BASIC ASSESSMENT REPORT

Draft – 20 April 2022

THE PROPOSED NYARHI SOLAR POWER PLANT NEAR VILJOENSKROON, FREE STATE PROVINCE

ENVIRONAMICS

PROJECT DETAIL

DFFE Reference No.	**:**	To be confirmed
Project Title	**:**	The proposed Nyarhi Solar Power Plant near Viljoenskroon, Free State Province.
Authors	**:**	Ms. Lisa Opperman Ms. Christia van Dyk
Reviewer	:	Mrs. Carli van Niekerk
Client	**:**	Nyarhi Solar Power Plant (RF) (Pty) Ltd
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GLOSSARY OF TERMS AND ACRONYMS

BA	Basic Assessment
BAR	Basic Assessment Report
BESS	Battery Energy Storage System
CEA	Cumulative Effects Assessment
DFFE	Department of Forestry, Fisheries and the Environment
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
GNR	Government Notice Regulation
I&AP	Interested and affected party
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
kV	Kilo Volt
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
REDZ	Renewable Energy Development Zone
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, 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. 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 (2019 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 1000MW 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 DMREs Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or any other programs/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, the largest greenhouse gas emitter of South Africa, has committed in principle to net zero emissions by 2050 and to increase its renewable capacity.

In response to the above, Nyarhi 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 various properties including Portion 1 of the Farm Die Hoek No. 114, Portion 1 of the farm Doornkom-oost No. 447 and farm Doornplaats No. 559, Registration Division Viljoenskroon, Free State Province (refer to Figure A for the locality map). The project entails the generation of up to 100MW electrical power through photovoltaic (PV) technology. The total development footprint of the project will approximately be 246 hectares (including supporting infrastructure on site, however excluding the overhead power line) within the 290 hectares identified and assessed as part of the Basic Assessment process, which is located within the three affected properties. From a regional site selection perspective, this region is preferred for solar energy development due to its global horizontal irradiation value of around 2068 kwh/m^2. The region is also preferred based on its inclusion within the Klerksdorp Renewable Energy Development Zone (REDZ) 10.

EXECUTIVE SUMMARY

Like many other small and developing municipalities in the country, the Moqhaka Local Municipality, within which the Nyarhi Solar Power Plant is proposed, faces a number of challenges in addressing the needs and improving the lives of the community. The Integrated Development Plan (2021-2022) of the Fezile Dabi District Municipality[1] states that it is the vision of the municipality to improve the lives of their citizens and progressively meet their economic, basic and social needs thereby restoring community confidence and trust in government. The municipality aims to achieve their key strategic goals, such as delivering quality basic services (i.e. electricity, water and sanitation) to their communities, stimulating local economic growth and to ensure sound financial management and viability within the municipality. The Moqhaka Local Municipality's Integrated Development Plan (2020-2021) vision is to create an environment for sustainable development and socio-economic growth. Providing quality, affordable, efficient and effective services to enhance the quality of life for the people of the community, is the mission of the Moqhaka Local Municipality. The development of the Nyarhi Solar Power Plant will contribute to the realisation of the vision and mission of the respective local and district municipalities that will be affected by the proposed development.

Nyarhi Solar Power Plant (RF) (Pty) Ltd intends to develop a photovoltaic solar facility and associated infrastructure on various properties including Portion 1 of the Farm Die Hoek No. 114, Portion 1 of the farm Doornkom-oost No. 447 and farm Doornplaats No. 559, Registration Division Viljoenskroon, Free State Province situated within the Moqhaka Local Municipality and the greater Fezile Dabi District Municipality. The solar facility will have a generating capacity of up to 100MW. The town of Viljoenskroon is located approximately 28km southeast and the town of Orkney is located approximately 7.5km northwest of the proposed development (refer to Figure A and Figure B for the respective locality and regional maps). The total development footprint of the project will approximately be 246 hectares (including supporting infrastructure on site, however excluding the overhead power line) within the 290 hectares identified and assessed as part of the Basic Assessment process, which is located within the three affected properties. The site[2] 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 into the national grid), 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). Grid connection infrastructure is also being proposed and assessed within this report. The grid connection infrastructure includes a 132kV power line to connect the facility from a 130 MVA (High Voltage - 132kV and Medium Voltage – 33kV) substation to the national grid by connecting either into either the existing Mercury-South Vaal 132kV or the South Vaal-Carrdell 132kV through a loop-in loop out connection or at the existing Vaal Reefs Eleven Substation 132/6.6kV through a direct connection. Two grid connection corridors, each with a width of between 100m and 250m, have been identified for the assessment and placement of the power line (i.e., the power line will be developed within one of the two proposed corridors).

[1] The Moqhaka Local Municipality falls within the Fezile Dabi District Municipality.

[2] The site is defined as Portion 1 of the Farm Die Hoek No. 114 , Portion 1 of the farm Doornkom-oost No. 447 and farm Doornplaats No. 559. The full extent of the site has been assessed as part of this BA process for the development by the EAP and the independent specialists.

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 Nyarhi Solar Power Plant. The following listed activities have been identified with special reference to the proposed development and is listed in the EIA Regulations (as amended):

- Activity 11(i) (GNR 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)(b) (GNR 327): *"The development of (ii) infrastructure or structures with a physical footprint of 100 square meters or more (a) within a watercourse or (b) 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 (GNR 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 meters 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)(gg) (GN.R 324): *"The development of a road wider than 4 metres with a reserve less than 13,5 metres (b) in the Free State, (i) outside urban areas and within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."*
- Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres*

(b) in the Free State (i) outside urban areas and within (ee) Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, within *(gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas 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)(iv) (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 2004, (ii) within critical biodiversity areas identified in bioregional plans and (iv) areas within a watercourse or wetland; or within 100 metres from the edge of watercourse or wetland."*

- Activity 14(ii)(a)(c)(b)(i)(ff)(hh) (GN.R 324): *"The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; in the (b) Free State Province, (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 and (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve."*

- Activity 18 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) 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, (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas 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 & 324) implies that the development could potentially have an impact on the environment that will require mitigation. The proposed Nyarhi Solar Power Plant (SPP) is located within a Renewable Energy Development Zone (REDZ) and subsequently a Basic Assessment process is required to be followed as described in Regulations 19 and 20 of the EIA Regulations (as amended). Environamics has been appointed as the independent Environmental Assessment Practitioner to undertake the Basic Assessment (BA) on behalf of Nyarhi Solar Power Plant (RF) (Pty) Ltd.

Regulation 19 of the EIA Regulations (2017) requires that a Basic Assessment Report (BAR) must contain the information set out in Appendix 1 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 1 of GNR326 requires that the environmental outcomes,

impacts and residual risks of the proposed activity be set out in the BAR. It has been determined through the BA 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. 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 summarized below.

Impacts during the construction phase:

Construction of the solar power plant will potentially result in the following impacts: habitat destruction and fragmentation, impacts to wetland features, soil, air and water pollution, increased soil erosion and sedimentation, spread and establishment of alien invasive species, impact on priority and resident avifauna, loss of avian habitats, impact on heritage objects, impact on fossil heritage, potential loss of grazing farmland, visual impact on observers in-migration or influx of job seekers, presence of construction workers on the local communities, increased risk of veld fires, impacts on daily living and movement patterns and generation of waste. Socio-economic impacts such as the creation of local employment and business opportunities, skills development and training and technical support to local farmers and municipalities will be positive impacts emanating from the construction.

Impacts during the operational phase:

During the operational phase, the site will serve as a solar power plant and the potential impacts will take place over a period of 20 – 25 years. The negative impacts are generally associated with impacts on the fauna and flora, soils and water pollution, spread and establishment of alien invasive species, displacement of priority and resident avifauna, collisions of avifauna with PV array and power lines, avifauna electrocution when perched on power line infrastructure, visual impacts and dangerous goods hazards as part of battery storage facility (catching fire, exploding or leaking dangerous pollutants). The provision of sustainable service delivery from the local municipality also needs to be confirmed. The operational phase will have a direct positive impact through the provision of employment opportunities for its duration, and the generation of income to the local community. Additional electricity will also be generated from a clean renewable resource.

Impacts during the decommissioning phase:

The physical environment will benefit from the closure of the solar power plant since the site will be rehabilitated to an acceptable state. The decommissioning phase will however potentially result in impact on the fauna and flora, dust impacts, 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.

Cumulative impacts:

According to this database approximately nine (9) applications have been submitted for renewable energy projects within the geographical area of investigation, with six (6) of these being considered valid in terms of an Environmental Authorisation as two (2) applications have lapsed or was withdrawn, one (1) application is only for transmission infrastructure and there is uncertainty regarding the completion of the EIA process for one (1) project which seems to be incorrectly listed on the DFFE database based on the lack of information available for the project. Environamics was the appointed EAP for four (4) other projects in close proximity to the development, which is not yet

included in the DFFE database, but is considered in the cumulative impact assessment. The majority of these projects are located in close proximity to Orkney, and to the north of the site considered for the Nyarhi Solar Power Plant.

The potentially most significant cumulative impacts during the construction phase relate to the impacts to fauna, flora and wetland features, displacement of priority avifauna, loss of important avian habitats, loss of fossils, and the impact with large scale in-migration of people. The potential cumulative effects during the operational phase relate to collision of avifauna with power line infrastructure, electrocution of avifauna when perched on power line infrastructure and visual impacts. During the decommissioning phase, the generation of waste may result in cumulative impacts. These are further discussed in the BAR.

In accordance with the EIA Regulations, this draft BAR evaluates and rates each identified potential impact and identifies and recommends mitigation measures which will be required in order to ensure the reduction of the impact significance of negative impacts to acceptable levels and the avoidance of negative residual risks. This draft BAR also contains information that is required by the competent authority (Department of Forestry, Fisheries and the Environment (DFFE)) to consider the Application for Environmental Authorisation and to reach a decision contemplated in Regulation 20 of GNR 326. No fatal flaws or impacts with unacceptable levels of significance were identified and the impacts from the proposed development are expected to be at an acceptable level with the implementation of mitigation measures and therefore the project can be authorised subject to the implementation of the recommended mitigation measures.

1 INTRODUCTION

This section aims to introduce the Basic Assessment Report (BAR) and specifically to address the following requirements of the regulations:

Appendix 1. (3) A basic 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:

(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 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

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(i)	• *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* • Activity 11(i) is triggered as 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 (132 kV), an on-site HV/MV substation (130 MVA, High Voltage:88/132kV, Medium Voltage: 33kV) and switching station. It is expected that generation from the facility will tie in with either the Mercury-South Vaal 132kV Power Line or the South Vaal-Carrdell 132kV Power Line via a loop-in loop-out connection (technically preferred). An alternative grid connection point

		being considered is a direct connection to the Vaal Reefs Eleven 132/6.6 kV Substation.
GNR. 327 (as amended in 2017)	Activity 12(ii)(a)(b)	• *"The development of (ii) infrastructure or structures with a physical footprint of 100 square meters or more (a) within a watercourse or (b) within 32 meters of a watercourse, measured from the edge of a watercourse."* • Activity 12(ii)(a)(b) is triggered as grid connection corridor option 1 crosses a valleybottom wetland with a channel. The power line pylons associated with the line will be located either within 32 meters or within the feature itself and will have a footprint of more than 100 square meters. The service road associated with the power line will also need to cross the watercourse. Should grid connection option 2 (technically preferred option) be authorised then this activity will not 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	• *"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 meters from a watercourse"* • Activity 19 is triggered as grid connection corridor option 1 crosses a valleybottom wetland with a channel. The power line pylons associated with the line will be located within the feature itself and will require the removal of more than 10 cubic meters of rock from the watercourse. The service road associated with the power line will also need to cross the watercourse. Should grid connection option 2 (technically preferred option) be authorised then this activity will not 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 properties have been used for grazing and pivot irrigation and the properties will be re-zoned to "special" use for the proposed development. The development footprint of the solar power plant will be 246 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 as the existing access to the affected properties 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 100 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 Reefs Dolomite sinkhole Woodland (Gh12) and a portion of the grid connection corridor option 1 within the Vaal-Vet Sandy Grassland (Gh10) which is described by Mucina and Rutherford (2006) respectively as 'vulnerable' and 'endangered'. Activity 15 is triggered since portions of the site have 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 246 hectares.
GNR. 324 (as amended in 2017)	Activity 4 (b)(i)(ee)(gg)	• *"The development of a road wider than 4 metres with a reserve less than 13,5 metres (b) in the Free State, (i) outside urban areas and within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."* • Activity 4(b)(i)(ee)(gg) is triggered since the internal roads will not have a reserve and will vary between 6 and 12 meters in width. The project is located within the Free State Province and falls outside of an urban area but a portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment.
GNR. 324 (as amended in 2017)	Activity 10 (b)(i)(ee)(gg)(hh)	• *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State (i) outside urban areas and within (ee) Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, within (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas and (hh) Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland.."* • Activity 10(b)(i)(ee)(gg)(hh) is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel) in

		containers with a combined capacity of 80 cubic metres. The dangerous goods will be stored in a bunded area within the construction site during the construction phase. During the operational phase the dangerous goods will be stored in a bunded area within the operations and maintenance areas. The dangerous goods to be stored on site relates to diesel/petrol and oil. The project is located within the Free State Province and falls outside of an urban area but a portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment. Furthermore, the Vaal River is located to the north and a valleybottom wetland with a channel is located to the east which are both within 100m of the proposed development.
GNR. 324 (as amended in 2017)	Activity 12 (b)(i)(ii)(iv)	• *"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 2004, (ii) within critical biodiversity areas identified in bioregional plans and (iv) areas within a watercourse or wetland; or within 100 metres from the edge of watercourse or wetland.."* • Activity 12(b)(i)(ii)(iv) is triggered since the proposed development is located in the Free State province and the vegetation on site is classified as being 'endangered' or 'vulnerable'. Portions of the site have not been lawfully disturbed during the preceding ten years. A portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. Furthermore, the Vaal River is located to the north and a valleybottom wetland with a channel is located to the east which are both within 100m of the proposed development.

		The development footprint of the project will be 246 hectares and therefore, more than 300 square meters of indigenous vegetation will be removed.
GNR. 324 (as amended in 2017)	Activity 14(ii)(a)(c)(b)(i)(ff)(hh)	• *"The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse, or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; in the (b) Free State Province, (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 and (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve."* • Activity 14(ii)(a)(c)(b)(i)(ff)(hh) is triggered as grid connection corridor option 1 crosses a valleybottom wetland with a channel. The power line pylons associated with the line will be located either within 32 meters or within the feature itself and will have a footprint of more than 10 square meters. The service road associated with the power line will also need to cross the watercourse. The proposed development is located in the Free State province, outside of an urban area. A portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment. Should grid connection option 2 (technically preferred option) be authorised then this activity will not be relevant.
GNR. 324 (as amended in 2017)	Activity 18 (b)(i)(ee)(gg)(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, (gg) areas within 10 kilometres from national parks or world heritage*

		sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas 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)(gg)(hh) is triggered since the existing access road to the site will need to be widened by more than 4 metres. The proposed development is located in the Free State province, outside of an urban area. A portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment. Furthermore, the Vaal River is located to the north and a valleybottom wetland with a channel is located to the east which are both within 100m of the proposed development.

The activities triggered under Listing Notice 1, 2 and 3 (Regulation 327, 325 & 324) for the project implies that the development is considered as potentially having an impact on the environment and therefore require the implementation of appropriate mitigation measures. Based on the location of the entire extent of the project within the Klerksdorp REDZ (see Figure D), the process to be followed will be as per GNR 114, as gazetted on 16 February 2018. Therefore, the Nyarhi Solar Power Plant is subject to a Basic Assessment process and not a full EIA process, as well as a shortened timeframe for the processing of the Application for Environmental Authorisation by the Department of Forestry, Fisheries and the Environment (DFFE). The Basic Assessment must be undertaken in line with the requirements stipulated under Regulations 19 – 20 of the EIA Regulations. According to Appendix 1 of Regulation 326, the objective of the basic assessment process 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;
- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Describe the need and desirability of the proposed alternatives;
- Through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine —

- The nature, significance, consequence, extent, duration and probability of the impacts occurring; and
- degree to which these impacts-
  - can be reversed;
  - may cause irreplaceable loss of resources, and
  - can be avoided, managed or mitigated; and

- Through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to –
  - Identify and motivate a preferred site, activity and technology alternative;
  - Identify suitable measures to avoid, manage or mitigate identified impacts; and
  - Identify residual risks that need to be managed and monitored.

This report is the draft Basic Assessment Report (BAR) that has been submitted to the Department of Forestry, Fisheries and the Environment (DFFE) for review and comment. According to GNR 326 all registered interested and affected parties (I&APs) and relevant State Departments (including Organs of State) must be allowed the opportunity to review and provide comment on the report. The draft BAR has been made available to registered I&APs and all relevant State Departments for a 30-day review and comment period from 20 April 2022 to 23 May 2022. They have been requested to provide written comments on the BAR within 30 days of receiving it. All issues identified during the review period will be documented and compiled into a Comments and Response Report (Appendix C6) to be submitted as part of the Final BAR to DFFE for decision-making.

1.2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

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

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
And/or	
Contact person:	Lisa Opperman
EAPASA Registration:	2020/2150
Postal Address:	14 Kingfisher Street, Tuscany Ridge Estate, Potchefstroom, 2531
Telephone:	084 920 3111 (Cell)
Electronic Mail:	lisa@environamics.co.za

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

1.3 DETAILS OF SPECIALISTS

Table 1.2 provides information of the independent specialists that have been appointed as part of the Basic Assessment process. Regulation 13(1)(a) and (b) determines that an independent and suitably qualified and experienced 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), which must comply with sub regulation 1. In terms of the independent status of the specialists, their declarations are attached as Appendix D to this report. The expertise of the specialists is also summarized in their respective curriculum vitae's.

Table 1.2: Details of specialists

Study	Prepared by	Contact Person	Postal Address	Tel	e-mail
Geotechnical Study	Geopractica	Colin Dalton	-	Tel: 011 674 1325	all@geopractica.co.za
Avifaunal 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 BA PROCESS

The BA process is conducted strictly in accordance with the stipulations set out in Regulations 19 – 20 and Annexure 1 of Regulation No. 326. Table 1.3 provides a summary of the BA process and future steps to be taken. It can be confirmed that to date:

- A site visit was conducted on 24 February 2022 and site notices were erected.
- 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 Klerksdorp Record on 04 March 2022 for the initial public participation.
- An application for Environmental Authorisation and the draft BAR was submitted to the DFFE on 20 April 2022.
- The Basic Assessment report has been made available for a 30-day review and comment period from 20 April 2022 to 23 May 2022.

It is envisaged that the BA process should be completed within approximately five months of submitting the Application for EA and the BAR, i.e. by August 2022 – see Table 1.3.

Table 1.3: Project schedule

Activity	Prescribed timeframe	Timeframe
Submit public participation plan	-	03 March 2022
Public Participation Plan Approval	-	11 March 2022
Site visits (Initial PP – Press Advertisement & Site Notices).	-	24 February & 04 March 2022
Receive specialist studies	-	March - April 2022 (4 weeks)
Submit application form and DBAR	-	20 April 2022
Public participation (DBAR)	30 Days	20 April 2022– 23 May 2022
Submit FBAR	90 Days	May 2022
Department acknowledges receipt	10 Days	June 2022
Decision	57 Days	By July 2022
Department notifies of decision	5 Days	By July 2022
Registered I&APs notified of decision	14 Days	July 2022
Appeal	20 Days	By August 2022

1.5 STRUCTURE OF THE REPORT

This report is structured in accordance with the prescribed contents stipulated in Appendix 1 of Regulation No.326. It consists of seven sections demonstrating compliance to the specifications of the regulations as illustrated in Table 1.4.

Table 1.4: Structure of the report

Requirements for the contents of a BAR as specified in the Regulations		Section in report
Appendix 1. (3) - A basic 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 activities to be undertaken including associated structures and infrastructure.	
(e)	a description of the policy and legislative context within which the development is proposed including:	3

	(i) An identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	
	(ii) How the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks and instruments;	
(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 site, activity and technology alternative.	5
(h)	a full description of the process followed to reach the preferred alternative within the site including –	
	(i) details of all the 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 alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	
	(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	6 & 7
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	

	(viii) the possible mitigation measures that could be applied and level of residual risk;	
	(ix) the outcomes of the site selection matrix;	
	(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 alternatives, including preferred location of the activity;	
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including -	
	(i) a description of all environmental issues and risks that were identified during the 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, impact management measures from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;	
(n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Not applicable
(o)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	8
(p)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	
(q)	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;	Not applicable
(r)	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; and	
(s)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Not applicable
(t)	any specific information that may be required by the CA; and	Not applicable

(u)	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 1. (3) An BAR (...) 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 Portion 1 of the Farm Die Hoek No. 114, Portion 1 of the farm Doornkom-oost No. 447 and farm Doornplaats No. 559, Registration Division Viljoenskroon, Free State Province situated within the Moqhaka Local Municipality. The proposed development is located in the Free State Province in the central interior of South-Africa (refer to Figure B for the regional map). The town of Viljoenskroon is located approximately 28km southeast and the town of Orkney is located approximately 7.5km northwest of the proposed development (refer to Figure A for the locality map).

