hectares of indigenous vegetation will be removed. The development footprint of the solar power plant will be 256ha in extent.
GNR. 324 (as amended in 2017)	Activity 4 (b)(i)(ee)	• "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."* • Activity 4 (b)(i)(ee) is triggered as internal and perimeter access roads with a width of between 6 and 12 meters will be constructed and a section of the development footprint is located within a CBA 1 area.
GNR. 324 (as amended in 2017)	Activity 10 (b)(i)(ee)(hh)	• *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 10(b)(i)(ee)(hh) is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel and oils) in containers with a capacity exceeding 30 but not exceeding 80 cubic metres. The project is located within the Free State Province and and a section of the development footprint is located within a CBA 1 area. Furthermore, wetlands (including a valleybottom wetland and a hill slope seep wetland) are located within

		the development footprint proposed for the Oryx solar Power Plant.
GNR. 324 (as amended in 2017)	Activity 12 (b)(i)(ii)(vi)	• *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment of 2004, (ii) within critical biodiversity areas identified in bioregional plans and (vi) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 12 (b)(i)(ii)(vi) is triggered since the proposed development is located in the Free State province and portions of the site has not been lawfully disturbed during the preceding ten years and therefore indigenous vegetation is present on the site. In terms of vegetation type the site falls within the Vaal-Vet Sandy Grassland and the Highveld Alluvial Vegetation which is described by Mucina and Rutherford (2006) as Endangered and least threatened. Furthermore, wetlands (including a valleybottom wetland and a hill slope seep wetland) are located within the development footprint proposed for the Oryx solar Power Plant. The development footprint of the solar power plant will be 256ha in extent.
GNR. 324 (as amended in 2017)	Activity 14(ii)(a)(c)(b)(i)(ff)	• "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."* • Activity 14(ii)(a)(c)(b)(i)(ff) is triggered based on the presence of wetlands (including a valleybottom wetland and a hill slope seep wetland) located within the development footprint proposed for the Oryx solar Power Plant. A section of the development footprint is located within a CBA 1 area.

GNR. 324 (as amended in 2017)	Activity 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) in the Free State (i) outside urban areas, within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 18 (b)(i)(ee)(hh) is triggered since the existing access road to the site will need to be widened by more than 4 metres. The project is located within the Free State Province and outside urban areas. Wetlands (including a valleybottom wetland and a hill slope seep wetland) are located within the development footprint proposed for the Oryx solar Power Plant. A section of the development footprint is located within a CBA 1 area.

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

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

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

This report is the Final Environmental Impact Report (EIR) that was submitted to the Department of Environment, Forestry and Fisheries for a 30-day review and comment period. According to Regulation 326 all registered I&APs and relevant State Departments must also be allowed the opportunity to review the report. The Draft EIR was made available to registered I&APs and all relevant State Departments for a 30-day review period from 19 October 2022 to 18 November 2022. These stakeholders and individuals were requested to provide written comments on the Draft EIR within the allocated timeframe. All issues identified during this review period have been documented and compiled into a Comments and Response Report as part of the Final EIR (**Appendix C7**). All comments received during the Scoping Phase of the project are available in the Comments and Response Report as referred to above, as well as Appendix C5 and C6 of this Final EIR.

1.2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

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

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

And/or

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

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

1.3 DETAILS OF SPECIALISTS

Table 1.2 provides information on the specialists that have been appointed as part of the EIA process. Regulation 13(1)(a) and (b) determines that an independent and suitably qualified, experienced and independent specialist should conduct the specialist study, in the event where the specialist is not independent, a specialist should be appointed to externally review the work of the specialist as contemplated in sub regulation (2), must comply with sub regulation 1. In terms of the independent status of the specialists, their declarations are attached as Appendix H to this report. The expertise of the specialists is also summarised in their respective reports.

Table 1.2: Details of specialists

Study	Prepared by	Contact Person	Postal Address	Tel	e-mail
Avifaunal Impact Assessment	Agreenco	ASH Haagner	PO Box 19896 Noordbrug, Potchefstroom 2522	Cell: 082 214 3738	adrian.haagner@agreencogroup.com
Terrestrial Biodiversity, Plant and Animal Species and Wetland /Riparian Impact Assessments	AGES Limpopo	Dr. BJ Henning	PO Box 2526, Polokwane 0700	Cell: 082 939 7067	bhenning@ages-group.com
Heritage Impact Assessment	J van Schalkwyk Heritage Consultant	J van Schalkwyk	62 Coetzer Avenue Monument Park 0181	Cell: 076 790 6777	jvschalkwyk@mweb.co.za
Paleontological Study	Banzai Environmental (Pty) Ltd	Elize Butler	-	Cell: 084 447 8759	elizebutler002@gmail.com
Agricultural Compliance Statement	Johann Lanz Soil Scientist	Johann Lanz	P. O. Box 6209 Uniedal ,Stellenbosch 7612	Tel: 021 866 1518 Cell: 082 927 9018	johann@johannlanz.co.za
Visual Impact Assessment	Donaway Environmental Consultants	Johan Botha	30 Fouche Street Steynsrus, 9515	Tel: 082 316 7749	phala.env@gmail.com
Social Impact Assessment	Donaway Environmental Consultants	Marelie Botha	30 Fouche Street Steynsrus, 9515	Cell: 082 493 5166	phala.env@gmail.com
Traffic Assessment Study	BVi Consulting Engineers	Liza Botha	Edison Square, Century City, 7441	Cell: 060 557 7467	lizab@bviwc.co.za

1.4 STATUS OF THE EIA PROCESS

The EIA process is conducted strictly in accordance with the stipulations set out in Regulations 21-24 of Regulation No. 326. Table 1.2 provides a summary of the EIA process and future steps to be taken. It can be confirmed that to date:

- A pre-application meeting request and public participation plan was submitted to DFFE on 03 March 2022.
- The DFFE accepted the public participation plan in an email dated 11 March 2022.
- A newspaper advertisement was placed in the Vista on 03 March 2022, informing the public of the EIA process and for the public to register as I&APs.
- A site visit was conducted by the EAP on 24 February 2022.
- Site notices were erected on site on 24 February 2022 informing the public of the commencement of the EIA process.
- An application form and the draft Scoping Report was submitted to DFFE on 27 May 2022.
- The draft Scoping Report was made available for a 30-day review and comment period from 27 May 2022 to 27 June 2022
- The final Scoping Report was submitted to the DFFE on 28 June 2022 for decision-making and approval of the Plan of Study for the EIA.
- The DFFE accepted the Final Scoping Report (FSR) on 12 August 2022.
- The Draft EIR Report was submitted to the DFFE (and registered I&APs) on 19 October 2022 for the 30-day review and comment period which will be from 19 October 2022 – 18 November 2022.

It is envisaged that the EIA process should be completed within approximately four months of submission of the Final EIR, i.e. by April 2023 – see Table 1.3.

Table 1.3: Estimated timeframe for completion of the 'scoping and EIA process'

Activity	Prescribed timeframe	Timeframe
Site visit		February 2022
Public participation (BID)	30 Days	04 April – 10 May 2022
Submit application form and DSR	-	By 27 May 2022

Public participation (DSR)	30 Days	27 May – 27 June 2022
Submit FSR	44 Days	28 June 2022
Department acknowledges receipt	10 Days	July 2022
Department approves/reject	43 Days	12 August 2022
Public participation (DEIR)	30 Days	19 Oct. – 18 Nov. 2022
Submission of FEIR & EMPr	-	22 Nov. 2022
Department acknowledges receipt	10 Days	Nov. 2022
Decision	107 Days	March 2023
Department notifies of decision	5 Days	March 2023
Registered I&APs notified of decision	14 Days	March 2023
Appeal	20 Days	April 2023

1.5 SPECIALIST STUDIES IDENTIFIED IN THE DFFE SCREENING TOOL REPORT

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

Table 1.4: Specialist studies identified by the DFFE Screening tool and specialist studies conducted

Study identified in the DFFE Screening Tool and sensitivity	Study included?	Confirmation / motivation
Agricultural Impact Assessment Sensitivity: High	Yes	An Agricultural Compliance Statement is included in Appendix E4. The high sensitivity is disputed by the report.
Landscape / Visual Impact Assessment	Yes	A Visual Impact Assessment is included in Appendix E3.

Sensitivity: Very High		
Archaeological and Cultural Heritage Impact Assessment Sensitivity: High	Yes	A Heritage Impact Assessment is included in Appendix E5.
Palaeontological Impact Assessment Sensitivity: Very High	Yes	A Palaeontological Impact Assessment is included in Appendix E6.
Terrestrial Biodiversity Impact Assessment Sensitivity: Very High	Yes	A Terrestrial Biodiversity Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Aquatic Biodiversity Impact Assessment Sensitivity: Very High	Yes	A Wetland / Riparian Impact Assessment is included in Appendix E1. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Civil Aviation Assessment Sensitivity: Medium	No	The Civil Aviation Authority has been consulted regarding the development of the project since the commencement of the EIA Process. No specific negative impacts or issues have been raised to date by the CAA regarding the project. The project is also not located within an area considered to be of a high sensitivity.
Defence Assessment Sensitivity: Low	No	The sensitivity for the entire extent of the site is low and

		therefore no assessment has been included.
RFI Assessment Sensitivity: Low	No	The RFI theme sensitivity is low for the entire extent of the project. The South African Radio Astronomy Observatory (SARAO) has been consulted regarding the development of the project since the commencement of the EIA Process. No specific negative impacts or issues have been raised to date by the SARAO regarding the project. The project is also not located within an area considered to be of a high sensitivity.
Geotechnical Assessment Sensitivity: Not indicated	No	The Geotechnical Assessment will be conducted before construction begins.
Socio-Economic Assessment Sensitivity: Not indicated	Yes	A Social Impact Assessment is included in Appendix E7.
Plant species Assessment Sensitivity: Low	Yes	Refer to Appendix E1. The Terrestrial Biodiversity Impact Assessment also includes the relevant Plant Species Assessment. This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.
Animal Species Assessment Sensitivity: Low	Yes	Refer to Appendix E1. The Terrestrial Biodiversity Impact Assessment also includes the relevant Plant Species Assessment.

		This assessment has been undertaken in terms of the Protocols of GNR320 – refer to the content of the report.

1.6 STRUCTURE OF THE REPORT

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

Table 1.5: Structure of the report

Requirements for the contents of an EIR as specified in the Regulations		Section in report
Appendix 3. (3) - An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-		
(a)	details of -	1
	(i) the EAP who prepared the report; and	
	ii) the expertise of the EAP, including a curriculum vitae.	
(b)	the location of the activity, including-	2
	(i) the 21-digit Surveyor General code of each cadastral land parcel;	
	(ii) where available, the physical address and farm name;	
	(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-	
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	
(d)	a description of the scope of the proposed activity, including-	
	(i) all listed and specified activities triggered and being applied for; and	
	(ii) a description of the associated structures and infrastructure related to the development.	
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	3
(f)	a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	4
(g)	A motivation for the preferred development footprint within the approved site.	5

(h)	a full description of the process followed to reach the proposed development footprint within the approved site, including –	
	(i) details of all the development footprint alternatives considered;	
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	
	(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and	
	(x) a concluding statement indicating the preferred alternative development location within the approved site.	
	(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	
	(viii) the possible mitigation measures that could be applied and level of residual risk;	
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-	6
	(i) a description of all environmental issues and risks that were identified during the EIA process; and	
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	
(j)	an assessment of each identified potentially significant impact and risk, including-	
	(i) cumulative impacts;	
	(ii) the nature, significance and consequences of the impact and risk;	
	(iii) the extent and duration of the impact and risk;	
	(iv) the probability of the impact and risk occurring;	
	(v) the degree to which the impact and risk can be reversed;	
	(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	

	(vii) the degree to which the impact and risk can be mitigated;	
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	6
(l)	an environmental impact statement which contains-	8
	(i) a summary of the key findings of the environmental impact assessment:	
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Not applicable
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Not applicable
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	8
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	8
(s)	an undertaking under oath or affirmation by the EAP in relation to-	Appendix A to the report
	(i) the correctness of the information provided in the report;	
	(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties (I&APs);	
	(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	
	(iv) any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs;	
(t)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Not applicable
(u)	an indication of any deviation from the approved scoping report, including the plan of study, including-	Not applicable

	(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	
(v)	any specific information that may be required by the CA; and	Not applicable
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not applicable

2 ACTIVITY DESCRIPTION

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

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

(b) the location of the activity, including-

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

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

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

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

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

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

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

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

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

2.1 THE LOCATION OF THE ACTIVITY AND PROPERTY DESCRIPTION

The activity entails the development of a photovoltaic solar facility and associated infrastructure on the Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225, Registration Division Theunissen, Free State Province situated within the Matjhabeng Local Municipality area of jurisdiction. The proposed development is located in the Free State Province in the northern central interior of South-Africa (refer to Figure B for the regional map). The town of Welkom is located approximately 20km to the north and Virginia is located approximately 11km to the northeast of the proposed development (refer to Figure A for the locality map).

The project entails the generation of up to 150MW electrical power through the installation and operation of photovoltaic (PV) panels. An area of 311ha has been assessed as part of this EIA report and a smaller area for the placement of the infrastructure (including supporting infrastructure on site), known as the development footprint has been placed within the larger area assessed. The development footprint is proposed to be 256ha in extent. Refer to Table 2.1 for general site information.

The property on which the facility is to be constructed will be leased by Oryx Solar Power Plant (RF) (Pty) Ltd from the property owner, William Peter Du Plessis Familie Trust, for the life span of the project (minimum of 20 years).

It is expected that generation from the facility will tie in with an existing power line present within the affected property and development footprint. Three grid connection points are being considered for the development which includes the Oryx 2 - Theseus 132kV Overhead Power Line, the Oryx 1 - Theseus 132kV Overhead Power Line and the Beatrix - Theseus 132kV Overhead Power Line. A new 132kV power line will be constructed to connect the solar power plant to one of the three connection points. For the placement of the new power line three grid connection corridors are being assessed (each with a width of between 100m and 115m). These are as follows:

- Grid connection corridor option 1 will connect the facility to the existing Oryx 2 - Theseus 132kV Overhead Power Line. This is considered to be the technically preferred option by the Applicant.
- Grid connection corridor option 2 will connect the facility to the existing Oryx 1 - Theseus 132kV Overhead Power Line.
- Grid connection corridor option 3 will connect the facility to the existing Beatrix - Theseus 132kV Overhead Power Line.

It must be noted that the grid connection corridor options 2 and 3 follow a similar route and therefore overlap. All three grid connection corridor options are located within the affected property and therefore no areas outside of the farm portion will be affected.

Table 2.1: General site information

Description of affected farm portion	<u>Solar Power Plant and Grid Connection:</u> • Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225
Province	Free State Province
District Municipality	Lejweleputswa District Municipality
Local Municipality	Matjhabeng Local Municipality
Ward numbers	9
Closest towns	Virginia is located approximately 11km to the northeast and Welkom is located approximately 20km to the north
21 Digit Surveyor General codes	<u>Solar Power Plant and Grid Connection:</u> • Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225 - F03300000000022500002
Title Deed	T001864/2003

Photographs of the site	Refer to the Plates
Type of technology	Photovoltaic solar facility
Structure Height	• Panels ~6m, • buildings ~ 6m, • power line ~32m and • battery storage facility ~8m
Battery storage	Within a 4ha area within the development footprint
Surface area to be covered (development footprint)	Approximately 256 ha
Structure orientation	The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun.
Laydown area dimensions (area assessed as part of the EIA)	Assessed 311 hectares for the development of the solar power plant, including the placement of all other associated infrastructure.
Generation capacity	Up to 150MW
Expected production	320-360 GWh per annum (Expected production by 150MWdc modules considering bifacial and one-axis tracker)

The site is located in a rural area and is bordered by agricultural land uses, as well as mining activities. The site survey revealed that the affected property currently consists of agricultural activities – refer to plates 1-11 for photographs of the affected property and proposed development footprint area.

2.2 ACTIVITY DESCRIPTION

The proposed development will trigger the following activities:

Table 2.2: Listed activities[2]

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(ii)	• *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* • Activity 11(i) is triggered since the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area. The infrastructure for the distribution of electricity will include a power line (132kV), an on-site HV/MV substation and switching station (132kV). It is expected that generation from the facility will tie in with either the Oryx 2 - Theseus 132kV Overhead Power Line or the Oryx 1 - Theseus 132kV Overhead Power Line or the Beatrix - Theseus 132kV Overhead Power Line via a loop-in loop-out connection.
GNR. 327 (as amended in 2017)	Activity 12(ii)(a)(c)	• "*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."* • Activity 12(ii)(a)(c) is triggered based on the presence of wetlands (including a valleybottom wetland and a hill slope seep wetland) located within the development footprint proposed for the Oryx solar Power Plant. Should the development footprint be optimized to avoid the wetlands, this listed activity will no longer be relevant.
GNR. 327 (as amended in 2017)	Activity 14	• *"The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres."* • Activity 14 is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel) in containers with

[2] Please refer to Table 6.2 for a detailed description of the relevant aspects of the development that will apply to each specific listed activity.

		combined capacity of 80 cubic metres. The capacity will not exceed 500 cubic metres.
GNR. 327 (as amended in 2017)	Activity 19	• "T*he infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."* • Activity 19 is triggered based on the presence of wetlands (including a valleybottom wetland and a hill slope seep wetland) located within the development footprint proposed for the Oryx solar Power Plant. The development footprint of the SPP includes these surface water features and will result in the removal of more than 10 cubic meters of rock from the watercourse. Should the development footprint be optimized to avoid the wetlands, this listed activity will no longer be relevant.
GNR. 327 (as amended in 2017)	Activity 24(ii)	• *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters.* • Activity 24(ii) is triggered as the internal roads will vary between 6 and 12 meters in width. The internal roads will be 6m in width and the perimeter road will be up to 12m in width.
GNR. 327 (as amended in 2017)	Activity 28(ii)	• *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."* • Activity 28(ii) is triggered as portions of the affected property have been used for grazing and the property will be re-zoned to "special" use for the proposed development. The development footprint of the solar power plant will be 256 hectares.
GNR. 327 (as amended in 2017)	Activity 56(ii)	• *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"*

		• Activity 56 (ii) is triggered since the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres.
GNR. 325 (as amended in 2017)	Activity 1	• *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."* • Activity 1 is triggered since the proposed photovoltaic solar facility will generate up to 150 megawatts electricity through the use of a renewable resource.
GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • In terms of vegetation type the site falls within the Vaal-Vet Sandy Grassland and the Highveld Alluvial Vegetation which is described by Mucina and Rutherford (2006) as Endangered and least threatened. Activity 15 is triggered since portions of the site has not been lawfully disturbed during the preceding ten years; therefore, more than 20 hectares of indigenous vegetation will be removed. The development footprint of the solar power plant will be 256ha in extent.
GNR. 324 (as amended in 2017)	Activity 4 (b)(i)(ee)	• "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."* • Activity 4 (b)(i)(ee) is triggered as internal and perimeter access roads with a width of between 6 and 12 meters will be constructed and a section of the development footprint is located within a CBA 1 area. .
GNR. 324 (as amended in 2017)	Activity 10 (b)(i)(ee)(hh)	• *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 10(b)(i)(ee)(hh) is triggered since the proposed development will need to develop infrastructure for the

		storage and handling of dangerous goods (diesel and oils) in containers with a capacity exceeding 30 but not exceeding 80 cubic metres. The project is located within the Free State Province and and a section of the development footprint is located within a CBA 1 area. Furthermore, wetlands (including a valleybottom wetland and a hill slope seep wetland) are located within the development footprint proposed for the Oryx solar Power Plant
GNR. 324 (as amended in 2017)	Activity 12 (b)(i)(ii)(vi)	• *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment of 2004, (ii) within critical biodiversity areas identified in bioregional plans and (vi) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 12 (b)(i)(ii)(vi) is triggered since the proposed development is located in the Free State province and portions of the site has not been lawfully disturbed during the preceding ten years and therefore indigenous vegetation is present on the site. In terms of vegetation type the site falls within the Vaal-Vet Sandy Grassland and the Highveld Alluvial Vegetation which is described by Mucina and Rutherford (2006) as Endangered and least threatened. Furthermore, wetlands (including a valleybottom wetland and a hill slope seep wetland) are located within the development footprint proposed for the Oryx solar Power Plant. The development footprint of the solar power plant will be 256ha in extent.
GNR. 324 (as amended in 2017)	Activity 14(ii)(a)(c)(b)(i)(ff)	• "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."* • Activity 14(ii)(a)(c)(b)(i)(ff) is triggered based on the presence of wetlands (including a valleybottom wetland

		and a hill slope seep wetland) located within the development footprint proposed for the Oryx solar Power Plant. A section of the development footprint is located within a CBA 1 area.
GNR. 324 (as amended in 2017)	Activity 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) in the Free State (i) outside urban areas, within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* • Activity 18 (b)(i)(ee)(hh) is triggered since the existing access road to the site will need to be widened by more than 4 metres. The project is located within the Free State Province and outside urban areas. Wetlands (including a valleybottom wetland and a hill slope seep wetland) are located within the development footprint proposed for the Oryx solar Power Plant. A section of the development footprint is located within a CBA 1 area.

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

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

- Civil works to be conducted:

    - Terrain levelling if necessary– Levelling will be minimal as the potential site chosen is relatively flat.
    - Laying foundation- The structures will be connected to the ground through cement pillars, cement slabs or metal screws. The exact method will depend on the detailed geotechnical analysis.
    - Construction of access and internal roads/paths – existing paths will be used where reasonably possible. Access will be obtained via the Beatrix Shaft 4 Rd off the R30 to the north of the site. Additionally, the turning circle for trucks will also be taken into consideration.
    - Trenching – all Direct Current (DC) and Alternating Current (AC) wiring within the PV plant will be buried underground. Trenches will have a river sand base, space for pipes, backfill of sifted soil and soft sand and concrete layer where vehicles will pass.

2.3 PHOTOVOLTAIC TECHNOLOGY

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

- PV Panel Array - To produce up to 150MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun.

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

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. Whilst Oryx Solar Power Plant (RF) (Pty) Ltd has not yet received a cost estimate letter from Eskom, it is expected that generation from the facility will tie in with either the existing Oryx 2 - Theseus 132kV Overhead Power Line, the Oryx 1 - Theseus 132kV Overhead Power Line or the Beatrix - Theseus 132kV Overhead Power Line via a loop-in loop-out connection. The Project will inject up to 100MW into the National Grid. The installed capacity will be approximately 150MW.

  For the placement of the new power line three grid connection corridors are being assessed (each with a width of between 100m and 115m). These are as follows:

  - Grid connection corridor option 1 will connect the facility to the existing Oryx 2 - Theseus 132kV Overhead Power Line. The length of the corridor is 133m. This is considered to be the technically preferred option by the Applicant.

  - Grid connection corridor option 2 will connect the facility to the existing Oryx 1 - Theseus 132kV Overhead Power Line. The length of the corridor is 95m.

  - Grid connection corridor option 3 will connect the facility to the existing Beatrix - Theseus 132kV Overhead Power Line. The length of the corridor is 95m.

  It must be noted that the grid connection corridor options 2 and 3 follow a similar route and therefore overlap. All three grid connection corridor options are located within the affected property and therefore no areas outside of the farm portion will be affected.

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

- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on site:

  - Office (~200m²);

  - Switch gear and relay room (~400m²);

  - Staff lockers and changing room (~200m²); and

  - Security control (~60m²)

- Battery storage – Up to 500 MW Battery Storage Facility with a maximum height of 8m and a maximum volume of 1740 m^3 of batteries and associated operational, safety and control infrastructure.

- Roads – Access will be obtained via the Beatrix Shaft 4 Rd off the R30 to the north of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure. The access and internal roads will be constructed within a 25-meter corridor.

- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.

2.4 LAYOUT DESCRIPTION

The layout plan will follow the limitations of the site and aspects such as environmentally sensitive areas, roads, fencing and servitudes on site will be considered – refer to Figure G and Figure H. The total surface area proposed include the PV panel arrays spaced to avoid shadowing, access and maintenance roads and associated infrastructure (buildings, power inverters, transmission lines and perimeter fences). Limited features of environmental significance exist on site, with the main features of significance being wetland and riparian features, as well as cultural and heritage resources. These features have been avoided by the layout of the facility. A final layout plan is included as Figure G and Table 2.3 below provides detailed information regarding the layout for the proposed facility as per DFFE specifications.

Table 2.3: Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	6 meters
Area of PV Array	256 Hectares (Development footprint)
Number of inverters required	Minimum 50

Area occupied by inverter / transformer stations / substations / BESS	Central inverters+ LV/MV trafo: 20 m^2 HV/MV substation with switching station: 15 000 m^2 BESS: 40 000 m^2
Capacity of on-site substation	132kV
Capacity of the power line	132kV
Area occupied by both permanent and construction laydown areas	Permanent Laydown Area: 256 Hectares Construction Laydown Area: ~2000 m^2
Area occupied by buildings	Security Room: ~60 m^2 Office: ~200 m^2 Staff Locker and Changing Room: ~200 m^2
Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3
Length of internal roads	Approximately 15 km
Width of internal roads	Between 6 & 12 meters
Grid connection corridor width	Between 100 and up to 115m in width
Grid connection corridor length	Option 1: 133m (technically preferred option) Option 2: 95m Option 3: 95m
Power line servitude width	32m
Height of fencing	Approximately 2.5 meters

Table 2.4 and Figures 2.1 and 2.2 provide and illustrate the corner coordinate points for the proposed development site as well as the coordinates for the preferred power line, access road and battery storage facility.

Table 2.4: Coordinates

Coordinates			
Project Site	A	28°11'3.23"S	26°44'1.89"E
	B	28° 9'52.51"S	26°45'8.74"E
	C	28°10'23.27"S	26°45'36.78"E
	D	28°10'52.29"S	26°45'13.13"E
	E	28°11'5.82"S	26°44'59.55"E
	F	28°11'0.78"S	26°44'49.46"E
	G	28°11'1.03"S	26°44'48.79"E
	H	28°11'22.55"S	26°44'37.75"E
Proposed Access	1	28°10'46.97"S	26°44'17.23"E
100m wide Power Line Corridor (Option 1)	1	28°10'51.61"S	26°44'17.19"E
	2	28°10'49.02"S	26°44'19.68"E
	3	28°10'49.35"S	26°44'20.15"E
	4	28°10'52.99"S	26°44'21.68"E
	5	28°10'54.10"S	26°44'18.23"E
100m wide Power Line Corridor (Option 2 and 3)	1	28°10'58.63"S	26°44'20.09"E
	2	28°10'57.50"S	26°44'23.55"E
	3	28°10'59.86"S	26°44'24.49"E
	4	28°11'1.53"S	26°44'21.31"E
Battery Energy Storage System (BESS)	A	28°10'51.94"S	26°44'21.59"E
	B	28°10'49.29"S	26°44'29.85"E
	C	28°10'55.38"S	26°44'29.83"E
	D	28°10'58.33"S	26°44'24.24"E
Substation corner coordinates	A	28°10'54.10"S	26°44'18.22"E
	B	28°10'53.00"S	26°44'21.66"E
	C	28°10'57.47"S	26°44'23.54"E
	D	28°10'58.62"S	26°44'20.08"E

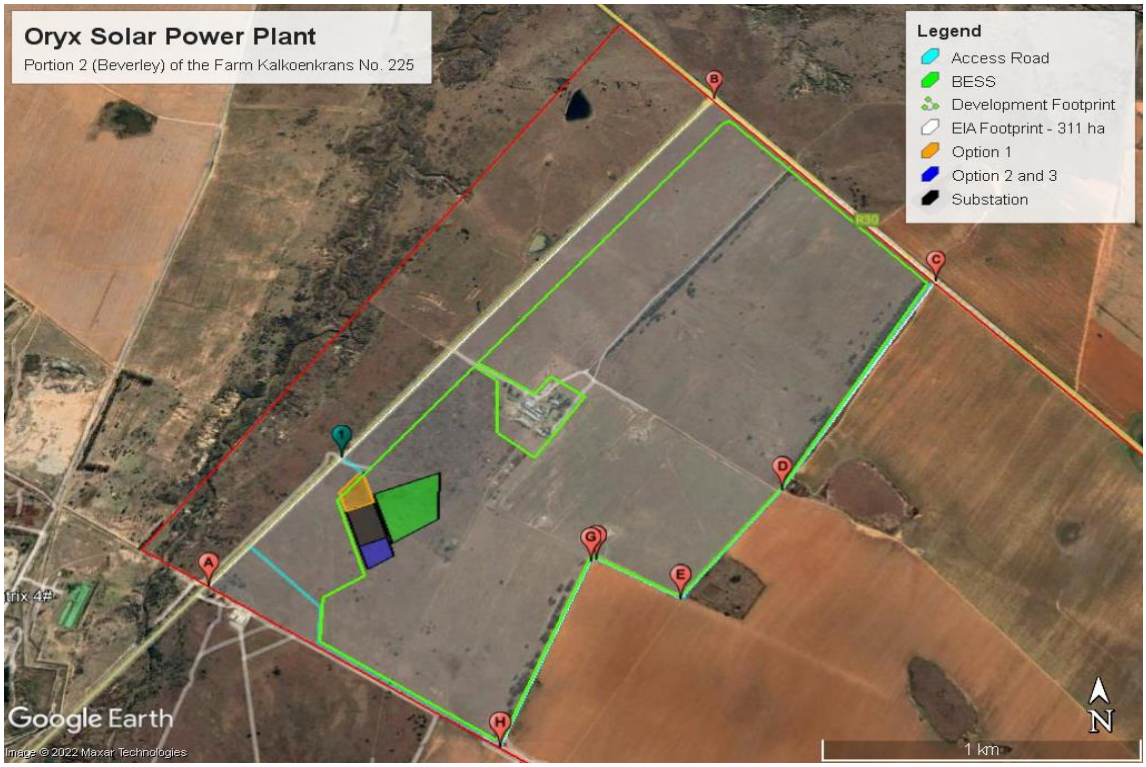


Figure 2.1: Map indicating coordinate points of the proposed Oryx Solar Power Plant (including the project site and the access road)

Figure 2.2: Map indicating coordinate points of the proposed Oryx Solar Power Plant (including the substation and the BESS)

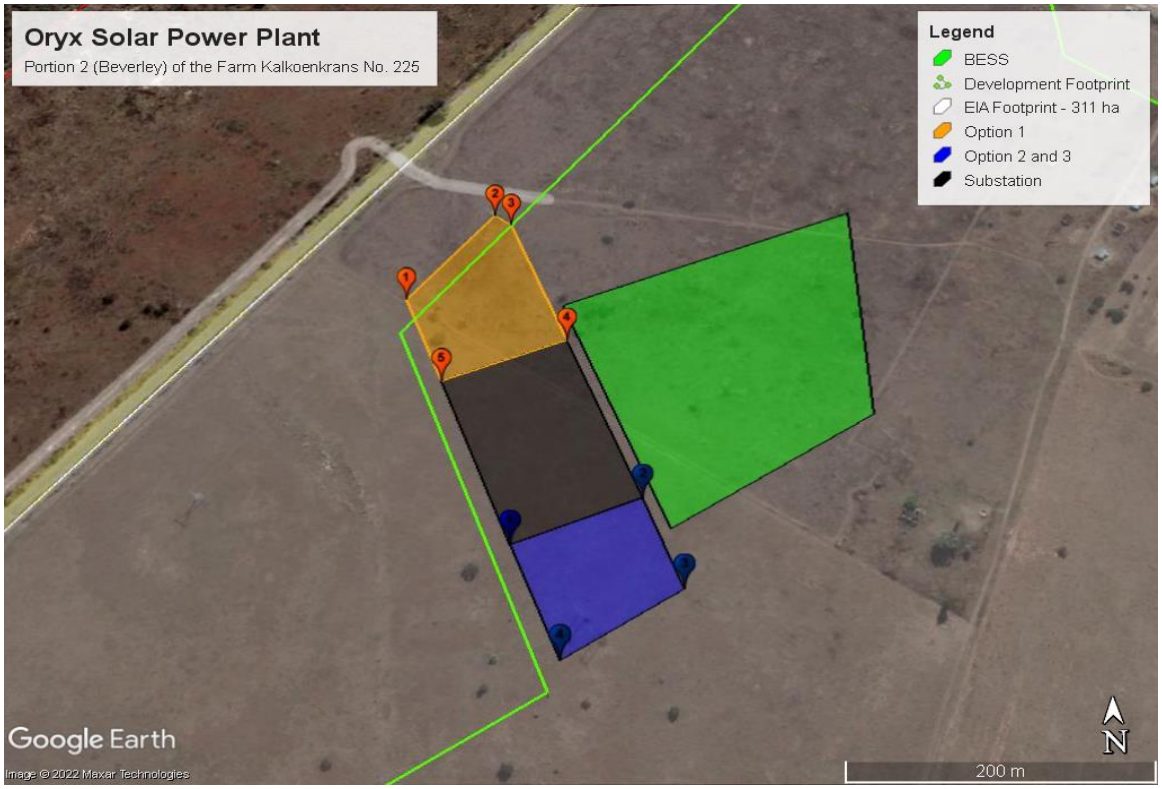


Figure 2.3: Map indicating coordinate points of the proposed Oryx Solar Power Plant (including the power line corridors)

2.5 SERVICES PROVISION

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

2.5.1 Water

Adequate provision of water will be a prerequisite for the development. Water for the proposed development will most likely be obtained from ground water resources or alternatively collected with water trucks from an authorized water service provider and stored on site. The Department of Water and Sanitation has been contacted by the project proponent to confirm the water resource availability in the relevant catchment management area in order to ensure sustainable water supply (refer to Appendix F for proof of correspondence). A full assessment of the application for water use authorisation will only be undertaken in the event that the project proponent has obtained preferred bidder status by the Department of Mineral Resources and Energy.