The project entails the generation of up to 100MW electrical power through the operation of photovoltaic (PV) panels. The total development footprint of the project will approximately be 246 hectares (including supporting infrastructure on site, however excluding the overhead power line) within the 290 hectares identified and assessed as part of the Basic Assessment process, which is located within the three affected properties – refer to Table 2.1 for general site information. The properties on which the facility is to be constructed will be leased by Nyarhi

Solar Power Plant (RF) (Pty) Ltd from the property owner, Mr. Arnold Botha, for the lifespan of the project (minimum of 20 years).

Table 2.1: General site information

Description of affected farm portion	Solar Power Plant Portion 1 of the Farm Die Hoek No. 114 Portion 1 of the farm Doornkom-oost No. 447 Doornplaats No. 559 Power Line: Option 1 Portion 1 of the Farm Die Hoek No. 114 Hoekplaats No. 598 Power Line: Option 2 (technically preferred) Farm Anglo No. 593 Portion 1 of the Farm Die Hoek No. 114 Farm Groot Vaders Bosch 593 Portion 2 of the farm Zuiping No. 394 Remaining Extent of the farm Zuiping No. 394
Province	Free State
District Municipality	Fezile Dabi District Municipality
Local Municipality	Moqhaka Local Municipality
Ward numbers	22
Closest towns	Viljoenskroon located ~28km south-east and Orkney ~7.5km north-west
21 Digit Surveyor General codes	Solar Power Plant Portion 1 of the Farm Die Hoek No. 114 - F03600000000011400001 Portion 1 of the farm Doornkom-oost No. 447 - F03600000000044700001 Doornplaats No. 559 - F03600000000059900000

	Power Line: Option 1 (technically preferred) Portion 1 of the Farm Die Hoek No. 114 - F03600000000011400001 Hoekplaats No. 598 - F03600000000059800000 Power Line: Option 2 (technically preferred) Farm Anglo No. 593 - F03600000000059300000 Portion 1 of the Farm Die Hoek No. 114 - F03600000000011400001 Farm Groot Vaders Bosch No. 592 - F03600000000059200000 Portion 2 of the Farm Zuiping No. 394 - F03600000000039400002 Remaining Extent of the Farm Zuiping No. 394 - F03600000000039400000
Type of technology	Photovoltaic solar facility
Structure Height	Panels ~6m, buildings ~ 6m, power line ~32m and battery storage facility ~8m height
Battery storage	Within a 4-hectare area
Surface area to be covered (Development footprint)	Approximately 246 hectares
Laydown area dimensions (EIA footprint)	Assessed 290 hectares (area identified within the three affected properties for assessment for the placement of the development footprint)
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.
Generation capacity	Up to 100MW (based on the available technology at the time of construction)

Expected production	320-360 GWh per annum (expected production by 100MWdc modules considering bifacial and one-axis tracker)

Over the three affected properties an area of 290 hectares have been assessed and a preferred development footprint of 246ha has been identified within this larger area.

The site is located in a rural area and is bordered by farms where mainly agricultural activities are undertaken and mines. The site survey revealed that the affected properties currently consist of grazing cattle as well as crop production through the use of pivot irrigation – refer to plates 1-13 for photographs of the development area.

2.2 ACTIVITY DESCRIPTION

The proposed development will trigger the following activity:

Table 2.2: Listed activities

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(i)	• *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* • Activity 11(i) is triggered as 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 (132 kV), an on-site HV/MV substation (130 MVA, High Voltage:88/132kV, Medium Voltage: 33kV) and switching station. It is expected that generation from the facility will tie in with either the Mercury-South Vaal 132kV Power Line or the South Vaal-Carrdell 132kV Power Line via a loop-in loop-out connection (technically preferred). An alternative grid connection point being considered is a direct connection to the Vaal Reefs Eleven 132/6.6 kV Substation.
GNR. 327 (as amended in 2017)	Activity 12(ii)(a)(b)	• *"The development of (ii) infrastructure or structures with a physical footprint of 100 square meters or more (a) within a watercourse or (b) within 32 meters of a*

		watercourse, measured from the edge of a watercourse." • Activity 12(ii)(a)(b) is triggered as grid connection corridor option 1 crosses a valleybottom wetland with a channel. The power line pylons associated with the line will be located either within 32 meters or within the feature itself and will have a footprint of more than 100 square meters. The service road associated with the power line will also need to cross the watercourse. Should grid connection option 2 (technically preferred option) be authorised then this activity will not 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	• *"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 meters from a watercourse"* • Activity 19 is triggered as grid connection corridor option 1 crosses a valleybottom wetland with a channel. The power line pylons associated with the line will be located within the feature itself and will require the removal of more than 10 cubic meters of rock from the watercourse. The service road associated with the power line will also need to cross the watercourse.

		Should grid connection option 2 (technically preferred option) be authorised then this activity will not 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 properties have been used for grazing and pivot irrigation and the properties will be re-zoned to "special" use for the proposed development. The development footprint of the solar power plant will be 246 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 as the existing access to the affected properties 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 100 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 Reefs Dolomite sinkhole Woodland (Gh12) and a portion of the grid connection corridor option 1 within the Vaal-Vet Sandy Grassland (Gh10) which is described by Mucina and Rutherford (2006) respectively as 'vulnerable' and 'endangered'. Activity 15 is triggered since portions of the site have 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 246 hectares.
GNR. 324 (as amended in 2017)	Activity 4 (b)(i)(ee)(gg)	• *"The development of a road wider than 4 metres with a reserve less than 13,5 metres (b) in the Free State, (i) outside urban areas and within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."* • Activity 4(b)(i)(ee)(gg) is triggered since the internal roads will not have a reserve and will vary between 6 and 12 meters in width. The project is located within the Free State Province and falls outside of an urban area but a portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment.

GNR. 324 (as amended in 2017)	Activity 10 (b)(i)(ee)(gg)(hh)	• *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State (i) outside urban areas and within (ee) Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, within (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas and (hh) Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland.."* • Activity 10(b)(i)(ee)(gg)(hh) is triggered since the proposed development will need to develop infrastructure for the storage and handling of dangerous goods (diesel) in containers with a combined capacity of 80 cubic metres. The dangerous goods will be stored in a bunded area within the construction site during the construction phase. During the operational phase the dangerous goods will be stored in a bunded area within the operations and maintenance areas. The dangerous goods to be stored on site relates to diesel/petrol and oil. The project is located within the Free State Province and falls outside of an urban area but a portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment. Furthermore, the Vaal River is located to the north and a valleybottom wetland with a channel is located to the east which are both within 100m of the proposed development.

GNR. 324 (as amended in 2017)	Activity 12 (b)(i)(ii)(iv)	• *"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 2004, (ii) within critical biodiversity areas identified in bioregional plans and (iv) areas within a watercourse or wetland; or within 100 metres from the edge of watercourse or wetland.."* • Activity 12(b)(i)(ii)(iv) is triggered since the proposed development is located in the Free State province and the vegetation on site is classified as being 'endangered' or 'vulnerable'. Portions of the site have not been lawfully disturbed during the preceding ten years. A portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. Furthermore, the Vaal River is located to the north and a valleybottom wetland with a channel is located to the east which are both within 100m of the proposed development. The development footprint of the project will be 246 hectares and therefore, more than 300 square meters of indigenous vegetation will be removed.
GNR. 324 (as amended in 2017)	Activity 14(ii)(a)(c)(b)(i)(ff)(hh)	• *"The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse, or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; in the (b) Free State Province, (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 and (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in*

		terms of NEMPAA or from the core area of a biosphere reserve." • Activity 14(ii)(a)(c)(b)(i)(ff)(hh) is triggered as grid connection corridor option 1 crosses a valleybottom wetland with a channel. The power line pylons associated with the line will be located either within 32 meters or within the feature itself and will have a footprint of more than 10 square meters. The service road associated with the power line will also need to cross the watercourse. The proposed development is located in the Free State province, outside of an urban area. A portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment. Should grid connection option 2 (technically preferred option) be authorised then this activity will not be relevant.
GNR. 324 (as amended in 2017)	Activity 18 (b)(i)(ee)(gg)(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, (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas 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)(gg)(hh) is triggered since the existing access road to the site will need to be widened by more than 4 metres. The proposed development is located in the Free State province, outside of an urban area. A portion of the PV development footprint falls within CBA 1 and grid connection corridor option 1 within a CBA 1 and CBA 2 as identified in the Free State 2015 Biodiversity Plan. The project is located within 5km of a protected area in terms of NEMPAA, known as Mispha Game Farm located approximately 1.3km south of the proposed development as per the South Africa Protected Area Database of the Department of Forestry, Fisheries and the Environment. Furthermore, the Vaal River is located to the north and a valleybottom wetland with a channel is located to the east which are both within 100m of the proposed development.

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 access to the site will need to be confirmed.
- 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 roads/paths – existing paths will be used were reasonably possible. A short access road will be used to link the site with an existing gravel road off the Vermaasdrift Road. 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 layering 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 100MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the yield.

- Wiring to Central Inverters - Sections of the PV array will be wired to 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 via the proposed power line. Whilst Nyarhi 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 via a loop-in loop-out line connection into the South Vaal – Cardell 132 kV Line or Mercury – South Vaal 132 kV Line or alternatively connect into the existing Vaal Reefs Eleven 132/6.6 kV Substation through a direct connection. The Project will inject up to 100MW into the National Grid. The installed capacity will be approximately 100MW.

  Two grid connection corridor alternatives, each with a width of between 100m and 250m, have been identified for the assessment and placement of the power line (i.e., the power line will be developed within one of the two proposed corridors).

  The grid connection corridor located directly to the south of the SPP site is Option 1. This corridor will connect the SPP into the existing Vaal Reefs Eleven Substation. The length of this option is ~2.4km.

  The grid connection corridor located to south-west of the SPP site (referred to as Option 2) will connect the SPP into either the existing Mercury-South Vaal 132kV (maximum length of power line: 1,22km) or the South Vaal-Carrdell 132kV (maximum length of

power line:1,18km). This is the preferred alternative from a development and technical perspective based on feedback received by the developer from Eskom.

Figure 2.1 below provides an indication of the grid connection corridor alternatives.

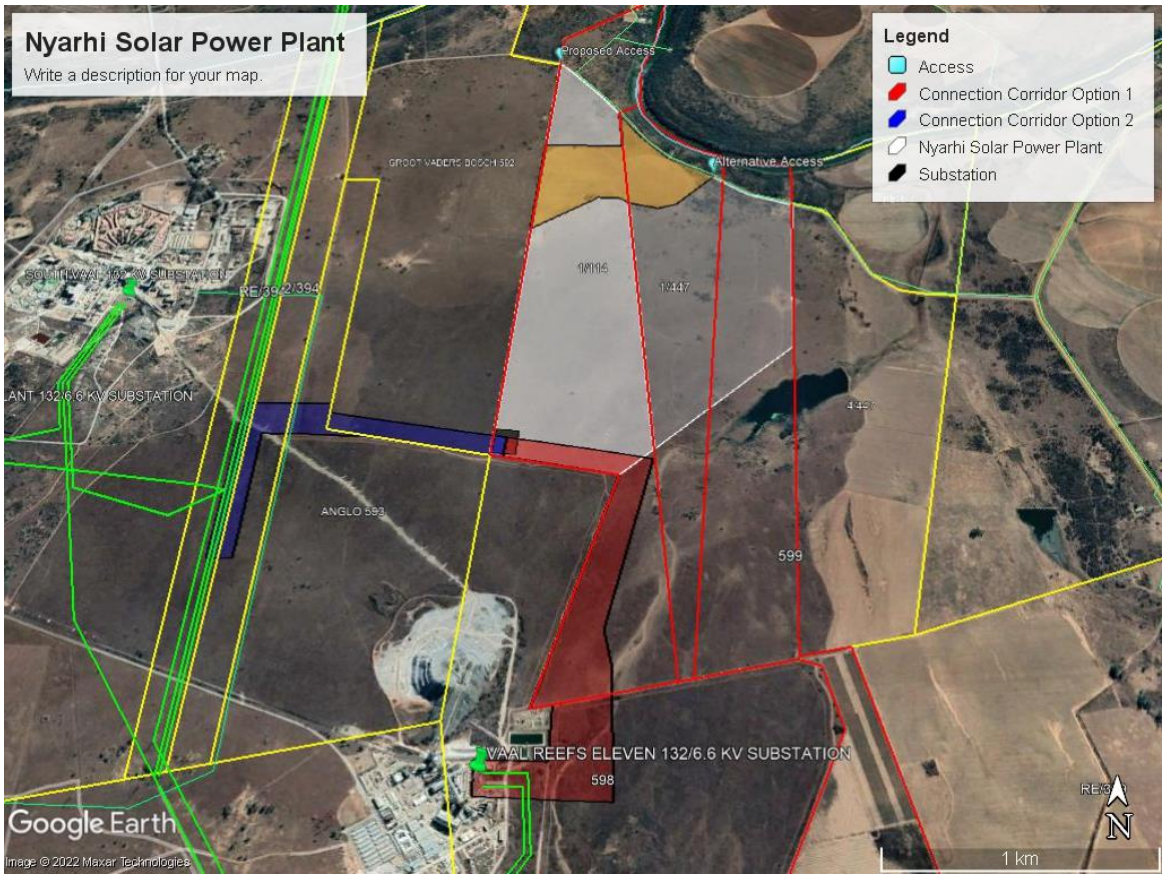


Figure 2.1: Proposed grid connection corridor alternatives proposed for the Nyarhi Solar Power Plant

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4 m underground as far as practically possible.
- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on site:
    - - Office (~200 m²);
    - Switch gear and relay room (~400 m²);
    - Staff lockers and changing room (~200 m²); and
    - Security control (~60 m²)

- Battery Energy Storage System – A 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 an existing gravel road to the north of the site, off the Vermaasdrift Road. An internal site road network will also be required, with a width of between 6 m and 12 m, 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 properties. Fencing with a height of 2.5 meters will be used.

2.4 LAYOUT DESCRIPTION

The layout plan will consider and adhere to the limitations of the site and aspects such as environmentally sensitive areas, roads, fencing and servitudes on site. The total surface area covered by the layout include the PV panel arrays (spaced to avoid shadowing), access and maintenance roads and associated infrastructure (buildings, power inverters, power lines, onsite substation and switching station and perimeter fences). Limited environmental features of significance exist on site. A final layout plan is included in Appendix H under Layout Plans in the report, as well as Figures H and I. Table 2.2 below provides detailed information regarding the layout for the proposed facility as per DFFE requirements.

Table 2.2: Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	6 meters
Area of PV Array	246 hectares (Development footprint) 290 hectares (EIA Footprint – area assessed)
Number of inverters required	Minimum 40
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: 4 000 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: 290 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	Up to 250m, with some areas being ~100m wide
Grid connection corridor length	Approximately 2.4 kilometers (Option 1) Approximately 1,22 kilometers (Option 2 – technically preferred)
Power servitude width	32m
Height of fencing	Approximately 2.5 meters

Table 2.4 provides the coordinate points for the proposed project site, associated infrastructure and grid connection corridor alternatives.

Table 2.4: Coordinates

Coordinates			
Project Site	A	26°56'41.41"S	26°48'17.62"E
	B	26°56'56.76"S	26°48'30.08"E
	C	26°57'4.15"S	26°48'34.75"E
	D	26°57'10.00"S	26°48'39.78"E
	E	26°57'15.09"S	26°48'48.53"E
	F	26°57'20.13"S	26°48'55.47"E
	G	26°57'22.77"S	26°49'3.17"E
	H	26°57'56.56"S	26°48'59.66"E
	I	26°58'22.19"S	26°48'28.39"E
	J	26°58'18.46"S	26°48'7.28"E

Proposed Access Point		26°56'41.54"S	26°48'17.84"E
Access Point (second option)		26°57'15.20"S	26°48'48.72"E
Connection Option 1			
Power Line Corridor – Option 1	A	26°58'18.38"S	26°48'29.05"E
	B	26°58'19.14"S	26°48'34.02"E
	C	26°58'47.96"S	26°48'25.67"E
	D	26°58'53.08"S	26°48'26.67"E
	E	26°59'11.76"S	26°48'26.69"E
	F	26°59'11.16"S	26°48'7.61"E
	G	26°59'6.36"S	26°48'7.60"E
	H	26°59'6.63"S	26°48'17.78"E
	I	26°58'58.61"S	26°48'18.18"E
	J	26°58'58.76"S	26°48'17.02"E
	K	26°58'22.21"S	26°48'28.40"E
	L	26°58'22.17"S	26°48'28.23"E
Substation	A	26°58'14.94"S	26°48'8.27"E
	B	26°58'15.83"S	26°48'13.36"E
	C	26°58'19.17"S	26°48'12.64"E
	D	26°58'18.27"S	26°48'7.54"E
Battery Energy Storage System (BESS)	A	26°58'11.81"S	26°48'8.19"E
	B	26°58'11.85"S	26°48'20.27"E
	C	26°58'16.62"S	26°48'20.25"E
	D	26°58'14.62"S	26°48'7.89"E
Connection Option 2			
	A	26°58'36.86"S	26°47'24.76"E
	B	26°58'8.57"S	26°47'25.53"E

Power Line Corridor – Option 2 (Technically Preferred)	C	26°58'8.60"S	26°47'39.94"E
	D	26°58'10.41"S	26°47'40.03"E
	E	26°58'14.85"S	26°48'8.29"E
	F	26°58'18.51"S	26°48'7.49"E
	G	26°58'14.57"S	26°47'29.20"E
	H	26°58'36.96"S	26°47'28.74"E

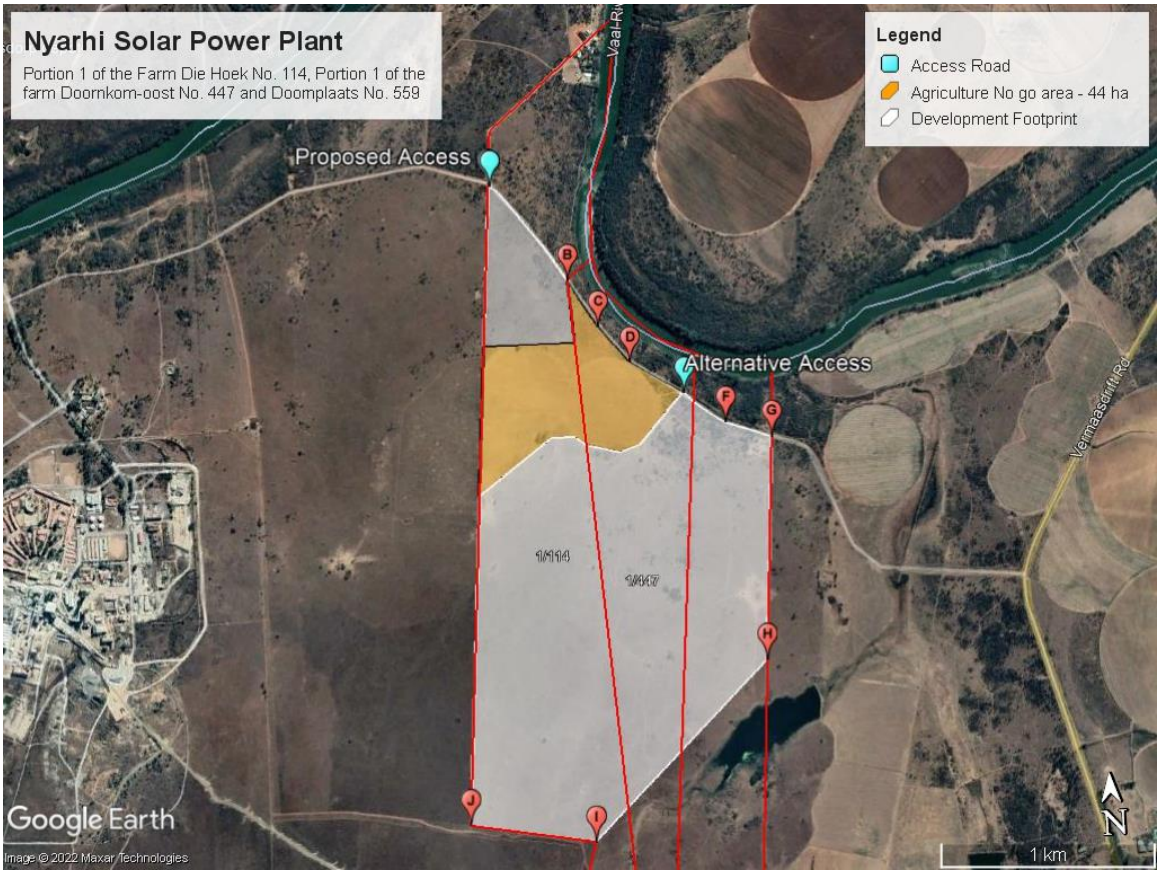


Figure 2.2 : Map indicating coordinate points of the proposed Nyarhi Solar Power Plant (including project site)

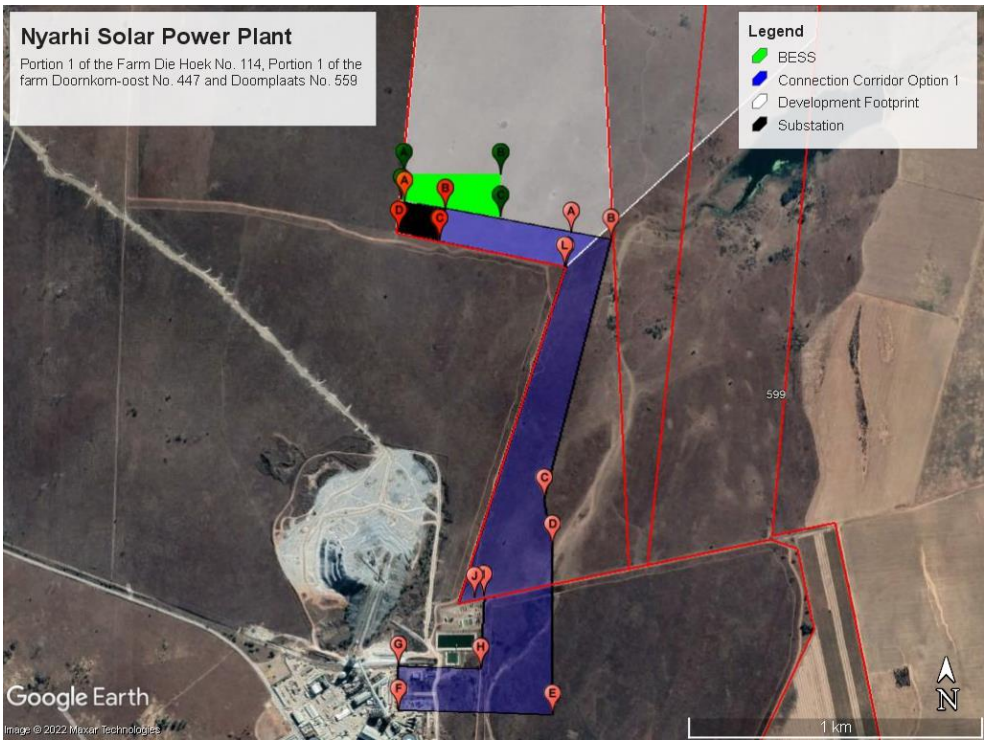


Figure 2.3: Map indicating coordinate points of the proposed Nyarhi Solar Power Plant proposed power line corridor, BESS and the substation for connection option 1.

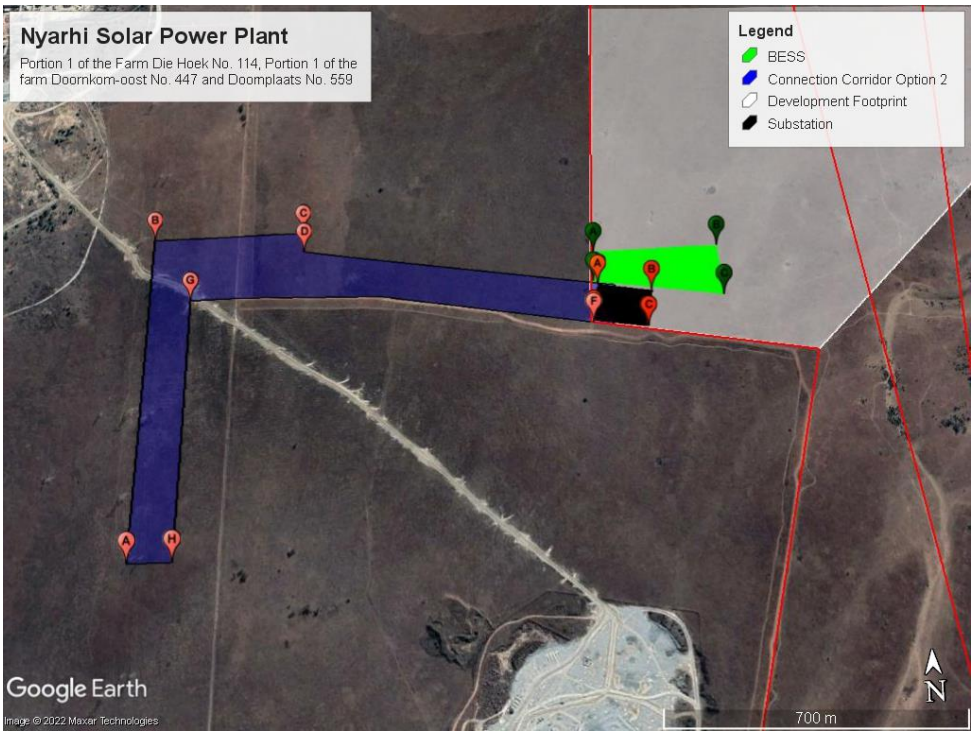


Figure 2.4: Map indicating coordinate points of the proposed Nyarhi Solar Power Plant proposed power line corridor, BESS and the substation for connection option 2.

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 the local municipality, or alternatively from ground water resources. The Department of Water and Sanitation has been asked by the Applicant to confirm the water resource availability in the relevant catchment management area in order to ensure sustainable water supply (Appendix G). 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 for the development of the project or is successful as part of any other generation programme.

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 operation is 4200m³ per annum. The majority of this usage is for the cleaning of the solar panels during the operation phase. Since each panel requires approximately 2 litres of water for cleaning, the total amount of 500000 panels will require 920 000 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 4,200,000 litres per annum for washing and allows 200,000 litres per annum (or 548 litres per day) for toilet use, drinking water, etc as part of operations. This total to approximately 4 200m^3 of water required per annum. Drinking water supplied will comply with the SANS:241 quality requirements and it is noted that the Moqhaka Local Municipality remains the Water Service Authority in the area.

Water saving devices and technologies such as the use of dual flush toilets and low-flow taps, the management of storm water, the capture and use of rainwater from gutters and roofs would 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 Storm water

To avoid soil erosion, it is recommended that the clearing of vegetation be limited. Storm water management and mitigation measures are included in the Environmental Management Programme (EMPr) – refer to Appendix F.

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 operation 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) will be 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) (Appendix G).

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 properties 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 will be considered by the developer. During the day, electricity will be sourced from the photovoltaic plant, and from the electricity connection at night.

2.6 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.

<u>The decommissioning process will consist of the following steps:</u>

- 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.
- Wastewater storage conservancy tank would be responsibly removed and the area would be rehabilitated.
- The underground cables would be unearthed and removed and buildings would be demolished and removed.
- The fencing would be dismantled and removed.
- The roads can be retained should the landowner choose to retain them, alternatively the roads will be removed and the compaction will be reversed.

- Most of the wires, steel and PV modules are recyclable and would be recycled to a reasonable extent. The Silicon and Aluminium in PV modules can be removed and reused in the production of new modules.
- Any rubble and non-recyclable materials will be disposed of at a registered landfill facility.

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

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

3 LEGISLATIVE AND POLICY CONTEXT

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

Appendix 1. (3) A BAR (...) 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 and associated infrastructure is based on numerous policy and legislative documents. These documents inform decisions on project level environmental authorisations issued by the National Department of Forestry, Fisheries and the Environment (DFFE) as well as comments from local and district authorities. Moreover, it is significant to note that they also inform strategic decision making reflected in IDPs and SDFs. Therefore, to ensure streamlining of environmental authorisations it is imperative for the proposed activity to align with the principles and objectives of key national, provincial and local development policies and legislation. The following acts and policies and their applicability to the proposed development are briefly summarised:

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

- Free state Provincial Spatial Development Framework (PSDF) (2012)
- Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa (2014)
- Fezile Dabi District Municipality Reviewed Final Integrated Development Plan (IDP) 2021-2022 (2022)
- Moqhaka Local Municipality Draft Integrated Development Plan 2020/2021 (2020)

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

3.2 LEGISLATIVE CONTEXT

Table 3.1: Legislative context for the construction of photovoltaic solar 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 Nyarhi 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 Forestry, Fisheries and the Environment (DFFE) and the Free State Province Department of Economic, Small	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.

	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 BA process undertaken for the Nyarhi 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 Nyarhi 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 and Sanitation (DWS)	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 falls within the C24B quaternary drainage region, this drainage region falls under Zone H, which refers to the amount of water that may be taken from the ground water resource, per

			hectare. The drainage region forms part of the Middle Vaal Management Area. Drainage occurs as sheet-wash into the drainage channels on site that eventually drains into the major river namely the Vaal River that occurs to the north 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 of Forestry, Fisheries and the Environment (DFFE)	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 of Forestry, Fisheries and the Environment (DFFE)	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 Nyarhi Solar Power Plant and all relevant documents were submitted for their comments and approval, an interim comment has been submitted by SAHRA on the proposed project. The Heritage Impact Assessment undertaken for the solar power plant is included as Appendix D5 and the Paleontological Impact Assessment report is included as Appendix D6 to this draft BAR.
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 Rural Development and Land Reform 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 Nyarhi Solar Power Plant and is included as Appendix D4 of this draft BAR.
The National Forests Act, 1998 (Act 84 of 1998)	Department of Forestry, Fisheries and the Environment (DFFE)	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, Plant and Animal Species Impact Assessment has been undertaken for the Nyarhi Solar Power Plant and is included in Appendix D1 of this draft BAR.

Free State Nature Conservation Ordinance, 1969 (Act 8 of 1969)	Free State Province Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA)	1969	The Act provides for the conservation of fauna and flora and the hunting of animals causing damage and for matters incidental thereto. This includes wild animals, fish, indigenous plants, as well as nature reserves. The Act also provides for the permitting of the disturbance of such species. A Terrestrial Biodiversity, Plant and Animal Species Impact Assessment has been undertaken for the Nyarhi Solar Power Plant and is included in Appendix D1 of this draft BAR.

3.3 POLICY CONTEXT

Table 3.2: Policy context for the construction of solar PV 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 Nyarhi 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 Nyarhi 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	2010-2030	The Integrated Resource Plan for Electricity for South Africa of 2010–2030 (further referred to as the IRP) is a "living plan" which is expected to be revised and updated continuously as necessary due to changing circumstances. According to the Summary of the plan the current IRP for South Africa, which was originally initiated by the Department of Energy (DoE) in June 2010 (the Department is now known as Department of Mineral Resources and Energy), led to the Revised Balanced Scenarios (RBS) for the period 2010–2030. "*This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation". In addition to all existing and committed power plants, the RBS included 11,4 GW of renewables, which relates to the proposed Nyarhi SPP. In 2010 several changes were made to the IRP model. The main changes in the IRP were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP), and wind options"* (RSA, 2011a). The summary of the IRP further explains that traditional cost-optimal scenarios were developed based on the previously mentioned changes in the IRP. This resulted in the Policy-Adjusted IRP, which stated that: "*The installation of renewables (solar PV, CSP and wind) have been brought forward in order to accelerate a local industry*; *To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW is included in the IRP;* *The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) is maintained; and*

Energy efficiency demand-side management (EEDSM) measures are maintained at the level of the RBS" (RSA, 2011a:6).

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

The IRP highlights the commitments before the next IRP. The commitments pertaining to the purpose of the proposed project in renewable energy is:

"*Solar PV programme 2012-2015: In order to facilitate the connection of the first solar PV units to the grid in 2012 a firm commitment to this capacity is necessary. Furthermore, to provide the security of investment to ramp up a sustainable local industry cluster, the first four years from 2012 to 2015 require firm commitment."*

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

In conclusion the IRP recommends that an accelerated roll-out in renewable energy options should be allowed with regards to the benefits of the localization in renewable energy technologies (RSA, 2011a). It is however important to take note that since the release of the IRP in 2011 there has been a number of developments in the energy sector of South Africa. Therefore, the IRP has been updated and were open for comments until March of 2017. The new IRP of 2019 was formally published in October 2019. The draft IRP of 2018 was open for comments until the end of October 2018. For the revision scenario analysis were conducted and the results thereof are included in the draft IRP of 2018. The results revealed that for the period ending 2030 that: *"The committed Renewable Energy Independent Power Producers Programme, including the 27 signed projects and Eskom capacity rollout ending with the last unit of Kusile in 2022, will provide more than sufficient capacity to cover the projected demand and decommissioning of plants up to approximately 2025"; "Imposing annual build limits on renewable energy will not affect the total*

			cumulative capacity and the energy mix for the period up to 2030"; and *"the scenario without renewable energy annual build limits provides the least-cost option by 2030*" (RSA, 2018:34). Lastly, the draft IRP of 2018 also included the scenario analysis for the period post 2030. Here it was observed that: "*Imposing annual build limits on renewable energy will restrict the cumulative renewable installed capacity and the energy mix for this period; adopting no annual build limits on renewables or imposing a more stringent strategy to reduce greenhouse gas emissions implies that no new coal power plants will be built in the future unless affordable cleaner forms of coal-to-power are available; and the scenario without renewable energy annual build limits provides the least-cost option by 2050*" (RSA, 2018:34–35). In the final IRP of 2019 key considerations were taken into consideration together with required actions to be taken for the IRP of 2019 to be credible. In terms of renewable energy technologies like solar and wind, the IRP stated that *"The application of renewable build limits 'smoothes out' the capacity allocations for wind and solar PV which provides a constant pipeline of projects to investment; this addresses investor confidence*". The decision stated against this key consideration is to *"retain the current annual build limits on renewables (wind and PV) pending the finalization of a just transition plan"* (RSA, 2019:46). Hereby the IRP also recognises renewable technologies' potential to diversify the electricity mix, create new industries and job opportunities and localize across the value chain (RSA, 2019:13). The Nyarhi 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 need 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 Nyarhi Solar Power Plant will contribute to the intervention strategy as identified within the plan.
National Infrastructure Plan of South Africa	Presidential Infrastructure Coordinating Commission	2012	In the year 2012 the South African Government adopted a National Infrastructure Plan (hereafter referred to as the Plan). The aim of this Plan is to transform the economic landscape, while strengthening the delivery of basic services and creating new employment opportunities. This Plan also supports the integration of African communities, and also sets out the challenges and enablers that our country needs in order to respond to the planning and development of infrastructure with regards to fostering economic growth (RSA, 2012). The Plan has developed eighteen (18) strategic integrated projects (further referred to as SIPs). These SIPs stretches 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 development of the Nyarhi Solar Power Plant is in line with SIP 8 and SIP 9 as it will provide "Green" energy in support of the South African Economy and will generate electricity which supports socio-economic development. The proposed power line associated with the Nyarhi Solar Power Plant is in line with SIP 10 as it will facilitate electricity transmission and distribution for all.
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 area identified within the framework, the Nyarhi Solar Power Plant is considered to be in-line with the framework.

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

			• Serves as a spatial plan that facilitates local economic development. • Lays down strategies, proposals and guidelines as it relates to sustainable development. • Facilitates cross-boundary co-operation between municipalities, adjoining provinces, and bordering countries. • Serves as a manual for integration and standardisation of the planning frameworks of all spheres of government in the Province. The Free State Provincial Growth and Development Strategy states that sustainable economic development is the only effective means by which the most significant challenge of the Free State, namely poverty, can be addressed is. The PSDF gives practical effect to sustainable development, which is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The PSDF is prepared in accordance with bioregional planning principles that were adapted to suit the site-specific requirements of the Free State. It incorporates and complies with the relevant protocols, conventions, agreements, legislation and policy at all applicable levels of planning, ranging from international to the local level. The PSDF builds upon achievements and learns from mistakes of the past, reacts to the challenges, incorporates the traditional knowledge of the people of the Free State, and builds upon international best-practice and technology. The development of the Nyarhi Solar Power Plant is in-line with the framework based on the contributions and opportunities presented by a development of this nature.
Fezile Dabi District Municipality Reviewed Final Integrated	Fezile Dabi District Municipality	2021 - 2022	The long-term vision of the Fezile Dabi DM is: “Improving the lives of citizens and progressively meeting their basic, social and economic needs, thereby restoring community confidence and trust in government”. The above stated vision defines what Fezile Dabi District Municipality would like to attain over medium to long-term, and for that achievement to effectively materialise, their mission is that: “Fezile Dabi District

Development Plan (IDP)			Municipality will strive to be a more responsive and accountable municipality towards sustainable development". Of the eighteen (18) SIPs that are contained in the National Infrastructure Plan (NIP), there are eight which impact on the Fezile Dabi District and therefore need to be recognised and where appropriate; 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 Nyarhi Solar Power Plant is in line with the plan.
Moqhaka Local Municipality Draft Integrated Development Plan (IDP)	Moqhaka Local Municipality	2020-2021	The vision of the Moqhaka LM is to "…strive to *be a Municipality that creates an enabling environment for socio-economic growth and sustainable development."* The Mission Statement is *"To maintain and enhance quality of life by providing effective, efficient quality and affordable services equitably and facilitating sustainable socio-economic growth through active community participation."* The vision and mission of the municipality have led to the conceptualisation of the following strategic objectives below: • Broaden access and improve quality of municipal services.

- Create an environment that promotes the development of the local economy an facilitates job creation.
- Build united, non-racial, integrated and safer communities.
- Promote a culture of participatory and good governance.
- Improved organisational cohesion and effectiveness.
- Improve overall financial management by developing and implementing appropriate financial managements policies, procedures, and systems.

The development of the Nyarhi Solar Power Plant will contribute to the local economy of the area and therefore assist (albeit to a limited extent) with socio-economic growth and therefore contribute to the strategic objectives of the LM.

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 BA:

- The Equator principles III (2013)[3]
- 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
- DEAT, (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

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

- 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 Basic Assessment 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, national guidelines, the World Bank EHS Guidelines, the IFC Performance Standards, and the Equator Principles.

The legislative and policy context plays an important role in identifying and assessing the potential social impacts associated with the proposed development. For this reason, the proposed development project will be assessed and has been considered 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 Nyarhi 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 generations 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 increase 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 indirectly support the applications of renewables as it will contribute to surety of electricity supply and improving the lives of the community.

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 Nyarhi 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 1. (3) An BAR (...) 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 this results in an annual, per capita carbon emission of ~8.9 tons per person. Based on 2008 fossil-fuel CO_2 emissions statistics released by the Carbon Dioxide Information Analysis Centre, South Africa is the 13th largest carbon dioxide emitting country in the world and the largest emitter in Africa (Boden, et al. 2011). In August 2021 article confirmed that South Africa is the 12th highest greenhouse gas emitter in the world (source: https://www.news24.com/fin24/economy/eskom-will-only-able-to-meet-global-air-quality-standards-by-2050-owing-to-financial-woes-20210818).

The proposed project is intended to form part of the Department of Mineral Resources and Energy's (DMREs) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or any other appropriate energy generation programmes / opportunities. The REIPPP Programme aims to secure 14 725 Megawatts (MW) of new generation capacity from renewable energy sources, while simultaneously diversifying South Africa's electricity mix. According to the 2021 State of the Nation Address, Government will soon be initiating the procurement of an additional 11 800 MW of power from renewable energy, natural gas, battery storage and coal in line with the Integrated Resource Plan 2019 and fulfilling their commitments under the United Nations Framework Convention on Climate Change and its Paris Agreement which include the reduction of greenhouse gas emissions. Eskom, the largest greenhouse gas emitter of South Africa, has committed in principle to net zero emission by 2050 and to increase its renewable capacity. During the 2022 State of the Nation Address it was indicated that during the past year the government had taken "firm steps" to bring additional generation capacity online as quickly as possible to close the shortfall in terms of electricity. As a result it was confirmed that several new generation projects will be coming online over the next few years.

Besides capacity additions, several assumptions have changed since the promulgation of the IRP 2010–2030. Key assumptions that changed include the electricity demand projection, Eskom's existing plant performance, as well as new technology costs. These changes

necessitated the review and update of the IRP which resulted in the draft IRP 2018 as per table 4.1 below:

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

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

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

According to the South African Energy Sector Overview (2021), there is currently 1 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.
- Lower costs of alternative energy - An increase in the number of solar facilities commissioned will eventually reduce the cost of the power generated through solar facilities. This will contribute to the country's objective of utilising more renewable energy and less fossil fuel-based power sources. It will assist in achieving the goal to generate 14 725 MW of electricity from renewable energy as per the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme of the Department of Mineral Resources and Energy. The Government will be initiating the procurement of an additional 11 800 MW of renewable energy as stated during the 2021 State of the Nation Address.
- Reduction in greenhouse gas emissions - The additional power supplied through solar energy will reduce the reliance on the combustion of fossil fuels to produce power. The South African electricity grid is predominantly coal-fired and therefore Greenhouse Gas (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 makes a contribution 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 885 employment opportunities will be created during the construction and 15 - 70 operational phases.
- Indirect socio-economic benefits - The increase in the demand for services such as accommodation, transportation, security, general maintenance and catering will generate additional indirect socio-economic benefits for the local community members.
- Effective use of resources - Because of predominantly the climate and soil limitations (shallow soils), the site has limited suitability for cultivated crops, and viable agricultural land use is limited to grazing only, with limited areas under pivot irrigation. 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 farming enterprise with increased cash flow and rural livelihood, and thereby improve the financial sustainability of agricultural activities by the landowner.
- Location of the activity within a REDZ - The Renewable Energy Development Zones (REDZ) have a key role to play in the South Africa's just energy transition. The REDZ create priority areas for investment in the electricity grid. Since the site is located within a REDZ it contributes to the desirability of the project.
- Cumulative impacts of low to medium significance – No cumulative impacts with a high residual risk have been identified. In terms of the desirability of the development of sources of renewable energy therefore, it may be preferable to incur a higher cumulative loss in such a region as this one, than to lose land with a higher environmental value elsewhere in the country.