The estimated maximum amount of water required during construction is 1200m³ per month during the 12 - 18 months of construction. The estimated maximum amount of water required during the facility's 20 years of production is 4200m³ per annum. The majority of this usage is for the cleaning of the solar panels. Since each panel requires approximately 2 litres of water for cleaning, the total

amount of ~500 000 panels will require 1 000 000 litres per wash. It is estimated that the panels may only need to be washed twice per annum, but provision is made for quaternary cleaning (March, May, July, and September). This totals approximately 4,000,000 litres per annum for washing, and allows 200,000 litres per annum (or 548 litres per day) for toilet use, drinking water, etc.

Drinking water supplied will comply with the SANS:241 quality requirements. Water quality from the borehole will be tested to confirm SANS:214 quality, if water quality is not sufficient for drinking, bottled water will be supplied to staff during construction and operational phases of the project.

Water saving devices and technologies such as the use of dual flush toilets and low-flow taps, the management of stormwater, the capture and use of rainwater from gutters and roofs will be considered by the developer. Furthermore, indigenous vegetation will be used during landscaping and the staff will be trained to implement good housekeeping techniques.

2.5.2 Stormwater

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

2.5.3 Sanitation and waste removal

Portable chemical toilets will be utilised, that will be serviced privately or by the local municipality. Waste will be disposed at a licensed landfill site. The construction- and hazardous waste will be removed and disposed of at licensed landfill sites accepting such kinds of wastes. During the operational phase household waste will be removed to a licensed landfill site by a private contractor or by the local municipality. The relevant Local Municipality(s) have been contacted, to formally confirm that it has the capacity to provide the proposed development with these services for the lifetime of the project (20 years). Sewage waste will be transported from site via private contractors to the Virginia decanting point (see appendix G09), thereafter the municipality will pump the sewage to the Virginia waste water treatment works (see appendix G08 for relevant certificate).

2.5.4 Electricity

During the construction phase of the development, electricity will either be generated on site through a small solar system or through the use of generators or the existing Eskom supply on the affected property will be utilised. This will depend on the Engineering, Procurement, and Construction (EPC) contractor appointed. During operation electricity use will be limited and will primarily be related to the lighting of the facility and domestic use. Design measures such as the use of energy saving light bulbs would be considered by the developer. During the day, electricity will be sourced from the photovoltaic plant, and from the electricity connection at night.

2.5.5 Decommissioning of the facility

The operating period will be 20 years from the commencement date of the operation phase. Thereafter two rights of renewal periods of 40 years and 20 years will be relevant. It is anticipated that new PV technologies and equipment will be implemented, within the scope of the Environmental Authorisation, when influencing the profitability of the solar facility.

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

The decommissioning process will consist of the following steps:

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

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

- Removal of all structures and rubble,
- Breaking up compaction where required, loosening of the soil and the redistribution of topsoil,
- The surface will be restored to the original contours and hydro seeding will take place.

3 LEGISLATIVE AND POLICY CONTEXT

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

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

3.1 INTRODUCTION

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

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA]
- The National Energy Act, 2008 (Act 34 of 2008)
- National Water Act, 1998 (Act No. 36 of 1998)
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999)
- Conservation of Agricultural Resources Act, 1983 (Act No. 85 of 1983)
- The National Forests Act, 1998 (Act 84 of 1998)
- The White Paper on the Energy Policy of the Republic of South Africa (1998)
- The White Paper on Renewable Energy (2003)
- Integrated Energy Plan (IEP) (2016)
- Integrated Resource Plan (IRP) for South Africa (2010-2030) (2019)
- National Development Plan of 2030 (2012)
- National Infrastructure Plan of South Africa (2012)
- New Growth Path Framework (2010)

- Climate Change Bill (2018)
- Climate Change Bill (2021) – for public comment
- Strategic Integrated Projects (SIPs) (2010 – 2030)
- Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa (2014)
- Free State Provincial Spatial Development Framework (PSDF) (2012)
- Lejweleputswa District Municipality Final Integrated Development Plan (IDP) 2021 – 2022 (2021)
- Matjhabeng Local Municipality Integrated Development Plan 2022/2023 (2022)
- Matjhabeng Municipal Spatial Development Framework Phase 4 (SDF) (2020/2021 – 2024/2025) (2021)

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

3.2 LEGISLATIVE CONTEXT

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

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

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

			The site is located within the C42K quaternary catchment and is situated in the Middle Vaal Water Management Area. Drainage occurs as sheet-wash into the drainage channels on site that eventually drains into the major river namely the Bosluisspruit that occurs to the west of the project area. Also, should a water use license be required for the project, the National Water Act will be applicable in terms of obtaining the relevant license.
National Environmental Management: Waste Act (Act No. 59 of 2008)	National Department Environmental Affairs (DEA) (now known as the Department of Forestry, Fisheries and the Environment)	2008	NEMWA has been developed as part of the law reform process enacted through the White Paper on Integrated Pollution and Waste Management and the National Waste Management Strategy (NWMS). The objectives of the Act relate to the provision of measures to protect health, well-being and the environment, to ensure that people are aware of the impact of waste on their health, well-being and the environment, to provide for compliance with the measures, and to give effect to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being. Regulations No. R921 (of 2013) promulgated in terms of Section 19(1) of the National Environmental Management: Waste Act (59 of 2008) determines that no person may commence, undertake or conduct a waste management activity listed in this schedule unless a license is issued in respect of that activity. It is not envisaged that a waste permit will be required for the proposed development as no listed activities in terms of waste management are expected to be triggered.
National Environment Management: Air Quality Act (Act No. 39 of 2004)	National Department Environmental Affairs (DEA) (now known as the Department of Forestry, Fisheries and the Environment)	2004	The object of this Act is to protect the environment by providing reasonable measures for the protection and enhancement of the quality of air in the Republic; the prevention of air pollution and ecological degradation; and securing ecologically sustainable development while promoting justifiable economic and social development. Regulations No. R248 (of 31 March 2010) promulgated in terms of Section 21(1)(a) of the National Environmental Management Act: Air Quality Act (39 of 2004) determine that an Atmospheric Emission License (AEL) is required for certain listed activities, which result in atmospheric emissions

			which have or may have a detrimental effect on the environment. The Regulation also sets out the minimum emission standards for the listed activities. It is not envisaged that an Atmospheric Emission License will be required for the proposed development.
The National Heritage Resources Act (Act No. 25 of 1999)	South African Heritage Resources Agency (SAHRA)	1999	The Act aims to introduce an integrated and interactive system for the management of heritage resources, to promote good governance at all levels, and empower civil society to nurture and conserve heritage resources so that they may be bequeathed to future generations and to lay down principles for governing heritage resources management throughout the Republic. It also aims to establish the South African Heritage Resources Agency together with its Council to co-ordinate and promote the management of heritage resources, to set norms and maintain essential national standards and to protect heritage resources, to provide for the protection and management of conservation-worthy places and areas by local authorities, and to provide for matters connected therewith. The Act protects and manages certain categories of heritage resources in South Africa. For the purposes of the Heritage Resources Act, a "heritage resource" includes any place or object of cultural significance. In this regard the Act makes provision for a person undertaking an activity listed in Section 28 of the Act to notify the resources authority. The resources authority may request that a heritage impact assessment be conducted if there is reason to believe that heritage resources will be affected. A case file has been opened on SAHRIS for the Oryx Solar Power Plant and all relevant documents have been submitted for their comments and approval. The Heritage Impact Assessment undertaken for the solar power plant is included as Appendix H6.
Conservation of Agricultural Resources Act (Act No. 85 of 1983)	National and Provincial Government	1983	The objective of the Act is to provide control over the utilisation of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith. Consent will be required from the Department of Agriculture, Forestry and Fisheries (now known as the Department of Forestry, Fisheries and the Environment) in order to confirm that the

			proposed development is not located on high potential agricultural land and to approve the long-term lease agreement. An Agricultural Compliance Statement has been undertaken for the Oryx Solar Power Plant and is included as Appendix E10 of this FinalEIR.
The National Forests Act, 1998 (Act 84 of 1998)	Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)	1998	The purposes of this Act are to: (a) promote the sustainable management and development of forests for the benefit of all; (b) create the conditions necessary to restructure forestry in State forests; (c) provide special measures for the protection of certain forests and trees: (d) promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes. (e) promote community forestry; (f) promote greater participation in all aspects of forestry and the forest products industry by persons disadvantaged by unfair discrimination. Section 12(1) read with s15(1) of the NFA stated that the Minister may declare a particular tree, group of trees, woodland; or trees belonging to a particular species, to be a protected tree, group of trees, woodland or species. A list of protected tree species was gazetted in GN 635 of 6 December 2019. The effect of the declaration is that no person may (a) cut, disturb, damage or destroy; or (b) possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except under a license granted by the Minister; or in terms of an exemption published by the Minister in the Gazette. A Terrestrial Biodiversity Impact Assessment has been undertaken for the Oryx Solar Power Plant and is included in Appendix E3.

3.3 POLICY CONTEXT

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

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

			• Lower energy densities; and • Lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. The Oryx Solar Power Plant is in line with this policy as it proposes the generation of renewable energy from the solar resource.
The White Paper on Renewable Energy	Department of Mineral Resources and Energy	2003	This White Paper on Renewable Energy supplements the *White Paper on Energy Policy*, which recognises that the medium and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. The White Paper notes that while South Africa is well-endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. The medium-term (10-year) target set in the White Paper is: *10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1667 MW) of the projected electricity demand for 2013 (41539 MW)* (Executive Summary, ix). The Oryx Solar Power Plant is in line with this paper as it proposes the generation of renewable energy from the solar resource.
Integrated Energy Plan (IEP) (2016)	Department of Mineral Resources and Energy	2016	The Integrated Energy Plan (IEP) (which was developed under the National Energy Act (No. 34 of 2008)), recognises that energy is essential to many human activities, and is critical to the social and economic development of a country. The purpose of the IEP is essentially to ensure the availability of energy resources, and access to energy services in an affordable and sustainable manner, while minimising

			associated adverse environmental impacts. Energy planning therefore needs to balance the need for continued economic growth with social needs, and the need to protect the natural environment. The 8 key objectives of the integrated energy planning process, are as follows: • Objective 1: Ensure security of supply. • Objective 2: Minimise the cost of energy. • Objective 3: Promote the creation of jobs and localisation. • Objective 4: Minimise negative environmental impacts from the energy sector. • Objective 5: Promote the conservation of water. • Objective 6: Diversify supply sources and primary sources of energy. • Objective 7: Promote energy efficiency in the economy. • Objective 8: Increase access to modern energy. The Oryx Solar Power Plant is in line with this policy as it proposes the generation of renewable energy from the solar resource.
Integrated Resource Plan (IRP) for South Africa	Department of Mineral Resources and Energy	2019	The Integrated Resource Plan (IRP) for Electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation. The current iteration of the IRP led to the Revised Balanced Scenario (RBS) that was published in October 2010. Following a round of public participation which was conducted in November / December 2010, several changes were made to the IRP model assumptions. The document outlines the proposed generation new-build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on a cost-optimal solution for new-build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation.

			The Policy-Adjusted IRP reflected recent developments with respect to prices for renewables. In addition to all existing and committed power plants, the plan includes 9.6GW of nuclear, 6.25GW of coal, 17.8GW of renewables, and approximately 8.9GW of other generation sources such as hydro, and gas. Besides capacity additions, several assumptions have changed since the promulgation of IRP 2010–2030. Key assumptions that changed include the electricity demand projection, Eskom's existing plant performance, as well as new technology costs. These changes necessitated the review and update of the IRP which resulted in the draft IRP 2018. According to the South African Energy Sector Overview (2021), there is currently 1 723MW of installed PV capacity, while an additional 2 600MW from wind and solar has been rewarded as part of Bid window 5. The Oryx Solar Power Plant is in line with this plan as it proposes the generation of renewable energy from the solar resource and will contribute to the energy mix of the country as set out in this plan.
National Development Plan of 2030	The Presidency: National Planning Commission	-	The National Development Plan aims to "eliminate poverty and reduce inequality by 2030" (RSA, undated). In order to eliminate or reduce inequality, the economy of South Africa needs to grow faster in order to benefit all South Africans. In May 2010 a draft national development plan was drafted, which highlighted the nine (9) key challenges for South Africa. The highest priority areas according to the plan are considered to be the creation of employment opportunities and to improve the quality of national education. In this regard, the plan sets out three (3) priority areas, namely, to raise employment by a faster growing economy, improve the quality of education, and to build the capability of the state in order to play a more developmental and transformative role. One of the key challenges identified was that the economy is unsustainably resource intensive, and the acceleration and expansion of renewable energy was identified as a key intervention strategy to address this challenge. The development of the Oryx Solar Power Plant will contribute to the intervention strategy as identified within the plan.
National Infrastructure	Presidential Infrastructure	2012	In the year 2012 the South African Government adopted a National Infrastructure Plan (hereafter referred to as the Plan). The aim of this Plan is to transform the economic landscape, while strengthening the delivery of basic services and creating new employment opportunities. This Plan also supports the integration of

Plan of South Africa	Coordinating Commission		African communities, and also sets out the challenges and enablers that our country needs in order to respond to the planning and development of infrastructure with regards to fostering economic growth (RSA, 2012). The Plan has developed eighteen (18) strategic integrated projects (further referred to as SIPs). These SIPs stretch over all nine (9) provinces, covering social and economic infrastructure, and projects that enhances development and growth. Of the eighteen (18), five (5) are geographically focused, three (3) spatial, three (3) energy, three (3) social infrastructure, two (2) knowledge, one (1) regional integration, and one (1) water and sanitation focussed. The three (3) SIPs according to the Plan, which are energy focused and correlate to the proposed project are as follow: - SIP 8: Green energy in support of the South African economy; - SIP 9: Electricity generation to support socio-economic development; and - SIP 10: Electricity transmission and distribution for all. SIP 8 according to the Plan "*support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the IRP 2010 and support bio-fuel production facilities*". The purpose of SIP 9 according to the Plan is to "*accelerate the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances*". SIP 9 should also monitor the implementation of major projects such as new power stations like Medupi, Kusile and Ingula. Lastly, SIP 10 aims to "*expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development*" (RSA, 2012:20). The Oryx Solar Power Plant is in line with this plan as it proposes the generation of renewable energy from the solar resource which supports socio-economic development and will contribute to meeting the electricity demand of the country as set out in this plan.
New Growth Path Framework	Department of Economic Development	-	The New Growth Path was developed after 16 years of South Africa's democracy, to respond to emerging opportunities and risks while building on policies. This framework provides a dynamic vision on how to collectively achieve a more developed, equitable and democratic society and economy. This framework mainly reflects the commitment of the South African Government to create employment opportunities for its people in all economic policies (RSA, 2011b).

			This framework sets out the markers for job creation and growth and also identify where there are viable changes in the character and structure of production, in order to create a more inclusive, greener economy on the long-term. It is stated in the framework that in order for this framework to reach its objectives, the Government is committed to: - Identify the possible areas of employment creation; and - Develop a policy to facilitate employment creation especially with regards to social equity, sustainable employment and growth in the creation of employment activities (RSA, 2011b). This framework also identifies investments in five key areas, one of which is energy. This framework also states that the green economy is a priority area, which includes the construction of and investment in renewable energy technologies like solar (RSA, 2011b). In this regard it will also assist creating employment opportunities over the medium- and long-term. Considering that the construction of and investment in renewable energy is a key are identified within the framework, the Oryx Solar Power Plant is considered to be in-line with the framework.
Climate Change Bill	National Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)	2018	On 08 June 2018 the Minister of Environmental Affairs published the Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. The following objectives are set within the Bill: • Provide for the coordinated and integrated response to climate change and its impacts by all spheres of government in accordance with the principles of cooperative governance; • Provide for the effective management of inevitable climate change impacts through enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic, and environmental resilience and an adequate national adaptation response in the context of the global climate change response;

			• Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe and in a manner that enables economic, employment, social and environmental development to proceed in a sustainable manner. Oryx Solar Power Plant comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Committee	2010 - 2030	The Presidential Infrastructure Coordinating Committee (PICC) is integrating and phasing investment plans across 18 Strategic Infrastructure Projects (SIPs) which have five core functions: to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development and enabling regional integration. SIP 8 and 9 of the energy SIPs supports the development of the solar energy facility: • SIP 8: Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010 – 2030) and supports bio-fuel production facilities. • SIP 9: Electricity generation to support socio-economic development: The proposed Springbok Solar Power Plant is a potential SIP 9 Project as electricity will be generated and social and economic upliftment, development and growth will take place within the surrounding communities. It would become a SIP 9 project if selected as a Preferred Bidder project by the Department of Energy. SIP 9 supports the acceleration of the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances. Oryx Solar Power Plant could be registered as a SIP project once selected as a preferred bidder under the REIPPP Programme. The project would then contribute to the above-mentioned SIPs.

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

The PSDF includes comprehensive plans and strategies that collectively indicate which type of land-use should be promoted in the province, where such land-use should take place, and how it should be implemented and managed. In broad terms, the PSDF:

- Adopt a holistic approach to spatial development in order to minimise the long-term negative impacts of current land use or development decisions.
- Ensure that spatial planning serves national, provincial and/or local interest.
- Support the long-term adequacy or availability of physical, social and economic resources to support or carry development.
- Protect existing natural, environmental, and cultural resources.
- Ensure that land which is currently in agricultural use would only be reallocated to other uses where real need exists, and prime agricultural land should remain in production.
- Support mining as a vital economic driver in the province without jeopardizing the biodiversity value of the environment.
- Adopt a climate change strategy that will provide for responsible actions to curb the effect of global warming and climate change.

The Spatial Challenges and Opportunities provide the crucial components that underlie sustainable development, i.e., need for basic infrastructure and development for the poor, economic growth and development, environmental conservation, and improved livelihoods. These spatial development priorities form the basis for guiding specific decisions regarding the desired spatial development and arrangement of broad land uses within Free State and investment and development spending.

The PSDF provides Spatial Framework and Development Strategies that will manage future growth and associated change in a way that protects and enhance the use of natural resources, biodiversity, and lifestyle values. This requires a highly sustainable pattern of development based on the efficient utilisation of land and infrastructure, supported by management decisions over ad hoc and dispersed forms of development.

			The PSDF builds upon achievements and learns from mistakes of the past, reacts to the challenges of our time, incorporates the traditional knowledge of the people of the Free State, and builds upon international best-practice and technology. The development of the Oryx Solar Power Plant is in-line with the framework based on the contributions and opportunities presented by a development of this nature.
Ngaka Modiri Molema District Municipality Draft Integrated Development Plan (IDP) 2020-2021	Ngaka Modiri Molema District Municipality	2020	The long-term vision of the Ngaka Modiri Molema DM is to be the: "Leaders in integrated municipal governance". The above stated vision defines what the Ngaka Modiri Molema DM would like to attain over medium to long-term, and for that achievement to effectively materialize, their mission is: "To provide a developmental municipal governance system for a better life for all". The SIPS provide an integrated framework for the delivery and implementation of social and economic infrastructure across the face of South Africa. Some of the SIPSs include catalytic projects that can be used to fast-track growth, address unemployment and reduce poverty and inequality. Due to the various nature and geographic spatial locations, the municipality is only involved in a few of the SIPS. The municipality's plans will be aligned with these SIPs in an effort to respond to national government's service delivery initiatives. Furthermore, work is to be done to align key cross-cutting areas, namely human settlement planning and skills development in line with each of the Strategic Infrastructure Projects, especially: - Green Energy in support of the South African economy (SIP 8): Supporting sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010). - Electricity Generation to support socio-economic development (SIP 9): acceleration of the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy; and addressing historical imbalances. Considering the plans for the alignment of the DM's plans with SIP 8 and SIP 9 it is confirmed that the Oryx Solar Power Plant is in line with the plan.
Ditsobotla Local Municipality	Ditsobotla Local Municipality	2020	The vision of the Ditsobotla LM is to be "A developmental municipality dedicated to the social and economic upliftment of its communities." The Mission Statement is: "Sustainable service delivery through transparent

Final Integrated Development Plan (IDP) 2020-2021			administration, dedicated staff, implementation of municipal programmes and consultation with communities". The development of the Oryx Solar Power Plant will contribute to the local economy of the area and therefore assist (albeit to a limited extent) to socio-economic growth.
Ditsobotla Local Municipality Spatial Development Framework	Ditsobotla Local Municipality	2018	The spatial development vision is aligned with the municipal general vision and mission statements: "A developmental Municipality dedicated to the social and economic upliftment of its communities". Its mission is: "Sustainable service delivery through transparent administration, dedicated staff, implementation of municipal programmes and consultation with communities". The municipal area is characterised by low to medium income, high unemployment and low skills. Because of the high level of needs in the area, the Municipality has been categorized as a Priority 1 Investment Area in the Province. Taking also into account the National Spatial Development perspective which states that economic growth and employment creation should be focussed in areas where it will be most effective and sustainable in terms of local potential, and supporting restructuring (addressing the mismatch where people have to live and work), the spatial development vision for Ditsobotla LM was formulated: "Address key national, provincial and local priorities by focussing the provision of socio-economic infrastructure in areas with the highest growth potential (with prospects of the highest return on capital and social upliftment) but still attending to the basic needs of people elsewhere." The development of the Oryx Solar Power Plant will contribute to the local economy of the area and therefore assist (albeit to a limited extent) to socio-economic growth and the alleviation of poverty.

3.4 OTHER LEGISLATION

Other legislation mainly refers to the following:

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

3.5 RELEVANT GUIDANCE

The following guidance was considered in conducting the EIA:

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

3.6 CONCLUSION

The EIA was undertaken in accordance with the EIA Regulations (2017) published in GNR 326, in terms of Section 24(5) and 44 of the NEMA as amended as well as all relevant National legislation, policy documents and national guidelines.

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

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

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

4 THE NEED AND DESIRABILITY

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

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

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

4.1 THE NEED FOR THE PROPOSED ACTIVITY

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

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

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

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

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

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

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

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

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

4.2 THE DESIRABILITY OF THE PROPOSED ACTIVITY

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

- Lesser dependence on fossil fuel generated power - The deployment of the facility will have a positive macro-economic impact by reducing South Africa's dependence on fossil fuel generated power and assisting the country in meeting its growing electricity demand.
- Increased surety of supply - By diversifying the sources of power in the country, the surety of supply will increase. The power demands of South Africa are ever increasing and by adding solar power this demand can be met, even exceeded without increasing pollution in relation to the use of fossil fuels. The project has the potential of "securing" economic activity by assisting in removing supply constraints if Eskom generation activities result in a supply shortfall. When supply is constrained, it represents a limitation to economic growth. When a supply reserve is available, it represents an opportunity for economic growth.

- Local economic growth - The proposed project will contribute to local economic growth by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Free State Province. The project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally. The development of the photovoltaic solar facility will in turn lead to growth in tax revenues for local municipalities and sales of carbon credits, resulting in increased foreign direct investment. he location of the proposed development within the Matjhabeng Local Municipality is desirable since 48,4% of households within the Municipality live within the poverty level with an income of less than R38 200. (Matjhabeng IDP, 2020/2021).
- Lower costs of alternative energy - An increase in the number of solar facilities commissioned will eventually reduce the cost of the power generated through solar facilities. This will contribute to the country's objective of utilising more renewable energy and less fossil fuel-based power sources. It will assist in achieving the goal to generate 14 725 MW of electricity from renewable energy as per the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme of the Department of Mineral Resources and Energy. The Government will soon be initiating the procurement of an additional 11 800 MW of renewable energy as stated during the 2021 State of the Nation Address.
- Reduction in greenhouse gas emissions - The additional power supplied through solar energy will reduce the reliance on the combustion of fossil fuels to produce power. The South African electricity grid is predominantly coal-fired and therefore GHG emissions intensive (coal accounts for more than 92% of the fuel used in South Africa's electricity generation). The reduction of GHG emissions as a result of the project implementation will be achieved due to reduction of CO_2 emissions from combustion of fossil fuels at the existing grid-connected power plants and plants which would likely be built in the absence of the project activity.
- CDM Project - A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e., a financial mechanism developed to encourage the development of renewable technologies).
- Climate change mitigation - On a global scale, the project contributes to greenhouse gas emission reduction and therefore contributes toward climate change mitigation.
- Reduced environmental impacts - The reduction in electricity consumed from the grid will not only result in a reduction in greenhouse gas emissions, but also the prevention of negative impacts associated with coal mining. For example, coal power requires high volumes of water, in areas of South Africa where water supply is already over-stretched and water availability is highly variable. Photovoltaic solar energy technology also does not produce the sulphur emissions, ash or coal mining concerns associated with conventional coal fired electricity generation technologies resulting in a relatively low level of environmental impacts. It is a clean technology which contributes toward a better-quality environment for employees and nearby communities.

- Social benefits - The project activity is likely to have significant long-term, indirect positive social impacts that may extend to a regional and even national scale. The larger scale impacts are to be derived in the utilisation of solar power and the experience gained through the construction and operation of the power plant. In future, this experience can be employed at other similar solar installations in South Africa.
- Provision of job opportunities - The main benefit of the proposed development operating in the area is that local companies or contractors will be hired for the duration of the construction period. The operational phase will provide permanent job opportunities to the local communities from the surrounding area since security guards and general labourers will be required on a full-time basis. Approximately 800 employment opportunities will be created during the construction and operational phases.
- Indirect socio-economic benefits - The increase in the demand for services such as accommodation, transportation, security, general maintenance, and catering will generate additional indirect socio-economic benefits for the local community members.
- Effective use of resources - Due to the climate limitations, the site is totally unsuitable for cultivated crops, and viable agricultural land use is limited to grazing only. The proposed development in this specific area will generate alternative land use income through rental for the energy facility, which will have a positive impact on agriculture. It will provide the landowner with increased cash flow and rural livelihood, and thereby improve the financial sustainability of agricultural activities.
- Increased access to electricity: According to the Matjhabeng LM IDP, the national electricity crises of 2010 and the resultant effects on South African residents and the economy has highlighted how highly reliant we are on electricity as a source of energy. Government has committed to developing measures to promote energy saving, reduce energy costs to the economy, and reduce the negative impact of energy use on the environment.
- Cumulative impacts of low to medium significance - No solar PV plants have been granted preferred bidder status within proximity radius of 30km to the proposed Oryx SPP. This Final EIR includes a detailed assessment of the potential cumulative impacts associated with the proposed development – refer to Section 7 of the report. No cumulative impacts with a high residual risk have been identified. In terms of the desirability of the development of sources of renewable energy therefore, it may be preferable to incur a higher cumulative loss in such a region as this one, than to lose land with a higher environmental value elsewhere in the country. Therefore, considering the cumulative impacts associated with the development and the significance ratings thereof being medium and low, the project can be considered as desirable for development.

5 DESCRIPTION OF ENVIRONMENTAL ISSUES

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

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

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

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

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

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

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

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

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

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

5.1 CONSIDERATION OF ALTERNATIVES

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

An initial site assessment (refer to Appendix D) was conducted by the developer on Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225 and the farm was found favorable due to its close proximity to grid connections, solar radiation, ecology and relative flat terrain. Some parts of the farm have been deemed not suitable for the proposed development such as areas under cultivation. Where specific features of environmental sensitivity are identified by the independent specialists as part of the Scoping Phase, these areas and the associated required buffers will be considered by the developer to ensure that the facility layout is appropriate considering the sensitive features present. The site selection also took the site geology, land capability, water availability and land use into consideration before deciding on the specific site within the affected property. A single alternative site on the same farm has been identified (Subsolar, 2022).

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

5.1.1 No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo of the affected environment. The description provided in section 5.3 of this report could be considered the baseline conditions (status quo) to persist should the no-go alternative be preferred. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for the current land uses present. The area associated with the development footprint has limited agricultural potential and is unsuitable for cultivation, with grazing considered to be the only agricultural option. The potential opportunity costs in terms of alternative land use income through rental for the energy facility and the supporting social and economic development in the area would be lost if the *status quo* persists.

5.1.2 Location alternatives

This alternative asks the question, if there is not, from an environmental perspective, a more suitable location for the proposed activity. No other properties have at this stage been secured by Oryx Solar Power Plant (RF) (Pty) Ltd in the Virginia/Welkom area to potentially establish the Oryx Solar Power Plant. From a local perspective Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225 is preferred due to its suitable climatic conditions, topography (i.e. in terms of slope), environmental conditions (i.e. agricultural potential and archaeology), proximity to a grid connection point (i.e. for the purpose of electricity evacuation), as well as site access (i.e. to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase).

Within the affected property, areas under cultivation have been excluded from the development footprint and is not being considered for development at all. No alternative areas on Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225 have been considered for the development footprint, as the area identified and assessed in this FinalEIA report avoids the areas currently under cultivation and is therefore considered available for development without excluding the current agricultural land use activities from the property.

However, provision have been made in this FinalEIA report to consider the results of the specialist studies to exclude the sensitive areas present, which includes the no-go buffer areas recommended by the specialist. The sensitive areas and associated buffers have been considered by the developer for the facility layout design to optimise the layout for avoidance of the environmental sensitivities identified.

As part of the specialist studies undertaken, areas that will need to be avoided has been identified which includes a burial site, as well as hillslope seep and valleybottom wetland features present within the development footprint. The development footprint is however large enough to ensure the avoidance of the sensitive features and the associated buffers by the facility layout and still provide an opportunity for the successful development and operation of the Oryx Solar Power Plant from a

technical perspective. Therefore, a single preferred location alternative was assessed – refer to Figures 5.1.

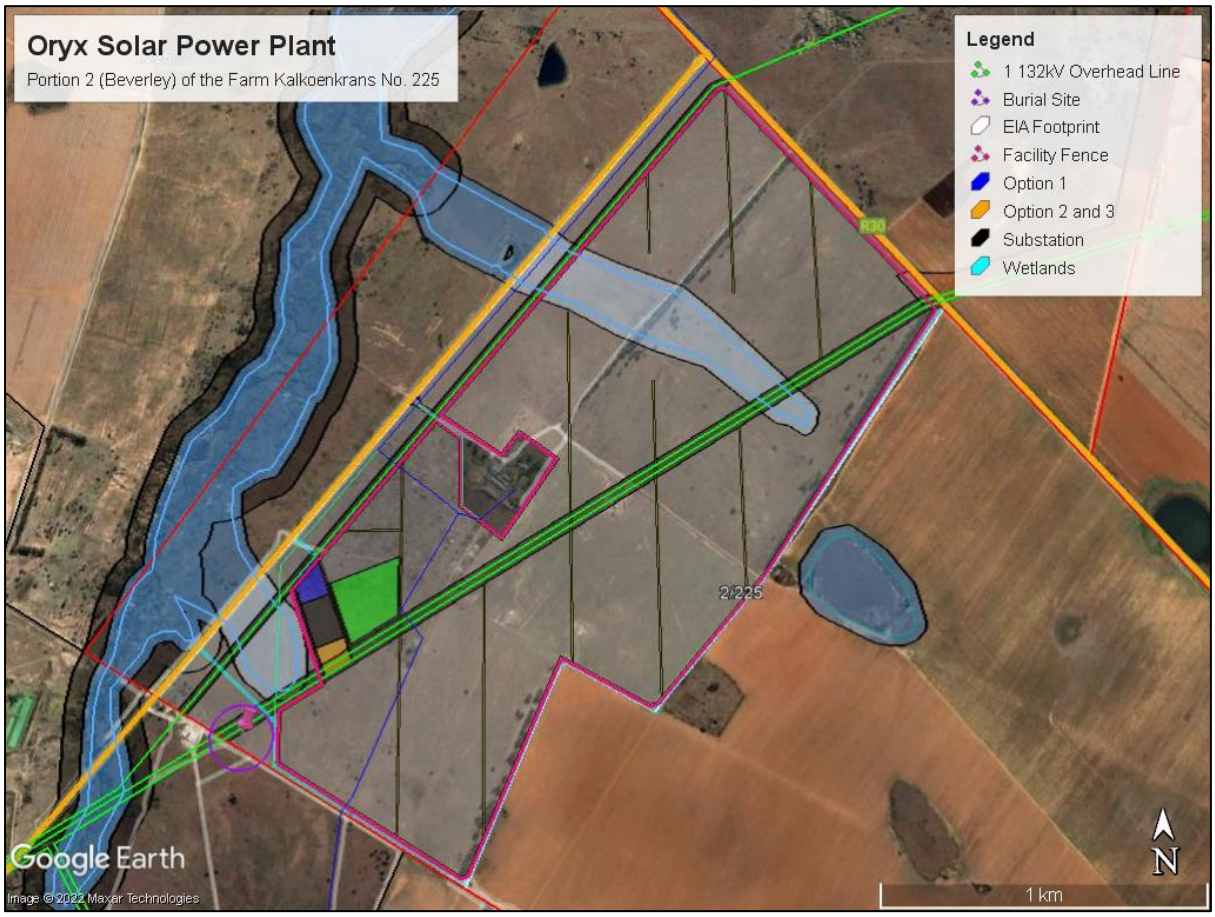


Figure 5.1: Location of the single preferred location alternative (i.e. development footprint) located within the affected property assessed.

5.1.3 Activity alternatives

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

- Photovoltaic (PV) solar facility – Oryx Solar Power Plant (RF) (Pty) Ltd is part of a portfolio of solar PV projects throughout South Africa. Oryx Solar Power Plant (RF) (Pty) Ltd is of the opinion that solar PV technology is perfectly suited to the site, given the high irradiation values for of the Welkom/Virginia area – refer to Figure 5.3. The technology furthermore entails low visual impacts, have relatively low water requirements, is a simple and reliable type of technology and all the components can be recycled.