5 DESCRIPTION OF ENVIRONMENTAL ISSUES

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

Appendix 1. (3) A BAR (...) must include-

(g) A motivation for the preferred site, activity and technology alternative;

(h) a full description of the process followed to reach the proposed preferred alternative, within the site, including –

(i) details of all the 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 alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

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

(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 DFFE 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 E) was conducted by the developer on Portion 1 of the Farm Die Hoek No. 114, Portion 1 of the farm Doornkom oost No. 447 and farm Doornplaats No. 559 and the project site was found to be favourable due to its proximity to grid connections, environmental conditions, relatively flat terrain, high solar radiation values and adequate site access. Some areas of the farm have been deemed less suitable for the proposed development such as areas under crop production through the implementation of pivot irrigation. These factors were taken into consideration and avoided as far as possible. The site selection also took the site geology, terrain, conservation planning, land capability,

grazing capability, water availability and land use into consideration before deciding the specific site (Subsolar, 2022).

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

5.1.1 No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. 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 land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for grazing for cattle (refer to the photographs of the site). It must be noted that the areas under pivot irrigation have been excluded from the development footprint and will therefore continue to be used for crop production. However, it should be noted that the area surrounding the proposed project is already impacted by gold and dolomite mining activities, as well as agricultural activities. The site has limited agricultural potential due to climatic limitation and the soils which are unsuitable for crop production due to the shallow depth (see Agriculture Compliance Statement in Appendix D4). 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 project. No other properties have at this stage been secured by Nyarhi Solar Power Plant (RF) (Pty) Ltd in the Orkney/ Viljoenskroon area to potentially establish the solar energy facility. From a local perspective, Portion 1 of the Farm Die Hoek No. 114, Portion 1 of the farm Doornkom-oost No. 447 and farm Doornplaats No. 559, is preferred due to its suitable climatic conditions, topography (i.e. in terms of gradient), environmental conditions (i.e. agricultural potential, ecological sensitivity), proximity to a feasible 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).

The proposed development falls within an area used for grazing, and avoids areas under crop production through pivot irrigation. The site is considered to have limited environmental sensitivity as a result.

Over the three affected properties an area of 290 hectares have been assessed and a preferred development footprint of 246 ha have been identified within this larger area.

No alternative areas for the development footprint within the three affected properties have been considered for the placement of infrastructure based on feedback from the landowner and the current land use areas (i.e. productive areas under pivot irrigation). Therefore, there is a single preferred location alternative that will be assessed – refer to Figure 5.1 below.

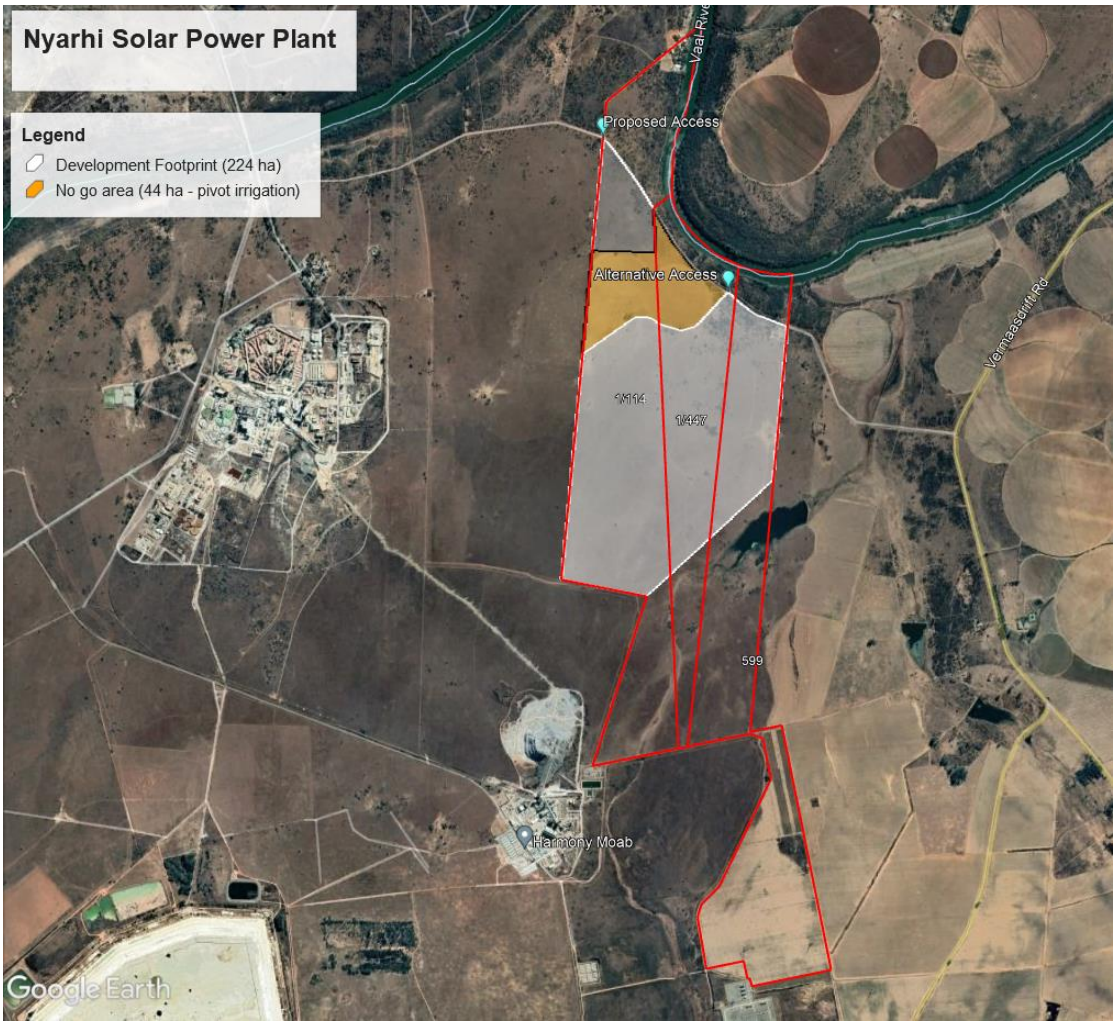


Figure 5.1: Location of the preferred alternative for the Nyarhi Solar Power Plant development footprint

5.1.3 Activity alternatives

The BA 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** – Nyarhi Solar Power Plant (RF) (Pty) Ltd is part of a portfolio of solar PV projects throughout South Africa. Nyarhi 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 the Orkney / Viljoenskroon area – refer to Figure 5.2. The technology furthermore entails low visual impacts, have relatively low water requirements, is a simple and reliable type of technology and all the components can be recycled.

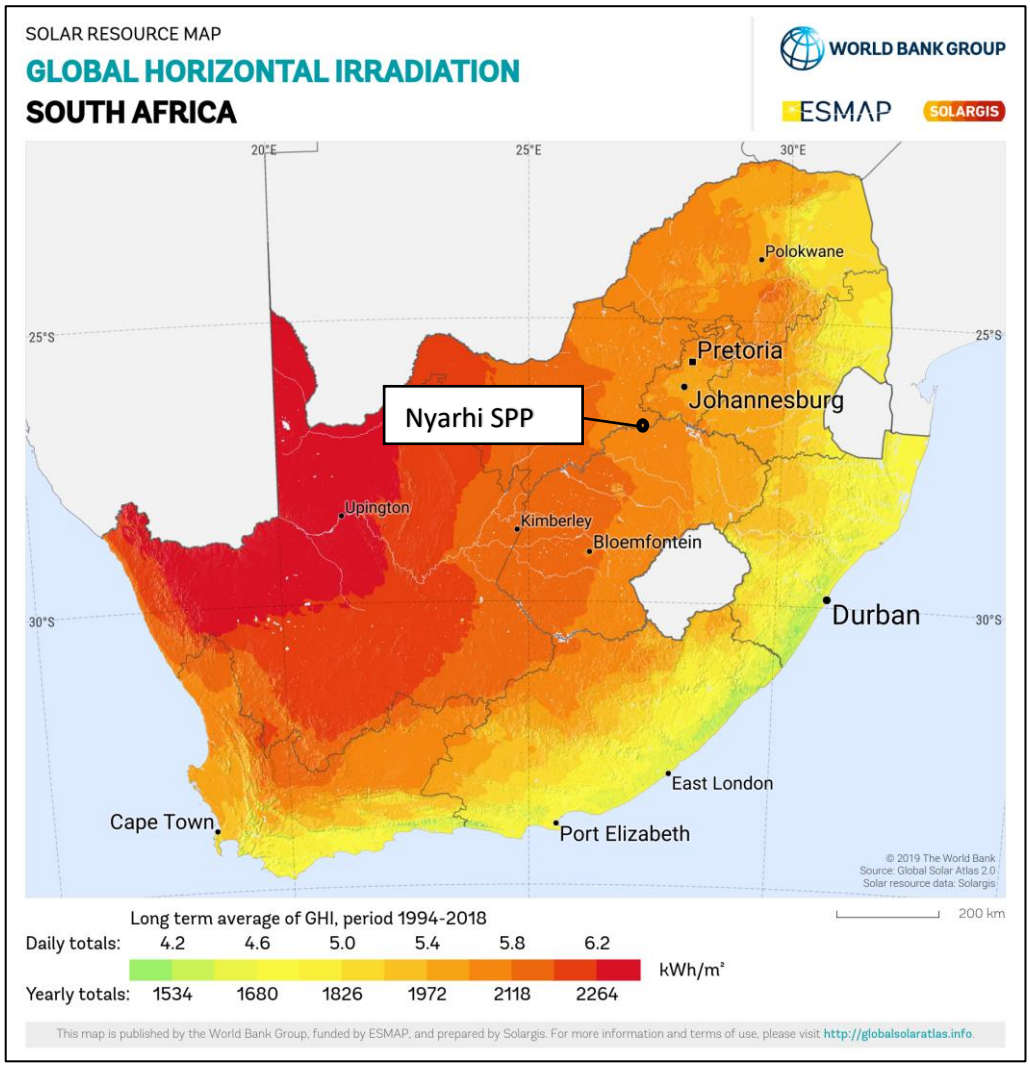


Figure 5.2: Global horizontal irradiation values for South Africa (SolarGIS, 2021) and the location of the Nyarhi Solar Power Plant

- **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. 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. While the irradiation values are high enough to generate sufficient solar power, the water constraints render this alternative not feasible. 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 BA process.

5.1.4.1 Distribution lines

It is expected that the facility will tie in with the Mercury-South Vaal 132kV Power Line or the South Vaal-Carrdell 132kV Power Line via a loop-in loop-out connection or through a direct connection into the Vaal Reefs Eleven 132/66 kV substation.

Two grid connection corridor alternatives, each with a width of between 100m and 250m, have been identified for the assessment and placement of the power line (i.e., the power line will be developed within one of the two proposed corridors).

The grid connection corridor located directly to the south of the SPP site is Option 1. This corridor will connect the SPP into the existing Vaal Reefs Eleven Substation. The length of this option is ~2.4km.

The grid connection corridor located to south-west of the SPP site (referred to as Option 2) will connect the SPP into either the existing Mercury-South Vaal 132kV (maximum length of power line: 1,22km) or the South Vaal-Carrdell 132kV (maximum length of power line:1,18km) via a loop-in loop-out connection. This is the preferred alternative from a development and technical perspective based on feedback received by the developer from Eskom. Refer to Figure 5.3.

5.1.4.2 Access Points

Two access point options are proposed along the northern boundary of the development footprint. These two options are considered to both be required for the development as the development footprint has been split into two sections to avoid the areas under pivot irrigation. Therefore, these access point options are not in essence considered as alternatives but rather two access points required for the development to ensure that access is available to the two sections which make up the development footprint as a whole. Refer to Figure 5.3.

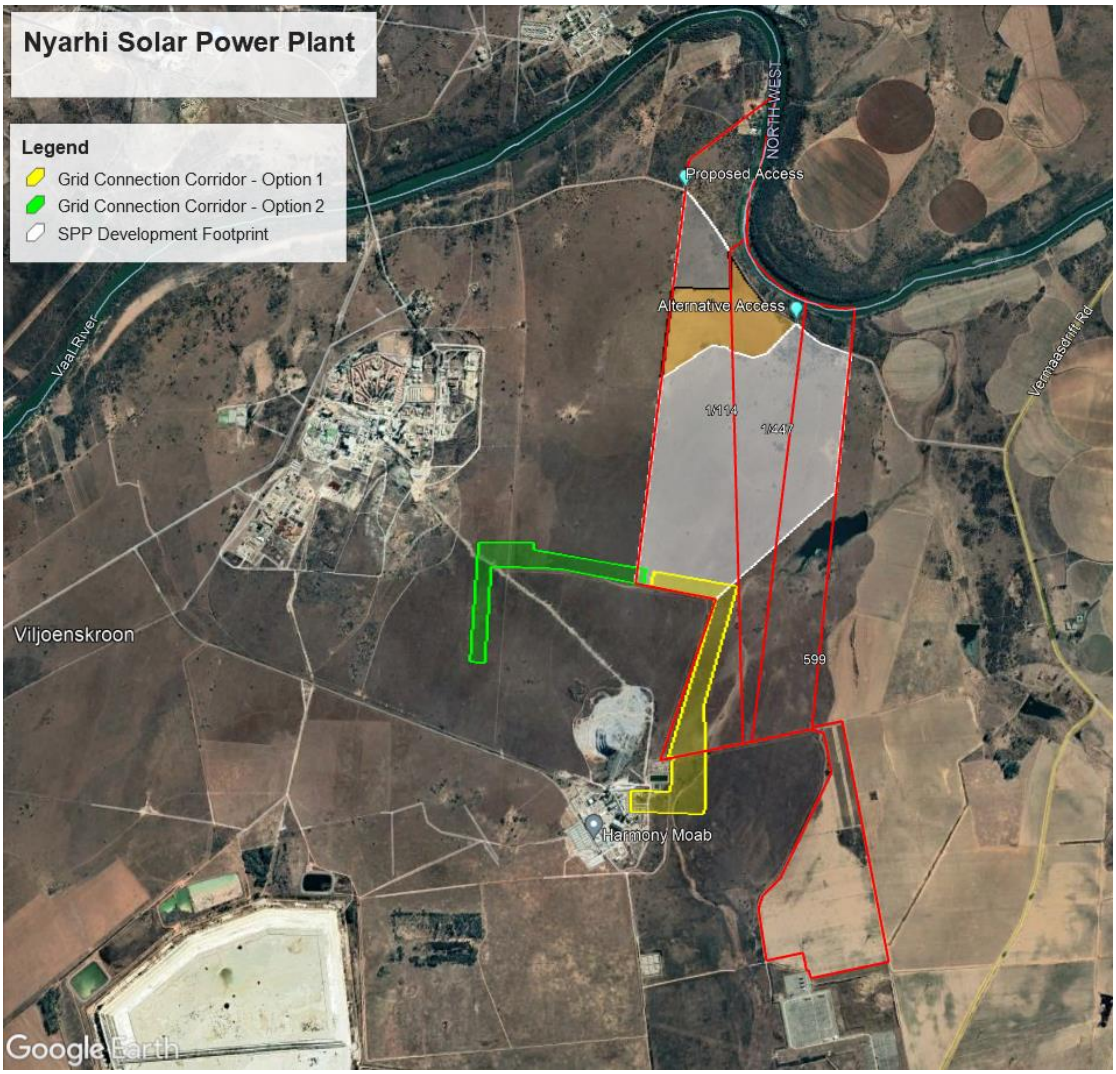


Figure 5.3: Two grid connection corridors are being considered to connect the Nyarhi Solar Power Plant to the grid via various grid connection points.

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

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

  The overall weather conditions in the Free State Province are unlikely to cause damage and faults on the proposed overhead transmission 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 the line can usually be put back into service within a few days. In terms of potential impacts caused by overhead transmission lines include visual intrusion and threats to sensitive habitat (where applicable).

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

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

The following alternatives may be considered for the overhead 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, which includes 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 because of 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.

5.1.4.3 Battery Energy Storage Facility (BESS)

It is proposed that a Battery Energy Storage Facility for grid storage would be housed in stacked containers, or 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 baseload 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. The layout plan is included in Appendix H and Figures H and I.

The layout follows the limitations of the site and aspects such as environmental sensitive areas (supported by specialist input), roads, areas under crop production through pivot irrigation, fencing and servitudes are considered. The total surface area proposed for layout options include the PV panel arrays spaced to avoid shadowing, access and maintenance roads and associated infrastructure (buildings, power inverters, power lines and substations, 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. The choice of pylon structure does not significantly affect the environmental impacts of the proposed development as provision has already been made for the visual, ecological, avifaunal and paleontological 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 power line must be constructed according to the authorised standards for a power line approved by Eskom Holdings SoC Ltd. The structure to be utilised

for the power line towers will also be informed by the local geotechnical and topographical conditions. The following alternatives are considered with regards to the proposed structures:

Steel lattice towers:

The steel lattice towers provide the following advantages over the other tower types available:

- Enables multipath earthing which enhances the overall electrical performance of the 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.

Steel monopoles:

The steel monopole is considered less suitable than the steel lattice towers for the following reasons:

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

Wood poles:

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

5.1.6 Technology alternatives

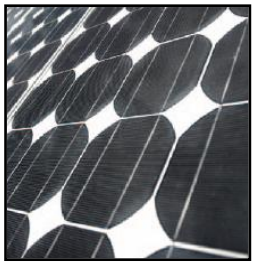
Technology alternatives for the development of a solar PV facility needs to be considered during the BA process.

5.1.6.1 Photovoltaic solar panels

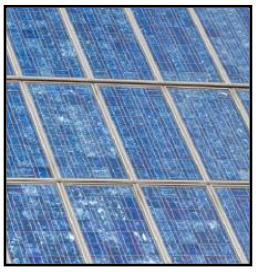
There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon, thin film or bifacial PV panels. These technologies are discussed in more detail below:

- **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.



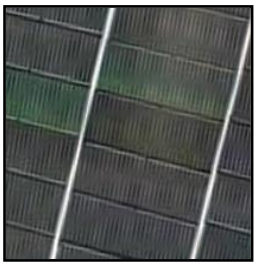
- ***Poly-crystalline Silicon*** – poly-crystalline panels use solar cells that are cut from multifaceted silicon crystals. They are less uniform in appearance than mono-crystalline cells, resembling pieces of shattered glass. These are the most common solar panels on the market, being less expensive 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, 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 more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability. However, due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

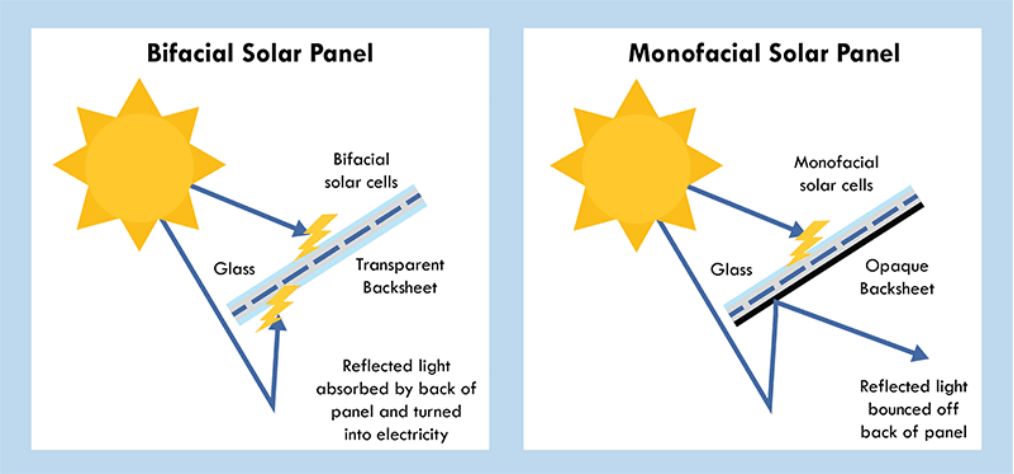


Figure 5.4: Bifacial vs Monofacial Solar Panel absorption

5.2 PUBLIC PARTICIPATION PROCESS

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

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 (i.e. used for grazing and crop production) 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:

- 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 (Klerksdorp Rekord) on the 04 March 2022 (see Appendix C1) notifying the public of the BA 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 from the placement of the advertisement.

- Site notices

  Site notices were placed on site in English and Afrikaans 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 C2.

- Direct notification of identified I&APs

  Identified and registered I&APs, including key stakeholders representing various sectors, were directly informed of the Basic Assessment process via telephone calls, WhatsApps and emails (as appropriate). See Appendix C3 to this report.

- Direct notification of surrounding landowners and occupiers

  Written notices were provided via WhatsApp or email to all surrounding landowners and occupiers – refer to Figure 5.5. The surrounding landowners were given the opportunity to raise comments within 30 days. For a list of surrounding landowners see Appendix C3.

- Circulation of Draft Basic Assessment Report

  The registered I&APs were notified of the availability of the draft BAR at the commencement of the 30-day review and comment period. This included the details of where the report can be accessed. They were requested to provide their comments on the report within 30 days (20 April 2022 – 23 May 2022). All issues that are identified, raised and recorded will be documented and compiled into a Comments and Responses Report (Appendix C6) and included as part of the Final Basic Assessment Report.

- 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. 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.