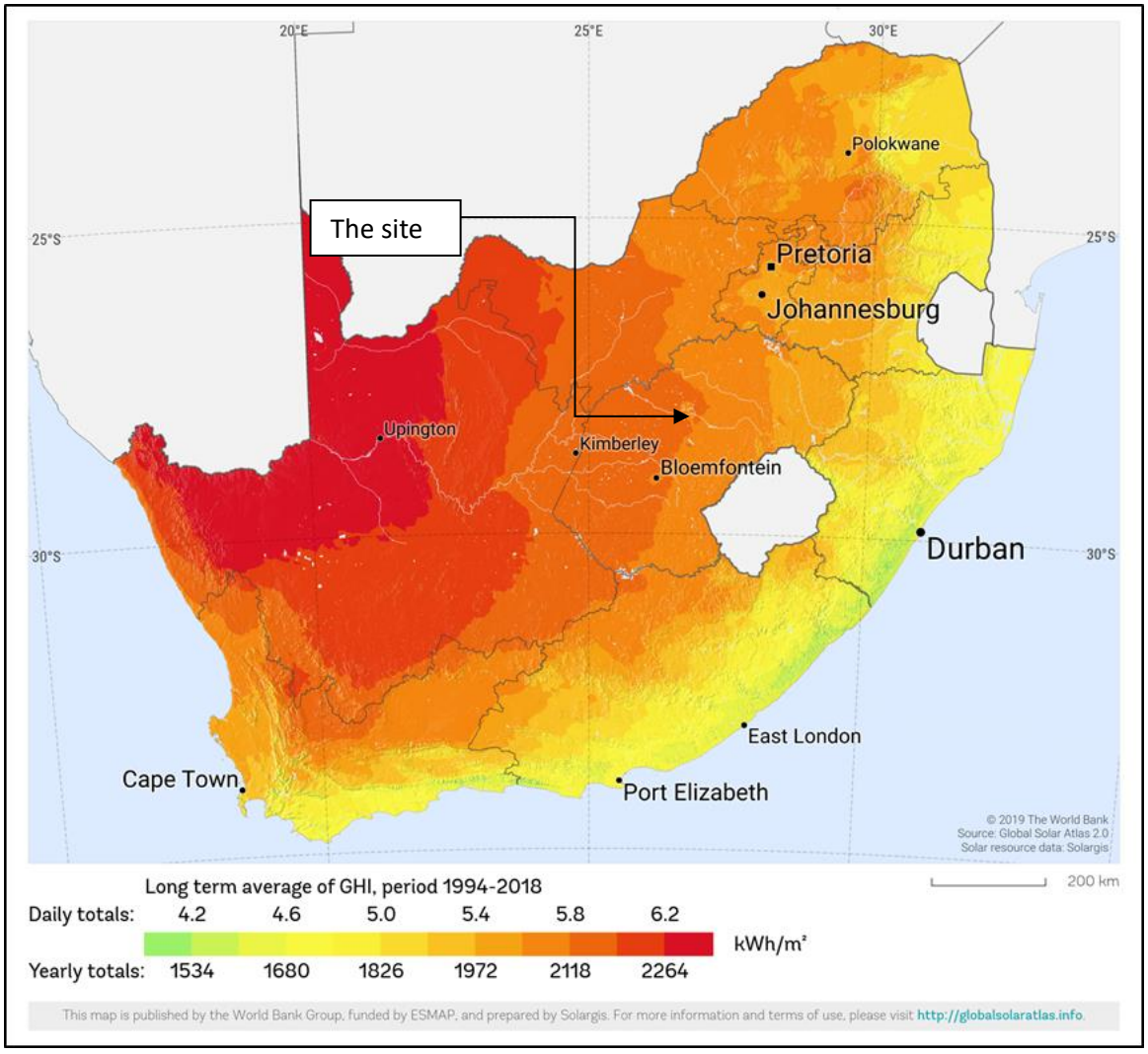


Figure 5.2: Global horizontal irradiation values for South Africa (SolarGIS, 2021).

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

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

5.1.4 Technical alternatives

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

5.1.4.1 Distribution lines

It is expected that generation from the facility will tie in with an existing power line present within the affected property and development footprint. Three grid connection points are being considered for the development which includes the Oryx 2 - Theseus 132kV Overhead Power Line, the Oryx 1 - Theseus 132kV Overhead Power Line and the Beatrix - Theseus 132kV Overhead Power Line. A new 132kV power line will be constructed to connect the solar power plant to one of the three connection points.

For the placement of the new power line three grid connection corridors are being assessed (each with a width of between 100m and 115m). These are as follows:

- Grid connection corridor option 1 will connect the facility to the existing Oryx 2 - Theseus 132kV Overhead Power Line. This is considered to be the technically preferred option by the Applicant for the project.
- Grid connection corridor option 2 will connect the facility to the existing Oryx 1 - Theseus 132kV Overhead Power Line
- Grid connection corridor option 3 will connect the facility to the existing Beatrix - Theseus 132kV Overhead Power Line

It must be noted that the grid connection corridor options 2 and 3 follow a similar route and therefore overlap. All three grid connection corridor options are located within the affected property and therefore no areas outside of the farm portion will be affected. Refer to Figure 5.3.

Following the consideration of the environmental sensitivities identified within the development footprint, the Applicant optimised the placement of the grid connection infrastructure within the development footprint to ensure avoidance of the sensitive features is achieved. Refer to Figure 5.4.

Figure 5.3: Grid connection corridor options considered and assessed for the development of the Oryx Solar Power Plant

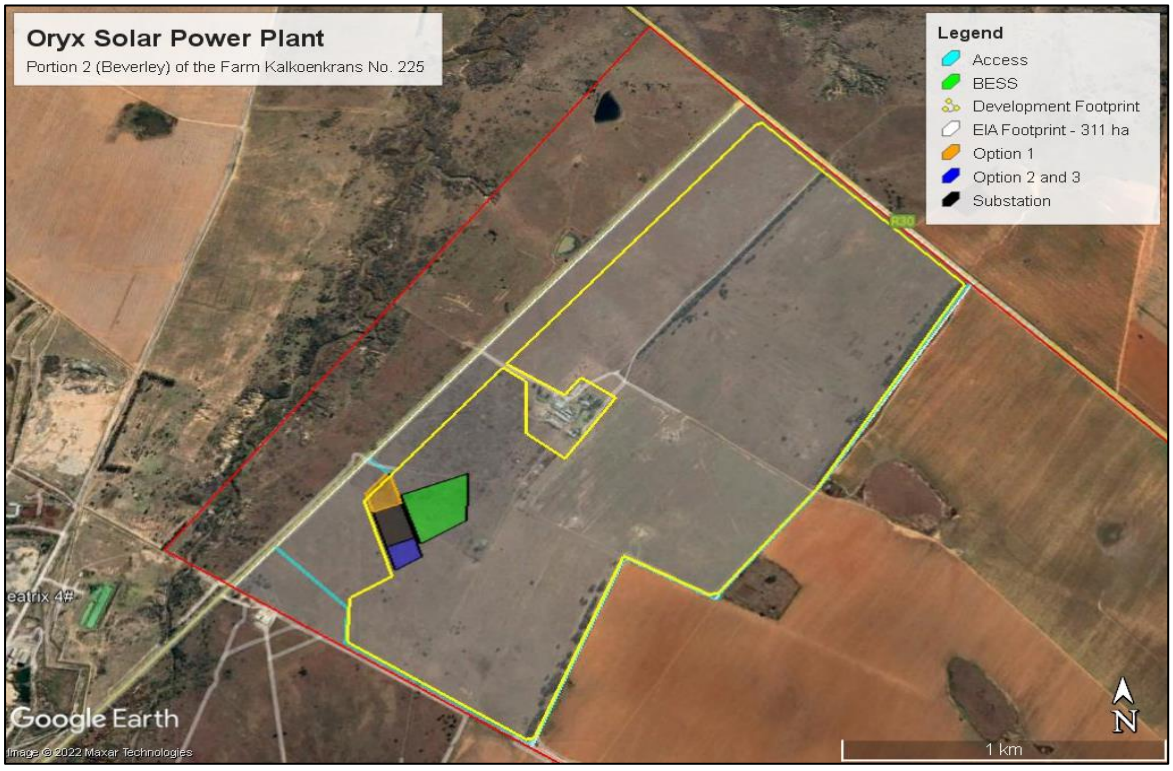


Figure 5.4: Optimised Grid connection corridor options following the identification and consideration of sensitive environmental features present in the development footprint that needs to be avoided

A 132kV overhead distribution line is the only preferred alternative for the applicant due to the following reasons:

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

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

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

  The choice of structure to be used for the power line will be determined in consultation with Eskom once the Engineers have assessed the geotechnical and topographical conditions of the route and decided on a suitable structure which meets the prescribed technical requirements. The choice of structures to be used will not have any adverse impacts on the environment, and the independent specialists, of various fields of study, have considered the development of the power line and recommended appropriate mitigation measures where required. The line will be constructed according to the authorised standards for a power line approved by Eskom Holdings SoC Ltd.

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

  - Single Circuit Overhead Power Line

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

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

  - Double Circuit Overhead Power Line

    Where sensitive environmental features are identified, and there is sufficient justification, Eskom will consider the use of double circuit (placing 2 power lines on either side of the

same tower structure) to minimise impacts. However, the use of double-circuiting has a number of technical disadvantages:

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

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

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

5.1.4.2 Battery Energy Storage Facility (BESS)

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

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

5.1.5 Design and layout alternatives

Design alternatives were considered throughout the planning and design phase (i.e. what would be the best design option for the development?). In this regard discussions on the design were held between the EAP and the developer, which also included the consideration of sensitive environmental

areas and features present as identified by the independent specialists that needs to be avoided by the placement of infrastructure. A final layout plan is included as Figure G and Appendix G.

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

The total surface area proposed include the PV panel arrays spaced to avoid shadowing, access and maintenance roads and associated infrastructure (buildings, power inverters, power lines, BESS and perimeter fences). With regards to the structure orientation, the panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun.

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

<u>Steel lattice towers:</u>
The steel lattice towers provide the following advantages over the other tower types available:

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

<u>Steel monopoles:</u>
The steel monopole is considered less suitable than the steel lattice towers for the following reasons:

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

<u>Wood poles:</u>

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

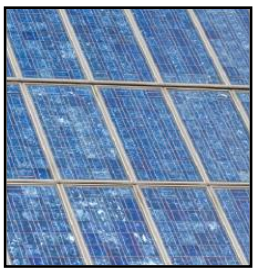
5.1.6 Technology alternatives

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

Crystalline (high efficiency technology at higher cost):

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

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



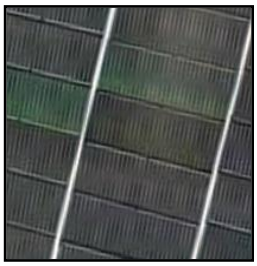
- Poly-crystalline Silicon – poly-crystalline panels use solar cells that are cut from multifaceted silicon crystals. They are less uniform in appearance than mono-crystalline cells, resembling pieces of shattered glass. These are the most common solar panels on the market, being less expensive than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

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

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

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

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



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

Bifacial panels:

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

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

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

solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

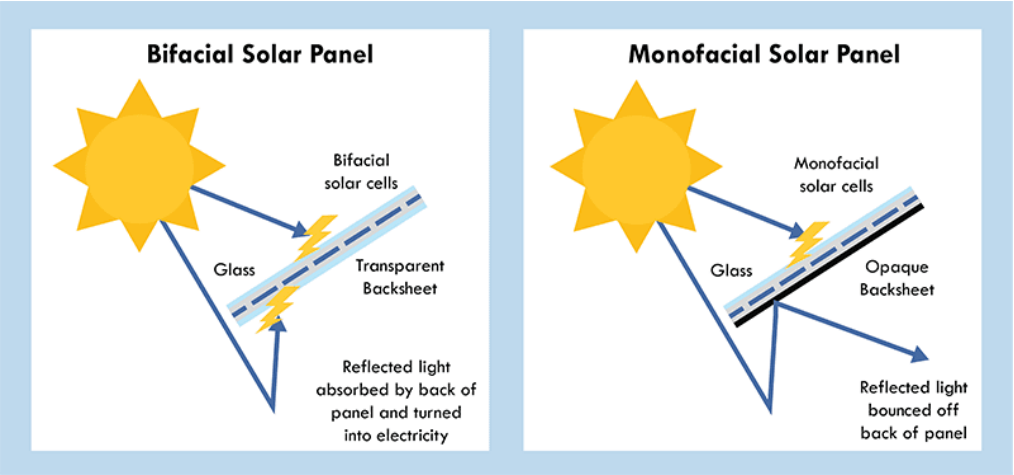


Figure 5.5: Bifacial vs Monofacial Solar Panel absorption.

5.2 PUBLIC PARTICIPATION PROCESS

The following sections provide detailed information on the public participation process conducted in terms of Regulations 39 to 44. The approved public participation plan is also included as Appendix J to the report.

5.2.1 General

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

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

Since the scale of anticipated impacts is low, the low environmental sensitivity of the site and the fact that no conflict was foreseen between potentially affected parties, no additional public participation mechanisms were considered at this stage of the process. The following actions have already been taken in line with the approved public participation plan (refer to Appendix J):

- Newspaper advertisement

  Since the proposed development is unlikely to result in any impacts that extend beyond the municipal area where it is located, it was deemed sufficient to advertise in a local newspaper. An advertisement was placed in English in the local newspaper (Vista Newspaper) on the 03 March 2022 (see Appendix C2) notifying the public of the EIA process and requesting Interested and Affected Parties (I&APs) to register with and submit their comments to Environamics

Environmental Consultants. I&APs were given the opportunity to raise comments within 30 days of the advertisement (by 04 April 2022).

- Site notices

  Site notices were placed on site in Afrikaans and English on 24 February 2022 to inform surrounding communities and immediately adjacent landowners of the proposed development. I&APs were given the opportunity to raise comments by 28 March 2022. Photographic evidence of the site notices is included in Appendix C3.

- Direct notification of identified I&APs

  Identified I&APs, including key stakeholders representing various sectors, has been directly informed of the EIA process on 04 April 2022 via registered post, telephone calls, WhatsApps and emails (as relevant). The Background Information Document (BID) was distributed with the notification. For a complete list of I&APs with their contact details see Appendix C4 to this report. It was expected from I&APs to provide their inputs and comments by 10 May 2022. To date comments have been received from various parties that have an interest in the development (Appendix C5 – C7).

- Direct notification of surrounding landowners and occupiers

  Written notices were also provided via registered post, WhatsApp or email (as relevant) to all surrounding landowners and occupiers on 04 April 2022. Refer to Figure 5.6 for the location of the surrounding land owners. The surrounding landowners were given the opportunity to raise comments within 30 days. For a list of surrounding landowners see Appendix C4. The surrounding landowners were given the opportunity to raise comments by 10 May 2022. To date comments have been received from various parties that have an interest in the development (Appendix C5 – C7).

- Circulation of Draft Scoping Report

  Copies of the draft Scoping report have been provided to all I&APs via courier, Dropbox and/or email (as relevant). Hard copies of the report will be made available on request and where an I&AP does not have the resources to view the report on an online platform. I&AP's and organs of state were requested to provide their comments on the report from 27 May 2022 until 27 June 2022. All issues identified during the 30-day review and comment period are recorded and documented and compiled into a Comments and Response Report included as part of the Final Scoping Report for decision-making (Appendix C5 – C7).

- Circulation of the Draft Environmental Impact Assessment Report

  All registered I&APs and State Department were informed of the availability of the Draft EIR on 19 October 2022 and requested to provide their comments within 30 days (refer to Appendix E). The 30-day review and comment period were from 19 October 2022 to 18 November 2022. All comments received during this period have been included in the final EIR. All

comments received prior to the release of the Draft EIR have been included in Appendix C. The Comments and Responses report are included as Appendix C7 of this final EIR.

- Circulation of decision and submission of appeals:

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

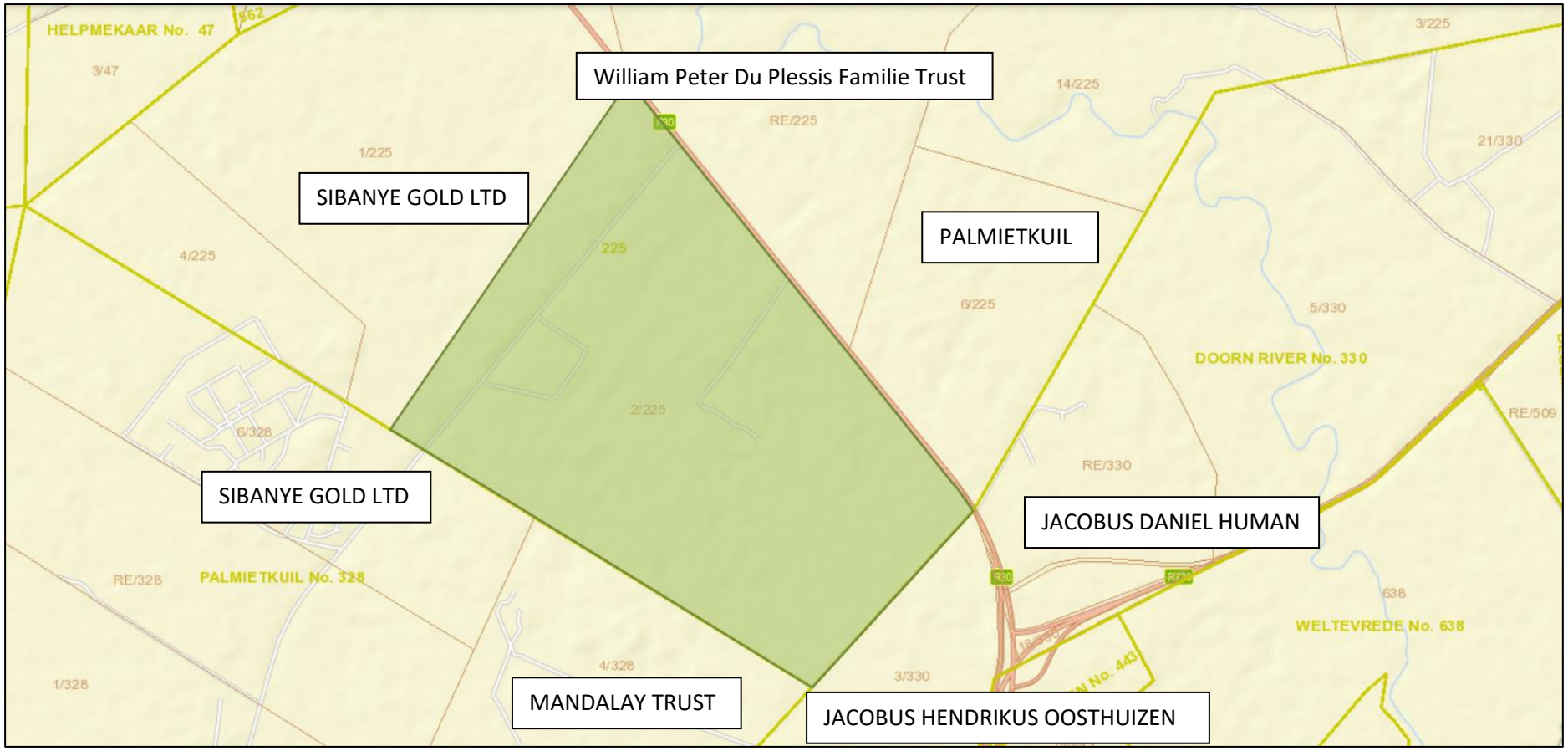


Figure 5.6: Surrounding Landowners

5.2.2 Consultation process

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

5.2.3 Registered I&APs

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

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

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

5.2.4 Issues raised by I&APs and consultation bodies

Comments have been received from some consultation bodies and is summarised in the Comments and Response Report included in Appendix C7. Furthermore, correspondence has been received by another Environmental Assessment Practitioner (EIMS) regarding a proposed development referred to as Tetra4 Cluster 2. This development entails the development of a gas gathering and production project which spans a significant area, including various properties, including the Oryx SPP affected property and site. Refer to Appendix C5 for proof of correspondence with EIMS. All comments received during the circulation of the Draft EIR have been addressed accordingly in the Final EIR. The full wording and original correspondence are included in Appendix C5 and Appendix C6 of the Final EIR.

5.3 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PREFERRED ALTERNATIVE

The following sections provide general information on the biophysical and socio-economic attributed associated with the preferred alternative.

5.3.1 Biophysical environment

The biophysical environment is described with specific reference to geology, soils, agricultural potential, vegetation and landscape features, climate, biodiversity, heritage features (in terms of archaeology and palaeontology), the visual landscape and the social environment to be affected. A number of specialists were consulted to assist with the compilation of this chapter of the report – refer to the Table 1.2.

However, due to the fact that the area proposed for development (i.e. the development footprint) exclusively consists of land used for grazing and excludes the areas under cultivation, limited sensitive areas from an ecological, heritage or conservation point have been identified. Sensitive areas include the two wetland features consisting of a hillslope seep wetland and a valleybottom wetland and an informal burial site. These features are described in more detail below.

5.3.1.1 Geology

The geology of the proposed Oryx Solar Power Plant and grid connection is indicated on the 1: 250 000 Winburg 2826 (Visser & Nolte;1998) Geological Map (Council for Geosciences, Pretoria) (Figure 5.7). The proposed development is underlain by Quaternary superficial deposits (Qs- yellow) as well as the Adelaide Subgroup (Pa; green) (Beaufort Group, Karoo Supergroup). Recent

The proposed development is underlain by Quaternary alluvium, colluvium and elluvium as well as the Balfour Formation of the Beaufort Group (Karoo Supergroup). According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Quaternary superficial deposits is Moderate while that of the Adelaide Subgroup is Very High (Almond et al, 2013; SAHRIS website). The Virginia/Welkom District is known for the presence of fluvial deposits along the present river courses that are terrestrial sediments and includes diatomite (diatom deposits), calcareous tufa, pedocretes, peats, spring deposits, soils and gravel and other Tertiary clacrete deposits, that is very important for understanding the Early and Late Pliocene period in this region (De Ruiter et al, 2010).

The late Cenozoic (Plio-Pleistocene) floodplain deposits (overbank sediments) found near the Sand-, Doring-, Vals- and Vet River systems including pan sites, contain confined but abundant mammal vertebrate fossil sites. In 1955, Meiring, described an in situ proboscidian fossil (mammoth), comprising of a lower molar, large part of a tusk as well as a proximal portion of an ulna from the Sand River near Virginia. This specimen was found in pebbly channel-fill sediments about 40m above the current riverbed. This specimen was originally described as Archidiskodon scotti (Meiring 1955) but was later assigned to the Pliocene species Mammuthus subplanifrons (Coppens et al. 1978). Later investigations uncovered diverse

fauna that include amphibians, birds, fish, reptiles, as well as several proboscideans, perissodactyls and artiodactyls from the same site (De Ruiter 2010).

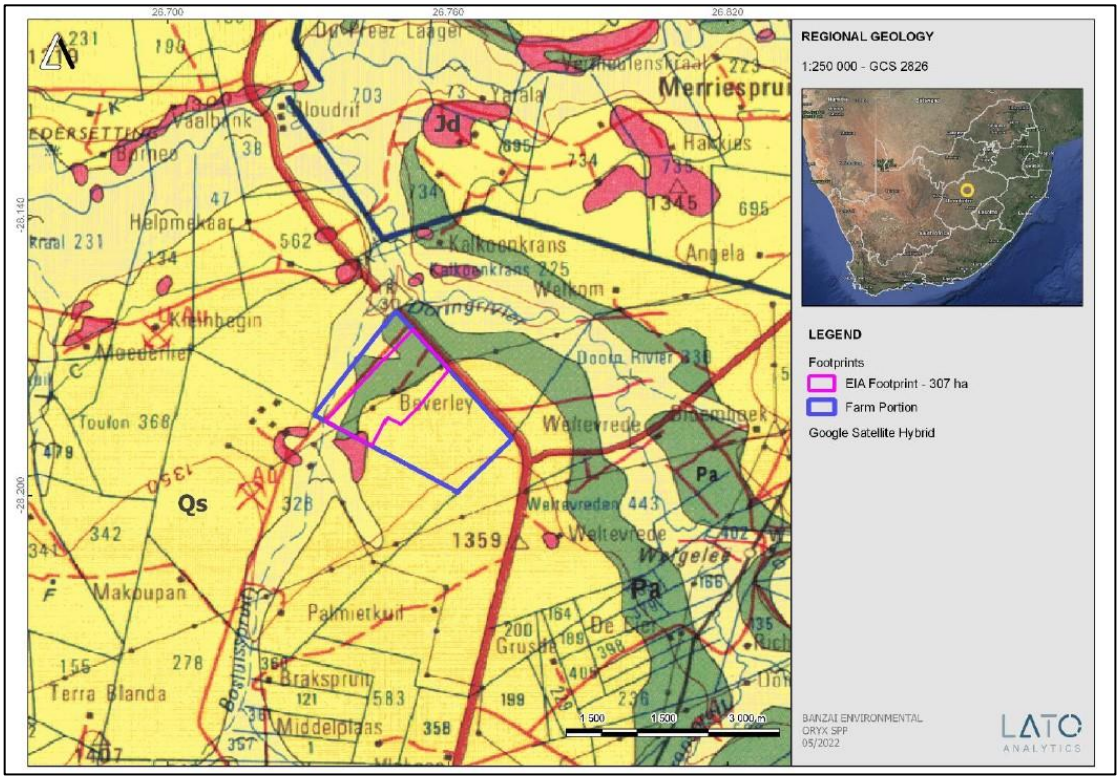


Figure 5.7: Extract of the 1:250 000 Winburg 2826 (Visser & Nolte;1998) Geological Map (Council for Geosciences, Pretoria) indicating the proposed Oryx Solar Power Plant near Virginia in the Free State.

Terrace gravels above the Vet River, southwest of Welkom have uncovered Pliocene fossils while surveys along the Doring, Vals, Sand and Vet Rivers produced moderately fossiliferous overbank sediments and erosional gullies that comprise of a variety of Quaternary-aged mammals (Brink et al. 1999; De Ruiter et al. 2011) Ancient pan sites, for example near Whites, produced rich Quaternary-aged mammal fossil remains.

The proposed development is underlain by a series of Karoo sandstones, mudstones, and shales, deposited under fluvial environments of the Adelaide Subgroup that forms part of the Beaufort Group. The Beaufort Group is the third of the main subdivisions of the Karoo Supergroup.

The Beaufort group overlays the Ecca Group and consists essentially of sandstones and shales, deposited in the Karoo Basin from the Middle Permian to the early part of the Middle Triassic periods and was deposited on land through alluvial processes. The Beaufort Group covers a total land surface area of approximately 200 000 km^2 in South Africa and is the first fully continental sequence in the Karoo Supergroup and is divided into the Adelaide subgroup and the overlying Tarkastad subgroup. The Adelaide subgroup rocks are deposited under a humid climate that allowed for the establishment of wet floodplains with high water tables and are interpreted to be fluvio-lacustrine sediments.

5.3.1.2 Soils and agricultural potential

According to the Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix E1) the soils associated with the site vary between very sandy on the plateaus and higher lying areas, to dark clayey soils in the low-lying pans and bottomlands. What does this mean for the development?

According to the Agriculture Compliance Statement (attached in Appendix E4) the site is on a gentle slope with a north-westerly aspect and a slope gradient of approximately 3%. The geology is shale, mudstone and sandstone of the Ecca and Beaufort Groups. The land type map shows two land types across the site, Bd20 and Dc8. Land type Bd20 has a high proportion of deep, well-drained soils of the Clovelly, Avalon and Hutton soil forms that are suitable for crop production. These soils occupy the plateau to the east of the site, which is on the same farm and all under crop production.

The other land type, Dc8 has a high proportion of shallow, clay-rich soils of the Valsrivier soil form that are unsuitable for crop production. The site investigation found that the land type boundary that separates the soils suitable for cropping from those that are unsuitable actually corresponds with the obvious terrain change at the edge of the plateau onto the slope, and therefore should be further to the south-east than it is. This also corresponds to the current boundary between the croplands and the grazing lands found within the affected property within which the development is proposed. Part of the slope was cropped in the past but was found, in the more recent agricultural economy, to be unsuitable for viable crop production. The soil investigation identified predominantly shallow Valsrivier soils across these slopes. The cropping potential is limited by the shallow depth above a limiting, dense clay horizon in the subsoil. In the relatively low rainfall of the site (463 mm per annum), the shallow soils have too little of a moisture reservoir to support viable cropping. This land is used only for grazing. The long-term grazing capacity of the site is 6 hectares per large stock unit.

When considering the DFFE Screening Tool Report (Appendix B), the two land types on the site (as discussed above) are rated with different land capabilities. The land type on the south-eastern side of the site is predominantly 8 but varies from 6 to 9. The land type on the north-western side of the site is predominantly 7, but also includes 6. Values of 6 to 8 translate to a medium agricultural sensitivity, and values of 9 translate to a high agricultural sensitivity. There is very little land that is rated as 9.

The allocation of high sensitivity to the south-eastern part of the site (red in Figure 5.8), by the DFFE Screening Tool Report (Appendix B), is because the land is classified as cropland in the dataset used by the screening tool. However, that data set is outdated. The lands indicated as croplands on the screening tool are not currently under crop production and have not been for at least 14 years according to the historical imagery available on Google Earth. These lands were found to be too marginal for viable crop production, and all cropping on them was stopped. All these lands are now used only for grazing. These lands should therefore no longer be classified as cropland or allocated high sensitivity because of it. The high agricultural sensitivity attributed to the site by the screening tool as a result of cropping status is therefore disputed by the Agricultural Compliance Statement (Appendix E4).

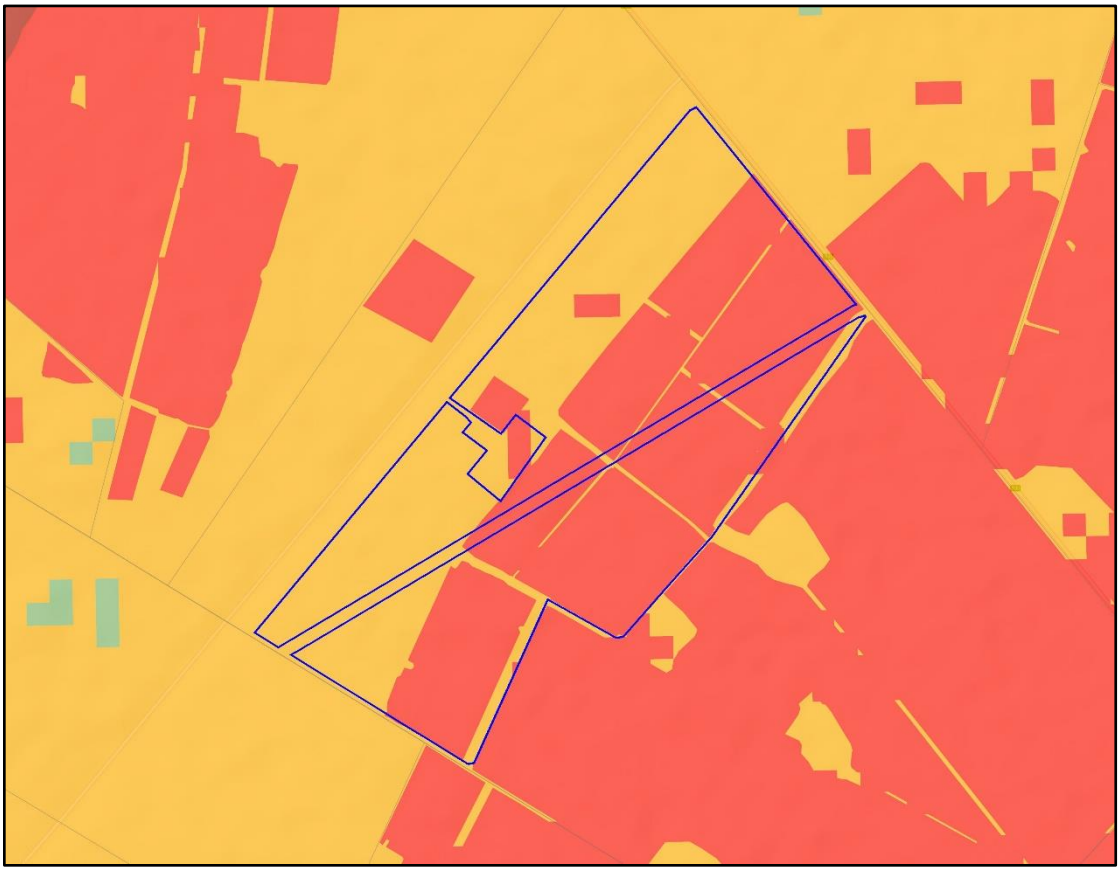


Figure 5.8: : Agricultural sensitivity of the development footprint as per the results of the DFFE Screening Tool (Appendix B).

This site sensitivity verification verifies the entire site as being of less than high agricultural sensitivity, with a land capability value of 7. The land capability value is in keeping with the combination of soil and climate that makes the site too marginal for crop production.

5.3.1.3 Vegetation and landscape features

The site lies completely within the Middle Vaal Water Management Area (WMA) and entirely within the Highveld ecoregion. The site is located within the C42H quaternary catchment. Drainage occurs as sheet-wash into the drainage channels on site that eventually drains into the major river namely the Bosluisspruit that occurs to the west of the affected property.