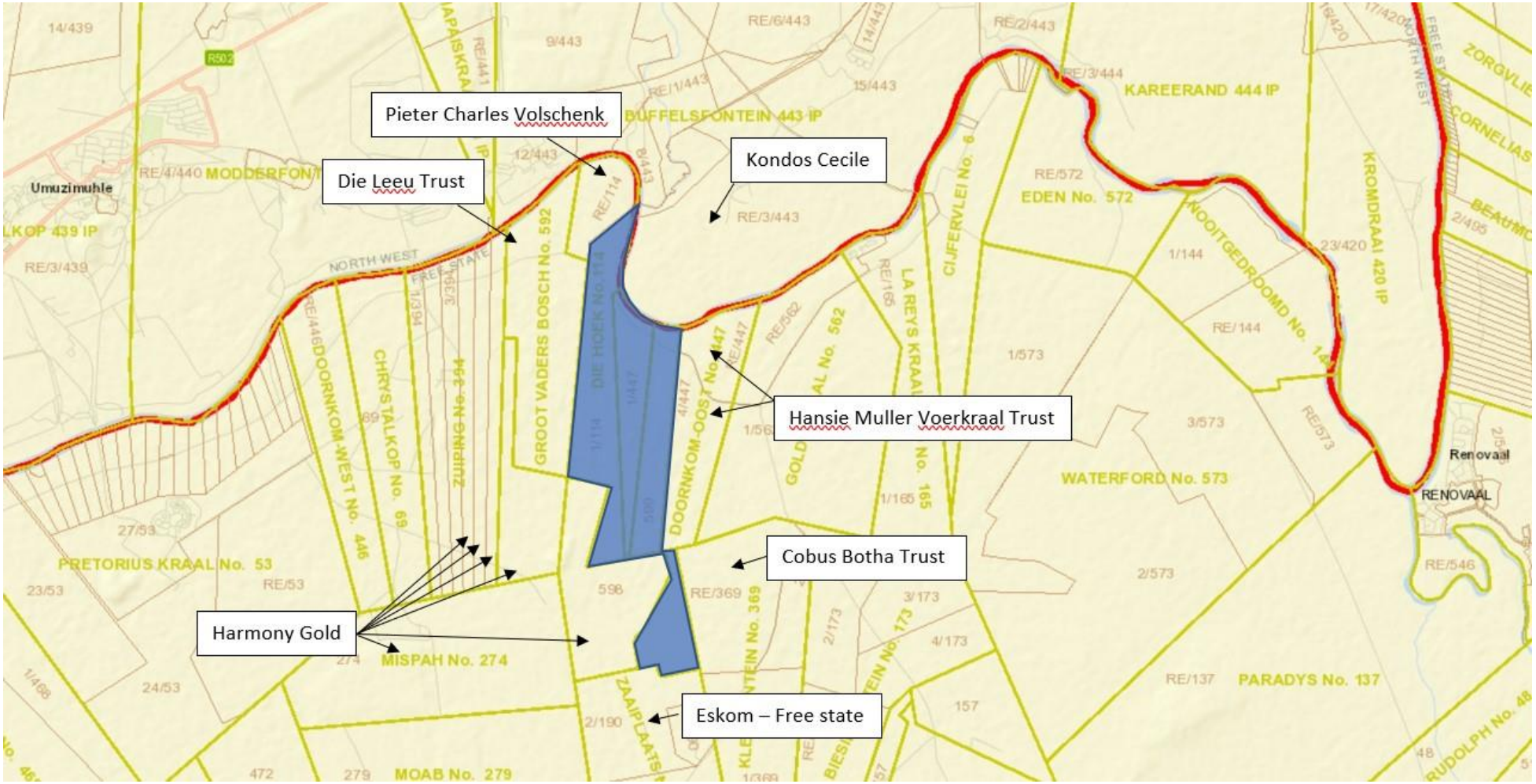


Figure 5.5: Surrounding Landowners

5.2.2 Consultation process

Regulation 41 requires that the landowner, surrounding landowners, municipality, relevant ward councillor, any organ of state having jurisdiction in respect of any aspect of the activity and any other party as required by the competent authority 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 C.

5.2.3 Registered I&APs

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

This report is the Draft Basic Assessment Report which has been made available to all potential and/or registered I&APs and State Departments. They have been provided with a copy of the Draft BAR and have been requested to provide written comments on the report within 30 days. All issues identified during this review period will be documented and compiled into a Comments and Response Report to be included as part of the Final BAR (Appendix C6).

All comments received prior to the release of the Draft BAR for the 30-day review and comment period have been included in this report as Appendix C5 and Appendix C6 to provide I&APs an opportunity to confirm that their comments raised during the initial public participation phase have been included and considered.

5.2.4 Issues raised by I&APs and consultation bodies

To date comments have been received from some consultation bodies, including the interim comment from SAHRA, and is summarised in the Comments and Response Report included in Appendix C6. Any comments received during the circulation of the Draft BAR will be summarised in the Final BAR. The full wording and original correspondence are included in Appendix C5 and Appendix C6.

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 location 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 pivot irrigation, limited sensitive areas from ab ecological or conservation point have been identified. These include the close proximity of the project to the Vaal River, wetland zones / fauna corridors associated with grid connection option 1 and areas of medium-high sensitivity which includes grasslands with perched water table conditions and sensitive fauna habitat.

5.3.1.1 Geology, soils and agricultural potential

According to the Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1) the soils associated with the site vary between very shallow and rocky on the plains and outcrops, to dark clayey soils in the low-lying plans and bottomlands. The landtype present within the site is Fa13, which consists of Glenrosa and / or Mispah soil forms (other soils may occur), lime rare or absent in the entire landscape. In terms of geology, the proposed development is underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani (Chuniespoort Group, Transvaal Supergroup)

According to the Agriculture Compliance Statement (attached in Appendix D4) the site is on slightly hilly terrain caused by rocky ridges of the underlying geology which is dolomite and chert belonging to the Chuniespoort Group. The site is covered by a single land type, namely Fa13 (as mentioned above). This land type is dominated by shallow soils on underlying rock, mostly of the Glenrosa and Mispah soil forms. Rock outcrops cover 10% of the surface area of the land type. A small proportion of the land type are deeper soils that occur in patches, for example the centre pivot area that has been excluded from the development footprint. The field investigation confirmed the dominance of shallow, rocky soils across the entire site.

Although the climate is suitable for crop production the limiting factor is the soils which are completely unsuitable for crop production because of their shallow depth. There is almost no crop production on the land type on which the site is located because of this. The proposed PV site is used only for grazing of cattle. The long term grazing capacity of the site is 7 hectares per large stock unit. Mining occurs in the surrounding area.

The sensitivity of the site, as identified by the DFFE Screening Report (Appendix B), is disputed by the Agricultural Compliance Statement. The motivation for disputing the sensitivity is that, while the climate and terrain is suitable for crop production, the soils are limiting. The site comprises shallow soils on underlying rock and rock outcrops also occur. The patch of deeper

soil that occurs in the area has been used for centre pivot irrigation and is therefore excluded from the site. A land capability of 9, which should indicate suitability for viable crop production, is definitely not justified for these soils on the site, and the land capability is assessed as being 6, because of the soil limitations. This translates to medium agricultural sensitivity.

This site sensitivity verification verifies the entire site as being of less than high agricultural sensitivity, with a land capability value of 6. The land capability value is in keeping with the climate (rainfall of 565 mm per annum) and dominance of shallow soils, that makes the site unsuitable for crop production.

5.3.1.2 Vegetation and, topography and landscape features

The site is located within the Middle Vaal Water Management Area (WMA) and entirely within the Highveld ecoregion. The topography of the general area is characterised by slightly undulating plains with wetlands and / or drainage channels bisecting the broader 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 1300 and 1320 meters above mean sea level (AMSL).

Most properties situated within a 500m radius of the proposed project are being used for livestock and crop cultivation. The proposed development land is used for livestock farming and crop cultivation at present. The natural vegetation of the site is mostly intact. Furthermore, the site is surrounded by agricultural areas in the east, mining areas in the south and west and the Vaal River in the north thus little connectivity with natural areas.

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 a woodland and the other a grassland (Figure 5.6).

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 Vaal Reefs Dolomite Sinkhole Woodland occurs on a slightly undulating landscape that is dissected by prominent rocky chert ridges. The vegetation is a grassland-woodland complex of which the woodland is the most typical feature. This woodland occurs naturally in clumps around sinkholes, especially in places of dolomite outcrops. The vegetation type is mapped at to course a scale and requires more clear separation from Carletonville Dolomite Grassland. This remark indicates that, where there is no woodland, the vegetation is a grassland that could be floristically equivalent to Carletonville Dolomite Grassland. The conservation status of the Vaal Reefs Dolomite Sinkhole Woodland vegetation unit (Gh 12) is Least Concern and whilst the conservation target is 24%, only a small patch is conserved in the statutory conservation area of the Sterkfontein Caves. Almost a quarter of this vegetation unit is already transformed, mainly by mining, cultivation, urban sprawl and road-building.

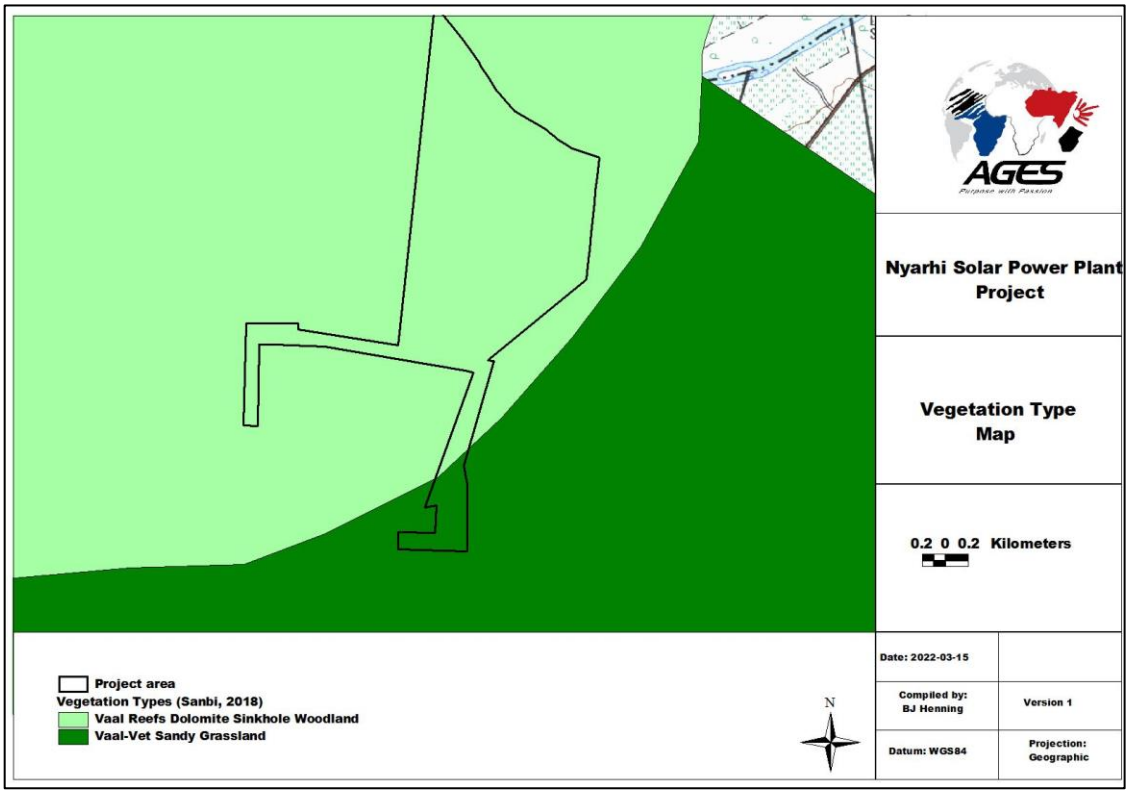


Figure 5.6: Approximate location of the project within the Vaal-Vet Sandy Grassland (Gh10) and the Vaal Reefs Dolomite Sinkhole Woodland (Gh 12) vegetation types

Vegetation Units:

Vegetation units have been identified according to soil characteristics, topography and land-use. Seven distinct vegetation units have been identified through a vegetation survey undertaken, including the grid connection corridors (Figure 5.7 and Table 5.1). The units include:

1) *Eragrostis gummiflua – Tristachya leucothrix* dolomitic grassland
2) *Eragrostis gummiflua – Vachellia karroo* dolomitic grassland with bushclumps
3) *Schizachyrium sanguineum – Elionorus muticus* rocky grassland
4) *Loudetia simplex – Schizachyrium sanguineum* rocky outcrop
5) *Vachellia karroo – Ziziphus mucronata* woodland
6) *Hyparrhenia hirta* grassland
7) Drainage features: Valleybottom wetland

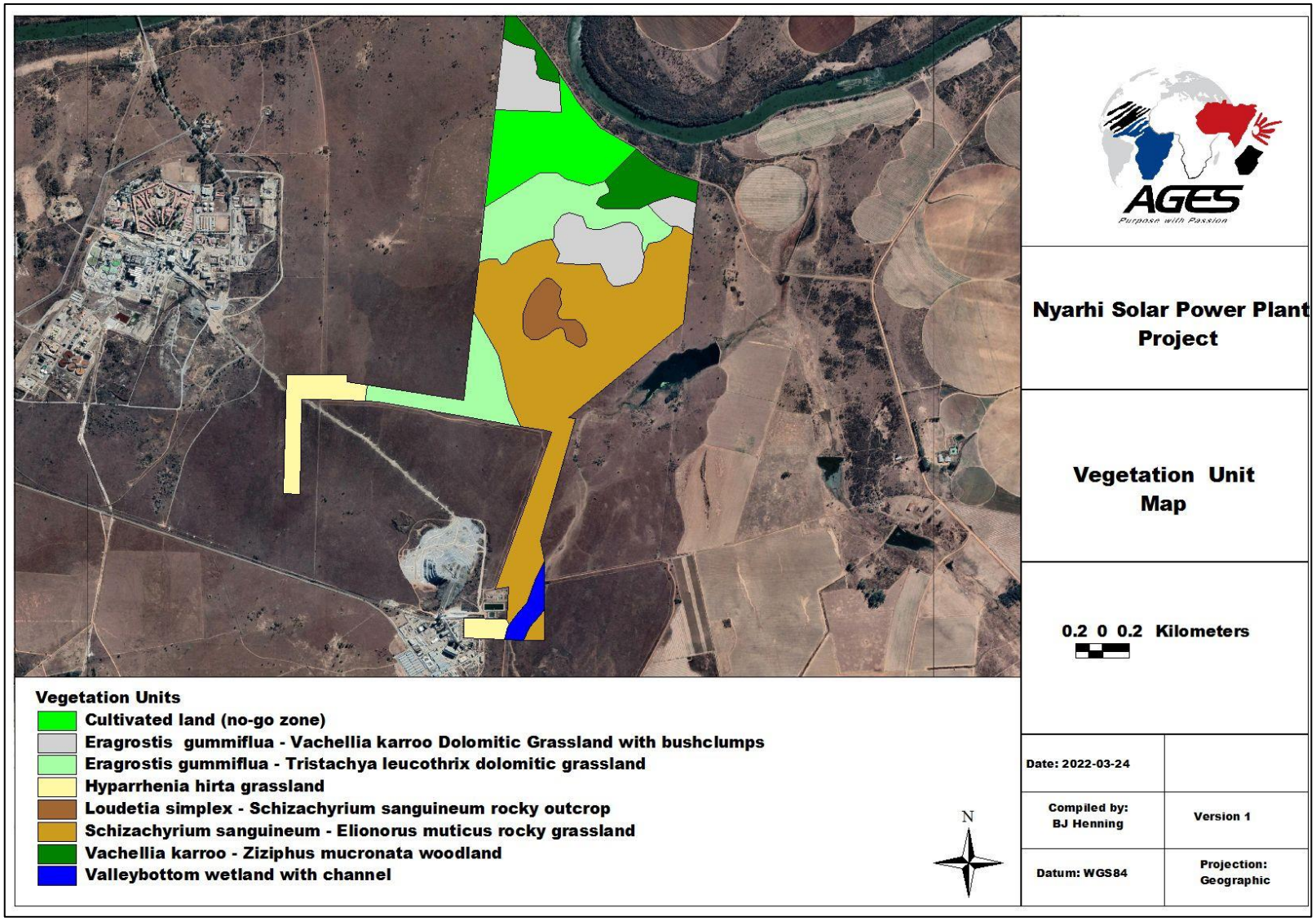


Figure 5.7: Vegetation units present within the Nyarhi Solar Power Plant Site

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

Vegetation Unit	Description	Characteristics	Photograph
Eragrostis gummiflua – Tristachya leucothrix dolomitic grassland	• Occurs in the northern section of the site • Associated with shallow, rocky soils derived from dolomite • Well-developed grass layer • Grasses that dominate: *Eragrostis gummiflua, Trachypogon spicatus, Tristachya leucothrix and etaria incrassatae* and *Themeda triandra.* • Vegetation structure is tall, closed grassland • No red listed or protected species documented. • The development in the area considered suitable subject to strict mitigation • Eradication of protected plant species would need a permit from local authorities.	• State of vegetation: natural, in a slightly degraded state • Need for rehabilitation: Low • Conservation priority: medium-high • Soils & geology: Shallow, rocky soils of the Mispah / Glenrosa soil forms • 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-High • Red data species: none observed • Protected species: *Helichrysum spp*. & *Boophane distichya*	
Eragrostis gummiflua – Vachellia karroo dolomitic grassland with bushclumps	• Typical of the Vaal Reefs Dolomite Sinkhole Woodland vegetation type • Forms patches of dolomitic grassland in between bushclumps dominated by *Vachellia karroo* • Herbaceous layer forms medium tall grassland on gravelly to red-yellow apedal soils of the Hutton or Glenrosa soil forms. • Grasses that dominate: *Eragrostis gummiflua* and *Trachypogon spicatus.* • The development in the area considered suitable subject to strict mitigation. • Eradication of protected plant species would need a permit from local authorities.	• State of vegetation: natural grassland with bushclumps, slightly degraded • Need for rehabilitation: Low • Conservation priority: Medium-High • Soils & geology: Red-yellow apedal sandy soils and gravelly soils derived from Dolomite • Density of woody layer: Trees: 5-10% (avg. height: 3-6m) & Shrubs:1-2% (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-High • Red data species: none observed • Protected species: *Helichrysum spp*. & *Boophane distichya*	

Schizachyrium sanguineum – Elionorus muticus rocky grassland	• Located in a large part of the site • Occurs on undulating terrain within the central and southern sections • Shallow rocky soils derived from chert with rocks covering 20-30% of the area • No trees present with the grasses having the highest cover • Grasses that dominate: *Schizachyrium sanguineum, Themeda triandra, Elionorus muticus* and *Eragrostis lehmanniana.* • Eradication of protected plant species would need a permit from local authorities. • Development of the solar development is considered suitable in this area.	• State of vegetation: natural grassland, slightly degraded state • Need for rehabilitation: Low • Conservation priority: Medium • Soils & geology: Red-yellow apedal sandy soils of the Hutton / Glenrosa soils derived from chert • 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: All *Helichrysum* species & *Boophane distichya*	
Loudetia simplex – Schizachyrium sanguineum rocky outcrop	• Forms part of the rocky outcrop in the central section of the site. • Characterised by slightly to moderately undulating slopes, although the area is not as steep as the typical ridges in the larger area. • Vegetation structure forms typical rocky grassland dominated *Loudetia simplex, Schizachyrium sanguineum, Xerophyta retinervis and Brachiaria serrata*. • No red data species documented. • The area could potentially support red data species and plays an important role for smaller mammals and reptiles • The main factors being classified as a medium-high sensitivity (ridge section) is rockiness, plant species composition, pristine state of the vegetation, microhabitats and potential red data fauna that utilize this area as habitat.	• State of vegetation: pristine state to slightly degraded • Characteristics: Varies from an open woodland to a typical rocky grassland. Medium – large sized rocks on outcrops with some rocky sheets along footslopes. Areas with boulders provide habitat to various woody species and shrubs • Conservation priority: High • 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: 1.2m) & Forbs: <1 (avg. height: 0.5m) • Sensitivity: Medium - High (ridge) • Red data species: None observed, but high potential for occurrence of various species	

	• Unique diversity of plant species occurs • The development in the area considered suitable subject to strict mitigation.	• Protected species: All *Helichrysum* species & *Boophane distichya*	
Vachellia karroo – Ziziphus mucronata woodland	• Occurs on soils that vary from red apedal soils of the Hutton soil form or black clayey soils of the Arcadia soil form. • Dominated by *Vachellia karroo, Vachellia tortilis* and *Ziziphus mucronata*. • Woody structure varies from open woodland to slightly denser woodland with bushclumps. • Grass layer in a slightly degraded state due to previous overgrazing and dominated by *Setaria incrassatae, Themeda triandra* and *Panicum maximum*. • Development of the solar development is considered suitable in this area.	• State of vegetation: Microphyllous woodland, slightly degraded state • Need for rehabilitation: Low • Conservation priority: Medium • Soils & geology: Red-yellow loamy soils or black clayey soils • Density of woody layer: Trees: 10% (avg. height: 3-6m) & Shrubs:5-10% (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	
Hyparrhenia hirta grassland	• Occurs in the grid connection corridor option 2. • Dominated by grasses and dwarf shrubs that has the highest cover. • Soil is red loam with few rocks present. • Dominated by the grasses *Hyparrhenia hirta, Eragrostis curvula* and the shrublet *Elephantorrhiza elephantina*. • Other species present include the grasses *Elionurus muticus*, *Pogonarthria squarrosa* and the forbs *Chamaesyce inaequilatera, Nemesia fruticans* and *Thesium utile*. • Vegetation probably overgrazed that caused soil to become eroded. • Grass layer is in a secondary state of succession at present. • Development of the solar development is considered suitable in this area.	• State of vegetation: Secondary grassland in degraded state • Need for rehabilitation: Low • Conservation priority: Medium-Low • Soils & geology: Red-yellow apedal sandy 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: None observed	

Drainage features: Valleybottom wetland with channel	• A channelled valley-bottom wetland bisects grid connection corridor option 1. • Vegetation comprises atypical (azonal) vegetation. • Soils are clayey with high water retention abilities. • Vegetation structure varies from the actual channels being closed grassland in certain areas, to a muddy riverbed with alluvial sand and reeds along the riverbanks. • Drainage channel that forms part of the channelled valley bottom wetland is mostly perennial. • Most abundant and most conspicuous plant species is hygrophilous grasses such as *Andropogon eucomis, Hyparrhenia tamba, Eragrostis gummiflua* and *Setaria sphacelata*. • Other plants are *Juncus effusus*, *Schoenoplectus corymbosus*, *Verbena bonariensis*, *Persicaria serrulata* and *Typha capensis*. • Provide a distribution route for weeds and invading trees. • Weeds recorded include *Xanthium strumarium* (Large cocklebur), *Datura stramonium, Tagetes minuta* and *Bidens bipinnata*. • No alteration of these important drainage areas must be undertaken. A 32-meter buffer should 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 within 500 meter 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 Mispha Game Farm, listed as a Nature Reserve, is located ~1.3km south of the site. Refer to Figure 5.8.