The topography is characterised by slightly undulating plains with wetlands and / or drainage channels bisecting the area. The topography of the site can be described as generally favourable, when considering that most of the area consists of slopes of less than 1:5. The site is located at an altitude of between 900 and 940 meters above mean sea level (AMSL).

Most properties situated within a 500m radius of the site are being used for livestock and crop cultivation. The proposed development land is used for livestock farming and maize cultivation at present. The natural vegetation of the site is mostly intact.

The site lies within the Grassland Biome which is found chiefly on the high central plateau of South Africa. Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. Trees are absent except in a few localised habitats. Geophytes are often abundant. Frost, fire and grazing maintain the grass dominance and prevent the establishment of trees.

The Highveld Ecoregion draws its name from the high interior plateau known as the Highveld, and the expansive cover of species-rich communities of grasses. The ecoregion is bordered by the Drakensberg in the east, the arid Karoo and Kalahari in the west, and the low-lying bushveld to the north. The Highveld Plateau is flat with elevations varying from 1,400 m to 1,800 m. The Highveld Grassland Ecoregion has further suffered extensive degradation. Because it is one of the best areas for farming in South Africa, large tracts of land have already been converted to agriculture, mainly for corn production. Urban expansion, fire, and overgrazing have led to increased fragmentation, as has coal mining and afforestation for stands of exotic trees, especially by species of Eucalyptus.

In terms of the vegetation types present within the site, and associated with the grid connection corridor options, two types are relevant, one being the Highveld Alluvial Vegetation and Vaal-Vet Sandy Grassland (Figure 5.9). The Vaal-Vet Sandy Grasslands vegetation unit is described as plains-dominated landscape with some scattered slightly irregular undulating plains and hills. Mainly low tussock grasslands with an abundant karroid element. Themeda triandra is dominant in this vegetation unit. This vegetation type is described as Endangered because approximately 63% of it has been transformed for commercial crop cultivation and grazing pressure from cattle and sheep. Only 0.3% of this vegetation type is statutorily conserved in Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolwespruit and Soetdoring Nature Reserves.

The Highveld Alluvial Vegetation is present along the alluvial drainage lines and floodplains along the rivers within the Grassland and Savanna Biomes. These rivers include the upper Riet, Harts, upper Modder, upper Caledon, Vet, Sand, Vals, Wilge, Mooi as well as the middle and upper Vaal Rivers. Each of these rivers has numerous tributaries that contribute to the water present in the rivers. The altitude ranges from 1 000 m – 1 500 m above mean sea level. The topography is mostly flat and support riparian thickets with seasonally flooded grasslands and disturbed herblands. This riparian vegetation is often dominated by alien plant species. The soils of this unit are mostly deep sandy to clayey soils of alluvial origin from the Quaternary alluvial sediments. The soil forms include Oakleaf, Dundee, Shortlands, Glenrosa and Mispah in the Vaal River floodplain. The rivers are mostly in flood during the summer season which is causing riverbank erosion. This contributes towards new fine soil deposits on the alluvium.

Highveld Alluvial Vegetation is classified as Least Threatened, with a conservation target of 31%. Only nearly 10% of the vegetation type is statutorily conserved in Barberspan (a Ramsar site), Faan Meintjie, Sandveld, Schoonspruit, Soetdoring and Wolwespruit Nature Reserves. More than a quarter has been transformed for cultivation and by building of dams (Bloemhof, Erfenis, Krugersdrif, Mockes and Vaalharts Dams).

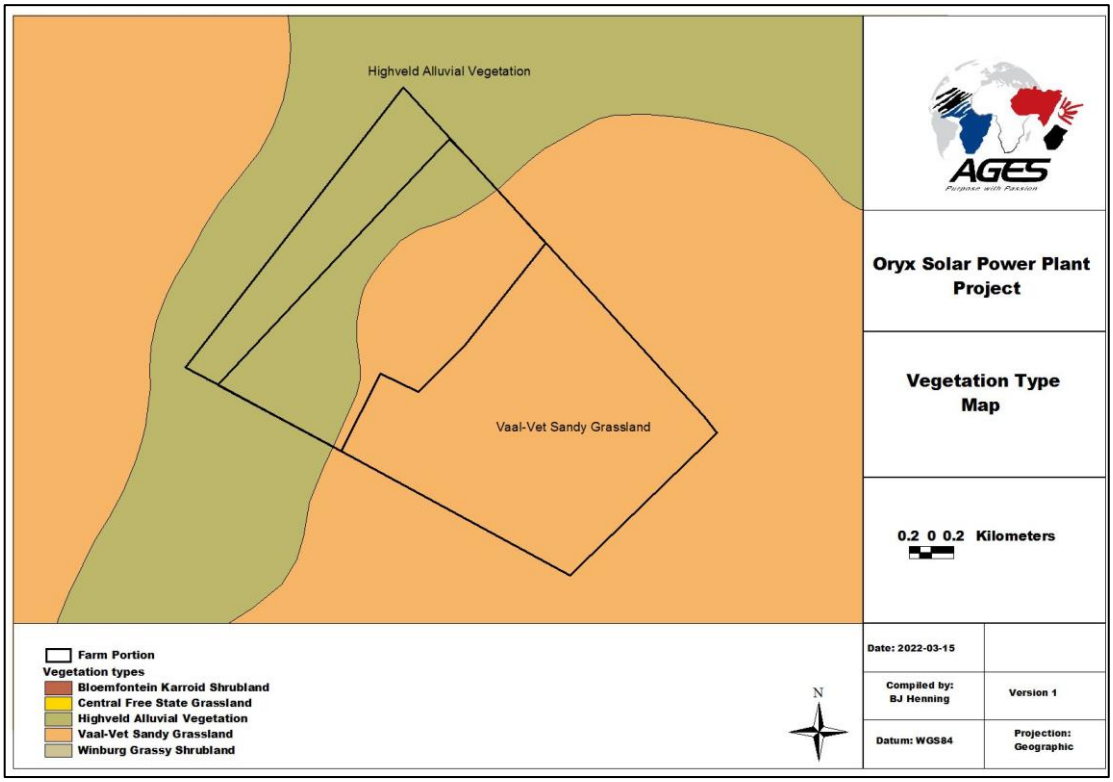


Figure 5.9: Approximate location of the development footprint and affected property within the Vaal-Vet Sandy Grassland and the Highveld Alluvial vegetation types

Vegetation Units:

The vegetation units on the site vary according to soil characteristics, topography, and land use. Vegetation units were identified on the development footprint and can be divided into five distinct vegetation units according to soil types and topography (Figure 5.9 and Table 5.1). The units include:

1) Setaria incrassatae – Themeda triandra clay grassland
2) Themeda triandra – Aristida congesta secondary grassland
3) Old fields / plated pastures
4) Drainage features, including:
    - Valleybottom wetland without channel
    - Hillslope seep wetland

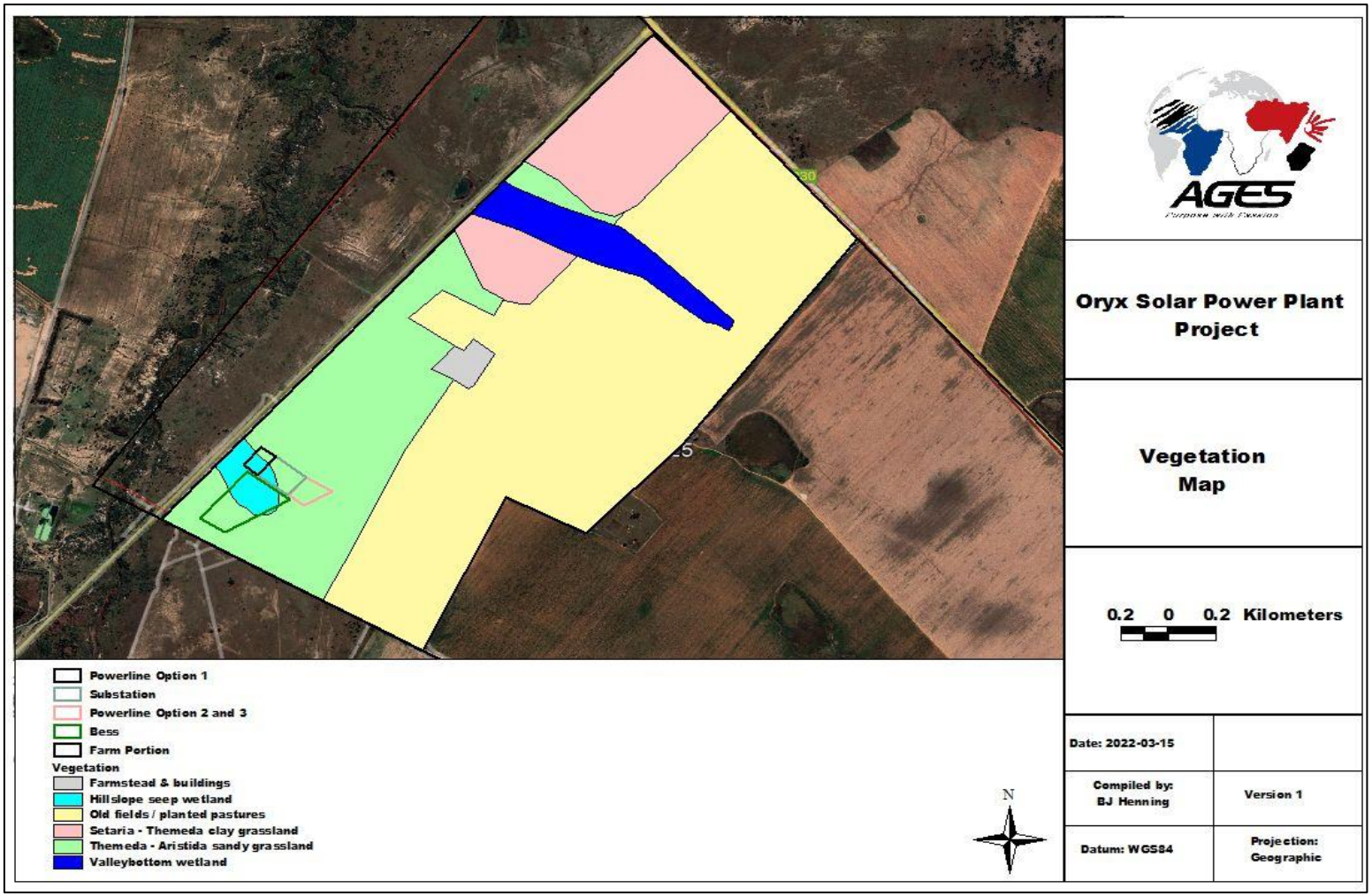


Figure 5.10: Vegetation units present within the Oryx Solar Power Plant development footprin

Table 5.1: Summary of the Vegetation units present at the Oryx Solar Power Plant

Vegetation Unit	Description	Characteristics	Photograph
Setaria incrassatae – Themeda triandra clay grassland	• Typical Central Free State Grassland • Occurs in the north-eastern section of the site around the valleybottom wetland in the development footprint. • The grass layer is well developed and underlied by dark clayey soils of the Arcadia or Swartland Soil Forms. • Grasses that dominate on the clayey soils are species such as *Setaria incrassatae* and *Themeda triandra*. • The vegetation structure is tall, closed grassland. • No red listed or protected species were documented in the area. • The vegetation unit is classified as having a medium sensitivity due to the widespread status through the larger area. • Development is considered suitable in this unit.	• State of vegetation: Natural grassland in a slightly degraded state • Need for rehabilitation: Low • Conservation priority: Medium • Soils & geology: Black clayey soils of the Swartland / Arcadia soil form • Density of woody layer: Trees: <1% (avg. height: 3-6m) & Shrubs:<1% (avg. height: 1-2m) • Density of herbaceous layer: Grasses: 70-80% (avg. height: 0.8-1.2m) & Forbs: <1% (avg. height: 0.8m) • Sensitivity: Medium • Red data species: None observed • Protected species: None observed	

Old fields / planted pastures	• The southern section of the affected property is dominated by old, cultivated fields. • Dominated by *Cynodon dactylon* or planted pasture dominated by *Digitaria eriantha*. • The herbaceous layer forms medium tall grassland on red-yellow apedal soils of the Hutton or black clayey soils of the Arcadia soil forms. • The vegetation unit is classified as having a Medium sensitivity due its widespread occurrence in the Grassland Biome. • Development is considered suitable in this unit.	• State of vegetation: Degraded grassland / planted pastures • Need for rehabilitation: Low • Conservation priority: Low • Soils & geology: Red-yellow apedal sandy soils of the Hutton soils and black clayey soils of the Arcadia soil form • Density of woody layer: Trees: <1% (avg. height: 3-6m) & Shrubs:<1% (avg. height: 1-2m) • Density of herbaceous layer: Grasses: 70-80% (avg. height: 0.8-1.2m) & Forbs: <1% (avg. height: 0.8m) • Sensitivity: Medium • Red data species: None observed • Protected species: None observed	
Themeda triandra – Aristida congesta secondary grassland	• This vegetation unit occurs on red-yellow apedal soils of the Hutton or Avalon soil forms. • The grass layer is in a secondary state of succession at present and dominated by species such as *Themeda triandra, Aristida congesta* and *Sporobolus africanus*. • The vegetation unit is classified as having a Medium-low sensitivity due to the secondary state of succession and degradation evident in the area. • The eradication of protected plant species *Helichrysum* would need a permit from local authorities in the Free State. • Development is considered suitable in this unit.	• State of vegetation: Natural grassland in a slightly degraded state • Need for rehabilitation: Low • Conservation priority: Medium • Soils & geology: Red-yellow apedal sandy soils of the Clovelly / Hutton soils • Density of woody layer: Trees: <1% (avg. height: 3-6m) & Shrubs:<1% (avg. height: 1-2m) • Density of herbaceous layer: Grasses: 70-80% (avg. height: 0.8-1.2m) & Forbs: <1% (avg. height: 0.8m) • Sensitivity: Medium-low • Red data species: None observed • Protected species: All *Helichrysum* species	

Valleybottom wetland	• The most dominant drainage feature in the development footprint of the solar power plant is classified as unchannelled valley-bottom wetlands. • Valley bottom wetlands are classified as low-lying, gently sloped areas that receive water from an upstream channel and/or form adjacent hillslopes, not subject to periodic over-bank flooding by a river channel. • Surface water in the valley bottom wetlands of the study area flows only seasonally, although the wetland is in most cases perennial. • This wetland vegetation comprises atypical (azonal) vegetation, mainly because of the prolonged moist conditions of the soils. The soils are clayey and do have relatively high water retention abilities. • Unchannelled valley-bottom wetland can be described as: a mostly flat valley-bottom wetland area without a major channel running through. • The most abundant and most conspicuous plant species is hygrophilous grasses such as *Andropogon eucomis, Hyparrhenia tamba, Eragrostis gummiflua* and *Setaria sphacelata*. Other plants associated with valley bottom channels are *Juncus effusus, Schoenoplectus corymbosus, Verbena bonariensis, Persicaria serrulata* and *Typha capensis*. • Unfortunately, the valley bottom wetlands provide a distribution route for weeds and invading trees. Many of the usual weeds were recorded together with *Xanthium strumarium* (Large cocklebur) *Datura stramonium, Tagetes minuta* and *Bidens bipinnata*. • The vegetation is mostly in a natural habitat, with all areas in the wetland zone or drainage channels classified as a high sensitivity areas with a high conservation priority, while natural vegetation outside the floodline is natural woodland with a Medium Sensitivity. • No alteration of these important drainage areas is recommended. • A 32-meter buffer must be implemented around the riparian zones of the smaller drainage channels and wetlands on site. • A Water Use Licence application should be submitted to the Department of Water and Sanitation for the development of the solar power plant within 500 meters of the wetland zones or the floodline zones of non-perennial drainage channels. • Only existing roads should be used to cross drainage lines, and mitigating measures should be implemented to prevent erosion of roads across drainage lines.	

Hillslope Seep Wetlands	• This represents the grassland areas classified as 'Hill slope Seep Wetlands' in the north-western section of the site. • The seep areas feed the Bosluisspruit. • A Hill slope seep is classified as a wetland area located on (gently to steeply) sloping land. Water inputs are primarily from precipitation. • Where hardpan has developed (as is the case of the study area) a perched water table is often present. • The most common grass species associated with hillslope seep wetland is *Eragrostis gummiflua* and *Setaria sphacelata*. The more natural variation of seeps is dominated by species such as *Helichrysum nudifolium, Eythrina zeyheri* and *Andropogon eucomis.* • The vegetation is mostly in a natural habitat, with all areas in the wetland zone or drainage channels classified as a high sensitivity areas with a high conservation priority, while natural vegetation outside the floodline is natural woodland with a Medium Sensitivity. • No alteration of these important drainage areas is recommended. • A 32-meter buffer must be implemented around the riparian zones of the smaller drainage channels and wetlands on site. • A Water Use Licence application should be submitted to the Department of Water and Sanitation for the development of the solar power plant within 500 meters of the wetland zones or the floodline zones of non-perennial drainage channels. • Only existing roads should be used to cross drainage lines, and mitigating measures should be implemented to prevent erosion of roads across drainage lines.	

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

According to the Department of Forestry, Fisheries and Environment's South African Protected Areas Database (SAPAD, Quarter 3, 2021) the Oryx solar Power Plant site is not located near / within 5km of a protected area. The Willie Pretorius Game Reserve that occurs to the east of the project is the closest protected area, and is also classified as an Important Bird Area (IBA).

The Free State Biodiversity Conservation Plan has been considered for the identification of the relevant Critical Biodiversity Areas (CBA) associated with the proposed development. Most of the proposed development footprint represents Ecological Support Areas (ESA), including ESA1 and ESA2 areas although most of these areas represent degraded grassland. The management objective for this area is to maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern. Small sections along the boundaries of the development footprint falls within CBA1, although the specialist has indicated that the areas categorised as CBA1 is more representative of ESAs. Refer to Figure 5.11.

Figure 5.11: Critical Biodiversity Map for the Oryx Solar Power Plant development footprint

Furthermore, the Oryx Solar Power Plant does not infringe on any focus areas associated with the National Protected Areas Expansion Strategy (NPAES). The closest NPEAS is located to the east of the project and is known as the Free State Highveld Grassland NPAES.

Species of Conservation Concern

A list of red data plant species previously recorded in the grid square in which the proposed development is planned was obtained from SANBI. No red listed plant species occur in the QDS or was recorded in the site. Ecological monitoring should however still be implemented

during the construction phase and specific sensitive habitats (riparian) needs to be avoided to ensure that any potential red data species potentially missed during the field surveys are preserved and not potentially impacted on. The DFFE Screening Report also did not highlight any red listed flora (Appendix B).

Protected Plants in terms of the Free State Nature Conservation Ordinance

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

After a detailed survey was conducted during February 2022, the listed species *Helichrysum nudifolium* was confirmed for the site (Figure 5.12). No eradication should be allowed without a permit.

Figure 5.12: Vegetation associated with the seep wetland including the *Helichrysum nudifolium, Eythrina zeyheri* and *Andropogon eucomis.*

Declared Invasive Alien Species

The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of the National Environmental Management: Biodiversity Act (10/2004). The regulation listed a total of 559 alien species as invasive and further 560 species are listed as prohibited and may not

be introduced into South Africa. Below is a brief explanation of the four categories of Invasive Alien Plants as per the regulation.

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

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

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

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

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

- *Argemone ochroleuca* – Category 1b
- *Conyza species* - Category 1b
- *Datura stramonium* - Category 1b
- *Eucalyptus camaldulensis* - Category 1b
- *Morus alba* - Category 3
- *Verbena brasiliensis* - Category 1b
- *Xanthium strumarium* - Category 1b

5.3.1.4 Wetlands and Riparian Features

The project is located near the listed National Freshwater Ecosystem Priority Areas (NFEPA) river, named Bosluisspruit, although this river will not be impacted on by the development footprint. A section of the development footprint represents a NFEPA wetlands as indicated in Figure 5.13. Three wetland types were identified namely a valleybottom wetland, depressions and hillslope seep wetland. The floodplain river (Bosluisspruit) can be classified as 'River channels', although these drainage channels are not wetlands in the 'true' sense of the word but should rather be described as water courses as stipulated in the National Water Act. Baseline soil information, landscape profile and vegetation were used to confirm riparian and terrestrial properties within the site. The impacts associated with the construction site is

reflected in the results of the PES assessment which indicates that the riparian zones, wetlands and watercourses are 'Moderately Modified'. It must be noted that only the valleybottom and hillslope seep wetlands occur within the development footprint. Refer to Figure 5.14.

The Ecological Importance and Sensitivity of the drainage system on site are MODERATE. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.

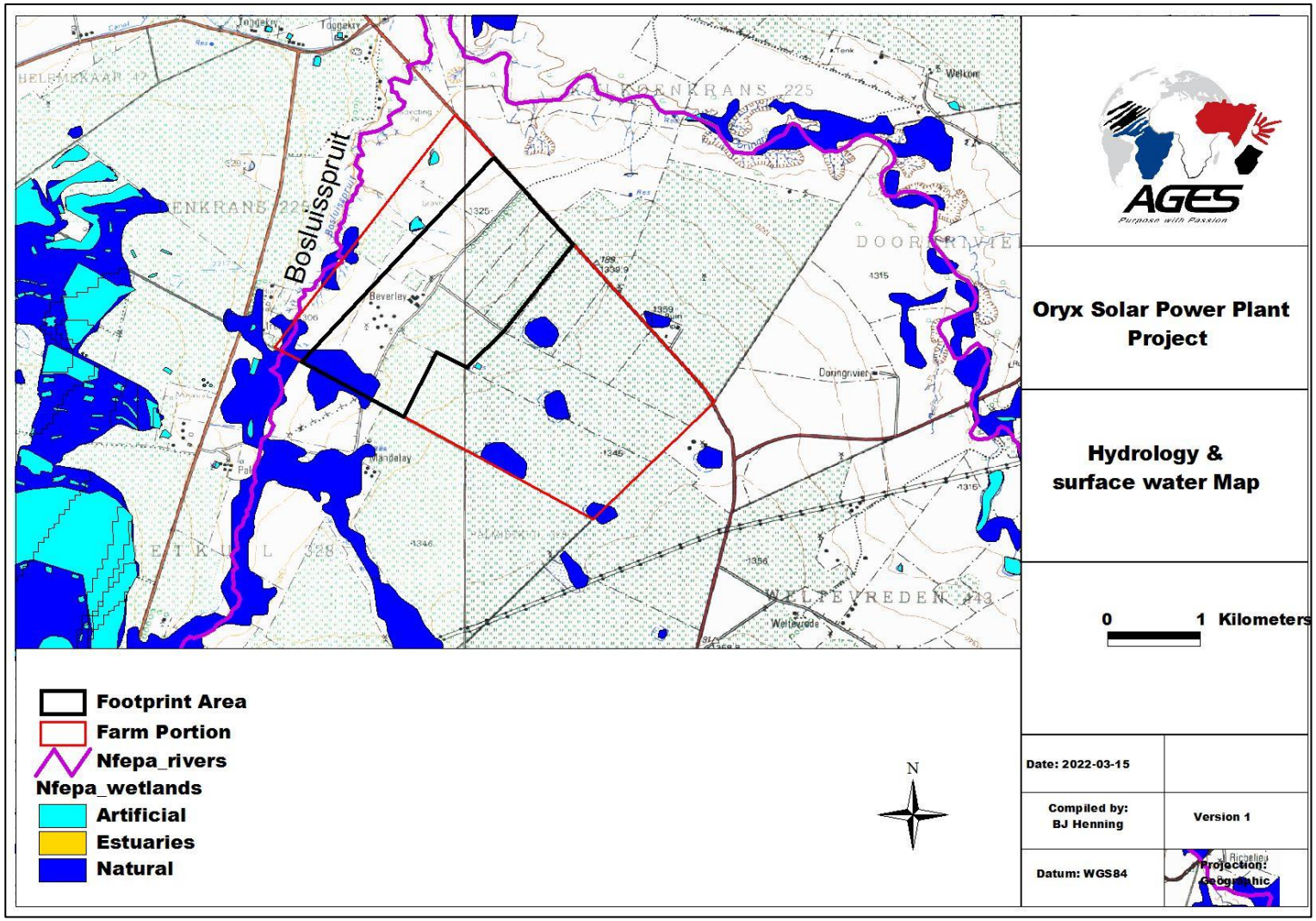


Figure 5.13: Location of the Oryx Solar Power Plant development footprint in relation to the NFEPA Rivers and Wetlands

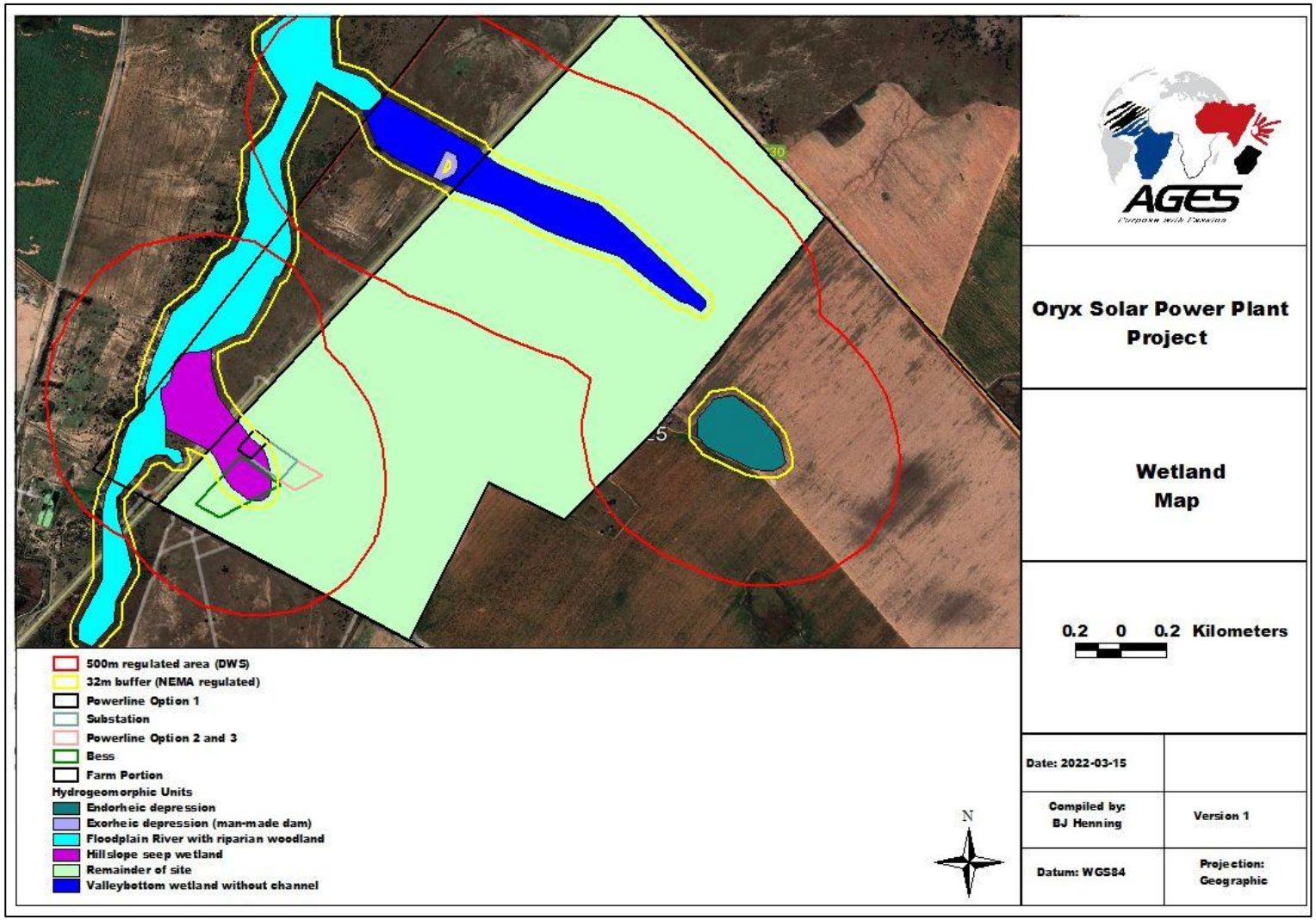


Figure 5.14: Riparian / wetland delineation map of the Oryx Solar Power Plant development footprint

The following descriptions are provided for the wetland features identified within and around the site.

Valleybottom wetland with channels

A valleybottom wetland with a channel is depicted in Figure 5.15 below. The most dominant drainage feature near the development footprint area of the solar power plant is classified as channelled valley-bottom wetlands. Valley bottom wetlands are classified as low-lying, gently sloped areas that receive water from an upstream channel and/or form adjacent hillslopes, not subject to periodic over-bank flooding by a river channel. Surface water in the valley bottom wetlands of the study area flows only seasonally, although the channels are in most cases perennial. This wetland vegetation comprises atypical (azonal) vegetation, mainly because of the prolonged moist conditions of the soils. The soils are clayey and do have relatively high water retention abilities.

The most abundant and most conspicuous plant species is hygrophilous grasses such as *Andropogon eucomis*, *Hyparrhenia tamba*, *Eragrostis gummiflua* and *Setaria sphacelata*. Other plants associated with valley bottom channels are Juncus effusus, *Schoenoplectus corymbosus*, *Verbena bonariensis*, *Persicaria serrulata* and *Typha capensis*.

Unfortunately, the valley bottom wetlands provide a distribution route for weeds and invading trees. Many of the usual weeds were recorded together with *Xanthium strumarium* (Large cocklebur), *Datura stramonium*, *Tagetes minuta* and *Bidens bipinnata*.

Figure 5.15: Valleybottom wetland with channel present in the development footprint

Depressions

The depressions in the project area can be classified into two variations namely man-made dams that form part of the valleybottom wetlands and are classified as exorheic depressions with channelled inflow or natural pans classified as endorheic depressions. A depression is classified as a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. Refer to Figure 5.16.

The vegetation associated with depressions is mostly sedges and bulrushes depending on the depth of the water and the substrate. Species such as *Persicaria serullata*, *Typha capensis*, *Schoenoplectus corymbosus*, *Ludwigia stolonifer* and *Leersia hexandra* mostly grow along the shallow edges of dam and pans in the site/affected property on a muddy substrate. The riparian woodland is characterised by *Vachellia karroo*, *Ziziphus mucronata* and *Grewia flava*.

Figure 5.16: Endorheic depression (pan) present in the affected property

River channels and floodplains

The Bosluisspruit located to the north of the project is depicted in Figure 5.17 below. All rivers and streams with their associated riparian vegetation in the project area are ecologically sensitive, forming important, limited and specialised habitats for several plant and fauna species. The drainage channels of the affected property eventually flow into the Bosluisspruit that occurs to the north of the site. The riverine woodland would be important dry season refuge areas for many fauna species in their natural state. It is also a centre of floral diversity.

Riparian areas have been identified as important dry season refuge areas for a variety of large mammal species.

Most of the drainage channels on site are non-perennial. The following geomorphological zones occur in the project area and are described as follows:

- Lowland River: a low-gradient alluvial fine-bed channel. It may be confined but has a fully developed meandering pattern within a distinct floodplain that develops in unconfined reaches where there is increased silt content in bed or banks. Characteristic gradient: 0.0001- 0.001.

The Bosluisspruit can be described as a floodplain river or a lowland river. The floodplain is not classified as a floodplain wetland, but a river with some wetland characteristics in the channel and its banks.

A floodplain, is a flat or nearly flat land adjacent a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge. It includes the floodway, which consists of the stream channel and adjacent areas (riparian woodland, hydrophilic grassland) that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current. In other words, a floodplain is an area near a river or a stream which floods easily.

The vegetation associated with the floodplain is mostly microphyllous woodland and hygrophilous grasses. Species such as *Vachellia karroo*, *Searsia pyroides*, *Ziziphus mucronata* and *Searsia lancea* mostly grow in the floodplain area (Figure 5.17), together with grass species such as *Sporobolus africanus* and *Eragrostis rotifer*.

Figure 5.17: Bosluisspruit floodplain river located to the north of the Oryx Solar Power Plant Development footprint

5.3.1.5 Climate

The project is situated within the summer and autumn rainfall region with very dry winters and frequent frost that occurs during the colder winter months. The spatial and temporal distribution of rainfall is very complex and has great effects on the productivity, distribution and life forms of the major terrestrial biomes. The mean annual precipitation for the region is around 560mm. The mean annual temperature for the area is 15.2°C, and the mean annual frost days is 43 days. Mean Annual Potential Evaporation is 2226mm, with Mean Annual Soil Moisture Stress of 78%.

5.3.1.6 Biodiversity

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

Avifaunal

According to the Avifaunal Impact Assessment (Appendix E2) the proposed Oryx Solar Power Plant is situated in an area of moderate avifaunal diversity, however, it is adjacent to an important flyway, the Doring River (and the confluence with a tributary), and, therefore, has the potential to impact many species. The resident avifauna is represented by relatively low

to moderate species richness and abundance. A good baseline dataset was generated during the site surveys, supplemented by a meagre SABAP2 dataset.

The typical species occurring on the site are common across the western highveld, with good representation from the widespread larks, pipits, cisticolas, finches, widowbirds, bishops, and whydahs in particular. Aerial feeding swallows, and swifts were also well represented. Most palearctic migrants were not present on the site during the late summer assessments, and most intra-African migrants appeared to have departed. Raptors were poorly represented, as were gamebirds.