However, when consider the location of the Game Farm, it is clear that it is located on a mining area of Harmony Gold, which include mining infrastructure and tailing dams. It is therefore not certain whether the information indicated by the database is correct.

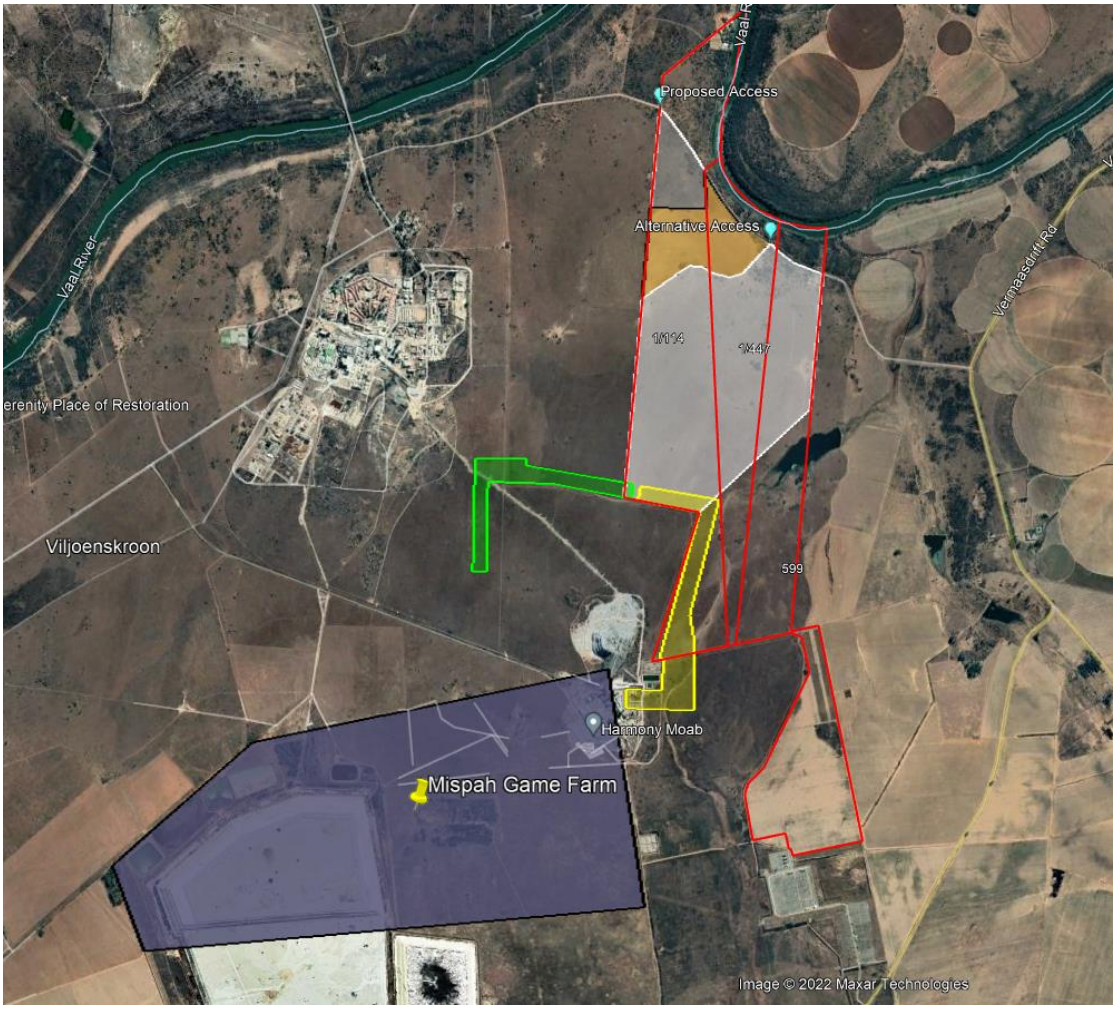


Figure 5.8: Nyarhi Solar Power Plant in relation to the Mispah Game Farm Protected Area, as listed in SAPAD.

The Free State Biodiversity Conservation Plan has been considered for the identification of the relevant Critical Biodiversity Areas associated with the proposed development. Most of the proposed development footprint is located within ESA1 and ESA2 areas although most of these areas represent dolomitic grassland. The management objective for this area is to maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern. Small sections represent CBA1 area, although the site is more representative of ESAs. Refer to Figure 5.9.

Figure 5.9: Critical Biodiversity Map for the Nyarhi Solar Power Plant

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, Boophane disticha and *Helichrysum nudifolium* was confirmed as present for the site. No eradication of these species should be allowed without a permit.

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

5.3.1.3 Watercourse Assessment

According to the Wetland/Riparian Impact Assessment (Appendix D1) two wetland types were identified namely a valleybottom wetland with channel and an exorheic depression (man-made dam). The floodplain river (Vaal River) 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 (Present Ecological State) assessment which indicates that the riparian zones, wetlands and water courses are 'Moderately Modified'. Refer to Figure 5.10.

The EIS (Ecological Importance and Sensitivity) 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.

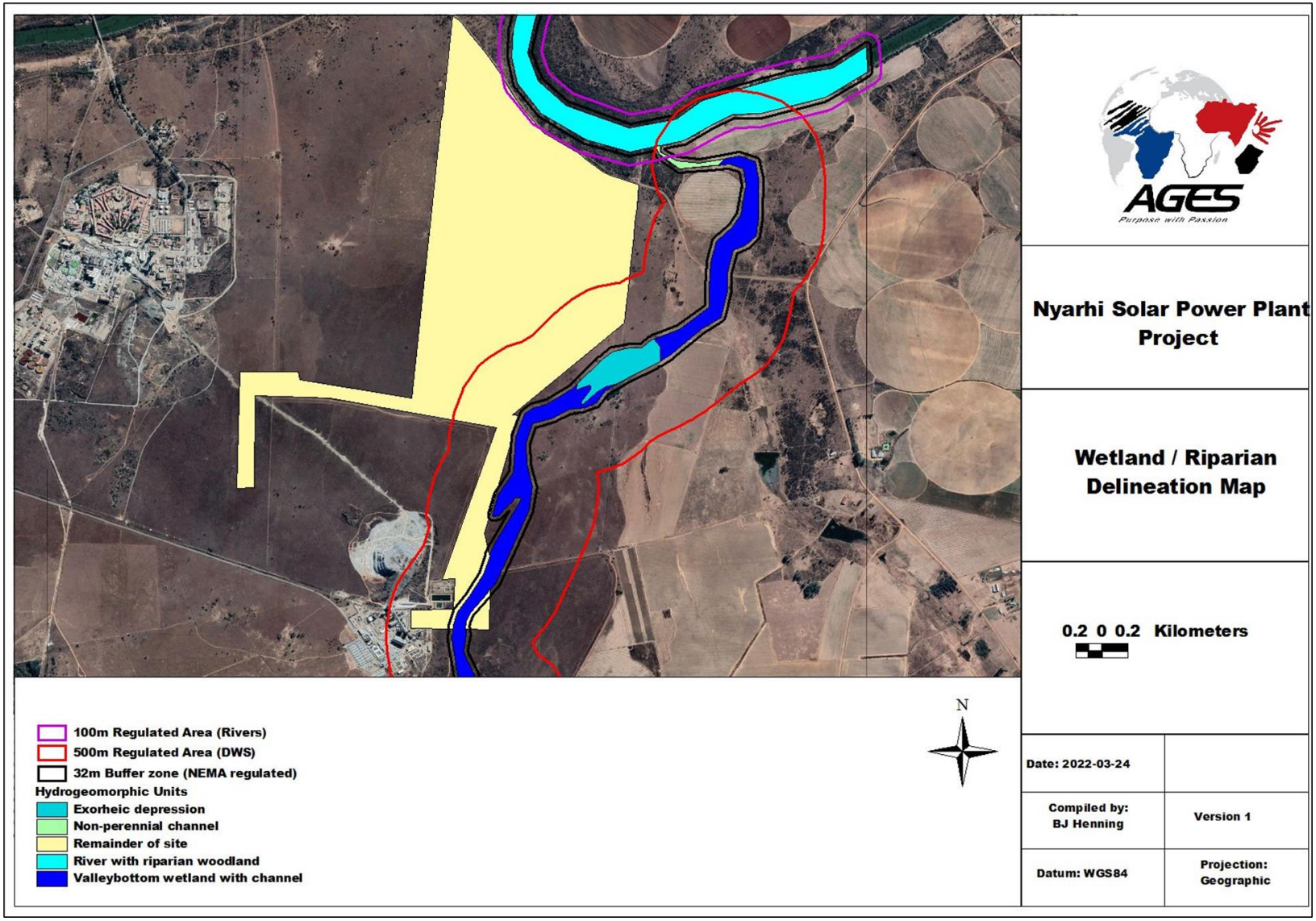


Figure 5.10: Riparian / wetland delineation map of the Nyarhi Solar Power Plant

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 5.11 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 vegetation structure of the valley bottom wetlands varies from the actual channels being closed grassland in certain areas, to a muddy riverbed with alluvial sand and reeds along the riverbanks. The drainage channels that formm part of the channelled valley bottom wetlands is mostly perennial. 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 5.11: Valleybottom wetland with channel present in the project area

Depressions

The depression can be classified as a man-made dam that forms part of the valleybottom wetlands and is classified as exorheic depressions with channelled inflow. 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.

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 s in the project area on a muddy substrate.

River channels and floodplains

The Vaal River located to the north of the project is depicted in Figure 5.12 below.

All rivers and streams with their associated riparian vegetation in the area are ecologically sensitive, forming important, limited and specialised habitats for several plant and fauna species. The species composition is unique and relatively limited in distribution and coverage. These habitats also form linear corridors linking different open spaces. The drainage channel of the project area eventually flows into the Vaal River that occurs to the north of the project. 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 vegetation is very important for connectivity with adjacent vegetation as well as a migratory route for riparian animals.

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 Vaal River can be described as a perennial 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, together with grass species such as *Sporobolus africanus* and *Eragrostis rotifer*.

Figure 5.12: Vaal River located to the north of the Nyarhi Solar Power Plant Development footprint

5.3.1.4 Climate

A summary diagram of the climate encountered within the Vaal Reefs Dolomite Sinkhole Woodland (which dominates the proposed development site) is shown in Figure 5.13 below. The climate is strongly seasonal and semi-arid, with an average rainfall volume of 565 mm/annum, falling between October and May. The summers are hot and wet, with summer temperatures ranging typically between 14-30°C. The winters are cold and dry, with wintertime temperatures ranging typically between -1 to 19°C. An average of 34 frost days occur each winter. The soils are perpetually moisture stressed, with mean annual evaporation of 2,407 mm, resulting in 78% of days where the soils lose more moisture than they receive from precipitation.

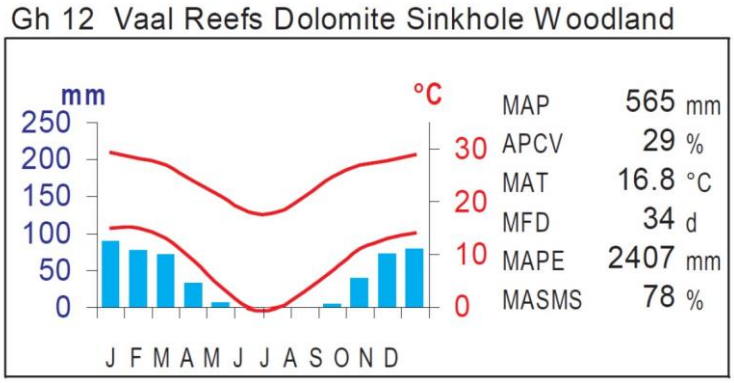


Figure 5.13: Climate diagram representative of the Nyarhi Solar Power Plant (Mucina & Rutherford, 2007)

5.3.1.5 Biodiversity

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

Avifaunal

According to the Avifaunal Impact Assessment (Appendix D2) the proposed Nyarhi Solar Power Plant is situated in an area of moderate avifaunal diversity, however, it is near (closest point ~90 m) to an important flyway (the Vaal River) and, therefore, has the potential to impact many large, fast-flying and otherwise powerline-sensitive species. The resident avifauna is also represented by relatively moderate species richness and abundance, with higher species richness and abundance nearer the Vaal River and low numbers on the remainder of the farm. A good baseline dataset was generated during the site surveys, supplemented by a comprehensive SABAP2 dataset.

The typical species occurring on the site are common across the western highveld, with moderate representation from the widespread larks, pipits, cisticolas, widowbirds, and bishops in particular. Aerial feeding bee-eaters, swallows and swifts were also well represented. Most expected palearctic migrants had already departed from the site, as had many intra-African migrants. Raptors were very 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 must be 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 has been seen within a 15 km radius and, therefore, has reasonable likelihood of occasionally occurring on site.
- Lanner Falcon- Vulnerable. Not recorded in the pentads or during the site visit, however suitable habitat exists, and it should be expected to have a reasonable likelihood of occasionally occurring on site.
- Red-footed Falcon- Near Threatened. Not recorded in the pentads or during the site visit but has been seen within a 15 km radius and, therefore, has 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 during the site visit, but recorded in the wider pentad, thus reasonable likelihood of occasionally occurring on site.

- African Marsh Harrier- Endangered. Not recorded in the pentads or during the site visit but has been seen within a 15 km radius (and the DFFE's screening tool indicates that the site is part of the habitat corridor) and, therefore, has reasonable 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 very low likelihood of sporadic occurrence.
- White-bellied Bustard- 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.
- 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.
- Yellow-billed Stork- Endangered. Not recorded on site but recorded for the wider pentad. Habitat suitability is marginal on the SPP site, thus has very low likelihood of sporadic occurrence.
- Caspian Tern- Vulnerable. Habitat suitability is marginal on the SPP site, thus has very low likelihood of sporadic occurrence.
- European Roller- Near-Threatened. Habitat suitability is marginal on the SPP site, thus has very low likelihood of sporadic occurrence.

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 all transects. Near-endemic
- Fiscal Flycatcher- recorded on site at one transect. Near-endemic
- Pied Starling- not recorded on site but recorded during SABAP2 assessments for the wider pentad. Endemic to South Africa, Lesotho and Swaziland.
- South African Cliff Swallow- recorded at power line option 2 only.
- Karoo Thrush- not recorded on site but recorded during SABAP2 assessments for the wider pentad. Near-endemic.
- Cape White-eye- not recorded on site but recorded during SABAP2 assessments for the wider pentad. 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

The avifauna specialist has further considered sensitive environmental features present within and around the site, specifically in consideration with the two grid connection corridor alternatives proposed. The specialist advises that Option 2 will be preferred from an avifaunal perspective as this option does not include a wetland feature, whereas option 1 infringes into a valleybottom wetland (see section 5.3.1.3) and has a man-made farm dam located adject to it on a neighbouring property.

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 valleybottom wetland is an important habitat and dispersal corridor for moisture-reliant small mammals. The conservation of the wetland and buffer zone 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 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 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 valleybottom wetland could provide habitat for the red listed giant bullfrog, and therefore the 32 meter buffer zone surrounding the wetland 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 also 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. 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		
Bontebok	Vulnerable (2016)	Low - confined to protected areas / game farms
African Clawless Otter	Near Threatened (2016)	Low – confined to perennial rivers outside development footprint
Spotted Necked otter	Near Threatened (2016)	Low – confined to perennial rivers outside development footprint
HERPETOFAUNA		
Giant Bull Frog	Near Threatened	Moderate

The DFFE Screening Report (Appendix B) identified the Near Threatened *Hydrictis maculicollis* (spotted necked otter) for the site and indicates that the habitat for the species is perennial rivers.

According to the Terrestrial Biodiversity, Plant and Animal Species Assessment (Appendix D1) these otters are aquatic and require permanent and continuous waterways. They prefer clear water with rocks. They are found in lakes, swamps, rivers, and may be found in mountain streams at higher elevations. They are absent in turbid rivers and shallow alkaline lakes. They live in dens, which are found near these sources of water.

The spotted-necked otter is typically solitary, but may be found in small family groups, depending on the time of year. The males have a big homerange within which more than one female may be located.

Their main food source is fish, although their diet includes both invertebrates and vertebrates. Frogs, crabs, molluscs, aquatic insects, and larvae are some of the items included in their diets.

The spotted-necked otters are in decline due to changes in their environment and human interference. One problem is the increased use of nylon fishing nets, in which the otters get tangled in and die. Erosion of soil near the source of the rivers is also a threat. Fish-farmers and fur-trappers are also playing a part in the decline of the spotted-necked otter.

The probability of occurrence on site is low due to the absence of suitable habitat on the proposed development footprint.

Probability of impact on the species during vegetation clearance is low as no suitable habitat has been observed on site and population of the species was documented.

5.3.1.6 Visual landscape

The proposed SPP development is located in close proximity to the Vaal River, approximately 150m north. The area drains to the north towards the Vaal River.

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 site is located at an above mean sea level (amsl) of approximately 1308m at the highest elevation and at an amsl of 1296m 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.
- Vaal Reefs Eleven Substation.
- Harmony Moab Mine.
- Tailings dams.
- Water Processing Plant.

- Other mining operations.
- Various homesteads on farms and smallholdings.
- Livestock grazing and crops.
- R502 road
- S643 road
- Vermaasdrift road
- Stokkiesdraai road
- Vaal River.
- Wawielpark Holiday Resort.

In terms of possible landscape degradation, the landscape does not appear to have any specific protection or importance and is characterised by mines. Figure 5.14, Figure 5.15 and Figure 5.16 below indicates the Zone of Theoretical Visibility for the PV facility.

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 to agricultural developments. Option 1 and Option 2 of the proposed power line routes will be visible from approximately the same viewpoints which makes both options suitable (refer to Figure 5.15 and Figure 5.16).

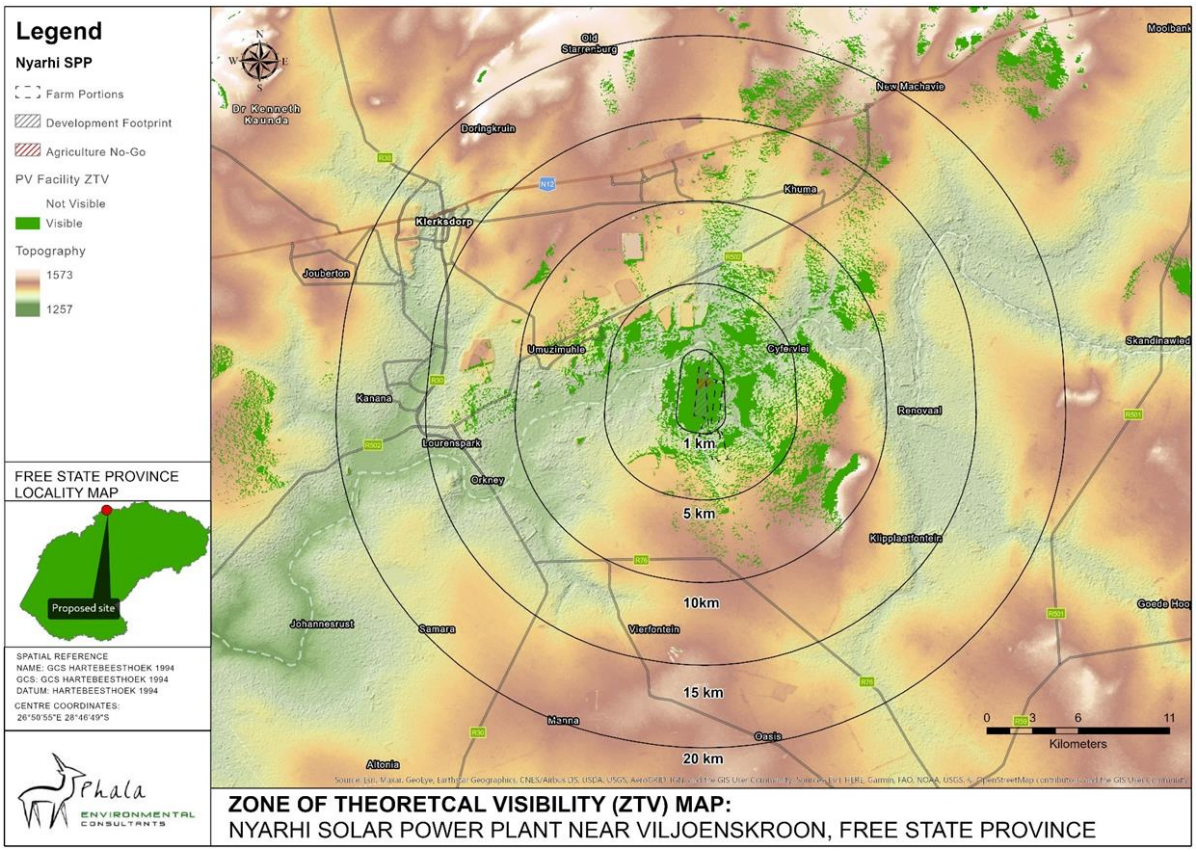


Figure 5.14: Zone of Theoretical Visibility (ZTV) for the Nyarhi Solar Power Plant – Topography.