There are Red Data species that could possibly occur on site, even as vagrants and the likelihood of their occurrence have been assessed. The potential red data species for the site, along with probability estimates and notes are presented. No Red Data species were recorded during the surveys, although suitable habitat does exist on site for the following species:

- Secretarybird- Vulnerable. Not recorded in the pentads or during the site visit but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- Lanner Falcon- Vulnerable. Not recorded in the pentads or during the site visit but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- Red-footed Falcon- Near Threatened. Not recorded in the pentads or during the site visit but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- Cape Vulture- Endangered. Not recorded in the pentads or during the site visit, very low likelihood of occasionally occurring on site if animal carcases are present.
- White-backed Vulture- Critically Endangered. Not recorded in the pentads or during the site visit, very low likelihood of occasionally occurring on site if animal carcases are present.
- Lappet-faced Vulture- Endangered. Not recorded in the pentads or during the site visit, very low likelihood of occasionally occurring on site if animal carcases are present.
- Martial Eagle- Endangered. Not recorded in the pentads or during the site visit, very low likelihood of occasionally occurring on site.
- Burchell's Courser- Vulnerable. Not recorded in the pentads or during the site visit but habitat on site appears marginal, and, therefore, should be expected to have at least a low likelihood of occasionally occurring on site.
- Black Harrier- Endangered. Not recorded in the pentads or during the site visit. Habitat suitability is marginal on the SPP site, thus has low likelihood of sporadic (winter) occurrence.
- Pallid Harrier- Near-Threatened. Not recorded in the pentads or during the site visit and habitat on site appears marginal, and, therefore, should be expected to have a low likelihood of occasionally occurring on site.
- African Marsh Harrier- Endangered. Not recorded in the pentads or during the site visit, and habitat on site appears marginal, and, therefore, should be expected to have a low likelihood of occasionally occurring on site.

- Blue Crane- Near-Threatened. Not recorded in the pentads or during the site visit but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- Abdim's Stork- Near-Threatened. Not recorded in the pentads or during the site visit but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- African Grass Owl- Vulnerable. Not recorded in the pentads or during the site visit. Habitat suitability is marginal on the SPP site, thus has very low likelihood of sporadic occurrence.
- Black-winged Pratincole- Near Threatened. Not recorded in the pentads or during the site visit. Habitat suitability is marginal on the SPP site but is expected to occasionally occur in the surrounding croplands.
- Maccoa Duck- Near-Threatened. Recorded in the pentads but not during the site visit, and suitable habitat exists only off-site, and it should be expected to have a low likelihood of occasionally crossing the site between waterbodies.
- Greater Flamingo- Near-Threatened. Recorded in the pentads but not during the site visit, and suitable habitat exists only off-site, and it should be expected to have a low likelihood of occasionally crossing the site between waterbodies.

In terms of range-restricted or endemic species South Africa has a rich diversity of nationally and regionally endemic species that are found nowhere else on earth and, therefore, warrant consideration for assessment of sensitivity to potential developments. The following endemic or near-endemic (most of the global range is within South Africa's borders) species were recorded either during prior SABAP2 assessments or during this SPP assessment:

- Cloud Cisticola- recorded on site at numerous transects. Near-endemic.
- Fairy Flycatcher - not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Near-endemic.
- Fiscal Flycatcher- not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Near-endemic.
- Pririt Batis- not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Near-endemic.
- Pied Starling- not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Endemic to South Africa, Lesotho and Swaziland.
- South African Cliff Swallow- recorded on site at numerous transects. Breeding Endemic to South Africa, Lesotho and Swaziland.
- Karoo Thrush- not recorded on site but recorded during SABAP2 assessments for the wider pentad(s). Near-endemic.

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

Fauna

A survey was conducted during February 2022 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups occurring in the quarter degree grid. Four major fauna habitats were observed in the area namely:

- Grassland.
- Microphyllous woodland (including riparian woodland).
- Open water habitats / wetlands.
- Croplands.

The following has been indicated regarding the mammals of the area. Much of the large and medium-sized mammal fauna that previously occurred on the site is now locally extinct or occurs in small, fragmented populations in reserves. Most of the habitat types are fragmented. Therefore, the expected mammalian richness on these areas is considered low, although slightly higher richness values are expected from the more intact grassland, woodland and wetland habitats.

The Highveld Ecoregion contains a higher number of mammals, although only the orange mouse (*Mus orangiae*) is restricted to the ecoregion, and the rough-haired golden mole (*Chrysospalax villosa*) is near-endemic. The ecoregion also supports populations of several large mammal species, some of which are rare in southern Africa. Among these are the brown hyena (*Hyaena brunnea*), African civet (*Civettictis civetta*), leopard (*Panthera pardus*), pangolin (*Manis temminckii*), honey badger (*Mellivora capensis*), striped weasel (*Poecilogale albinucha*), aardwolf (*Proteles cristatus*), oribi (*Ourebia ourebi*), and mountain zebra (*Equus zebra hartmannae*).

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

The wetlands are an important habitat and dispersal corridor for moisture-reliant small mammals. The conservation of the wetlands and buffer zones will conserve the moisture reliant African marsh rat (Near Threatened) on the site and act as a movement corridor for small mammals.

The connectivity of the project site to the remainder of the larger area is Moderate due to other surrounding areas representing natural grassland and drainage channels. Of significance is the role of the channels and riparian zone as a zoogeographical dispersal corridor.

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

The following has been indicated regarding the herpetofauna (reptiles and amphibians) of the area. Twenty-nine amphibians occur within the ecoregion, but none are endemic. Breeding

habitat of frogs and toads can be found mostly in the permanent wet zone of the wetlands and dams in the larger area. Amphibian species potentially occurring in the larger area include Common River Frog, Natal Sand Frog, Gutteral Toad, Raucous Toad and Bubbling Kassina. These species are non-threatened and widespread, and as such the development will not have any impact on amphibian conservation within the region. The wetlands could provide habitat for the red listed giant bullfrog, and therefore the 32-meter buffer zone surrounding the wetlands should be adhered to.

Relatively few reptile species occur within the Highveld Ecoregion, mainly due to its cool climate. However, the ecoregion supports some of Africa's most characteristic reptile species, including Nile crocodile (*Crocodylus niloticus*), African rock-python (*Python sebae*), water monitor (*Varanus niloticus*) and veld monitor (*Varanus exanthematicus albigularis*). There are two strict endemic reptiles: giant girdled lizard (*Cordylus giganteus*), and *Agama distanti*. Several additional reptile species are near-endemics, including Drakensberg rock gecko (*Afroendura niravia*), giant spinytail lizard (*Cordylus giganteus*), and Breyer's whiptail (*Tetrodactylus breyeri*).

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

The following Species of Conservation Concern can potentially be found:

English Name	Conservation Status	Probability of occurrence on site
MAMMALS		
Oribi	Endangered	Low
Roan Antelope	Endangered (2016)	Zero – restricted to game reserves
African wild dog	Endangered (2016)	Zero – restricted to game reserves
Vaal Rhebok	Near Threatened (2016)	Low
Southern African Hedgehog	Near Threatened (2016)	Moderate
Lechwe	Near Threatened (2017)	Zero – restricted to game reserves
(Southern African) Tsessebe	Vulnerable (2016)	Zero – restricted to game reserves
Sable antelope	Vulnerable (2016)	Zero – restricted to game reserves
Ground Pangolin	Vulnerable (2016)	Low

English Name	Conservation Status	Probability of occurrence on site
African White-tailed Rat	Vulnerable (2016)	Moderate
Hartmann's Mountain Zebra	Vulnerable A3bcd (IUCN, 2019)	Zero – restricted to game reserves
HERPETOFAUNA		
Giant Bull Frog	Near Threatened	Moderate
Giant Girdled Lizard	Vulnerable (SARCA 2014)	Low

The DFFE Screening Report (Appendix B) has not identified any sensitive animal species.

5.3.1.7 Visual landscape

The proposed SPP development is located within close proximity to a tributary of the Doringrivier. The area drains towards the north-west and the tributary. The site is located in an area with relatively low significance in elevation, meaning that the site is not located on a mountain, at the foot of a mountain or in an area with a significant difference in elevation. The preferred site is located at an above mean sea level (amsl) of approximately 1344m at the highest elevation and at an amsl of 1320m at the lowest elevation.

The landform and drainage described above is unlikely to limit visibility. Areas within 5km from the proposed development might have a clear view without taking existing screening into account. The observers in a 5km radius include:

- Eskom power line infrastructure.
- Sibanye Gold Beatrix 4 mine.
- Various homesteads on farms.
- Livestock grazing and crop farming.
- R30.
- R730.
- Beatrix Shaft 4 Road.
- Farm roads.
- Doringrivier.
- Tributary of the Doringrivier.

Other observers are located outside of the 5km radius from the site which includes the Senwes Grainlink Silo: Welgelee, Beatrix Mine, Adamsonvlie Primary School, Goldfields Game Ranch and the Sandrivier.

In terms of possible landscape degradation, the landscape does not appear to have any specific protection or importance and is characterised by mines and agricultural

developments. Figure 5.18, Figure 5.19 and Figure 5.20 below indicates the Zone of Theoretical Visibility (ZTV) for the solar power plant and the proposed grid connection corridor options. The ZTV assessment did not consider existing screening such as buildings and vegetation cover but rather the terrain's above mean sea level (AMSL) which indicates line of sight. The main visual receptors in the area are industrial developments, the mining sector and agricultural developments (refer to Figure 5.19 and Figure 5.20).

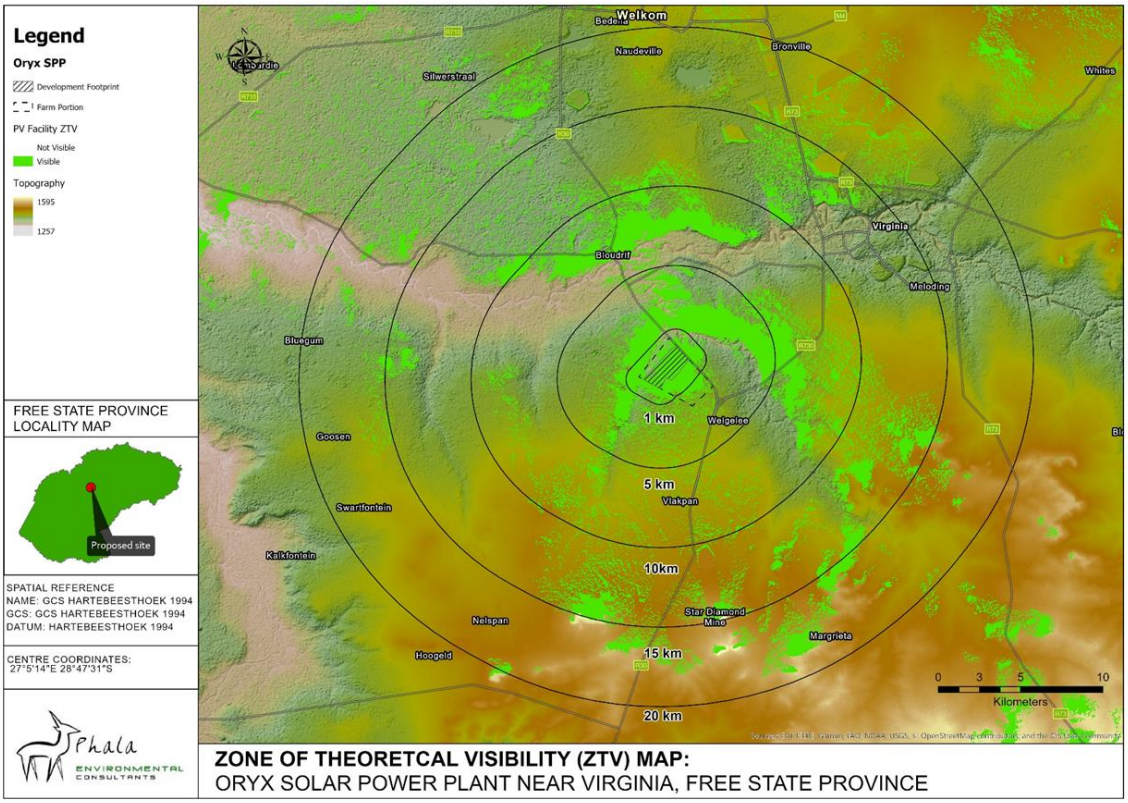


Figure 5.18: Zone of Theoretical Visibility (ZTV) for the Oryx Solar Power Plant.

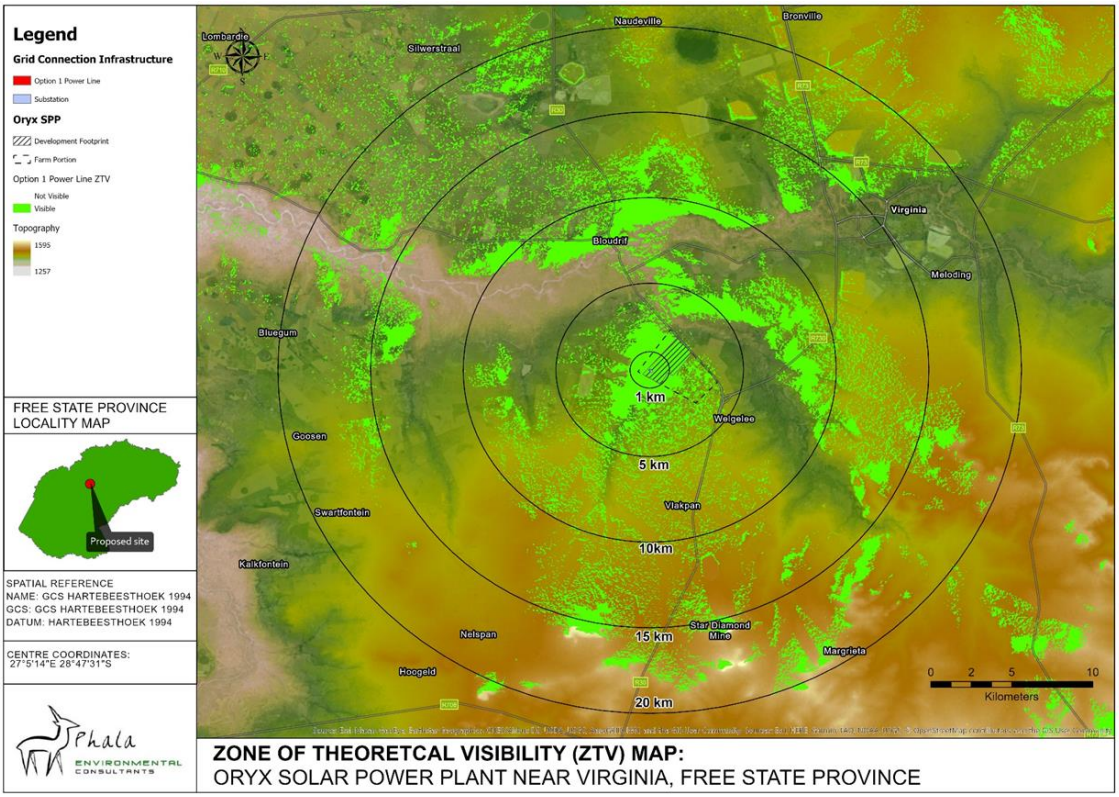


Figure 5.19: Zone of Theoretical Visibility (ZTV) for the proposed grid connection corridor option 1.

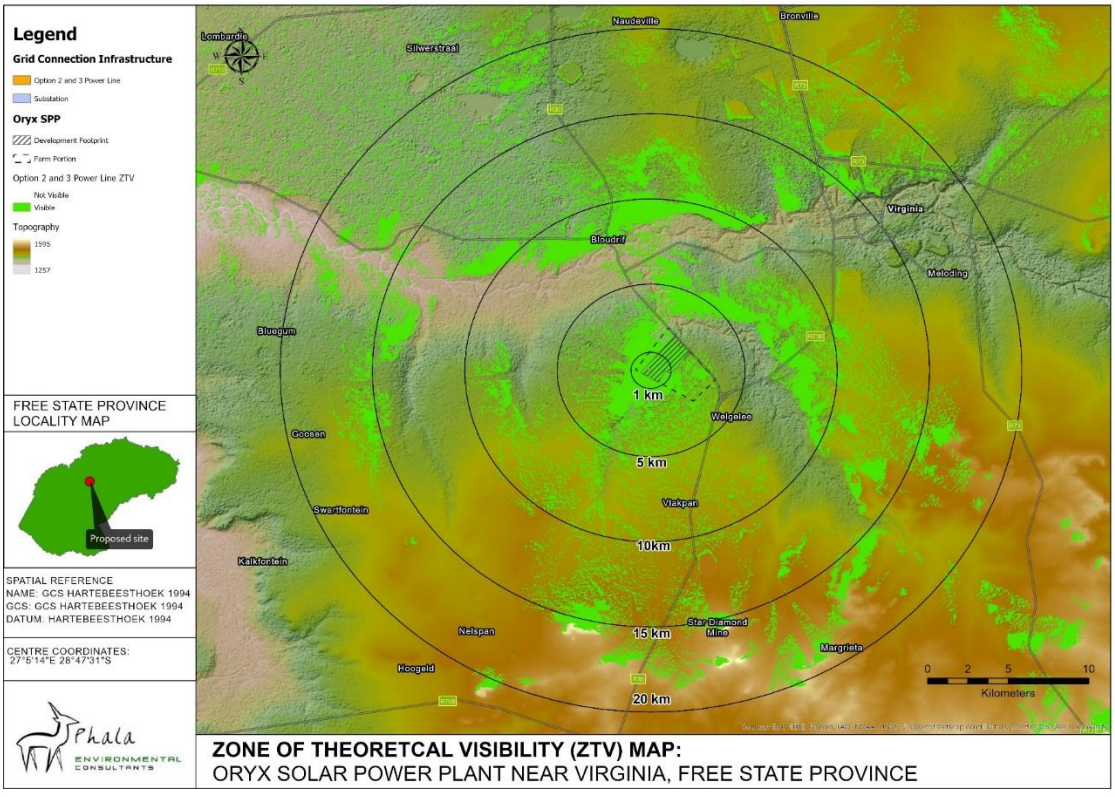


Figure 5.20: Zone of Theoretical Visibility (ZTV) for the proposed grid corridor options 2 & 3.

5.3.1.8 Traffic consideration

According to the Traffic Impact Study (Appendix E8), the existing external road network, in the vicinity of the Oryx Solar Power Plant consists of R30, R730 and Beatrix 4 Shaft Road. Access to the Oryx Solar Power Plant will be via Beatrix 4 Shaft Rd. A formal application for these access points will need to be lodged with the Matjhabeng Local Municipality and the Free State Department: Police, Roads and Transport. The formalisation of these access points to the standard, will in all probability be a requirement as part of the wayleave approval.

An internal site road network will also be required to provide access to the solar field and associated infrastructure. It is anticipated that approximately 15 km of internal roads will be required for the facility. Furthermore, an additional 15 km of smaller tracks may be required, for cleaning and maintenance of the solar modules.

Two (2) possible ports of entry have been identified from where the solar panel technology and large electrical components will be transported, namely: Durban and Richards Bay. The distance from Durban to the Oryx Solar Power Plant, via road, is approximately 585 km via the N3 and N5 and from Richards Bay to the Oryx Solar Power Plant is approximately 685 km via the N5. It is critical to ensure that the abnormal load vehicle will be able to move safely and without obstruction along the preferred route.

1.1.1 Description of the socio-economic environment

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

5.3.1.9 Socio-economic conditions

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

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

The Free State is situated in the heart of the country, between the Vaal River in the north and the Orange River in the south, bordered by the Northern Cape, Eastern Cape, North West, Mpumalanga, KwaZulu-Natal and Gauteng provinces, as well as Lesotho. The Free State is a rural province of farmland, mountains, goldfields, and widely dispersed towns. This province is an open, flat grassland with plenty of agriculture that is central to the country's economy. Mining is its largest employer.

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

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

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

Lejweleputswa District Municipality

The Lejweleputswa District Municipality is a Category C municipality situated in the north-western part of the Free State. It borders the North West Province to the north, Fezile Dabi and Thabo Mofutsanyana to the north-east and east respectively, Mangaung and Xhariep to the south, and the Northern Cape Province to the west.

The District Municipality makes up almost a third of the province, covering an area of 32 287km^2, and consists of the following five local municipalities, with approximately 18 towns distributed throughout: Masilonyana, Tokologo, Tswelopele, Matjhabeng and Nala. The main economic sectors include: Mining (31%), construction, transport, electricity and trade. In 2011 the Municipality had a population of 624 746 with a dependency ratio of 51.3. By 2016 the population has increased to 646 920 and the dependency ratio was reduced to 46.2.

Matjhabeng Local Municipality

The Matjhabeng Local Municipality is a Category B municipality situated in the Lejweleputswa District in the Free State. It is bound by Nala to the north, Masilonyana to the south, Tswelopele to the east and Moqhaka to the west and covers an area of 5 690km^2. It is one of five municipalities in the district. Matjhabeng represents the hub of mining activity in the Free State Province.

There is one formal land-based protected area in the municipality, being the Willem Pretorius Nature Reserve. There are no Ramsar sites. There are six towns in the municipality, namely, Allanridge, Henneman, Odedaalsrus, Ventersburg, Virginia and Welkom. The main economic sectors in the municipality are mining and manufacturing.

5.3.1.10 Cultural and heritage aspects

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a very limited pre-colonial Stone Age and Iron Age occupation. The second and much later component is a colonial farmer one,

with a very limited urban component consisting of a number of smaller towns, most of which developed during the last 100 to 120 years. Most of the towns in the region developed as a direct result of the exploitation of the Free State gold fields.

Stone Age

The larger region has probably been inhabited by humans since Early Stone Age (ESA) times, although evidence of this is very limited. Tools dating to this period are mostly, although not exclusively, found in the vicinity of watercourses. The oldest of these tools are known as choppers, crudely produced from large pebbles found in the river. Later, Homo erectus and early Homo sapiens people made tools shaped on both sides, called bifaces.

During Middle Stone Age (MSA) times (c. 150 000 – 30 000 BP), people became more mobile, occupying areas formerly avoided. Open sites were still preferred near watercourses. These people were adept at exploiting the huge herds of animals that passed through the area, on their seasonal migration. As a result, tools belonging to this period also mostly occur in the open or in erosion dongas. Similar to the ESA material, artefacts from these surface collections are viewed not to be in a primary context and have little or no significance.

Later Stone Age (LSA) people had even more advanced technology than the MSA people and therefore succeeded in occupying even more diverse habitats. The stone artefacts they produced are much smaller than those of the Middle Stone Age and consist of a great variety of functional types. LSA people preferred, though not exclusively, to occupy rock shelters and caves and it is this type of sealed context that make it possible for us to learn much more about them than is the case with earlier periods. At present, no stratified, sealed site dating to the Stone Age is known for the immediate region.

Habitation of the larger geographical area took place since Early Stone Age times. This is confirmed by the occurrence of stone tools dating to the Early, Middle and Late Stone Age found in a number of places. However, these are mostly located in the vicinity of rivers, such as the Doringspruit north of Kroonstad and the Vals River south of Kroonstad.

Iron Age

Iron Age people started to settle in southern Africa c. AD 300, with one of the oldest known site at Silver Leaves south east of Tzaneen dating to AD 270. The oldest local EIA site is located at Broederstroom south of Hartebeestpoort Dam and has a radio-carbon date of AD 470.

The occupation of the larger geographical area (including the site) did not start much before the 1500s. To understand all of this, we have to take a look at the broader picture. Towards the end of the first millennium AD, Early Iron Age communities underwent a drastic change, brought on by increasing trade on the East African coast. This led to the rise of powerful ruling elites, for example at Mapungubwe. The abandonment of Mapungubwe (c. AD 1270) and other contemporaneous settlements show that widespread drought conditions led to the decline and eventual disintegration of this state Huffman (2005).

By the 16th century things changed again, with the climate becoming warmer and wetter, creating conditions that allowed Late Iron Age (LIA) farmers to occupy areas previously

unsuitable, for example the Witwatersrand and the treeless, wind-swept plains of the Free State and the Mpumalanga escarpment.

This period of consistently high rainfall started in about AD 1780. At the same time, maize was introduced from Maputo and grown extensively. Given good rains, maize crops yield far more than sorghum and millets. This increase in food production probably led to increased populations in coastal areas as well as the central highveld interior by the beginning of the 19th century. Due to their specific settlement requirements, Late Iron Age people preferred to settle on the steep slope of a mountain, possibly for protection, or for cultural considerations such as grazing for their enormous cattle herds. Because of the lack of trees, they built their settlements in stone. The complexity of these communities, as is reflected in their settlement layout, has been demonstrated for example by the extensive archaeological excavations done on some of these sites.

Sites dating to the Late Iron Age are known to occur in the larger region, especially to the south, in the vicinity of the Sandrivier, but also the east of the site. These are typical stone walled sites that are linked with Sotho-speakers and date to the period after 1600.

Historic period

European hunting parties allegedly crossed the Orange River in the first two decades of the 19th century, exploring as far as the current Wepener district. On the heels of these explorers, cattle farmers from the Cape Colony started moving out of the northern Cape Colony borders from 1821 for seasonal grazing, but did not encounter any Bantu tribes. Driven by droughts in the Cape, loss of livestock during the seasonal travels and the uninhabited district of the Transgariep led to numerous farmers settling themselves permanently in the area after 1824.

Between 1825 and 1841 European settlers started to occupy the area of the Modder River between the Orange and Caledon Rivers, west of Langeberg. In 1829 Rudolph van Wyk settled on the farm Rietpoort, where the town of Smithfield was founded in 1848, and P.E. Wepener claimed the farm Zuurbult, which would become Rouxville in 1863. Roughly at the same time fifteen families occupied the farm Zevenfontein which eventually became the Beersheba Mission Station. The town of Zastron was founded on the farm named Verliesfontein, which was settled between 1836 and 1840, and by that time nearly 300 families had settled in the area currently known as the Eastern Free State. During the beginnings of the 1830's a new, organised group of European settlers, the forerunners of the Groot Trek, saw a large but temporary influx of settlers. During this time A.H. Potgieter also bought land from the Bataung captain Makwana in 1836.

It was only after the annexation of Natal in 1843 that many Trekkers returned to the Transgariep as well as to the northern parts of the Eastern Free State's Borderbelt. Notable amongst these settlers were J.I.J.Fick, after whom Ficksburg was named, W. van de Venter - founder of Fouriesburg and P.R. Botha who settled in Rietvlei. French missionaries were the last to settle in the area, and in 1833 E. Casalis and T. Arbusset opened the Missionary Station at Morija after a request from Moshoeshoe. North of Smithfield hon. S. Rolland, accepting the jurisdiction of Moshoeshoe without any reservation, founded the Beersheba Mission Station in 1835. This meant that a part of the southeast Transgariep immediately became declared as a Basotho region and ensured that Moshoeshoe received ownership over a region where no

Basotho lived. French missionaries also founded mission stations Carmel (near Smithfield), Hebron (near Zastron) and Mequatling (in the Ladybrand district) and their influence would play a crucial role in the relationship between European settlers and the Basotho in the Transgariep future.

The historic period started with the arrival, in the late 18th century by Korana raiders in the area. They were soon followed, in the early 19th century, by traders, explorers and missionaries. By the middle of the 19th century, farms were taken up and later towns were developed – Theunessin was established in 1907 and named Smaldeel, which was changed to Theunissen in 1912. Towns such as Virginia (1954) and Welkom (1946) were only established as part of the development of the gold mining industry in the region. Infra-structural development, such as the development of roads, bridges and railway lines also took place. One of the original stations was called Virginia and was established in 1892. This makes the former town actually much older.

The Free State gold fields started in 1945 with a mining lease granted to the St Helena Gold Mine. By the end of 1992 the gold field had produced 7 360 t of gold from some 20 mines in the region. Some of these mines have now been amalgamated into larger, more cost-effective mines, which includes Loraine, Freegold North (an amalgamation of Freddies, Free State and Western Holdings), Freegold South (an amalgamation of President Brand, President Steyn, Free State Saaiplaas and Erfdeel), St Helena, Harmony, now merged with Merriespruit and Virginia, Unisel, Oryx (which now incorporates Beisa and Beatrix) and H.J. Joel.

Gold was not the only mineral mined in this area. A kimberlite pipe on the farm Kaalvallei, located a few kilometres to the southeast of Welkom, was mined since 1890, but was eventually forced to close down when an aquifer was encountered, which subsequently flooded the mine.

Site specific review

From a review of the available old maps and aerial photographs it can be seen that the site has always been open space, with the main activity being grazing or the making of agricultural fields. From the early aerial photographs and topographic maps, the only development to be seen are agricultural fields, dams and access roads, with the current farmstead located in the near centre of the site. In addition, some structures usually indicated as farm labourer homesteads are scattered across the western section.

During the survey, no sites, features or objects of cultural significance dating to the Stone Age or Iron Age were identified. However, in terms of the Historic Period a burial site was identified within the affected property and the development footprint. It consists of a large area that used to be completely fenced off. It contains an unknown number of graves – due to the tall and dense vegetation cover and exact count could not be done. Only a few have headstones with inscriptions are present, and most are marked only with of low stone cairns. The site has not been visited by descendants in recent years. No other signs of habitation could be detected. Refer to Figure 5.21 and Figure 5.22.

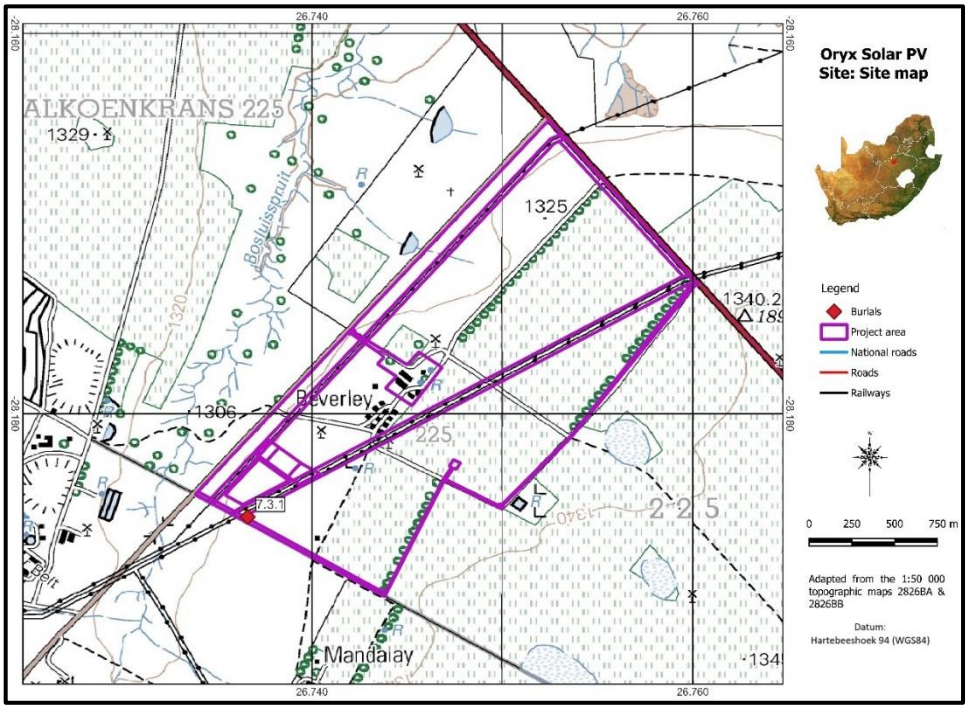


Figure 5.21: Location of heritage sites associated with the Oryx Solar Power Plant

Figure 5.22: Photos of the graves located within the Oryx solar Power Plant development footprint

Figure 5.23: Views of the burial site located within the Oryx solar Power Plant development footprint

Palaeontology

The Palaeontological Impact Assessment (refer to Appendix E6) found that the Oryx Solar Power Plant near Virginia in the Free State is underlain by alluvium, colluvium and elluvium as well as the Balfour Formation of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup). According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Quaternary superficial deposits is Moderate while that of the Balfour Formation is very High (Almond et al, 2013; SAHRIS website). Refer to Figure 5.24.

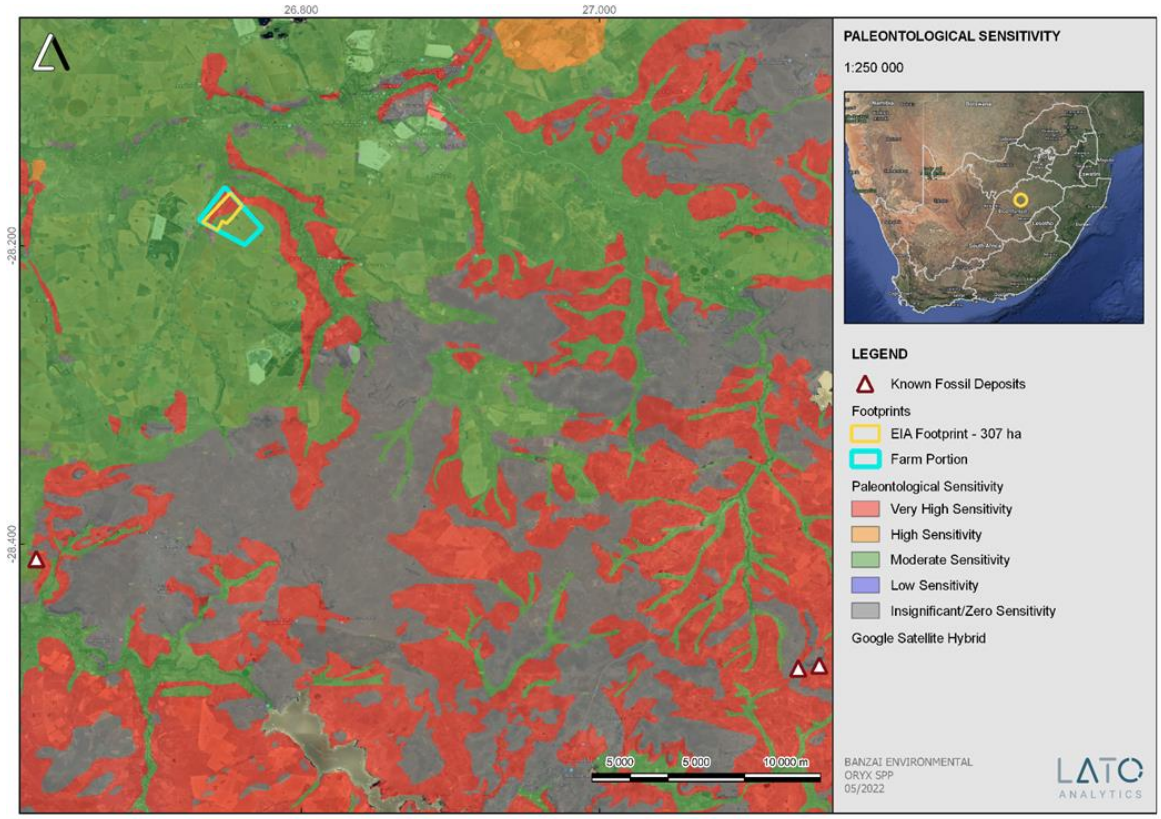


Figure 5.24: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development in yellow.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12-13 March 2022. No fossiliferous outcrops were detected. For this reason, a low Palaeontological significance has been allocated to the proposed development. It is therefore considered that the development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.