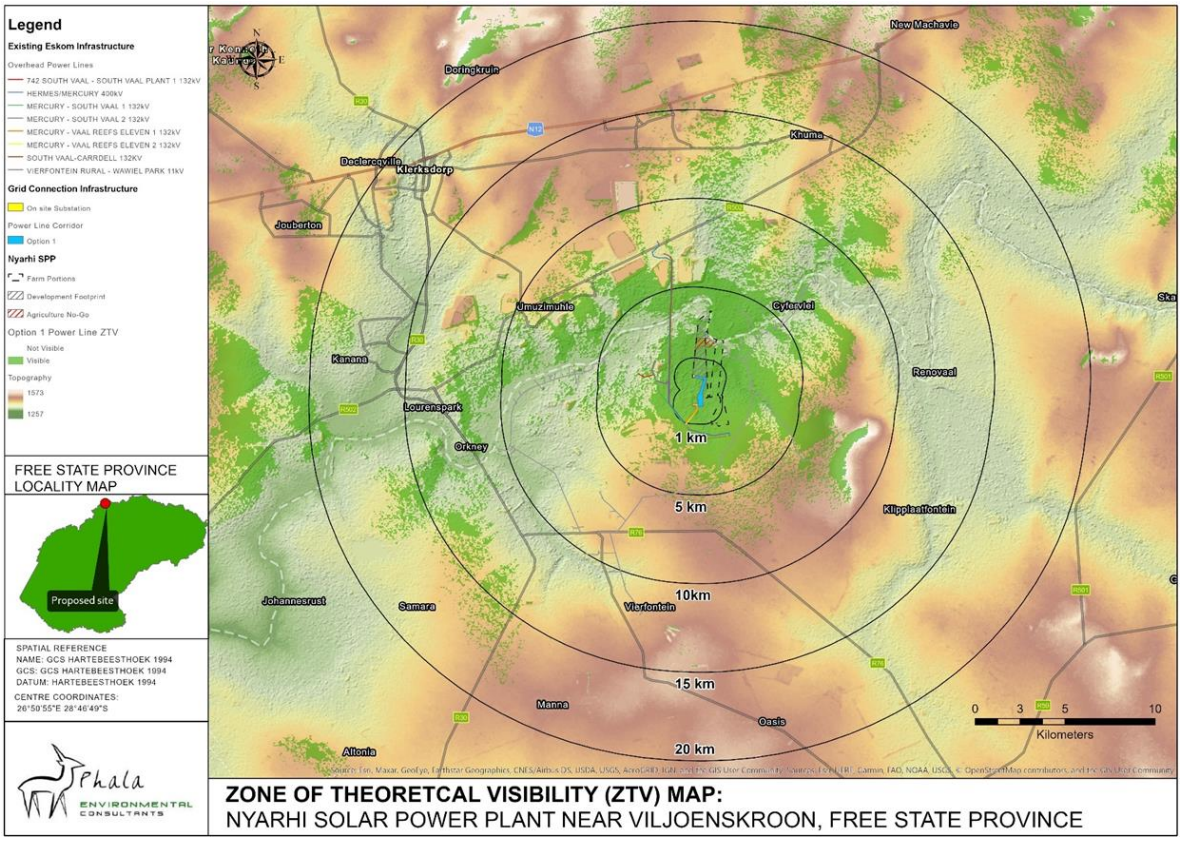


Figure 5.15: Zone of Theoretical Visibility (ZTV) for the proposed grid corridor option 1.

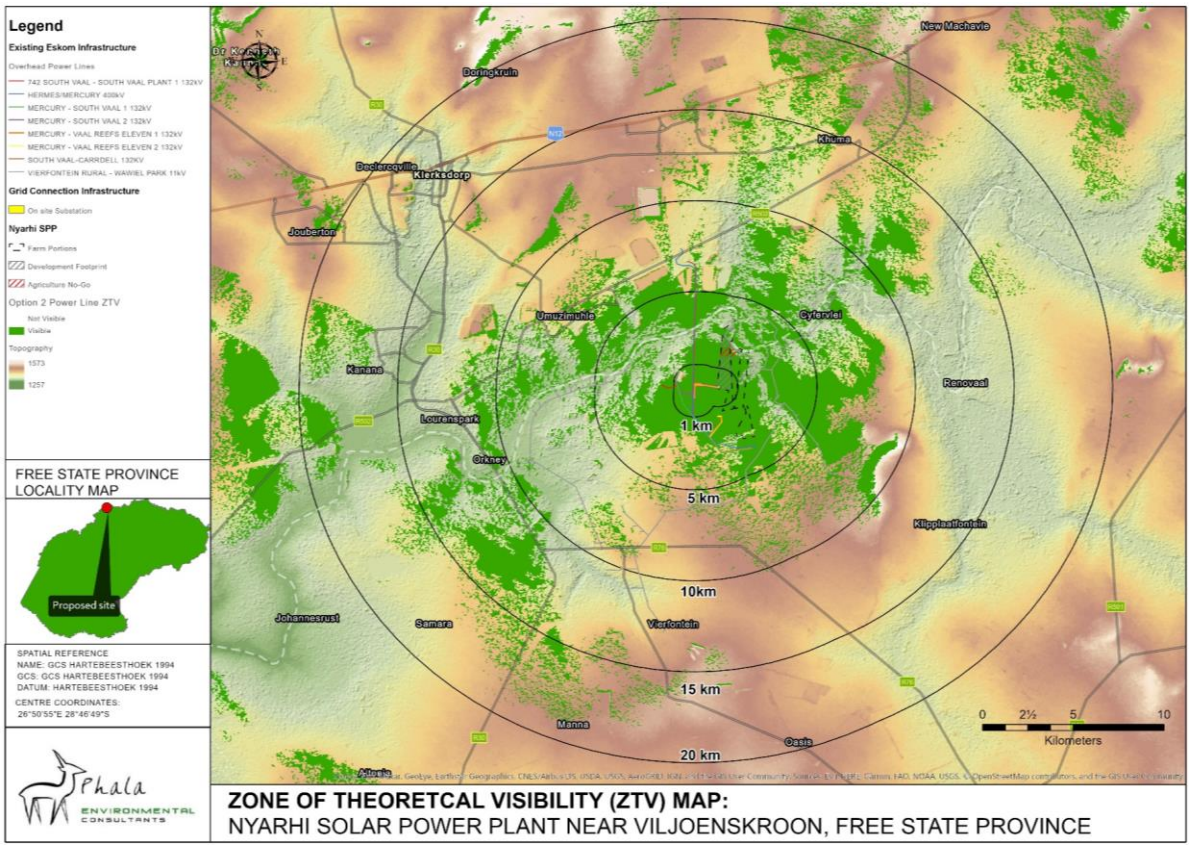


Figure 5.16: Zone of Theoretical Visibility (ZTV) for the proposed grid corridor option 2.

5.3.1.7 Traffic consideration

According to the Traffic Impact Study (Appendix D8), the existing external road network, in the vicinity of the Nyarhi Solar Power Plant consists of the R502, S643, Vermaasdrift Road and S729. Access to the Nyarhi Solar Power Plant will be via an existing gravel road, off the Vermaasdrift Rd. Two (2) possible access points have been identified for the development area, both of which are located off this gravel road. It must be noted, however, that an extension of the existing gravel tracks may be required. In addition, an additional access point has been identified, which is located off Secondary Route 729 (S729). Refer to Figure 5.17.

A formal application for the recommended access points will need to be lodged with the Moqhaka Local Municipality and the Free State Department: Police, Roads and Transport. The formalisation of this access point 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.

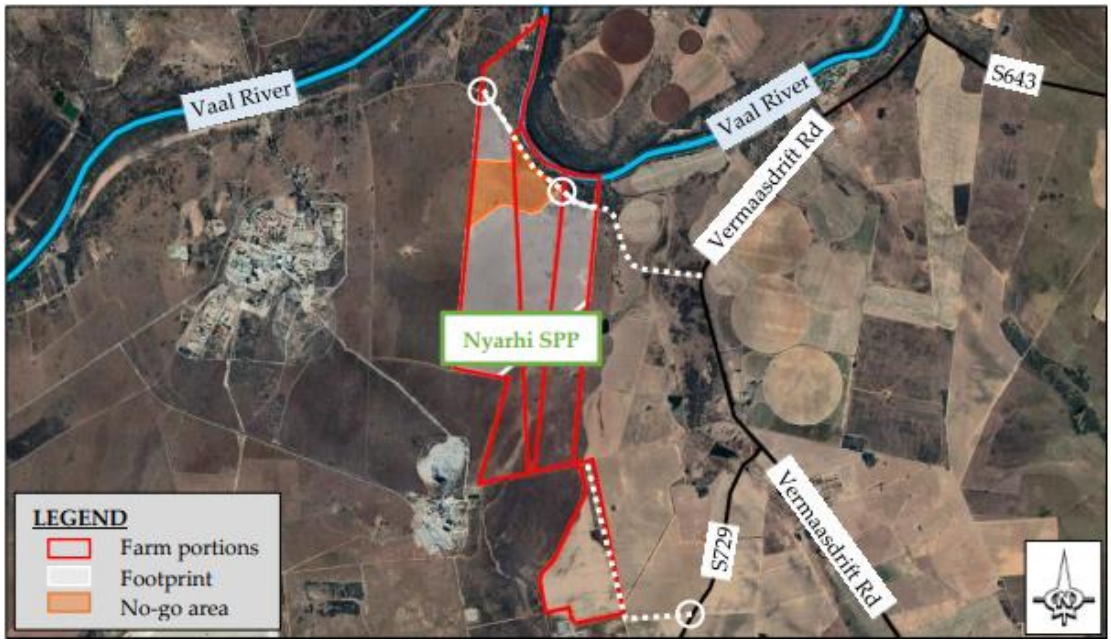


Figure 5.17: Proposed access points and roads**.**

Two (2) possible ports of entry has been identified from where the solar panel technology and large electrical components will be transported, namely: Durban (620 km) and Richards Bay (720 km). Based on the shortest travel distance, it is recommended that the Port of Durban be the preferred port of entry. The Port of Durban is South Africa's main cargo and container port, handling the largest volume of sea-going traffic of any port in southern Africa. It is ideally placed on major shipping routes and have excellent rail and road links. Refer to Figure 5.18.

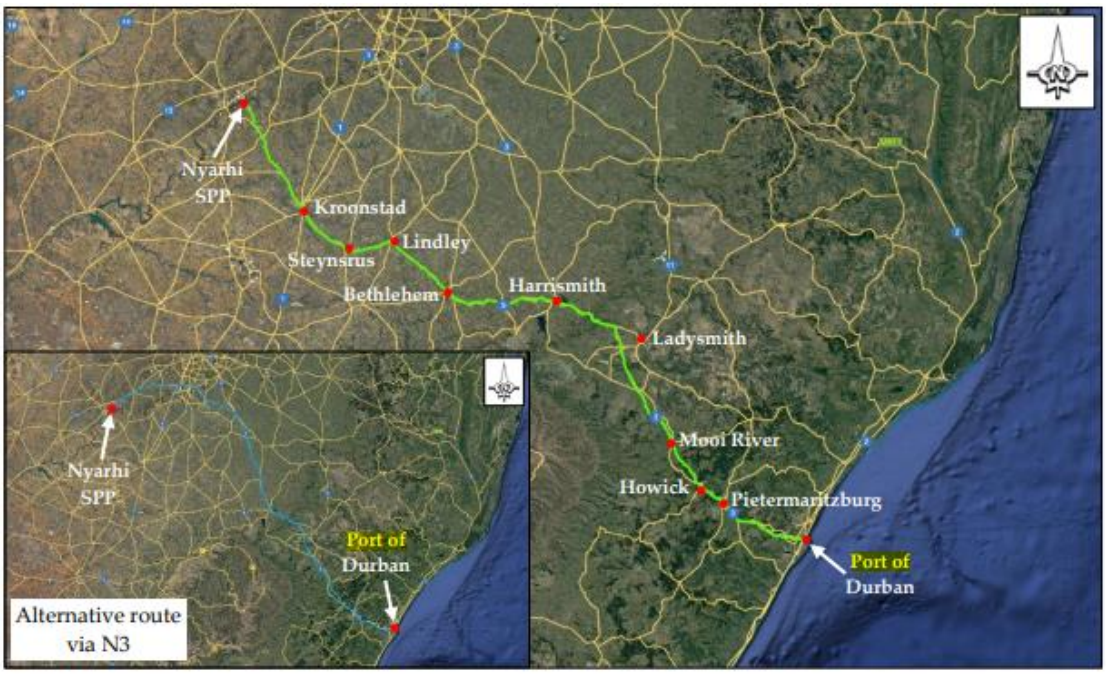


Figure 5.18: The preferred route for imported components.

It is critical to ensure that the abnormal load vehicle will be able to move safely and without obstruction along the preferred route. The preferred route should be surveyed prior to construction to identify any problem areas.

this stage, only a high-level assessment can be undertaken as no information of the exact location of the manufacturer is known and all road structures (such as bridges and culverts) need to be confirmed for their load bearing by the South African National Roads Agency (SANRAL) or the respective Roads Authority.

The nearest towns in relation to the proposed development site are Orkney, Klerksdorp, Stilfontein, Viljoenskroon, Vierfontein and Potchefstroom. It is envisaged that most materials, water, plant, services and people will be procured within a 50 km radius of the proposed facility.

5.3.2 Description of the socio-economic environment

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

5.3.2.1 Socio-economic conditions

According to the Social Impact Assessment (Appendix D7) 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. Although the Free State is the third-largest province in South Africa, it has the second-smallest population and the second-lowest population density. It covers an area of 129 825km² and has a population of 2 834 714 – 5.1% of the national population. Languages

spoken include Sesotho (64.4%), Afrikaans (11.9%) and Zulu (9.1%). The Free State Province contributes 5.4% to South Africa's total gross domestic product (2006).

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

The Fezile Dabi District Municipality is a Category C municipality, formerly known as the Northern Free State District Municipality, situated in the north of the Free State. It is bordered by the North West, Gauteng and Mpumalanga Provinces to the north, Thabo Mofutsanyana District to the south, and Lejweleputswa District to the west. In 2011 the Municipality had a population of 488 036 with an unemployment rate of 33.9% and a youth unemployment rate of 44.4%. By 2016 only 48.3% of dwellings had piped water inside their dwellings and 7.7% of household still did not have electricity in their dwellings. The main attraction site, the Vredefort Dome, being the third-largest meteorite site in the world, is located within the district.

The main economic sectors of the District Municipality include: Trade (22%), community services (20%), manufacturing (13%), households (13%), agriculture (12%), finance (7%), construction (6%), transport (5%).

The Moqhaka Local Municipality is a Category B municipality situated within the southern part of the Fezile Dabi District in the Free State Province. It is the largest of four municipalities in the district, making up over a third of its geographical area and covering an area of 7 925m^2. The former Kroonstad, Steynsrus and Viljoenskroon Transitional Local Councils and sections of the Riemland, Kroonkop and Koepel Transitional Rural Councils are included in the municipality. The general tendency of migration from rural to urban areas is also occurring in the area, as is the case in the rest of the Free State Province. In comparison to the other municipalities within the Fezile Dabi District, it appears as if Moqhaka is significantly less urbanised. The population dwindled from 2011 at 160 532 to 154 732 in 2016. In 2011 the unemployment rate stood at 35.2% and the youth unemployment rate at 47.2%. In 2016 89.7% of households had flush toilets connected to sewerage and 96.3% of households had electricity for lighting in their dwellings. The main economic sectors in the municipality are agriculture, commercial transport, business services and mining.

In the Moqhaka LM there are 55 594 economically active (employed or unemployed but looking for work) people, and of these 35,2% are unemployed. Of the 27 349 economically active youth (15–34 years) in the area, 47,2% are unemployed. The creation of employment opportunities within the formal sector as a result of the development of Nyarhi SPP could therefore contribute towards growing employment within the formal sector in both the LM and DM, which could lead to greater levels of job security than may typically be associated with employment in the informal sector.

The Harmony Moab Kotsong mine is located to the south of the site and the Vaal River to the north. The surrounding properties are characterised by agriculture and mining activities.

5.3.2.2 Cultural and heritage aspects

According to the Heritage Impact Assessment (Appendix D5) special attention was given to the identification of possible cultural or heritage resources on site.

Stone Age

Very little habitation of the highveld area took place during Stone Age times. Tools dating to the Early Stone Age period are mostly found in the vicinity of larger watercourses, e.g. the Vaal River, or in sheltered areas such as the mountainous regions north of Klerksdorp and as far east as the Vredefort Dome area. During Middle Stone Age (MSA) times (c. 150 000 – 30 000 BP), people became more mobile, occupying areas formerly avoided. The MSA is a technological stage characterized by flakes and flake-blades with faceted platforms, produced from prepared cores, as distinct from the core tool-based ESA technology. Open sites were still preferred near watercourses.

Late Stone Age (LSA) people had even more advanced technology than the MSA people and therefore succeeded in occupying even more diverse habitats. Also, for the first time we get evidence of people's activities derived from material other than stone tools. Ostrich eggshell beads, ground bone arrowheads, small, bored stones and wood fragments with incised markings are traditionally linked with the LSA. The LSA people have also left us with a rich legacy of rock art, which is an expression of their complex social and spiritual believes. A number of sites containing rock engravings are known to exist to the east and south of the site.

Iron Age

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

As far as is known, no Early Iron Age sites have yet been identified in the Free State Province. The occupation of the larger geographical area (including the site and surrounding area) did not start much before the 1500s. By the 16th century things changed, with the climate becoming warmer and wetter, creating conditions that allowed Late Iron Age (LIA) farmers to occupy areas previously unsuitable, for example the treeless plains of the Free State and the Mpumalanga highveld. This wet period came to a sudden end sometime between 1800 and 1820 by a major drought lasting 3 to 5 years. The drought must have caused an agricultural collapse on a large, subcontinent scale.

The stone walled settlements dating to the Late Iron Age occur on a wide front over much of the central interior plateau area. In the larger vicinity of the site, these sites conform to Maggs' (1976) type Z settlements. Such site consists mostly of a number of large primary enclosures clustered together, with, associated but on the outside, smaller primary enclosures.

This was also a period of great military tension. Military pressure from Zululand spilled onto the highveld by at least 1821. Various marauding groups of displaced Sotho-Tswana moved across the plateau in the 1820s. Mzilikazi raided the plateau extensively between 1825 and 1837. The Boers trekked into this area in the 1830s. And throughout this time settled communities of Tswana people also attacked each other. As a result of this troubled period, Sotho-Tswana people concentrated into large towns for defensive purposes. Because of the lack of trees, they built their settlements in stone. These stone-walled villages were almost always located near cultivatable soil and a source of water. Such sites are known to occur north of Klerksdorp and in the Vredefort Dome area.

Historic period

White settlers moved into the area during the first half of the 19th century. They were largely self-sufficient, basing their survival on cattle/sheep farming and hunting. Pretoria was started in 1850, but Johannesburg only dates to the 1880s, after the discovery of gold.

In 1837 the establishment of a trekker settlement at Klerksdorp marked the beginning of a new phase in the history of the region. Originally twelve trekker families settled on the farm Elandsheuvel, belonging to C.M. du Plooy. This settlement, known as 'Oude Dorp', had its first landdros Jacob de Clercq, after which the settlement was then named. In 1853, the name was changed to Klerksdorp. With the discovery of gold in 1886 on the farm Rietpoort, the gold rush gave rise to a new settlement called 'Nieuwe Dorp'. In 1897 the railway line from Krugersdorp reached Klerksdorp. The railway line from Fourteen Streams (Warden region), on the main line from Kimberley to Zimbabwe (Then Rhodesia) was completed in 1906. (SESA 1973).

The town of Orkney was established in 1940 at the junction of the various railway lines. It was named after the old gold mine opened by Thomas Leask, who came from the Orkney Islands, in 1880 (SESA 1973).