1.2 SITE SELECTION MATRIX

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

The receptiveness of the site to PV Development includes the presence of optimal conditions for a solar energy facility due to high irradiation values and optimum grid connection opportunities (i.e. the grid connection points are located within the affected property which minimizes the length of power line development and consolidates the overall impacts and disturbance of the project within the affected property). Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225, where the project is proposed to be located is considered favorable and suitable from a technical perspective due to the following characteristics:

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

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

- Extent of the site: A significant portion of land is required to evacuate the prescribed 150MW and space is a constraining factor in PV facility installations. Provision was made to assess a larger area than is required for the facility to make provision for any other environmental or technical constraints that may arise and avoiding those areas. Larger farms are sought after to make provision for any constraints imposed by the Department of Agriculture on the extent of land that may be used for such facilities per farm, as well as the opportunities presented for the avoidance of sensitive environmental features present. Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225, and the development footprint assessed therein is considered to provide an opportunity for the successful construction and operation of a solar power plant with a capacity of 150MW, as well as opportunities for the avoidance and mitigation of impacts on the affected environment and sensitive environmental features.

- Site availability and access: The land is available for lease by the developer. Reluctant farm owners or farmers over capitalizing hamper efforts to find suitable farms. Access will be obtained via the Beatrix Shaft 4 Rd off the R30 to the north of the site.

- Grid connection: In order for the PV facility to connect to the national grid the facility will have to construct an on-site substation, Eskom switching station and a power line from the project site to connect to the Eskom grid. Available grid connections are becoming scarce and play a huge role when selecting a viable site. Three grid connection options are available and all three are located within the affected property which presents an opportunity for the consolidation of infrastructure and disturbance within the affected landscape.

- Environmental sensitivities: From an environmental perspective the proposed site is considered desirable due to limited environmental sensitivities in terms of geology, and soils, agricultural potential, vegetation and landscape features, climate, biodiversity and the visual landscape – refer to Section 5.3.1 of this report. The area proposed for development exclusively consists of land used for agriculture, but wetland features and a historical burial site are located on the development footprint, as well as a few protected plant species, that will need to be considered by the

developer for the placement of the facility infrastructure within the development footprint.

It is evident from the discussion above that Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225 may be considered favourable and suitable in terms of the site and environmental characteristics. As mentioned previously, no alternative areas on the property have been considered for the placement of the development footprint as the assessed development footprint avoids areas that are under cultivation within the affected property. The development footprint of this project will cover a significant portion of the farm, however, provision will be made to exclude any sensitive areas from the facility layout to be developed within the development footprint.

1.3 CONCLUDING STATEMENT ON ALTERNATIVES

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

Therefore, development of the 150 MW Oryx Solar Power Plant on Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225 is the preferred option. The final layout is included as part of this Final EIR (refer to Figure H1 and H2). It may be concluded that this is the only location that will be assessed in further detail within sections 6 and 7.

6 DESCRIPTION OF THE IMPACTS AND RISKS

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

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

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

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

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

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

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

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

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

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

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

(i) cumulative impacts;

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

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

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

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

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

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

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

6.1 SCOPING METHODOLOGY

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

- Checklist (see section 6.1.1): The checklist consists of a list of structured questions related to the environmental parameters and specific human actions. They assist in ordering thinking, data collection, presentation and alert against the omission of possible impacts.

- Matrix (see section 6.1.2): The matrix analysis provides a holistic indication of the relationship and interaction between the various activities, development phases and the impact thereof on the environment. The method aims at providing a first order cause and effect relationship between the environment and the proposed activity. The matrix is designed to indicate the relationship between the different stressors and receptors which leads to specific impacts. The matrix also indicates the specialist studies that have been conducted to address the potentially most significant impacts.

6.1.1 Checklist analysis

The independent consultant conducted a site visit on 13 April 2021. The site visit was conducted to ensure a proper analysis of the site-specific characteristics of the site. Table 6.1 provides a checklist, which is designed to stimulate thought regarding possible consequences of specific actions and so assist scoping of key issues. It consists of a list of structured questions related to the environmental parameters and specific human actions. They assist in ordering thinking, data collection, presentation and alert against the omission of possible impacts. The table highlights certain issues, which are further analysed in matrix format in section 6.2.

Table 6.1: Environmental checklist

QUESTION	YES	NO	Un-sure	Description
1. Are any of the following located on the site earmarked for the development?				
I. A river, stream, dam or wetland	✕			Three wetland types were identified on site namely valleybottom wetland, depressions and hillslope seep wetlands.

II. A conservation or open space area		×		Most of the proposed development footprint represents Ecological Support Areas (ESA), including ESA1 and ESA2 areas and most of these areas represent degraded grassland. A small section of the south western corner of overlaps with a Critical Biodiversity Area 1.
III. An area that is of cultural importance	×			A historic burial site is located on the site.
IV. Site of geological significance		×		None.
V. Areas of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.
VII. Floodplain		×		None.
VIII. Indigenous Forest		×		None.
IX. Grass land	×			A portion of the site is located in the Vaal-Vet Sandy grasslands which is classified as being endangered.
X. Bird nesting sites		×		The Avifauna Impact Assessment (refer to Appendix E2) does not make any reference to nesting sites on the area earmarked for the development.
XI. Red data species		×		The Avifauna Impact Assessment (refer to Appendix E2) did not record any Red Data Species on site but indicated that they could possibly occur on site.
XII. Tourist resort		×		None.
2. Will the project potentially result in potential?				
I. Removal of people		×		None.

II. Visual Impacts	×			The VIA (refer to Appendix E3) confirmed that the significance of the visual impact will be a "Negative Low Impact". The only receptors likely to be impacted by the proposed development are the nearby property owners and road users on nearby roads. The visual landscape is already degraded due to the large number of mines and Eskom electricity infrastructure in the area.
III. Noise pollution		×		Construction activities will result in the generation of noise over a period of 12-18 months. The noise impact is unlikely to be significant.
IV. Construction of an access road		×		Access will be obtained via a gravel road off the R30 regional road.
V. Risk to human or valuable ecosystems due to explosion/fire/ discharge of waste into water or air.		×		None.
VI. Accumulation of large workforce (>50 manual workers) into the site.	×			Approximately 800 employment opportunities will be created during the construction phase and 99 employment opportunities during the operation phase of the SPP project.
VII. Utilisation of significant volumes of local raw materials such as water, wood etc.	×			The estimated maximum amount of water required during the facility's 20 years of production is approximately 4200m³ per annum.

VIII. Job creation	×			Approximately 800 employment opportunities will be created during the construction and 99 employment opportunities during the operational phases for the SPP.
IX. Traffic generation	×			It is estimated that 72 trips per day will be generated over the 12–18-month construction period for the SPP.
X. Soil erosion	×			The site will need to be cleared or graded to a limited extent, which may potentially result in a degree of dust being created, increased runoff and potentially soil erosion. The time that these areas are left bare will be limited to the construction phase, since vegetation will be allowed to grow back after construction.
XI. Installation of additional bulk telecommunication transmission lines or facilities		×		None.
3. Is the proposed project located near the following?				
I. A river, stream, dam or wetland	×			Three wetland types were identified namely valleybottom wetland, depressions and hillslope seep wetlands. Bosluisspruit floodplain river located to the north of the Oryx Solar Power Plant Development footprint
II. A conservation or open space area		×		None.
III. An area that is of cultural importance		×		None.
IV. A site of geological significance		×		None.
V. An area of outstanding natural beauty		×		None.

VI. Highly productive agricultural land	×			Productive farmland is located directly adjacent to the site and within the surrounding areas.
VII. A tourist resort	×			The Goldfields Game Ranch is located 1.35km to the south-east. It must be noted that the Springbok solar Power Plant was recently authorised for development on this property.
VIII. A formal or informal settlement	×			Welkom (located approximately 17 km north of the proposed development). Virginia (located approximately 10km north-northeast of the proposed development).

6.1.2 Matrix analysis

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

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

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

Detailed impact assessments have been undertaken by each of the respective specialists which has informed the matrix analysis as included in Table 6.2 below, as well as the key issues identified as included in sections 6.2.1-6.2.3. The table included on the overleaf includes

reference to the sections in the respective specialist studies where the details of the in-depth assessment of potential environmental impacts can be obtained.

Specialist Study	Impact Assessment (pg.)	Cumulative Impacts (pg.)	Mitigation Measures (pg.)
Terrestrial Biodiversity Impact Assessment (Appendix E1)	60 - 82	58 - 59	Same as Impact Assessment
Avifauna Impact Assessment (Appendix E2)	49 – 50 PV Panels 52 – 53 PL 56 – 58 Description	50 – 51 PV Panels 53 – 55 PL	59 - 61 PV Panels 62– 64 PL
Agriculture Compliance Statement (Appendix E4)	11 - 12	12 - 14	16 - 22
Heritage Impact Assessment (Appendix E5)	17 – 19 Site survey 19 – 22	19 – 20	22 - 25
Palaeontological Impact Assessment (Appendix E6)	42 – 43	43 – 46	46 - 47
Social Impact Assessment (Appendix E7)	58 – 61	85 – 89	Same as Impact Assessment
Visual Impact Assessment (Appendix E3)	49 – 66	62 – 65	66 – 68
Traffic Impact Assessment (Appendix E8)	17 - 19	19 – 20	None Applicable

Table 6.2: Matrix analysis

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

Low significance	Medium significance	High significance	Positive impact

LISTED ACTIVITY (The Stressor)	ASPECTS OF THE DEVELOPMENT /ACTIVITY	POTENTIAL IMPACTS			SIGNIFICANCE AND MAGNITUDE OF POTENTIAL IMPACTS							MITIGATION OF POTENTIAL IMPACTS			SPECIALIST STUDIES / INFORMATION
			Receptors	Impact description / consequence	Minor	Major	Extent	Duration	Probability	Reversibility	Irreplaceable loss of resources	Possible Mitigation	Possible mitigation measures	Level of residual risk	
CONSTRUCTION PHASE															
Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* Activity 12(ii)(a)(c) (GN.R. 327): *"The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."* Activity 14 (GNR 327): *"The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or*	Site clearing and preparation Certain areas of the site will need to be cleared of vegetation and some areas may need to be levelled. Civil works The main civil works are: • Terrain levelling if necessary– Levelling will be minimal as the potential site chosen is relatively flat. • Laying foundation- The structures will be connected to the ground through cement pillars, cement slabs or metal screws. The exact method will depend on the detailed geotechnical analysis. • Construction of access and inside roads/paths – existing paths will be used were reasonably possible. Additionally, the turning	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	• Direct habitat destruction • Habitat fragmentation • Increased soil erosion and sedimentation. • Soil and water pollution • Air pollution • Spread and establishment of alien invader species. • Negative effect of human activities on fauna and road mortalities.		-	S	L	D	PR	ML	Yes	- See Table 6.3	L	Terrestrial Biodiversity, Animal and Plant Species Assessment (Appendix E1)
			Avifauna	• Displacement of priority avian species from important habitats. • Displacement of resident avifauna through increased disturbance. • Loss of important avian habitats.		-	S	M	Pr	PR	ML	Yes	- See Table 6.3	L	Avifauna Impact Assessment (Appendix E2)
			Air	• Air pollution due to the increase of traffic of construction vehicles and the undertaking of construction activities.	-		S	S	D	CR	NL	Yes	- Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to	L	-

more but not exceeding 500 cubic metres." Activity 19 (GN.R. 327): *"The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."* *Activity 24 (ii) (GN.R 327): "The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters."* Activity 28(ii) (GN.R. 327): *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."* Activity 56 (ii) (GN.R 327): "*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* Activity 1 (GN.R. 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the*	circle for trucks will also be taken into consideration. Transportation and installation of PV panels into an Array The panels are assembled at the supplier's premises and will be transported from the factory to the site on trucks. The panels will be mounted on metal structures which are fixed into the ground either through a concrete foundation or a deep-seated screw. Wiring to the Central Inverters Sections of the PV array would be wired to central inverters which have a maximum rated power of 2000kW each. The inverter is a pulse width mode inverter that converts DC electricity to alternating electricity (AC) at grid frequency.											transport sand and building materials are fitted with tarpaulins or covers.		
			Soil	• Loss of agricultural potential by occupation of land. • Loss of agricultural potential by soil degradation. • Soil degradation, including erosion. • Disturbance of soils and existing land use (soil compaction). • Physical and chemical degradation of the soils by construction vehicles (hydrocarbon spills). • Loss of topsoil.		-	S	S	Pr	PR	ML	Yes	- See Table 6.3	L	Agricultural and Soils Compliance Statement (Appendix E4)
			Geology	• Collapsible soil. • Seepage. • Active soil (high soil heave). • Erodible soil. • Hard/compact geology. If the bedrock occurs close to surface it may present problems when driving solar panel columns. • The presence of undermined ground. • Instability due to soluble rock. • Steep slopes or areas of unstable natural slopes. • Areas subject to seismic activity.	-	-	S	S	Pr	CR	NL	Yes	- The most effective mitigation will be the minimisation of the project footprint by using the existing roads in the area and not create new roads to prevent other areas also getting compacted. - Retention of vegetation where possible to avoid soil erosion.	L	-
			Existing services infrastructure	• Generation of waste that need to be accommodated at a licensed landfill site. • Generation of sewage that need to be accommodated by the local sewage plant.	-		L	S	D	PR	ML	Yes	-	L	Confirmation from the Local Municipality

electricity output is 20 megawatts or more..." Activity 15 (GN.R. 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation..."* Activity 4 (b)(i)(ee) (GN.R 324): "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee) within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."* Activity 10 (b)(i)(ee)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."* Activity 12 (b)(i)(ii)(vi) (GN.R 324): *"The clearance of an area*				• Increase in construction vehicles on existing roads.											
			Groundwater	• Pollution due to construction vehicles and the storage and handling of dangerous goods.	-		S	S	Pr	CR	ML	Yes	- A groundwater monitoring programme (quality and groundwater levels) should be designed and installed for the site. - Monitoring boreholes should be securely capped, and must be fitted with a suitable sanitary seal to prevent surface water flowing down the outside of the casing. - Full construction details of monitoring boreholes must be recorded when they are drilled. - Sampling of monitoring boreholes should be done according to recognised standards.	L	-
			Surface water	• Impact on the characteristics of the watercourse • Soil compaction and increased risk of sediment transport and erosion • Soil and water pollution • Spread and establishment of alien invasive species		-	L	S	Pr	PR	ML	Yes	- See Table 6.3	L	Wetland Riparian Delineation and Aquatic Biodiversity Assessment (Appendix E1)
			General Environment (risks associated with BESS)	• Mechanical breakdown / Exposure to high temperatures • Fires, electrocutions and spillage of toxic substances		-	S	M	Pr	PR	ML	Yes	- See Table 6.6	L	-

of 300 square metres or more of indigenous vegetation (b) in the Free State, (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment of 2004, (ii) within critical biodiversity areas identified in bioregional plans and (vi) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland." <u>Activity 14(ii)(a)(c)(b)(i)(ff) (GN.R 324):</u> "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."* <u>Activity 18 (b)(i)(ee)(hh) (GN.R 324):</u> *"The widening of a road by more than 4 metres, or the lengthening of a road by more*				into the surrounding environment. • Spillage of hazardous substances into the surrounding environment. • Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas. • Water Pollution – spillages into surrounding watercourses as well as groundwater. • Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water. • Generation of hazardous waste											
	SOCIAL/ECONOMIC ENVIRONMENT	Local unemployment rate	• Job creation. • Business opportunities. • Skills development.		+	P	S	D	I	N/A	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
		Visual landscape	• Potential visual impact on residents of farmsteads and motorists in close proximity to proposed facility. • Lighting impacts. • Solar glint and glare impacts. • Visual sense of place impacts.	-		L	S	D	CR	NL	Yes	- See Table 6.3	M	Visual Impact Assessment (Appendix E3)
		Traffic volumes	• Increase in construction vehicles.	-		L	S	Pr	CR	NL	Yes	- Delivery and construction trips will be insignificant when compared to the Average Daily Traffic (ADT) and will not affect the existing	L	Traffic Impact Assessment (Appendix E8)

than 1 kilometre (b) in the Free State (i) outside urban areas, within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."												Level of Service (LOS). It can therefore be concluded that, on both routes, no mitigation measures will be necessary.		
			Health & Safety	• Air/dust pollution. • Road safety. • Impacts associated with the presence of construction workers on site and in the area. • Influx of job seekers to the area. • Increased safety risk to farmers, risk of stock theft and damage to farm infrastructure associated with presence of construction workers on the site. • Increased risk of veld fires.		-	L	L	Pr	PR	ML	Yes	- See Table 6.3	M	Social Impact Assessment (Appendix E7)
			Noise levels	• The generation of noise as a result of construction vehicles, the use of machinery such as drills and people working on the site.	-		L	S	D	CR	NL	Yes	- During construction care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the surrounding residential areas. Plant equipment such as generators, compressors, concrete mixers as well as vehicles should be kept in good operating order and where appropriate have effective exhaust mufflers.	L	Social Impact Assessment (Appendix E7)
			Tourism industry	• Since there are no sensitive tourism facilities in close proximity to the site, the proposed activities will not	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

				have an impact on tourism in the area.											
			Heritage resources	• Loss or damage to sites, features or objects of cultural heritage significance	-		S	S	U	PR	ML	Yes	- See Table 6.3	L	Heritage Impact Assessment (Appendix E5)
			Paleontological Heritage	• Disturbance, damage or destruction of legally-protected fossil heritage* within the development footprint during the construction phase	-		S	P	U	IR	ML	Yes	N/A	L	Paleontological Impact Assessment (Appendix E6)
OPERATIONAL PHASE															
Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* Activity 1 (GN.R 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."* Activity 10 (b)(hh) (GN.R 324): "*The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic*	The key components of the proposed project are described below: • PV Panel Array - To produce 150 MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun. • Wiring to Central Inverters - Sections of the PV array will be wired to central inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC)	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	• Direct habitat destruction • Habitat fragmentation • Increased soil erosion and sedimentation. • Soil and water pollution • Air pollution • Spread and establishment of alien invader species. • Negative effect of human activities on fauna and road mortalities.		-	L	L	Po	PR	ML	Yes	- See Table 6.4	L	Terrestrial Biodiversity, Animal and Plant Species Assessment (Appendix E1)
			Avifauna	• Displacement of priority avian species from important habitats. • Displacement of resident avifauna through increased disturbance. • Collisions with PV panels leading to injury or loss of avian life. • Insignificnt impacts expected to be associated with the power line as the line is proposed to be of a very short length.		-	S	L	Pr	PR	ML	Yes	- See Table 6.4	M	Avifaunal Impact Assessment (Appendix E2)
			Air quality	• The proposed development will not result in any air pollution during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

metres (b) in the Free State (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."	electricity at grid frequency. • Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. • Supporting Infrastructure – Auxiliary buildings with basic services such as water and electricity will be constructed on the site and will have an approximate footprint 820m². Other supporting infrastructure includes voltage and current regulators and protection circuitry. • Roads – Access will be obtained via gravel road off the R30. An internal site road network will also be required to provide access to the solar field and associated infrastructure. All site roads will require a		Soil	• Soil degradation, including erosion. • Disturbance of soils and existing land use (soil compaction). • Loss of agricultural potential (low significance relative to agricultural potential of the site).		-	L	L	D	PR	SL	Yes	- See Table 6.4	L	Agricultural and Soil Compliance Statement (Appendix E4)
			Geology	• Collapsible soil. • Active soil (high soil heave). • Erodible soil. • Hard/compact geology. If the bedrock occurs close to surface it may present problems when driving power line columns. • The presence of undermined ground. • Instability due to soluble rock. • Steep slopes or areas of unstable natural slopes. • Areas subject to seismic activity. • Areas subject to flooding.	-		S	S	Po	PR	ML	Yes	- Surface drainage should be provided to prevent water ponding. - Mitigation measures proposed by the detailed engineering geological investigation should be implemented.	L	-
			Groundwater	• Leakage of hazardous materials. The development will comprise of a distribution substation and will include transformer bays which will contain transformer oils. Leakage of these oils can contaminate water supplies.	-		L	L	Po	PR	ML	Yes	- All areas in which substances potentially hazardous to groundwater are stored, loaded, worked with or disposed of should be securely bunded (impermeable floor and sides) to prevent accidental discharge to groundwater.	L	-
			Surface water	• Impact on the characteristics of the watercourse	-		L	L	Pr	PR	ML	Yes	- See Table 6.4	L	Wetland Riparian Delineation and Aquatic Biodiversity

	width of approximately 6 m – 12 m. • Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm.			• Soil compaction and increased risk of sediment transport and erosion • Soil and water pollution • Spread and establishment of alien invasive species											Assessment (Appendix E1)
		SOCIAL/ECONOMIC	Visual landscape	• Visual impact on observers travelling along the roads and residents at homesteads within a 5km radius of the SPP. • Visual impact on observers travelling along the roads and residents at homesteads within a 5-10km radius of the SPP. • Visual impacts of lighting at night on sensitive visual receptors in close proximity to the proposed facility. • Visual impacts of glint and glare on sensitive visual receptors in close proximity to the proposed facility. • Visual impacts on observers travelling along the roads and residents at homesteads in close proximity to the power line structures. • Visual impacts and sense of place impacts associated with the operation phase of SPP.		-	L	L	D	PR	ML	Yes	- See Table 6.4	L	Visual Impact Assessment (Appendix E3)
			Traffic volumes	• The proposed development will not result in any traffic impacts during the operational phase.	-		L	L	Po	CR	NL	Yes	-	L	Traffic Impact Assessment (Appendix E8)
			Health & Safety	• The proposed development will not result in any health and safety	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	N/A

				impacts during the operational phase.											
			Noise levels	• The proposed development will not result in any noise pollution during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• Loss or damage to sites, features or objects of cultural heritage significance	-		S	S	U	PR	ML	Yes	- See Table 6.4	L	Heritage Impact Assessment (Appendix E5)
			Electricity supply	• Generation of additional electricity. The power line will transport generated electricity into the grid.	+		I	L	D	I	N/A	Yes	-	N/A	-
			Electrical infrastructure	• Additional electrical infrastructure. The proposed solar facility will add to the existing electrical infrastructure and aid to lessen the reliance of electricity generation from coal-fired power stations.	+		I	L	D	I	N/A	Yes	-	N/A	-
DECOMMISSIONING PHASE															
-	<u>Dismantlement of infrastructure</u> During the decommissioning phase the Solar PV Energy facility and its associated infrastructure will be dismantled. <u>Rehabilitation of biophysical environment</u> The biophysical environment will be rehabilitated.	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	• Improvement of habitat through revegetation / succession over time • Soil erosion and sedimentation. • Spreading and establishment of alien invasive species • Habitat degradation due to dust • Spillages of harmful substances • Road mortalities of fauna / impact of human activities on site.		-	S	L	Po	N/A	N/A	Yes	- See Table 6.5	L	Terrestrial Biodiversity, Animal and Plant Species Assessment (Appendix E1)

			Air quality	• Air pollution due to the increase of traffic of construction vehicles.	-		S	S	D	CR	NL	Yes	- Regular maintenance of equipment to ensure reduced exhaust emissions.	L	-
			Soil	• Soil degradation, including erosion. • Disturbance of soils and existing land use (soil compaction). • Physical and chemical degradation of the soils by construction vehicles (hydrocarbon spills).		-	S	S	Pr	PR	M	Yes	- See Table 6.3	L	Agricultural and Soil Compliance Statement (Appendix E4)
			Geology	• It is not foreseen that the decommissioning phase will impact on the geology of the site or vice versa.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Existing services infrastructure	• Generation of waste that needs to be accommodated at a licensed landfill site. • Generation of sewage that needs to be accommodated by the municipal sewerage system and the local sewage plant. • Increase in construction vehicles.	-		L	S	D	I	NL	Yes	-	L	-
			Groundwater	• Pollution due to construction vehicles.	-		S	S	Pr	CR	ML	Yes	-	L	-
			Surface water	• Increase in stormwater run-off. • Pollution of water sources due to soil erosion.		-	L	S	Pr	PR	ML	Yes	- Removal of any historically contaminated soil as hazardous waste. - Removal of hydrocarbons and other hazardous substances by a suitable contractor to reduce contamination risks.	M	-

													- Removal of all substances which can result in groundwater (or surface water) contamination.		
			Visual landscape	• Potential visual impact on visual receptors in close proximity to proposed facility. • The decommissioning phase of the project will result in the same visual impacts experienced during the construction phase of the project. However, in the case of Oryx SPP it is anticipated that the proposed facility will be refurbished and upgraded to prolong its life.	-		L	S	D	CR	NL	Yes	- See Table 6.3	L	Visual Impact Assessment (Appendix E3)
			Traffic volumes	• Increase in construction vehicles.	-		L	S	Pr	CR	NL	Yes	- Movement of heavy construction vehicles through residential areas should be timed to avoid peak morning and evening traffic periods. In addition, movement of heavy construction vehicles through residential areas should not take place over weekends.	L	Traffic Impact Assessment (Appendix E8)
			Health & Safety	• Air/dust pollution. • Road safety. • Increased crime levels. The presence of construction workers on the site may increase security risks associated with an increase in crime levels as a result of	-		L	S	Pr	PR	ML	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)

				influx of people in the rural area.											
			Noise levels	• The generation of noise as a result of construction vehicles, the use of machinery and people working on the site.	-		L	S	D	CR	NL	Yes	- See Table 6.3	L	Social Impact Assessment (Appendix E7)
			Tourism industry	• Since there are no tourism facilities in close proximity to the site, the decommissioning activities will not have an impact on tourism in the area.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• It is not foreseen that the decommissioning phase will impact on any heritage resources.	-		S	S	U	PR	ML	Yes	- See Table 6.3	L	Heritage Impact Assessment (Appendix E5)

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

The recommended mitigation measures are included in the Environmental Management Programme for the project. The EMPr for the Solar Power Plant is included in Appendix F1. The EMPr for the power line is included in Appendix F2 and the EMPr for the substation is included in Appendix F3.

The Alien Invasive Plant Species Management and Rehabilitation Plan is included as Appendix F4.

6.2 KEY ISSUES IDENTIFIED

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

6.2.1 Impacts during the construction phase

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

- Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."*
- Activity 12(ii)(a)(c) (GN.R. 327): "*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse or (c) within 32 meters of a watercourse measured from the edge of a watercourse."*
- Activity 14 (GNR 327): *"The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres."*
- Activity 19 (GN.R. 327): "T*he infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse."*
- *Activity 24 (ii) (GN.R 327): "The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters."*
- Activity 28(ii) (GN.R. 327): *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."*
- Activity 56 (ii) (GN.R 327): "*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"*
- Activity 1 (GN.R. 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more..."*
- Activity 15 (GN.R. 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation..."*
- Activity 4 (b)(i)(ee) (GN.R 324): "*The development of a road wider than 4 metres with a reserve less than 13,5 metres within (b) the Free State, (i) outside urban areas, (ee)*

within critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."

- Activity 10 (b)(i)(ee)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State, (i) outside urban areas,(ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

- Activity 12 (b)(i)(ii)(vi) (GN.R 324): *"The clearance of an area of 300 square metres or more of indigenous vegetation (b) in the Free State, (i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment of 2004, (ii) within critical biodiversity areas identified in bioregional plans and (vi) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

- Activity 14(ii)(a)(c)(b)(i)(ff) (GN.R 324): "*The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs (a) within a watercourse or (c) within 32 metres of a watercourse, measured from the edge of a watercourse, (b) within the Free State, (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans."*

- Activity 18 (b)(i)(ee)(hh) (GN.R 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) in the Free State (i) outside urban areas, within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

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

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial Biodiversity, Animal and Plant Species Assessment (Appendix E1)	Direct habitat destruction	Negative Very High	Negative Medium	• The removal of indigenous plants must be kept to a minimum necessary. Trim, rather than fell of woody species along the edges of the development site where possible. The clearing and damage of plant growth in the riparian and wetland areas must be restricted to the actual road crossing where possible, and not into the sensitive adjacent areas. Where protected plants such as geophytes will need to be cleared or pruned, permits must be obtained from the relevant authority. • Peripheral impacts around the development footprint on the surrounding vegetation of the area must be avoided and a monitoring programme must be implemented to ensure the impacts are kept to a minimum, while the rehabilitation of the site must be prioritized after construction has been completed. • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. • An avifauna specialist must be consulted to conduct a specialist study for the project area and monitoring of the potential impact of the solar plant in the future. • All development activities must be restricted to specific recommended areas. The Environment Control Officer (ECO) should control these areas. Storage of equipment, fuel and other materials must be limited

				to demarcated areas. Layouts must be adapted to fit natural patterns rather than imposing rigid geometries. The entire development footprint must be clearly demarcated prior to initial site clearance and prevent construction personnel from leaving the demarcated area. This would only be applicable to the construction phase of the proposed development. • The ECO must advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO must enforce any measures that he/she deem necessary. Regular environmental training must be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. • Where holes for poles pose a risk to animal safety, they must be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling during planting of the poles along the lines. • Poisons for the control of problem animals must be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin must only be used after approval from an ecologist. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. • Monitoring must be implemented during the construction phase of the development to ensure that minimal impact is caused to the fauna and flora of the area.
	Habitat fragmentation	Negative Very High	Negative Medium	• Use existing facilities (e.g., impacted areas) to the extent possible to minimize the amount of new disturbance.

				• Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive features such as surrounding woodland and riparian woodland outside the project area during construction. • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place. • Construction activities must remain within defined construction areas. No construction / disturbance must occur outside these areas.
	Increased Soil Erosion and Sedimentation	Negative High	Negative Low	• The project must be divided into as many phases as possible, to ensure that the exposed areas prone to erosion are minimal at any specific time. • Cover disturbed soils as completely as possible, using vegetation or other materials. • Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. • Protect sloping areas and drainage channel banks that are susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas. • Repair all erosion damage as soon as possible to allow for sufficient rehabilitation growth. • Gravel roads to the construction sites must be well drained to limit soil erosion.

				• Control the flow of runoff to move the water safely off the site without destructive gully formation. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas.
	Soil and Water Pollution	Negative Medium	Negative Low	• Any excess or waste material or chemicals should be removed from the site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously. • Hazardous chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. • Spill kits should be on-hand to deal with spills immediately. • All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.
	Air Pollution	Negative Very High	Negative Low	• A speed limit must be enforced on dirt roads (preferably 30-40km/h). • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
	Spread and establishment of alien invasive species	Negative Medium	Negative Low	• Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the CARA or in terms of Working for Water guidelines. The control of these species should even begin prior to the construction phase considering that

				small populations of these species was observed during the field surveys. • Institute strict control over materials brought onto site, which should be inspected for seeds of noxious plants and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual herbicides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species listed by the CARA regulations should be eradicated. • Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme should be implemented to ensure that the species' do not spread to surrounding natural ecosystems.
	Negative effect of human activities on fauna and road mortalities	Negative Medium	Negative Low	• No staff must be accommodated on the site. If practical, construction workers should stay in one of the nearby villages and transported daily to the site. • The ECO must regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around the entire development footprint. • Educate construction workers regarding risks and correct disposal of cigarettes. • More fauna is normally killed the faster vehicles travel. A speed limit must be enforced (preferably 40 km/hour). It can be considered to install speed bumps in sections where the speed limit tends to be

				disobeyed. (Speed limits will also lessen the probability of road accidents and their negative consequences). • Travelling at night must be avoided or limited as much as possible.
Avifauna Impact Assessment (Appendix E2)	Displacement of priority avian species from important habitats	Negative Medium	Negative Low	• Limit the construction footprint and retain indigenous vegetation wherever possible, limit access to the remainder of area, avoid breeding season (summer), lay-down areas must be placed only on disturbed zones, construct in shortest timeframe possible, control noise to minimum.
	Displacement of resident avifauna through increased disturbance	Negative Medium	Negative Low	• Limit construction footprint and retain indigenous vegetation wherever possible, limit access to the remainder of area, avoid breeding season (summer), lay-down areas only to be placed in zones that have been disturbed, construct in shortest timeframe possible, control noise to minimum.
	Loss of important avian habitats	Negative Medium	Negative Low	• Limit construction footprint, limit access to the remainder of the area, lay-down areas only to be placed in zones that have been disturbed, construct in shortest timeframe possible, • use existing roads as far as possible, rehabilitate with indigenous vegetation.
Wetland Riparian Delineation and Aquatic Biodiversity Assessment (Appendix E1)	Impact on the characteristics of the watercourse	Negative High	Negative Medium	• Clearing of vegetation should be scheduled for the drier winter months and limited to areas immediately needed for construction. Vegetation stripping should occur in parallel with the progress of construction to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Only selected plant species must be used in the re-vegetation process. • Minimize soil exposure around the solar development. Re-vegetate exposed areas surrounding the solar development and allow a

				sufficient buffer between the development to prevent sedimentation into the wetlands / rivers. • Manage water effectively on, to, within, and from this site. • Employ sediment capture techniques and stormwater attenuation techniques. • All development activities should be restricted to the footprint areas of the proposed development. The Environment Site Officer (ESO) should demarcate and control these areas. Storage of building equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries. • The Environment Control Officer (ECO) should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment and specifically wetlands. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. • Rehabilitation of the development area after construction have been completed should be considered a high priority and all areas rehabilitated should be audited after construction has ceased by a suitably qualified environmentalist. • Should the development be approved by authorities, environmental monitoring of environmental aspects should be implemented during and after the construction phase of the development to ensure that minimal impact is caused to the floodline or wetlands of the area. • Demarcate all riparian boundaries with pegs and danger tape.

				• Edge effects of pre-construction and construction activities, including erosion, sedimentation and alien/weed control, need to be strictly managed in wetland areas as well as their associated buffer zones.
				• The following general rehabilitation measures should be implemented in the disturbed riparian zone:
				  ○ All disturbed surface areas must be re-shaped to resemble the surrounding natural topography. Surfaces must be ripped / scarified, and re-vegetated with indigenous grass species.
				  ○ As far, as is practical, implement concurrent rehabilitation processes to limit degradation of soil biota.
				  ○ Terrestrial invasive removal programs must be maintained throughout the proposed development as well as in the aftercare and maintenance phases.

	Soil compaction and increased risk of sediment transport and erosion	Negative High	Negative Low	• Stringent controls must be put in place to prevent any unnecessary disturbance or compaction of alluvial soils. Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilized and any alien plants which establish should be cleared and follow up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., “ripping” the affected area). Topsoil should preferably be separated from the subsoil, and topsoil sections should be kept intact as deep as possible. • Reprofiling of the banks of disturbed drainage areas to a maximum gradient of 1:3 to ensure bank stability. • Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles. This is especially relevant for the stormwater outlet area.

				• Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion. • Erosion control mechanisms must be established as soon as possible. Further financial provision should be continued over the subsequent years to allow for maintenance of the gabions, reno mattresses, and associated structures. • A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure must include the estimated costs for erosion control post-construction. • If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is preferable as it will not be associated with the nitrogen negative period associated with organic material that is not composted. • Vehicle traffic should not be allowed on the rehabilitated areas, except on allocated roads. It will have a negative impact due to the dispersive/compaction characteristics of soils and its implications on the long term. • Appropriate design and mitigation measures must be developed and implemented to minimise impacts on the natural flow regime of the watercourse i.e., through placement of structures/supports and to minimise turbulent flow in the watercourse. • The indiscriminate use of machinery within the in-stream and riparian habitat will lead to compaction of soils and vegetation and must therefore be strictly controlled. • A buffer zone of 32 meters must be implemented around the drainage channels and riparian zone to prevent sediment changes to the channels.

				• Perform scheduled maintenance to be prepared for storms. Ensure that culverts have their maximum capacity, ditches are cleaned, and that channels are free of debris and brush than can plug structures.
	Soil and water pollution	Negative Medium	Negative Low	• No dumping of waste should take place within the riparian zone. If any spills occur, they should be immediately cleaned up. • Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility. • Excess waste should be removed from site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously. • All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier. • Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation. • A speed limit (preferably 40 km/hour) should be enforced on dirt roads. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
	Spread and establishment of alien invasive species	Negative Medium	Negative Low	• Alien and invader vegetation must not be allowed to colonise the area. Control involves killing alien invasive plants present, seedlings and establishing an alternative plant cover to limit re-growth. The use of

				indigenous plants must be encouraged in the rehabilitated areas (stormwater canals). Control should begin prior to construction phase considering small populations of invader plant species occur around the project area. • Institute strict control over materials brought onto site, which must be inspected for seeds and steps taken to eradicate these before transport to the site. The contractor is responsible for the control of weeds and invader plants. • Rehabilitate disturbed areas as quickly as possible. • Institute a monitoring programme to detect alien invasive species early. • Institute an eradication/control programme for early intervention if invasive species are detected. The use of indigenous plants must be encouraged in the rehabilitated areas. Active management and eradication of exotic / alien plant species must also occur when seedlings are found
Visual Impact Assessment (Appendix E3)	Visual impact of construction activities on sensitive visual receptors in close proximity to the SPP.	Negative Medium	Negative Low	Planning • Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction • Ensure that vegetation is not unnecessarily removed during the construction phase. • Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) where possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.

				• Ensure that rubble, litter, etc. are appropriately stored (if it can't be removed daily) and then disposed of regularly at a licenced waste site. • Reduce and control dust during construction by utilising dust suppression measures. • Limit construction activities to between 07:00 and 18:00, where possible, in order to reduce the impacts of construction lighting. • Rehabilitate all disturbed areas immediately after the completion of construction work and maintain good housekeeping.
Agricultural and Soils Compliance Statement (Appendix E4)	Loss of agricultural potential by occupation of land	Negative Low	Negative Low	• No mitigation measures are proposed.
	Loss of agricultural potential by soil degradation	Negative Low	Negative Low	• Loss of topsoil can result from poor topsoil management during construction related excavations. Topsoil should be stored for later use. • Hydrocarbon spillages from construction activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth. Spillage and contamination of soil should be avoided. • Due to the very low slope of the land, the site has a low susceptibility to soil degradation.
	Erosion	Negative Low	Negative Low	• Implement an effective system of storm water run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points, and it must prevent any potential down slope erosion.

				• Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.
	Topsoil loss	Negative Low	Negative Low	• If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.
Heritage Impact Assessment (Appendix E5)	Loss or damage to sites, features or objects of cultural heritage significance	Negative Medium	Negative Low	<u>Burial site:</u> • Due to the dense grass cover it was impossible to determine the exact extent of the burial site, making the creation of a buffer zone very difficult. It is therefore recommended that once the developer has decided on a final layout, the vegetation cover is manually removed from the burial site in order to determine its exact size and the number of graves located in it. • Due to its locality close to the western boundary of the project area, the following mitigation measures are proposed: o Avoidance/Preserve: If it is decided to retain the burial site, and its exact size has been determined it should be fenced off permanently by means of a wire fence or brick wall, with a buffer zone of at least 100m. o (2) Relocation of graves: This option can be implemented with additional design and construction inputs. This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated. Mitigation is to excavate the site by archaeological techniques, document the site (map and photograph) and analyse the recovered material to

				acceptable standards. This can only be done by a suitably qualified archaeologist. • This option should be implemented when it is impossible to avoid impacting on an identified site or feature.
Palaeontological Impact Assessment (Appendix E6)	Disturbance, damage or destruction of legally-protected fossil heritage (Refers essentially to impacts on well-preserved and / or rare fossils of scientific and conservation value within the development footprint during the construction phase)	Negative Low	Negative Low	• The ECO for this project must be informed that the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) has a Very High Palaeontological Sensitivity. • If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance Find Protocol, attached, should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (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 (recording and collection) can be carried out. • Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
Social Impact Assessment (Appendix E7)	Creation of direct and indirect employment opportunities.	Positive Low	Positive Medium	• A local employment policy should be adopted to maximise opportunities made available to the local labour force. • Labour should be sourced from the local labour pool, and only if the necessary skills are unavailable should labour be sourced from (in order of preference) the greater Matjhabeng LM, Lejweleputswa DM, Free State Province, South Africa, or elsewhere. • Where feasible, training and skills development programmes should be initiated prior to the commencement of the construction phase.

				• As with the labour force, suppliers should also as far as possible be sourced locally. • As far as possible local contractors that are compliant with Broad-Based Black Economic Empowerment (B-BBEE) criteria should be used. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
	Economic multiplier effects from the use of local goods and services.	Positive Low	Positive Medium	• It is recommended that a local procurement policy is adopted to maximise the benefit to the local economy. • A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g., construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable. • Local procurement is encouraged along with engagement with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible.
	Potential loss in productive farmland	Negative Medium	Negative Low	• The proposed site for the Oryx SPP needs to be fenced off prior to the construction phase and all construction related activities should be confined in this fenced off area. • Livestock grazing on the proposed site need to be relocated. • All affected areas, which are disturbed during the construction phase, need to be rehabilitated prior to the operational phase and should be continuously monitored by the Environmental Control Officer (ECO). • Implement, manage and monitor a grievance mechanism for the recording and management of social issues and complaints.

				• Mitigation measures from the Agricultural and Soil Compliance Statement, should also be implemented.
	In-migration of labourers in search of employment opportunities, and a resultant change in population, and increase in pressure on local resources and social networks, or existing services and infrastructure.	Negative Medium	Negative Low	• Develop and implement a local procurement policy which prioritises "locals first" to prevent the movement of people into the area in search of work. • Engage with local community representatives prior to construction to facilitate the adoption of the locals first procurement policy. • Provide transportation for workers (from Welkom, Virginia and surrounds) to ensure workers can easily access their place of employment and do not need to move closer to the project site. • Working hours should be kept between daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities. • Compile and implement a grievance mechanism. • Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour. • Prevent the recruitment of workers at the site. • Implement a method of communication whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. • Establish clear rules and regulations for access to the proposed site. • Appoint a security company and implement appropriate security procedures to ensure that workers do not remain onsite after working hours. • Inform local community organisations and policing forums of construction times and the duration of the construction phase. • Establish procedures for the control and removal of loiterers from the construction site.

	Temporary increase in safety and security concerns associated with the influx of people	Negative Medium	Negative Low	• Working hours should be kept within daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities. • Provide transportation for workers to prevent loitering within or near the project site outside of working hours. • The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site. The fencing of the site should be maintained throughout the construction period. • The appointed EPC Contractor must appoint a security company to ensure appropriate security procedures and measures are implemented. • Access in and out of the construction site should be strictly controlled by a security company appointed to the project. • A CLO should be appointed as a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process. • The EPC Contractor should implement a stakeholder management plan to address neighbouring farmer concerns regarding safety and security. • The project proposed must prepare and implement a Fire Management Plan; this must be done in conjunction with surrounding landowners. • The EPC Contractor must prepare a Method Statement which deals with fire prevention and management.
	Impacts on daily living and movement patterns	Negative Medium	Negative Medium	• All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. • Heavy vehicles should be inspected regularly to ensure their road worthiness.

				• Provision of adequate and strategically placed traffic warning signs and control measures along the R730, R30 and gravel road to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be always visible, especially at night. • Implement penalties for reckless driving to enforce compliance to traffic rules. • Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work). • The developer and EPC Contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities. • The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if disturbed due to construction activities. • The EPC Contractor must ensure that damage / wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase. • A method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.
	Nuisance impact (noise and dust)	Negative Medium	Negative Low	• The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible. • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.

				• Ensure all vehicles are road worthy, drivers are qualified and are made aware of the potential noise and dust issues. • A CLO should be appointed, and a grievance mechanism implemented.
	Increased risk of potential veld fires	Negative Medium	Negative Low	• A firebreak should be implemented before the construction phase. The firebreak should be controlled and constructed around the perimeters of the project site. • Adequate fire-fighting equipment should be provided and readily available on site and all staff should be trained in firefighting and how to use the fire-fighting equipment. • No staff (except security) should be accommodated overnight on site and the contractor should ensure that no open fires are allowed on site. • The use of cooking or heating implements should only be used in designated areas. • Contractors need to ensure that any construction related activities that might pose potential fire risks, are done in the designated areas where it is also managed properly. • Precautionary measures need to be taken during high wind conditions or during the winter months when the fields are dry. • The contractor should enter an agreement with the local farmers before the construction phase that any damages or losses during the construction phase related to the risk of fire and that are created by staff during the construction phase, are borne by the contractor.
	Impacts on the sense of place	Negative Low	Negative Low	• Implement mitigation measures identified in the Visual Impact Assessment (VIA) prepared for the project. • Limit noise generating activities to normal daylight working hours and avoid weekends and public holidays.

				• The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible. • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. • All vehicles must be road-worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits. • Communication, complaints, and grievance channels must be implemented and contact details of the CLO must be provided to the local community in the site.
Traffic Impact Assessment (Appendix E8)	Traffic impacts relating to the construction phase of the Oryx SPP	Negative Medium	N/A	• All construction vehicles must be roadworthy and drivers must have the relevant licenses for the type of vehicles they are operating; and • All vehicle drivers need to strictly adhere to the rules of the road.

6.2.2 Impacts during the operational phase

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

- Activity 11(i) (GN.R. 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."*
- Activity 14 (GNR 327): *"The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres."*
- Activity 1 (GN.R 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."*
- Activity 10 (b)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State (hh) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*

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

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial Biodiversity, Animal and Plant Species Assessment (Appendix E1)	Habitat destruction / fragmentation of fauna habitats	Negative High	Negative Medium	• Refer to Construction Phase mitigation.
	Soil erosion and sedimentation	Negative High	Negative Low	• Refer to Construction Phase mitigation.
	Spreading and establishment of alien invasive species	Negative Medium	Negative Low	• Refer to Construction Phase mitigation.
	Habitat degradation due to dust	Negative High	Negative Low	• Refer to Construction Phase mitigation.
	Spillages of harmful substances	Negative Medium	Negative Low	• Refer to Construction Phase mitigation.
	Road mortalities of fauna / impact of human activities on site	Negative Medium	Negative Low	• Refer to Construction Phase mitigation.

Avifauna Impact Assessment (Appendix E2)	Displacement of priority avian species from important habitats	Negative Medium	Negative Low	• Limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with indigenous vegetation, limit roadways and vehicle speeds.
	Displacement of resident avifauna through increased disturbance	Negative Medium	Negative Low	• Limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with indigenous vegetation, limit roadways and vehicle speeds.
	Collisions with PV panels leading to injury or loss of avian life	Negative Medium	Negative Low	• Panels to be flat at night, preferably low sheen/matt surfaces, quarterly fatality monitoring.
Wetland Riparian Delineation and Aquatic Biodiversity Assessment (Appendix E1)	Impact on the characteristics of the watercourse	Negative High	Negative Medium	• Refer to Construction Phase mitigation.
	Soil compaction and increased risk of sediment transport and erosion	Negative High	Negative Low	• Refer to Construction Phase mitigation.
	Soil and water pollution	Negative Medium	Negative Low	• Refer to Construction Phase mitigation.
	Spread and establishment of alien invasive species	Negative Medium	Negative Low	• Refer to Construction Phase mitigation.
	Visual impact on observers travelling along the roads and residents at	Negative Medium	Negative Low	Planning • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.

Visual Impact Assessment (Appendix E3)	homesteads within a 5km radius of the SPP.			• Where insufficient natural vegetation exists next to the property, a 'screen' can be planted using endemic, fast growers that are water efficient. Operations • Maintain general appearance of the facility as a whole.
	Visual impact on observers travelling along the roads and residents at homesteads within a 5-10km radius of the SPP.	Negative Low	Negative Low	Planning • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. • Where insufficient natural vegetation exists next to the property, a 'screen' can be planted using endemic, fast growers that are water efficient. Operations • Maintain general appearance of the facility as a whole.
	Visual impacts of lighting at night on visual receptors in close proximity to the SPP.	Negative Medium	Negative Low	• Shield the source of light by physical barriers (walls, vegetation etc.) • Limit mounting heights of lighting fixtures, or alternatively use footlights or bollard level lights. • Make use of minimum lumen or wattage in fixtures. • Make use of down-lighters, or shield fixtures. • Make use of low-pressure sodium lighting or other types of low impact lighting. • Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.
	Glint and glare on sensitive visual receptors	Negative Low	N/A	• No mitigation measures applicable

	in close proximity to the proposed facility.			
	Visual impact of sensitive visual receptors located within a 500m radius of the proposed power line.	Negative Low	Negative Low	Planning • Retain/re-establish and maintain natural vegetation immediately adjacent to the power line servitude. Operations • Maintain the general appearance of the servitude as a whole.
	Visual impact and impacts on sense of place	Negative Medium	Negative Low	• The subjectivity towards the project in its entirety can be influenced by creating a "Green Energy" awareness campaign, educating the local community and potentially tourists on the benefits of renewable energy. This can be achieved by also hosting an 'open day' where the local community can have the opportunity to view the completed project which may enlist a sense of pride in the renewable energy project in their area. • Implement good housekeeping measures
Agricultural and Soils Compliance Statement (Appendix E4)	Enhanced agricultural potential through increased financial security for farming operations	Positive Low	Positive Low	• No enhancement measures are proposed.
	Dust impact	Negative Low	Negative Low	• Implement dust suppression during the construction phase.

	Erosion	Negative Low	Negative Low	• Implement an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points, and it must prevent any potential down slope erosion. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion
	Topsoil Loss	Negative Low	Negative Low	• If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.
Heritage Impact Assessment (Appendix E5)	Loss or damage to sites, features or objects of cultural heritage significance	Negative Low	Negative Low	• 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 heritage sites and held accountable for any damage.
Social Impact Assessment (Appendix E7)	Creation of employment opportunities and skills development	Positive Low	Positive Medium	• It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. • Vocational training programs should be established to promote the development of skills.
	Development of non-polluting, renewable energy infrastructure	Positive Medium	Positive Medium	• No mitigation measures are proposed
	Loss of agricultural land and overall productivity	Negative Medium	Negative Low	• The proposed mitigation measures for the construction phase should have been implemented at this stage. • Mitigation measures from the Agricultural and Soil Compliance Statement, should also be implemented.
	Contribution to LED and social upliftment	Positive Medium	Positive High	• A Community Needs Analysis (CNA) must be conducted to ensure that the LED and social upliftment programmes proposed by the project are meaningful.

				• Ongoing communication and reporting are required to ensure that maximum benefit is obtained from the programmes identified, and to prevent the possibility for such programmes to be misused. • The programmes should be reviewed on an ongoing basis to ensure that they are best suited to the needs of the community at the time (bearing in mind that these are likely to change over time).
	Potential impacts related to the impact on tourism.	Low Positive	Low Positive	• Due to the extent of the project no viable mitigation measures can be implemented to eliminate the visual impact of the PV panels, but the subjectivity towards the PV panels can be influenced by creating a "Green Energy" awareness campaign, educating the local community and tourists on the benefits of renewable energy. Tourists visiting the area should be made aware of South Africa's movement towards renewable energy. This might create a positive feeling of a country moving forward in terms of environmental sustainability. This could be implemented by constructing a visitor's centre on the property allocated to the proposed solar farm which should be open to school fieldtrips, the local community, and tourists.
	Visual impact and impacts on sense of place	Negative Low	Negative Low	• To effectively mitigate the visual impact and the impact on sense of place during the operational phase of the proposed Oryx SPP, it is suggested that the recommendations made in the Visual Impact Assessment (specialist study) should be followed in this regard.

6.2.3 Impacts during the decommissioning phase

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

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial Biodiversity, Animal and Plant Species Assessment (Appendix E1)	Improvement of habitat through revegetation / succession over time	Positive Low	Positive Medium	• Plant vegetation species for rehabilitation that will effectively bind the loose material, and which can absorb run-off from the mining areas. • Rehabilitate all the land where infrastructure has been demolished. • Monitor the establishment of the vegetation cover on the rehabilitated sites to the point where it is self-sustaining. • Protect rehabilitation areas until the area is self-sustaining. • Diversion trenches and storm water measures must be maintained • Water management facilities must stay operational and maintained and monitored until such a stage is reached where it is no longer necessary. • The development areas must be shaped to make it safe. • All the monitoring and reporting on the management and rehabilitation issues to the authorities must continue till closure of the mine is approved. • Monitor and manage invader species and alien species on the rehabilitated land until the natural vegetation can outperform the invaders or aliens. • Refer to mitigation measures for the construction phase needed during the closure phase that are relevant.
	Soil erosion and sedimentation.	Negative Medium	Negative Low	
	Spreading and establishment of alien invasive species	Negative Medium	Negative Low	
	Habitat degradation due to dust	Negative High	Negative Low	
	Spillages of harmful substances	Negative Medium	Negative Low	
	Road mortalities of fauna / impact of human activities on site	Negative Medium	Negative Low	

Avifauna Impact Assessment (Appendix E2)	Displacement of priority avian species from important habitats	Negative Low	Negative Low	• None required due to low significance
	Displacement of resident avifauna through increased disturbance	Negative Low	Negative Low	• None required due to low significance
Wetland Riparian Delineation and Aquatic Biodiversity Assessment (Appendix E1)	Improvement of habitat through revegetation / succession over time	Positive Low	Positive Medium	• Plant vegetation species for rehabilitation that will effectively bind the loose material, and which can absorb run-off from the development areas. • Rehabilitate all the land where infrastructure has been demolished. • Monitor the establishment of the vegetation cover on the rehabilitated sites to the point where it is self-sustaining. • Protect rehabilitation areas until the area is self-sustaining. • Diversion trenches and storm water measures must be maintained • Water management facilities must stay operational and maintained and monitored until such a stage is reached where it is no longer necessary. • The development areas must be shaped to make it safe. • All the monitoring and reporting on the management and rehabilitation issues to the authorities must continue till closure of the site is approved.
	Soil erosion and sedimentation	Negative Medium	Negative Low	
	Spreading and establishment of alien invasive species in wetlands	Negative High	Negative Low	
	Spillages of harmful substances in wetlands	Negative Medium	Negative Low	

				• Monitor and manage invader species and alien species on the rehabilitated land until the natural vegetation can outperform the invaders or aliens. • Refer to mitigation measures for the construction phase needed during the closure phase that are relevant
Agricultural and Soils Compliance Statement (Appendix E4)	Erosion	Negative Low	Negative Low	• Implement an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.
	Top Soil	Negative Low	Negative Low	• If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.
Social Impact Assessment (Appendix E7)	Loss of employment opportunities	Negative Low	Negative Low	• It is not expected that the facility will be decommissioned.

6.3 SUMMARY OF RECOMMENDATIONS FROM SPECIALIST STUDIES

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

- Terrestrial Biodiversity, Plant and Animal Impact Assessment – AGES (see Appendix E1)
- Wetland and Riparian Assessment – AGES (see Appendix E1)
- Avifaunal Impact Assessment – Agreenco Environmental Projects (see Appendix E2)
- Visual Impact Assessment – Phala Environmental Consultants (see Appendix E3)
- Heritage Impact Assessment – JA van Schalkwyk (see Appendix E5)
- Palaeontological Impact Assessment – Natura Viva CC (see Appendix E6)
- Social Impact Assessment – Phala Environmental Consultants (see Appendix E7)
- Traffic Impact Assessment – Bvi Consulting Engineers (see Appendix E8)
- Agricultural Compliance Statement – Johann Lanz (see Appendix E4)
- A detailed assessment of the cumulative impacts associated with the proposed development – conducted by the lead consultant, Environamics, in conjunction with the project specialists (refer to Section 7 of this report).

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

6.3.1 Heritage and archaeological impacts

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

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

The Heritage Impact Assessment (Refer to Appendix E5) confirmed the following:

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a very limited pre-colonial Stone

Age and Iron Age occupation. The second and much later component is a colonial farmer one, with a very limited urban component consisting of a number of smaller towns, most of which developed during the last 100 to 120 years. Most of the towns in the region developed as a direct result of the exploitation of the Free State gold fields.

During the survey the following sites, features or objects of cultural significance were identified.

- 7.3.1 An informal burial site with probably more than 50 graves was identified on the western boundary of the project area. Most are only marked with stone cairns. No signs of recent visits by descendants could be detected.

From a heritage point of view, it is recommended that the proposed project be allowed to continue on acceptance of the condition that once the final layout has been decided on, the vegetation cover must be manually removed from the identified burial site in order to determine the exact size and significance.

6.3.2 Ecological Impacts

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

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

The Terrestrial Biodiversity Impact Assessment (refer to Appendix E1) confirmed that the development and start-up of the Oryx SPP covers the period when considerable changes take place as the infrastructure, plant and facilities are constructed. The most immediate impacts are seen as disruptions and disturbances to fauna and flora communities due to site clearance for construction of the plant, access road and other related infrastructure. This is usually a significant change to the visual appeal of the area.

Exposure of soils to rainfall and wind may lead to atmospheric contamination by dusts and increased erosion of the site and sedimentation of local water courses. An increase in the movement of construction vehicles will result in an increase in the ambient noise levels and dust levels in the area.

The construction phase of the development and associated infrastructure will result in loss of and damage to natural habitats if the vegetation is cleared for the development of the solar power plant. Rehabilitation of some areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction phase. Vegetation communities are likely to be impacted on a small spatial scale in comparison to the extent of the vegetation communities' total area in the region. The natural movement patterns of fauna will disrupted for a limited period and, to a varying degree depending on

how different species react to these barriers will result in the fragmentation of natural populations, although the impact will be minimal and restricted to the construction phase.

Construction activities may result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil erosion promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora. Construction activities always carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on fauna and flora. During the construction phase heavy machinery and vehicles would be the main contributors to potential pollution problems.

Continued movement of vehicles on and off the site during the construction phase will result in a risk of importation of alien species. Vehicles often transport many seeds, and some may be of invader species, which may become established along the access road, especially where the area is disturbed. The construction carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

An increase in human activity on the site and surrounding areas is anticipated. The risk of snaring, killing, and hunting of certain faunal species is increased. If staff compounds are erected for construction workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive fauna and flora are increased. The presence of many construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires arising from cooking fires, improperly disposed cigarettes etc.

Large numbers of fauna are also killed daily on roads. They are either being crushed under the tyres of vehicles in the case of crawling species, or by colliding with the vehicle itself in the case of avifauna or flying invertebrates. The impact is intensified at night, especially for flying insects, as result of their attraction to the lights of vehicles.

The proposed development should avoid sensitive areas such as wetlands, while also allowing corridors of indigenous grassland outside the development footprint to be preserved. Where sensitive areas of natural vegetation cannot be avoided, mitigation measures have been recommended to minimise and/or offset impacts (licence application for eradication of protected species, buffer zones around wetlands). Negative impacts can be minimised by strict enforcement and compliance with an Environmental Management Plan which considers the recommendations for managing impacts detailed above.

Provided that the proposed development and layout plans are consistent with the sensitivity map and take all the mitigation measures into consideration stipulated in this report, the planned development, with the implementation of the optimized layout plan, can be supported from a Terrestrial Biodiversity Perspective.

6.3.3 Wetland Impacts

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

"How will the proposed development impact on wetlands?"

According to the Wetland/Riparian Impact Assessment (Appendix E1), three wetland types were identified namely a valleybottom wetland with channel, depressions and hillslope seep wetlands. The floodplain river (Bosluisspruit) can be classified as 'River channels', although these drainage channels are not wetlands in the 'true' sense of the word but should rather be described as water courses as stipulated in the National Water Act. Baseline soil information, landscape profile and vegetation were used to confirm riparian and terrestrial properties within the project site. The impacts associated with the construction site is reflected in the results of the PES assessment which indicates that the riparian zones, wetlands and watercourses are 'Moderately Modified'.

The Ecological Importance and Sensitivity (EIS) of the drainage system on site are MODERATE and are ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.

An impact assessment was conducted for the wetlands and riparian zones on site in addition to the mitigation measures recommended to ensure the protection of the riverine ecosystems. Impacts relating to the proposed development on the watercourses / riparian zones are as follows:

- Impact on the characteristics of the watercourse i.e., flow regime, habitat, biota, water quality and geomorphology due to construction within floodline zone.
- Soil erosion and sedimentation.
- Water pollution from spillages, vehicle emissions and dust.
- Spread and establishment of alien invasive species in wetlands.

Specific mitigation measures need to be implemented in the areas surrounding the riparian zones and water courses to prevent any negative impacts other than the impacts that will be caused during the solar power plant development, which includes the 32m buffer area.

Provided that all the mitigation measures and recommendations surrounding the watercourses and riparian zones are strictly adhered to the development of the solar power plant can be supported.

6.3.4 Avifaunal Impacts

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

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

According to the Avifaunal Impact Assessment (Appendix E2) the Oryx SPP is situated in an area of moderate avifaunal diversity; however, it is adjacent to an important flyway, the Doring River, and much of the site is in the Endangered Vaal-Vet Sandy Grassland ecosystem type. Much of the surrounding area has been transformed by agriculture. The resident avifauna is represented by relatively moderate to low species richness and abundance, for which the total transformation of habitat will generate impacts.

The total avifaunal dataset is limited; however good winter and summer baseline assessment were successfully undertaken to supplement the relatively poor SABAP2 dataset.

There are individual impacts that are relatively high, however most can be effectively mitigated through the controls prescribed in this report. The overall mitigated impacts can result in the project having an overall Low-Negative impact rating on avifauna.

The two power line corridor options present very low avifaunal risks (very short ~80 m and directly adjacent to existing power lines).

The specialist indicates that there is no objection, from an avifaunal perspective to the development of the Oryx SPP. The overall impact of the project on avifauna can be reasonably mitigated, should the controls/mitigation measures prescribed by the specialist be adequately followed, with sufficient monitoring of mitigation effectiveness.

6.3.5 Visual Impacts

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

"To what extent will the proposed development be visible to observers and to will the landscape provides any significant visual absorption capacity"

The Visual Impact Assessment (Refer to Appendix E3) concluded that the post mitigation impact is a "*Negative Low"* impact during the construction, decommissioning and operational phases. The only receptors likely to be impacted by the proposed development are the nearby property owners and road users on nearby roads. The visual landscape is already degraded due to the large number of mines and Eskom electricity infrastructure in the area.

The construction and operational phases of the Oryx SPP and its associated infrastructure, may have a visual impact on the area, especially within (but not restricted to) a 5km radius of

the proposed SPP. The visual impact will differ amongst places, depending on the distance of the SPP.

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

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

Taking into account all positive factors of such a development including economic factors, social factors and sustainability factors, especially in an arid country, and the industrialised and degraded landscape, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view. The specialist recommends that the details of the power line be submitted with the South African Civil Aviation Authority (SACAA).

The specialist recommends that the project be approved from a visual perspective.

6.3.6 Agricultural / impacts on the soil

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

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

The Agricultural Compliance Statement (Appendix E4) stated that an agricultural impact is a temporary or permanent change to the future production potential of land. Whether a development should receive agricultural approval or not should be evaluated by asking the question: Does the extent of the loss of future agricultural production potential that will result from this development, justify keeping the land solely for agricultural production and therefore not approving the development?

South Africa needs agricultural production for food security. It also urgently needs renewable energy development. In order to achieve its renewable energy generation goals, agriculturally zoned land will inevitably need to be used for renewable energy generation.

The conclusion of the assessment is that the proposed development will not have an unacceptable negative impact on the agricultural production capability of the site. Instead the

development represents the ideal, win win situation for both agricultural production and for electricity generation in South Africa, where renewable energy facilities are integrated with agricultural production in a way that provides benefits to agriculture and leads to insignificant loss of future agricultural production potential.

This is substantiated by the following points:

- The layout of the facility has been deliberately designed to include only land within the farm that was identified as having soil limitations that make it unsuitable or marginal for supporting viable and sustainable crop production. There is not a scarcity of such agricultural land in South Africa and it is therefore considered to be below the threshold for being prioritised for conservation as agricultural production land
- The amount of agricultural land loss is within the allowable development limits prescribed by the agricultural protocol. These limits reflect the national need to conserve valuable agricultural land and therefore to steer, particularly renewable energy developments, onto land with lower agricultural production potential.
- The proposed development also offers some positive impact on agriculture by way of improved financial security for farming operations, as well as security benefits against stock theft and other crime.
- The PV panels will not totally exclude agricultural production. The area can still be used to graze sheep that will, in addition, be protected against stock theft within the security area graze sheep that will, in addition, be protected against stock theft within the security area of the facility.
- The loss of agricultural potential by occupation of land is not permanent. The land will permanent. The land will become fully available again for agricultural production once the proposed activity cases, become fully available again for agricultural production once the proposed activity ceases.
- The proposed development poses a low risk in terms of causing soil degradation, which can be adequately and fairly easily managed by adequately and fairly easily managed by standard, best practice mitigation management d, best practice mitigation management actions.
- The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy. In addition, it will contribute to additional income and employment in the local economy. In addition, it will contribute to the country's need for energy generation, particularly renewable energy that has lower environmental and agricultural impact, on a national scale, than existing, coal powered environmental and agricultural impact, on a national scale, than existing, coal powered energy generation.

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

6.3.7 Socio-economic impacts

A Social Impact Assessment has been compiled in order to provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility; to provide a description and assessment of the potential social issues associated with the proposed facility; and the identification of enhancement and mitigation aimed at maximizing opportunities and avoiding and or reducing negative impacts (refer to Appendix H8). The main question which needs to be addressed is:

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

The findings of the Social Impact Assessment (Refer to Appendix E7) indicate that there are some vulnerable communities within the area that may be affected by the development of the Oryx SPP and its associated infrastructure. Traditionally, the construction phase of a SPP is associated with most social impacts. Many of the social impacts are unavoidable and will take place to some extent but can be managed through the careful planning and implementation of appropriate mitigation measures. Several potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are sufficiently significant to allow them to be classified as "fatal flaws.

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

The development will introduce employment opportunities during the construction phase(temporary employment) and a limited number of permanent employment opportunities during operation phase.

The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases.

The proposed development also represents an investment in infrastructure for the generation of non-polluting, Renewable Energy, which, when compared to energy generated because of burning polluting fossil fuels, represents a positive social benefit for society.

It should be noted that the perceived benefits associated with the project, which include Renewable Energy generation and local economic and social development, outweigh the perceived negative impacts associated with the project.

The specialist concludes that the project, and its associated infrastructure, will be unlikely to result in permanent damaging social impacts, and therefore from a social perspective the

project can be development subject to the implementation of the recommended mitigation measures.

6.3.8 Paleontological Impacts

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

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

According to the Palaeontological Impact Assessment (Appendix E6) indicates The Oryx Solar Power Plant near Virginia in the Free State is underlain by alluvium, colluvium and eluvium as well as the Balfour Formation of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup). According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Quaternary superficial deposits is Moderate while that of the Balfour Formation is very High (Almond et al, 2013; SAHRIS website). Three possible connection options are available but as they have the same geology there is no preference between the options from a Palaeontological point of view.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12-13 March 2022. No fossiliferous outcrops were detected. For this reason a low Palaeontological significance has been allocated to the proposed development. It is therefore considered that the development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. The proposed development may be authorised, as the whole extent of the development footprint is not considered sensitive in terms of Palaeontological Heritage.

6.3.9 Traffic Impacts

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

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

According to the Traffic Impact Assessment (Appendix E8) The existing traffic volumes on the transportation routes were sourced from permanent count stations only, as this is the most reliable and accurate data that was available. The impact of the construction, operation and decommissioning trip generation, on the future background traffic volumes near the Oryx SPP and along transportation routes, are expected to be medium to low.

Two (2) possible ports of entry has been identified from where the solar panel technology and large electrical components will be transported, namely: Durban (585 km) and Richards Bay (685 km). Based on the shortest travel distance, it is recommended that the Port of Durban be the preferred port of entry. All construction materials and solar modules will be transported via normal loads. Transformer and substation components will be transported via abnormal loads.

The access points to the site are situated off Beatrix 4 Shaft Rd. The formalisation of these access points, to the standard, might be a requirement as part of the wayleave approval of the Free State Department: Police, Roads and Transport. All internal roads considered should conform to the geometric and pavement design parameters as indicated on the design standard certificate. Adequate traffic accommodation signage must be erected and maintained on either side of the accesses, on Beatrix 4 Shaft Rd, throughout the construction phase of the Oryx SPP. In addition, traffic accommodation signage should also be erected at affected major intersections on the transportation routes.

The direct impact and significance of the Oryx SPP is considered medium to low. The cumulative impact and significance of the various nearby renewable energy projects is considered to have a low/ negligible impact and therefore no corrective measures will be required.

The development of the Oryx SPP on Portion 2 (Beverley) of the Farm Kalkoenkrans No. 225 in the Free State Province, can be supported from a traffic perspective.

6.3.10 Risk Assessment for battery storage system

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

As with any fire or explosion, a potential consequence of Li-ion battery fires is the endangerment of life and property. These consequences are assessed based on their severity and likelihood. First, the severity of this consequence changes based on the quantity of cells in a system, as well as the system's proximity to people and property. Therefore, the size and location of the installation should be taken into consideration. For the Oryx SPP the location of the BESS and the fact that the area is sparsely populated will reduce the risk associated with toxic chemicals, flammability and overpressure from explosions. The risk level is seen to be of a low risk that is unlikely to occur with the proper safety measures taken as mitigation. Provided that the facility is designed and managed properly, and the batteries are handled in

the manner prescribed by the manufacturer, an incident is unlikely to happen. However, because of the risk special management actions are recommended in the EMPr to reduce the risk of an incident and manage an incident should one ever occur.

6.4 METHOD OF ENVIRONMENTAL ASSESSMENT

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

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 6.6.

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

6.4.1 Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

Table 6.6: The rating system

NATURE
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.

GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).

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

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

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

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

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

7 CUMULATIVE EFFECTS ASSESSMENT

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

7.1 Introduction

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

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

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

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

7.2 Geographic Area of Evaluation

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

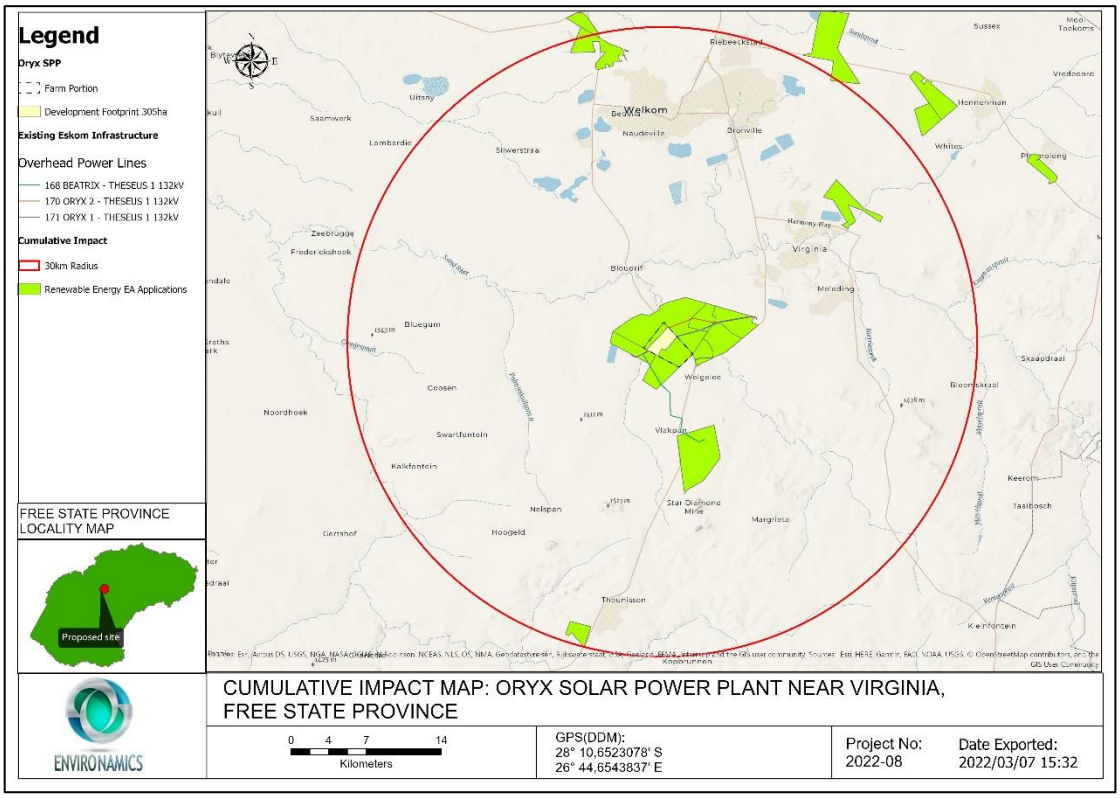


Figure 7.1: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines

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

7.3 Temporal Boundary of Evaluation

A temporal boundary is the timeframe during which the cumulative effects are reasonably expected to occur. The temporal parameters for this cumulative effects analysis are the

anticipated lifespan of the proposed project, beginning in 2023 and extending out at least 20 years, which is the minimum expected project life of the proposed project. Where appropriate, particular focus is on near-term cumulative impacts of overlapping construction schedules for proposed projects in the area of evaluation.

7.4 Other Projects in the Area

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

7.4.1 Existing projects in the area

According to the DFFE's database nine PV solar plant applications have been submitted to the Department within the geographic area of investigation – refer to table 7.1.

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

Site name	Distance from study area	Proposed generating capacity	DEFF reference	EIA process	Project status
Kalkoenkrans	0.6km	19 MW	12/12/20/2669	BAR	Approved
Palmietkuil No. 328	0.7km	19.9 MW	12/12/20/2666/A	BAR	Approved
Leeubult No. 52	6 km	19.9 MW	12/12/20/2668	BAR	Approved
Palmietkuil No. 328	0.7km	19 MW	12/12/20/2666	BAR	Approved
Leeubult	5.7km	14 MW	12/12/20/2667	BAR	Approved
Onverwag No. 728 and PTN 2 of the farm Vaalkranz No. 220	13km	75 MW	14/12/16/3/3/2/580	Scoping and EIA	In Process

Springbok Solar Power Plant[4]	6 km	150MW	14/12/16/3/3/2/2087	Scoping and EIA	In Process
Harmony Eland Solar	24 km	10MW	14/12/16/3/3/1/1471	BAR	Approved
Harmony Nyala Solar	24km	10MW	14/12/16/3/3/1/1472	BAR	Approved
Oryx solar energy facility	2km	75 MW	14/12/16/3/3/2/526	Scoping and EIA	In Process
Sonvanger PV	28km	75 MW	14/12/16/3/3/2/672	Scoping and EIA	Approved
Uitkyk RE/509, Helderwater RE/494 and Doornpan 1/426	29km	75 MW	14/12/16/3/3/2/581	Scoping and EIA	In Process
Keren Energy Korhaan Creek Project 2 (Pty) Ltd		-	14/12/16/3/3/2/543	Scoping and EIA	Withdrawn/Lapsed

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

7.5 SPECIALIST INFORMATION ON CUMULATIVE EFFECTS

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

[4] Environamics was the EAP responsible for the Scoping and EIA for the Springbok Solar Power Plant.

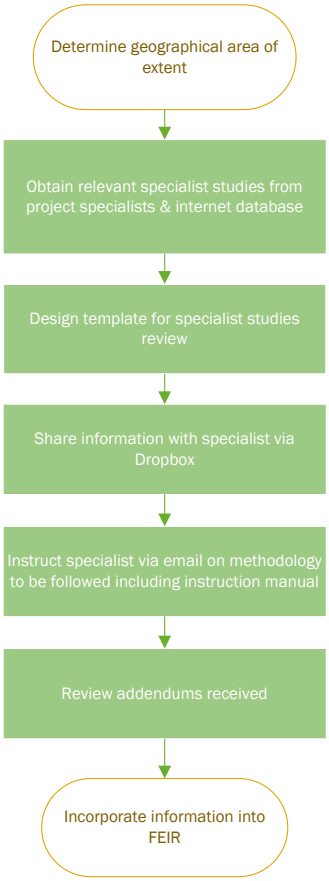


Figure 7.2: Process flow diagram for determining cumulative effects

1.3.1 Soil, Land Capability and Agricultural Potential

According to the Agriculture Compliance Statement (Appendix E4), the cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. It is important to note that the cumulative impact assessment for a particular project, like what is being done here, is not the same as an assessment of the impact of all surrounding projects. The cumulative assessment for this project is an assessment only of the impacts associated with this project, but seen in the context of all surrounding impacts. It is concerned with this project's contribution to the overall impact, within the context of the overall impact. But it is not simply the overall impact itself.

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

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

What level of loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

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

All of these projects have the same agricultural impacts in a similar agricultural environment, and therefore the same mitigation measures apply to all.

In quantifying the cumulative impact, the area of land taken out of agricultural production (grazing) as a result of all 12 developments (total generation capacity of 562 MW) will amount to a total of approximately 1,405 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to only 0.50% of the surface area. That is within an acceptable limit in terms of loss of land which is only suitable for grazing, of which there is no particular scarcity in the country.

As previously indicated, the proposed development poses a low risk in terms of causing soil degradation because it can be fairly easily and effectively prevented by standard best practice soil degradation control measures, as recommended and included in the EMPr of the EIA Report. If the risk for each individual development is low, then the cumulative risk is also low.

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

1.3.2 Ecology

The Terrestrial Biodiversity, Plant and Animal Assessment (refer to Appendix E1) confirmed that cumulative impacts, from an ecological point of view, are those that will impact the natural faunal and floristic communities and habitats surrounding the proposed solar development, mainly by other similar developments and their associated infrastructure in its direct vicinity. As more and more similar developments occur in the direct vicinity of the currently proposed development, habitat losses and fragmentation will occur more frequently and populations of threatened, protected or other habitat specific species (both faunal and

floral) will be put under increasing pressure through competition for suitable habitat. Fragmentation of habitats prevent the natural flow of ecosystem services and may have a detrimental effect on the gene pool of a species, which may lead to the loss of a population of such a species on fragmented portions. Through a development, such as the one proposed for the study area, natural habitat is totally transformed and although some vegetation cover generally returns to these areas, microhabitats are totally destroyed and the area will probably never again be able to function without some human maintenance and management.

- The cumulative impact of the solar project in the project area should all the projects be approved and developed are as follows:
    - The cumulative impact on the natural ecosystems (fauna and flora) would be moderate considering that large sections of the area for development has already been degraded through agricultural activities (crop cultivation, overgrazing etc.).
    - The moderate cumulative impacts are however dependant on the strict implementation of mitigation measures and monitoring during the construction, operational and decommissioning phases of the solar developments.

1.3.3 Avifauna

The Avifauna Impact Assessment (refer to Appendix E2) states It is the cumulative impacts, when considering the existing transformation of the threatened habitats to croplands and mining, in addition to the prevalence of planned solar developments, that increase the cumulative risks and, therefore, warrant mitigations.

Mitigating the cumulative impacts would require limiting the impact of Oryx SPP to an absolute minimum, which is not necessarily feasible but should be pursued. The mitigations to reduce cumulative impacts involve limiting the disturbance footprint (overall size), limiting human activity and noise throughout the project life, disturbing as little natural vegetation as possible, retaining the natural vegetation beneath the panels and around infrastructure, limiting the extent and width of roadways, reducing the speeds that vehicles travel, and then thoroughly rehabilitating the entire footprint back to natural grassland after decommissioning.

Implementing successful mitigations would reduce the cumulative impacts of displacement of priority species by 32% to Medium-Negative, would reduce the cumulative impacts of displacement of resident avifauna by 24% to an acceptable Low-Negative score, and would reduce the cumulative impacts of loss of important avian habitats by 28% to Medium-Negative.

Despite some residual and cumulative impacts, there is no objection, from an avifaunal perspective, to the development of the proposed SPP development.

1.3.4 Social Impact Assessment

The Social Impact Assessment (refer to Appendix E7) indicate that from a social impact point of view the project represents an important development opportunity for the communities surrounding Oryx SPP. Should it be approved, it will not only supply the national grid with much needed clean power, but will also provide a number of opportunities for social upliftment. The cumulative impacts for each of the potential social impacts were assessed throughout the report. The most significant cumulative social impacts are both positive and negative: the community will have an opportunity to better their social and economic well-being, since they will have the opportunity to upgrade and improve skills levels in the area, but impacts on family and community relations may, in some cases, persist for a long period of time. Also, in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.

1.3.5 Visual

The Visual Impact Assessment (refer to Appendix E3) confirmed that the construction and operation of the PV facility may increase the cumulative visual impact together with farming activities, dust on gravel roads, existing Eskom power line infrastructure and new projects, mines in the area and other proposed solar power facilities in the area. The significance of the visual impacts can only be determined once projects have been awarded preferred bidder status. However, taking into account the already disturbed visual surrounds due to extensive mining activities in the area and all the positive factors of such a development including economic factors, social factors and sustainability factors, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view.

1.3.6 Heritage

The Heritage Impact Assessment (Refer to Appendix E5) concluded that from a review of available databases, publications, as well as available heritage impact assessments done for the purpose of developments in the region, it was determined that the Oryx SPP 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 farmsteads, formal and informal burial sites. For 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 cumulative impacts to heritage are expected to be of generally low significance before mitigation.

For the project area, the impacts to heritage sites are expected to be of medium significance. However, this can be ameliorated by implementing mitigation measures, including 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 negligible. After mitigation, the overall impact significance would therefore be low.

7.5.1 Paleontology

According to the Palaeontological Impact Assessment (refer to Appendix E6), based on the SAHRIS website, the only palaeontological heritage assessments (PIAs) available for this region (Almond 2015, Brink undated, Groenewald 2013b, Millsteed 2013b) are all at desktop level with no field data. The cumulative Impacts of the area will include approved electrical facilities within a 30 km radius of the project site. As the mentioned MTS and Powerlines and corridors are all underlain by similar geology the Impact on these developments will be similar. The Palaeontological Significance of the proposed Oryx SPP is rated as Low and the cumulative Impacts will thus also be Low Negative.

1.3.7 Traffic

According to the Traffic Impact Assessment (refer to Appendix E8) depending on the timing of the other nearby renewable energy projects, where construction in particular could overlap, traffic impact will increase accordingly. It should be noted that the volume of traffic is related to the specific development stage, logistics planning and development size.

The construction period for other renewable energy projects is relatively short (between 12 and 18 months), where traffic flow will vary during the construction period. It is assumed that 50% of these projects' construction periods would likely coincide with the Oryx SPP construction period. This additional traffic, however, will be widely dispersed and easily accommodated on the surrounding road network. In addition, the traffic impact of the operational and maintenance periods will be low/ negligible and it is also unlikely that the decommissioning of these projects will coincide with each other.

In conclusion, the cumulative impact and significance of the various nearby renewable energy projects is considered to have a low/ negligible impact and therefore no corrective measures will be required.

7.6 IMPACT ASSESSMENT

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

7.6.1 Potential Cumulative Effects

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

Table 7.2: Potential Cumulative Effects for the proposed project

	Valued Ecosystem Components (VECs)	Rationale for Inclusion / Exclusion	Level of Cumulative Effect
Construction Phase			
Terrestrial Biodiversity Impact Assessment	Habitat destruction & Fragmentation	The construction phase of the development and associated infrastructure will result in loss of and damage to natural habitats if the vegetation is cleared for the development of the solar plant. Rehabilitation of some areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction phase.	- Medium
	Soil erosion and sedimentation	The construction activities associated with the development may result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil erosion promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora. The impact is considered as cumulative as it will influence the vegetation communities in the area.	- Low
	Dust pollution	The environmental impacts of wind-borne dust, gases and particulates from the construction activities associated with the proposed development are primarily related to human health and ecosystem damage. Poor air quality results in deterioration of visibility and aesthetic landscape quality of the region, particularly in winter due to atmospheric inversions. The impact is considered to be cumulative as dust pollution has an impact on	- Low

		the surrounding environment and as the surrounding area is already impacted by mining and agricultural activities.	
	Spillages of harmful substances	Construction work for the proposed development will always carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on fauna and flora. During the construction phase heavy machinery and vehicles would be the main contributors to potential pollution problems. The impact is considered to be cumulative as the spillages of harmful substances can have indirect impacts to the surrounding environment.	- Low
	Spreading of alien invasive species	Continued movement of vehicles on and off the site during the construction phase will result in a risk of importation of alien species. Vehicles often transport many seeds, and some may be of invader species, which may become established along the access road, especially where the area is disturbed. The construction carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.	- Low
	Negative effect of human activities on fauna and flora and road mortalities on fauna	Continued movement of vehicles on and off the site during the construction phase will result in a risk of importation of alien species. Vehicles often transport many seeds, and some may be of invader species, which may become established along the access road, especially where the area is disturbed. The construction carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest	- Low

		risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites. The wider area is already impacted by the spread of alien invasive species due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of spread of alien invasive species. The impact will be low as the mitigation measures proposed will reduce the overall impact of the development.	
Wetland/Riparian Assessment	Impact on the characteristics of the watercourse	The construction activities associated with the proposed solar power plant will potentially have an impact on the wetland areas and water levels, whether it is through direct or indirect impacts. The clearance of vegetation for the solar power plant will either have a direct or indirect impact on the wetlands and smaller drainage channels. Loss of the riparian and instream habitat will also result in permanent loss or displacement of the invertebrates, birds and small mammals' dependant on the wetland vegetation for feeding, shelter and breeding purposes. All functions associated with the wetland zones and the surrounding landscape will be compromised if mitigation measures are not applied correctly. Other indirect impacts of the construction of the solar power plant on the characteristics of the water course include impacts on water quality and changes to the geomorphology should the development cause impacts on downstream areas. The impact is considered to be cumulative due to proposed development impacting on the characteristics of the watercourse.	- Medium
	Soil erosion and sedimentation	The use of heavy machinery during the construction and decommissioning phases of the development will result in the compaction of soil, resulting in decreased infiltration of rainwater and increased surface run-off volumes and velocities leading to a greater erosion risk. The hardened surfaces of the road and compacted soils of the proposed development area will also lead to an increase in surface run-off during storm events which will likely be discharged via stormwater outlet points, concentrating flows leaving the exposed areas. This can lead to erosion in the cleared areas and channel forming where culverts concentrate water on the	- Low

		side of the road where the river and riverine area are located. It can lead to sedimentation, in the river. The impact is considered to be cumulative due to proposed development contributing to the risk of sediment transport and erosion in the area.	
	Soil and water pollution (Spillages of harmful substances)	Construction work will also carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface- or groundwater, leading to potential medium/long-term impacts on fauna and flora. The impact is considered to be cumulative due to proposed development contributing to the risk of soil and water pollution in the area.	- Low
	Spread and establishment of alien invasive species	The construction almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites. Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. Furthermore, the spread of the alien invasive species through the area will be accelerated when seeds are carried by stormwater into the drainage features on the site that will cause environmental degradation and indigenous species to be displaced. The wider area is already impacted by the spread of alien invasive species due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of spread of alien invasive species. The impact will be low as	- Low

		the mitigation measures proposed will reduce the overall impact of the development.	
Avifaunal Impact Assessment	Displacement of priority avian species from important habitats	The displacement of resident avifauna through increased disturbance and possible collisions with PV panels leading to injury or loss of avian life are considered as a cumulative impact due to the large number of planned solar development in a 30 km radius.	- Medium
	Displacement of resident avifauna	The displacement of resident avifauna through increased disturbance and possible collisions with PV panels leading to injury or loss of avian life are considered as a cumulative impact due to the large number of planned solar development in a 30 km radius.	- Low
	Loss of important avian habitats	The loss of important avian habitats through increased disturbance are considered as a cumulative impact due to the large number of planned solar development in a 30 km radius.	- Medium
Agricultural and Soils Compliance Statement	Loss of agricultural land	The cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved. Because of the negligible agricultural impact of grid connection infrastructure, its cumulative impact is also assessed as negligible.	- Low
Heritage Impact Assessment	Loss or damage to sites, features or objects of cultural heritage significance	The cultural heritage profile of the larger region is very limited. 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. 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.	- Low

		Because of the low likelihood of finding further significant heritage resources in the relevant area proposed for development and the generally low density of sites in the wider landscape the cumulative impacts to the heritage are expected to be of low significance.	
Palaeontological Impact Assessment	Disturbance, damage or destruction of legally-protected fossil heritage within the development footprints during the construction phase (impacts on well-preserved and / or rare fossils of scientific and conservation value)	A low palaeontological significance has been allocated to the proposed development. It is therefore considered that the development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.	- Low
Social Impact Assessment	Impacts of employment opportunities, business opportunities and skills development	Oryx SPP and the establishment of other solar power projects within the area has the potential to result in significant positive cumulative impacts, specifically with regards to the creation of a number of socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local, regional, and national economy through employment and procurement of services are more considerable than that of Oryx SPP alone.	+ Medium
	Impact with large-scale in-migration of people	While the development of a single solar power project may not result in a major influx of people into an area, the development of several projects may have a cumulative impact on the in-migration and movement of people. In addition, the fact that the project is proposed within an area characterised by good levels of solar irradiation suitable for the development of commercial solar energy facilities implies that the surrounding area is likely to be subject to considerable future applications for PV energy facilities. Levels of unemployment, and the low level of earning potential may attract individuals to the area in search of better	- Medium

		employment opportunities and higher standards of living. It is exceedingly difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring.	
Traffic Impact Study	Increase in construction vehicles	The construction and decommissioning phases are the only significant traffic generators for renewable energy projects. The duration of these phases is short term (i.e. the impact of the generated traffic on the surrounding road network is temporary and renewable energy facilities, when operational, do not add any significant traffic to the road network). Even if all renewable energy projects within the area are constructed at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.	- Low
Operational Phase			
Terrestrial Biodiversity Impact Assessment	Habitat destruction & Fragmentation	The development and associated infrastructure will result in loss of and damage to natural habitats if the vegetation is cleared for the development of the solar plant. Rehabilitation of some areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction phase.	- Medium
	Soil erosion and sedimentation	The development may result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil erosion promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora. The impact is considered as cumulative as it will influence the vegetation communities in the area.	- Low

	Dust pollution	The environmental impacts of wind-borne dust, gases and particulates from the operation and maintenance activities associated with the proposed development are primarily related to human health and ecosystem damage. Poor air quality results in deterioration of visibility and aesthetic landscape quality of the region, particularly in winter due to atmospheric inversions. The impact is considered to be cumulative as dust pollution has an impact on the surrounding environment and as the surrounding area is already impacted by mining and agricultural activities.	- Low
	Spillages of harmful substances	Maintenance work for the proposed development will always carry a risk of soil and water pollution. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on fauna and flora. The impact is considered to be cumulative as the spillages of harmful substances can have indirect impacts to the surrounding environment.	- Low
	Spreading of alien invasive species	Continued movement of vehicles on and off the site will result in a risk of importation of alien species. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites. Movement of vehicles will however be reduced during operation and maintenance of the facility.	- Low
	Negative effect of human activities on fauna and flora and road mortalities on fauna	Continued movement of vehicles on and off the site will result in a risk of importation of alien species. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites. The wider area is already impacted by the spread of alien invasive species due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of spread of alien invasive species. The impact will be low as the mitigation measures proposed will reduce the overall impact of the development.	- Low

Wetland/Riparian Assessment	Impact on the characteristics of the watercourse	The operation and maintenance activities associated with the proposed solar power plant will potentially have an impact on the wetland areas and water levels, whether it is through direct or indirect impacts. All functions associated with the wetland zones and the surrounding landscape will be compromised if mitigation measures are not applied correctly. Other indirect impacts o include impacts on water quality and changes to the geomorphology should the development cause impacts on downstream areas. The impact is considered to be cumulative due to proposed development impacting on the characteristics of the watercourse.	- Medium
	Soil erosion and sedimentation	The hardened surfaces of the road and compacted soils of the proposed development area will lead to an increase in surface run-off during storm events which will likely be discharged via stormwater outlet points, concentrating flows leaving the exposed areas. This can lead to erosion in the cleared areas and channel forming where culverts concentrate water on the side of the road where the river and riverine area are located. It can lead to sedimentation, in the river. The impact is considered to be cumulative due to proposed development contributing to the risk of sediment transport and erosion in the area.	- Low
	Soil and water pollution (Spillages of harmful substances)	Maintenance work will also carry a risk of soil and water pollution, with large construction vehicles (where used) contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface- or groundwater, leading to potential medium/long-term impacts on fauna and flora. The impact is considered to be cumulative due to proposed development contributing to the risk of soil and water pollution in the area.	- Low
	Spread and establishment of alien invasive species	Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. Furthermore, the spread of the alien invasive species through the area will be	- Low

		accelerated when seeds are carried by stormwater into the drainage features on the site that will cause environmental degradation and indigenous species to be displaced. The wider area is already impacted by the spread of alien invasive species due to agricultural and mining activities. Therefore, the development will contribute towards the cumulative impact of spread of alien invasive species. The impact will be low as the mitigation measures proposed will reduce the overall impact of the development.	
Visual Impact Assessment	Visual intrusion of the development on observers within the area	The operation and maintenance of the facility will create visual instruction on observers that utilise and travel through the area, including travellers using the local roads	- Medium
Decommissioning Phase			
General	Generation of waste	During the decommissioning of the facility waste will be generated that will need to be disposed of where recycling and re-use is not available. This may lead to pressure on waste disposal facilities in the area.	- Medium

7.7 CONCLUSION

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

The potential most significant cumulative impacts relate to:

- <u>Cumulative effects during construction phase:</u>
  - Habitat destruction and fragmentation (- Medium)
  - Impact on the characteristics of the watercourse (- Medium)
  - Displacement of priority avian species from important habitats (- Medium)
  - Loss of important avian habitats (- Medium)
  - Impacts of employment opportunities, business opportunities and skills development (+ Medium)

- Impact with large-scale in-migration of people (- Medium)

➢ Cumulative effects during the operational phase:

- Habitat destruction and fragmentation (- Medium)
- Impacts on the characteristics of the watercourse (- Medium)
- Visual intrusion (- Medium)

➢ Cumulative effects during the decommissioning phase:

- Generation of waste (- Medium)

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

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

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

8 ENVIRONMENTAL IMPACT STATEMENT

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

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

(l) an environmental impact statement which contains-

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

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

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

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

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

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

8.1 SUMMARY OF KEY FINDINGS AND ASSESSMENT RESULTS

Based on the contents of the report the following key environmental issues were identified, which were addressed in this EIA report:

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

- Habitat destruction and fragmentation (- Medium)
- Displacement of priority avian species from important habitats (- Medium)
- Impact on the characteristics of the watercourse (- Medium)
- Creation of employment opportunities and skills development. (+ Medium)
- Development of non-polluting, renewable energy infrastructure. (+ Medium)
- Contribution to LED and social upliftment (+ High)

➢ Impacts during the decommissioning phase:

- Improvement of habitat through revegetation / succession over time (+ Medium)

➢ Cumulative biophysical impacts resulting from similar development in close proximity to the proposed activity.

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

8.2 SENSITIVITY ANALYSIS SUMMARY AND SITE-SPECIFIC CONDITIONS

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

The main features to be avoided are related to heritage and ecology. The heritage feature includes the burial site located on the project site. The specialist has recommended a 100m buffer area. Furthermore the sensitive features related to ecology includes a valleybottom wetland with channel, depressions and hillslope seep wetlands. The specialist has recommended a 32m buffer surrounding the wetlands. These areas have been avoided by the proposed layout as per Figure G.

Further mitigation measures for the development, as recommended by the independent specialists, have been included in the EMPr(s) for the project as per Appendix I1-I4.

8.3 TECHNICAL DETAILS OF THE PROPOSED INFRASTRUCTURE TO BE AUTHORISED

- PV Panel Array - To produce up to 150MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun.

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

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. Whilst Oryx Solar Power Plant (RF) (Pty) Ltd has not yet received a cost estimate letter from Eskom, it is expected that generation from the facility will tie in with either the existing Oryx 2 - Theseus 132kV Overhead Power Line, the Oryx 1 - Theseus 132kV Overhead Power Line or the Beatrix - Theseus 132kV Overhead Power Line via a loop-in loop-out connection. The Project will inject up to 100MW into the National Grid. The installed capacity will be approximately 150MW.

  For the placement of the new power line three grid connection corridors are being assessed (each with a width of between 100m and 115m). These are as follows:

  - Grid connection corridor option 1 will connect the facility to the existing Oryx 2 - Theseus 132kV Overhead Power Line. The length of the corridor is 133m. This is considered to be the technically preferred option by the Applicant.
  - Grid connection corridor option 2 will connect the facility to the existing Oryx 1 - Theseus 132kV Overhead Power Line. The length of the corridor is 95m.
  - Grid connection corridor option 3 will connect the facility to the existing Beatrix - Theseus 132kV Overhead Power Line. The length of the corridor is 95m.

  It must be noted that the grid connection corridor options 2 and 3 follow a similar route and therefore overlap. All three grid connection corridor options are located within the affected property and therefore no areas outside of the farm portion will be affected.

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

- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on site:

  - Office (~200m²);
  - Switch gear and relay room (~400m²);
  - Staff lockers and changing room (~200m²); and
  - Security control (~60m²)

- Battery storage – Up to 500 MW Battery Storage Facility with a maximum height of 8m and a maximum volume of 1740 m^3 of batteries and associated operational, safety and control infrastructure.
- Roads – Access will be obtained via the Beatrix Shaft 4 Rd off the R30 to the north of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure. The access and internal roads will be constructed within a 25-meter corridor.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.

8.4 RECOMMENDATION OF EAP

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

- The scoping phase complied with the agreement and specification set out in Regulation 21 and Appendix 2 EIA Regulations (as amended in 2017) – already approved by the environmental authority.
- All key consultees have been consulted as required by Chapter 6 of the EIA Regulations (as amended in 2017) and the public participation plant - already approved by the environmental authority.
- The EIA process has been conducted as required by the EIA Regulations (as amended in 2017), Regulations 23 and Appendix 3.
- The EMPr has been compiled in accordance with Appendix 4 of the EIA Regulations (as amended in 2017).
- The proposed mitigation measures will be sufficient to mitigate the identified impacts to an acceptable level.
- No additional specialist studies are proposed on any environmental issue raised and therefore, no terms of reference are provided for such studies.
- Option 1 of the grid connection alternatives is preferred from an environmental perspective and is therefore recommended for approval as part of the EA.

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

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

The final recommendation of the EAP is that:

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

- Implementation of the proposed mitigation measures set out in the EMPrs (Appendix F1-F4).
- Implementation of the proposed mitigation measures set out in the specialist studies.
- The proposed solar facility must comply with all relevant national environmental laws and regulations.
- All actions and tasks allocated in the EMPr should not be neglected and a copy of the EMPr should be made available onsite at all times.
- Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.
- The required biodiversity walk-throughs must be undertaken prior to construction.
- The period for which the Environmental Authorisation is required is between 7 and 10 years. This is based on the fact that the project is proposed to be bid as part of the DMRE REIPPP Programme, with there being uncertainty regarding the announcement of the next bidding rounds, and the need for a valid Environmental Authorisation. It must however be noted that the project will also participate in other programs/opportunities to generate power in South Africa, as available.

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

Ms Lisa Opperman
Environamics Environmental Consultants

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