Site Specific Review:

From a review of the available old maps and aerial photographs it can be seen that the project area has always been open space, with the main activity being grazing or the making of agricultural fields. Very little built structure development is visible in the development footprint and most seems to be farm labourer homesteads, ranging in date from the late 1960s to the 1980s.

One site, destroyed, shows the remains of face-bricks that were used for the buildings. Two rectangular structures, built with local stone, are located about 80m to the west. These are interpreted as small-stock enclosures that are related to the main structure.

Due to the fact that these features are demolished, they judged to have low significance and are viewed to be sufficiently documented after having been included in the Heritage Impact Assessment report (Appendix D5). The location of these features is indicated in Figure 5.19.

No sites, features or objects of cultural significance from the Stone Age, Iron Age or the historic period were identified on site.

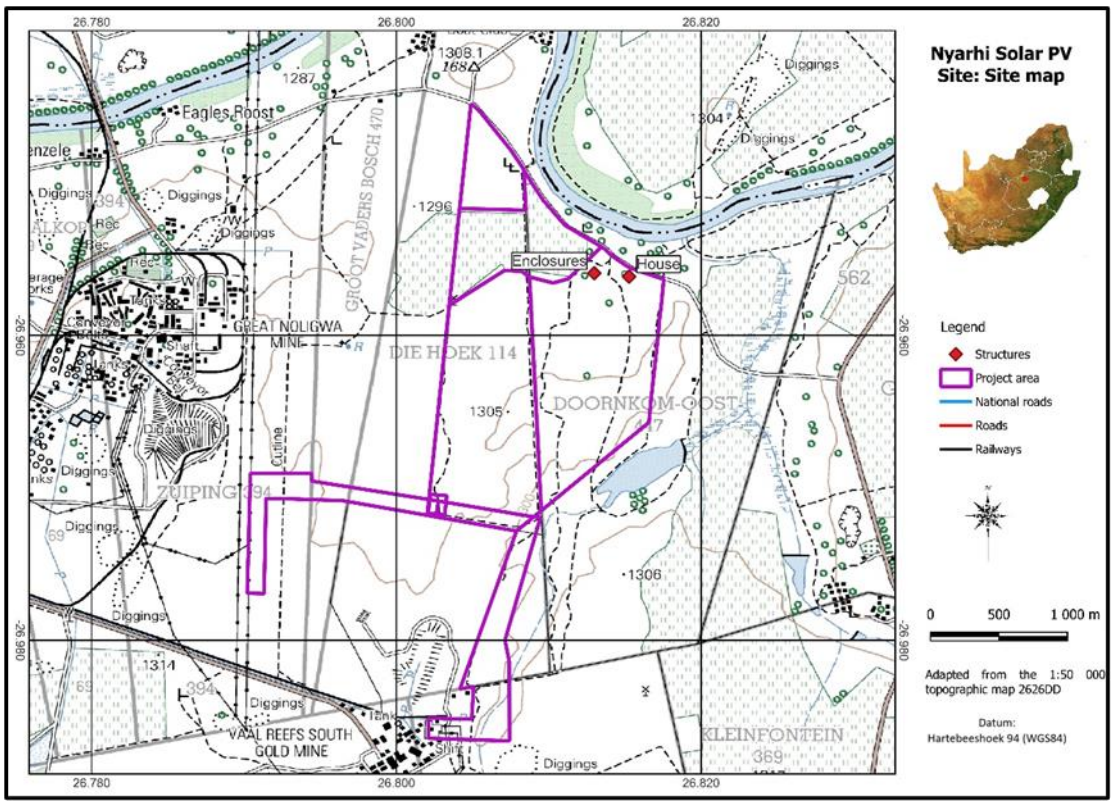


Figure 5.19: Location of low significance structures present within the Nyarhi Solar Power Plant development footprint

Palaeontology

The geology of the proposed Nyarhi Solar Power Plant and grid connection corridor alternatives is indicated on the 1: 250 000 Wes-Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria) (Figure 5.20). The proposed development is underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani Subgroup (blue-green - Vmd) (Chuniespoort Group) within the Transvaal Supergroup. According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Malmani Subgroup is Very High.

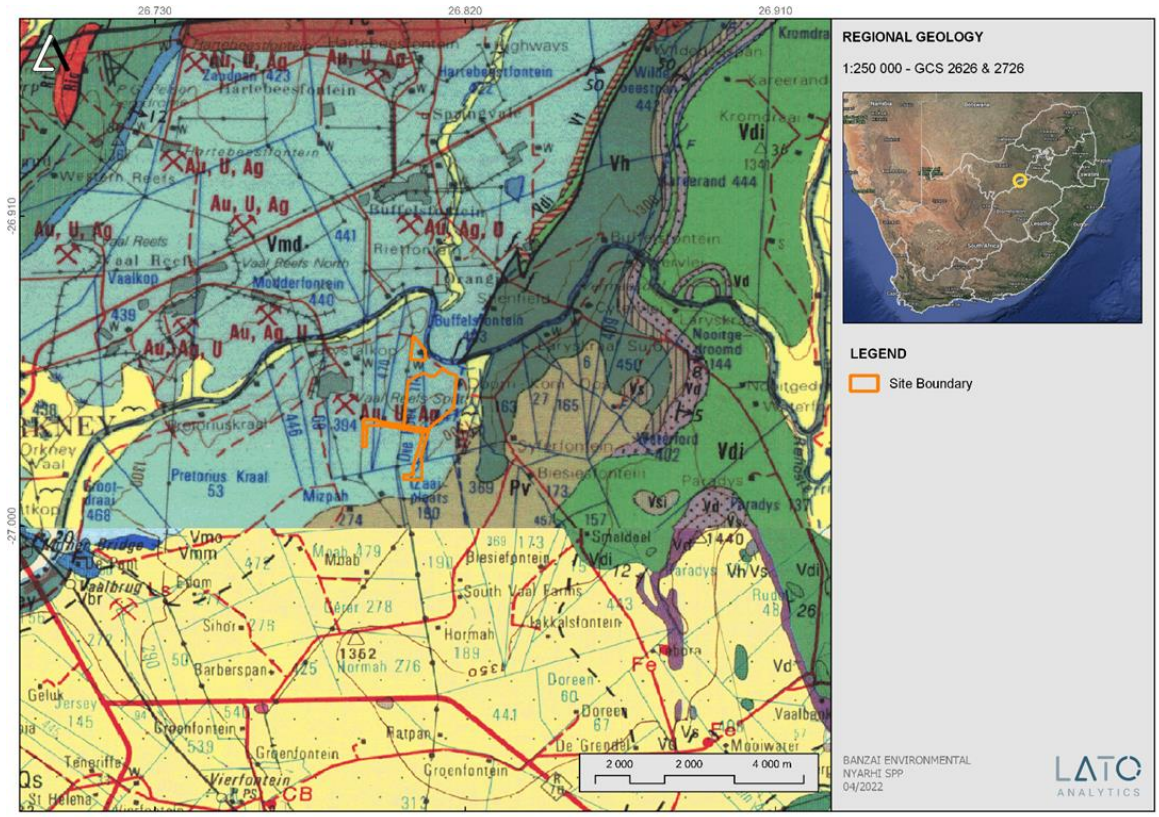


Figure 5.20: Extract of the 1:250 000 2626 Wes-Rand (1986) Geological Map (Council for Geosciences, Pretoria) indicating the proposed Nyarhi Solar Power Plant and power line corridors.

The Malmani Subgroup carbonates of the Transvaal Basin comprise of an assortment of stromatolites (microbial laminates), ranging from supratidal mats to intertidal columns and large subtidal domes (Eriksson et al. 2006). Stromatolites are layered mounds, columns and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. These algae photosynthesised in the low oxygen atmosphere and deposited layer upon layer of calcium sulphate, magnesium sulphate and calcium carbonate as well as other compounds to form these domes. Researchers have examined and classified the stromatolite structures but seldomly find preserved algal cells. The oxygen atmosphere that we depend on today was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Eriksson and Altermann, 1998). Detailed descriptions of South African Archaean stromatolites are available in the literature (Altermann, 2001; Buick, 2001; and Schopf, 2006). The Malmani stromatolites literature includes articles by Truswell and Eriksson (1972, 1973, 1975), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner (2000), Schopf (2006).

The Malmani Subgroup succession is about 2 km-thick and consists of a series of formations of oolitic and stromatolitic carbonates (limestones and dolomites), black carbonaceous shales and minor secondary cherts. The Malmani Dolomites also consist of historic lime mines, and palaeocave fossil deposits. Dolomite (limestone rock) forms in warm, shallow seas from slow gathering remainders of marine microorganisms and fine-grained sediment. Dolomites of the Malmani Subgroup has a higher magnesium content than other limestones. These materials contain high levels of calcium carbonate and are often referred to as carbonates.

The Vaalriver lies just north of the proposed Nyarhi Solar Power Plant. Quaternary alluvium is deposited in this area. The Quaternary superficial deposits are the youngest geological deposits formed during the most recent period of geological time (approximately 2.6 million years ago to present). Most of the superficial deposits are unconsolidated sediments and consist of gravel, sand, silt, and clay, and they form relatively thin, often discontinuous patches of sediments or larger spreads onshore.

The Quaternary deposits are of most importance due to the palaeoclimatic changes that are reflected in the different geological formations (Hunter et al., 2006). During the climate fluctuations in the Cenozoic Era most geomorphologic features in southern Africa where formed (Maud, 2012). Barnosky (2005) indicated that various warming and cooling events occurred in the Cenozoic but states that climatic changes during the Quaternary Period, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past. Climate variations that occurred in the Quaternary Period were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth et al., 2004).

Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages may in some cases occur in extensive alluvial and colluvial deposits cut by dongas. In the past palaeontologists did not focus on Caenozoic superficial deposits although they sometimes comprise of significant fossil deposits. These fossil assemblages resemble modern animals and may comprise of mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

The Vryheid Formation (Ecca Group, Karoo Supergroup) is present to the south and east of the proposed Nyarhi Solar Power Plant. The Vryheid Formation is characterized by light grey, fine to course sandstone and siltstone sediments. The dark coloured siltstones can be accredited to the existence of carbon enrichment and coal beds. Infrequent coal seams, deltaic mudrocks and sandstones as well as coastal and fluvial deposits are present in this formation. These sediments were probably deposited on a sandy shoreline that stretched out beyond massive swamplands. In these swamps, plants accumulated and formed the coal deposits that are mined today (Johnson et al, 2006).

The Vryheid Formation is world renowned for the occurrence of coal beds formed by the accumulation of plant material over long periods of time. Numerous plant fossils have been described from this formation by Bamford (2011). The Vryheid Formation is also characterised by its trace fossil assemblages of the non-marine *Mermia Ichnofacies*, insect fossils track ways, fish and small crustaceans. The *Mesosaurus* reptile may also be present.

The Hekpoort Formation of the Pretoria Group is present to the east of the site. The Hekpoort formation consists of Basaltic andesite and pyroclastic rocks and is volcanic in origin. No fossils have been recorded from this formation.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12-13 March 2022. Outcrops of weathered to well-preserved stromatolites were discovered on the whole development. It is important to note that a small portion of a stromatolite is usually exposed at the surface while the largest part of the specimen is below surface.

Figure 5.21 below indicates the location of the well preserved oolites and stromatolites preserved in the area.

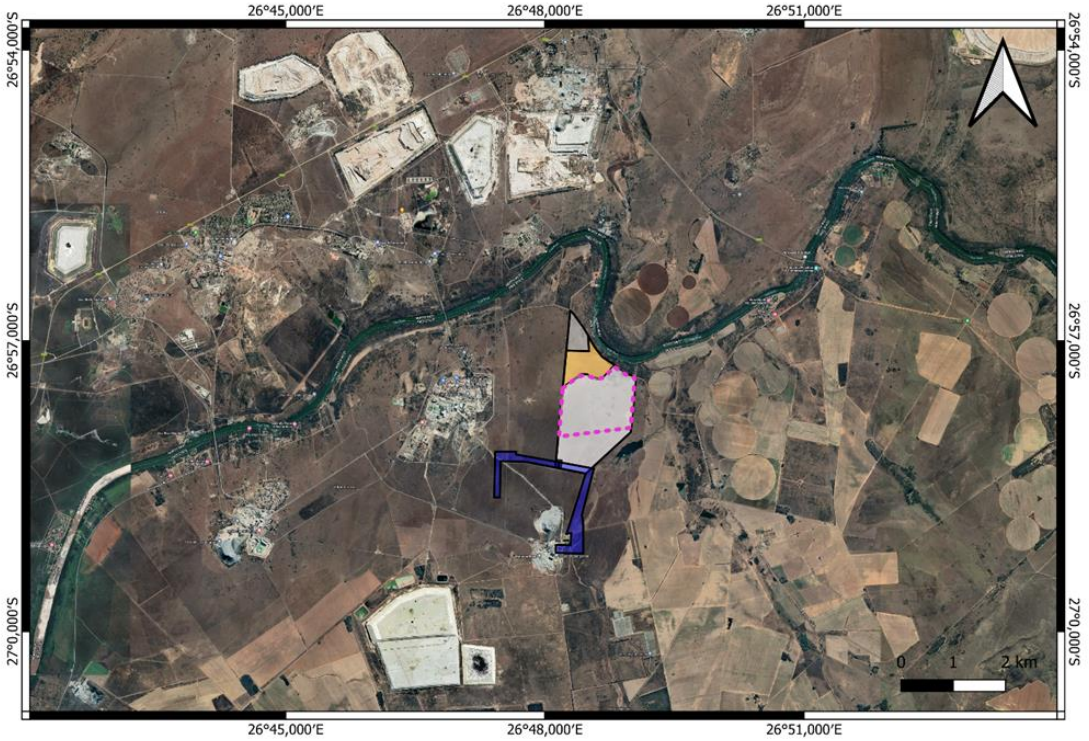


Figure 5.21: Well preserved oolites and stromatolites are preserved in the purple dashed line. The concentration of fossils reduces from north to south.

5.4 SITE SELECTION MATRIX

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

The receptiveness of the site to PV development includes the presence of optimal conditions for the siting of a solar energy facility due to high irradiation values and optimum grid connection opportunities. The site where the project is proposed to be located is considered favourable 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 energy facility is directly dependent on the annual direct solar irradiation values of a particular area. The Free State receives a high average 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 per year is relevant in the area.

- **Renewable Energy Development Zone (REDZ):** The site is also located in the Klerksdorp Renewable Energy Development Zones (REDZ). The solar PV assessment domain was based on the location of the majority of existing solar PV project applications at the commencement of the Strategic Environmental Assessment (SEA) and includes the five provinces of Northern Cape, Western Cape, Eastern Cape, Free State and North West.

- **Site availability and access:** The land is available for lease by the developer and consent has been provided by the affected landowner for the undertaking of the BA process on the three affected properties. Reluctant farm owners or farmers over capitalizing hamper efforts to find suitable farms. Access will be easily obtained via the existing gravel road, to the north of the project, off the Vermaasdrft Road.

- **Grid connection**: In order for the PV facility to connect to the national grid a 132kV power line will be constructed. It is expected that generation from the facility will tie in with the existing the South Vaal – Cardell 132 KV Line or Mercury – South Vaal 132 KV Line via a loop-in loop-out line connection or a direct connection to the Vaal Reefs Eleven 132/6.6 kV Substation.

  Two grid connection corridor alternatives, each with a width of between 100m and 250m, have been identified for the assessment and placement of the power line (i.e., the power line will be developed within one of the two proposed corridors).

  The grid connection corridor located directly to the south of the SPP site is Option 1. This corridor will connect the SPP into the existing Vaal Reefs Eleven Substation. The length of this option is ~2.4km.

  The grid connection corridor located to south-west of the SPP site (referred to as Option 2) will connect the SPP into either the existing Mercury-South Vaal 132kV (maximum length of power line: 1,22km) or the South Vaal-Carrdell 132kV (maximum length of power line:1,18km) via a loop-in loop-out connection. This is the preferred alternative from a development and technical perspective based on feedback received by the developer from Eskom.

  Available grid connections are becoming scarce and play a huge role when selecting a viable site.

- **Environmental sensitivities:** From an environmental perspective the proposed site/development footprint is considered desirable due to limited environmental sensitivities in terms of geology, and soils, agricultural potential, vegetation and landscape features, climate, biodiversity and ecological features and the visual landscape – refer to Section 5.3.1 of this report. Where ecological features and

habitats have been identified and considered the relevant ecological specialist has advised that development within these areas are appropriate subject to the implementation of strict mitigation measures. Areas under crop production through pivot irrigation within the area under assessment have been avoided and demarcated as no-go to development by the developer from the onset of the process. Important features of note was identified from an ecological, avifaunal and conservation point of view, which included a valleybottom wetland located within the grid connection corridor option 1. The specialist recommends a 32m buffer to be adhered to for this feature with no disturbance to be allowed. Well preserved oolites and stromatolites are preserved in the development footprint. The concentration of fossils reduces from north to south and examples of exceptionally well preserved oolites were recovered from the centre portion of the development footprint. Although these palaeontological features are not considered to be no-go for development, specific mitigation measures will need to be implemented if development takes place here.

It is evident from the discussion above that the area and development footprint under assessment may be considered favourable and suitable in terms of these site characteristics. As mentioned previously, no alternative areas on the within the affected properties have been considered. However, provision was made for the avoidance of the areas under pivot irrigation.

5.5 CONCLUDING STATEMENT ON ALTERNATIVES

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

Therefore, development of the 100 MW Nyarhi Solar Power Plant on Portion 1 of the Farm Die Hoek No. 114, Portion 1 of the farm Doornkom-oost No. 447 and farm Doornplaats No. 559, is the preferred option. The preferred layout included in the attached Appendix H. It is therefore concluded that no other alternatives are considered as part of the BA process.

For the two grid connection options considered, it can be concluded that Option 2 will represent the least environmental impact as the vegetation is considered to be degraded, and there are no specific environmental sensitivities located within the corridor that will be disturbed. This option has also been identified by the Applicant as the preferred option from a technical perspective. This option is therefore more desirable to be developed from an environmental perspective.

The grid connection corridor option 1 includes the presence of a Valleybottom wetland feature that must be buffered by 32m and disturbance within must be avoided. The presence of this feature also increases the sensitivity of the area from a faunal and avifaunal perspective as it presents a corridor for faunal movement.

Therefore, the grid connection corridor option 2 is nominated as the preferred option from an environmental perspective.

6 DESCRIPTION OF THE IMPACTS AND RISKS

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

Appendix 1. (3)(i) An BAR (...) must include-

(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 report;

6.1 SCOPING METHODOLOGY

The contents and methodology of the basic assessment 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 24 February 2022. 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 to 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	×			Vaal River is located 200m to the north of the site. A Valleybottom wetland is located within grid connection corridor option 1, and a depression (which is a mad-made dam) is located to the east of the site, outside of the development footprint.
II. A conservation or open space area	×			The southern section of the site overlaps with a CBA 1. Grid connection corridor option 1 overlaps with a CBA 1 and CBA 2. Majority of the site and grid connection corridor option 2 is located within an ESA 1 and ESA 2.
III. An area that is of cultural importance		×		None.
IV. Site of geological/palaeontological significance	×			Outcrops of weathered to well-preserved stromatolites were discovered on the whole development, but less prominent in the south of the development. Examples of exceptionally well preserved oolites were recovered from the centre portion of the development footprint.
V. Areas of outstanding natural beauty		×		None.

VI. Highly productive agricultural land	×			Areas under crop production through pivot irrigation is present, however these areas are avoided by the development footprint.
VII. Floodplain	×			Vaal River is located 200m to the north of the site.
VIII. Indigenous Forest		×		None.
IX. Grass land	×			The site falls within the Vaal Reefs Dolomite sinkhole Woodland (Gh12) and a portion of the grid connection corridor Option 1 within the Vaal-Vet Sandy Grassland (Gh10) which is described by Mucina and Rutherford (2006) respectively as 'vulnerable' and 'endangered'.
X. Bird nesting sites		×		None.
XI. Red data species		×		None.
XII. Tourist resort		×		None.
2. Will the project potentially result in potential?				
I. Removal of people		×		None.
II. Visual Impacts	×			The VIA (refer to Annexure D3) confirmed that the development of the solar power plant and associated power line will have a negative low visual impact on observers. 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 months. However, there are mines located directly adjacent to the site. The noise impact is therefore insignificant in comparison to the noise generated by the mine and will only be temporary in nature.

IV. Construction of an access road	×			Access will be obtained via an existing gravel off the Vermaasdrfit Road off. Internal access roads will be constructed for the facility.
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 885 employment opportunities will be created during the construction and 15 - 70 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 4200 m^3 per annum.
VIII. Job creation	×			Approximately 885 employment opportunities will be created during the construction and 15 - 70 employment opportunities during the operational phases for the SPP.
IX. Traffic generation	×			It is estimated that on average 42 trips per day will be generated over the 12-18 month construction period for the SPP. This will however differ during the different stages of construction.
X. Soil erosion	×			The site will need to be cleared or graded, 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. No existing areas of erosion was identified.

XI. Installation of additional bulk telecommunication, transmission lines or facilities	×			There is existing Eskom infrastructure in the area and the Solar Power Plant will require the development of a power line to be constructed.
3. Is the proposed project located near the following?				
I. A river, stream, dam or wetland	×			Vaal River is located 200m to the north of the site. A Valleybottom wetland is located within grid connection corridor option 1, and a depression (which is a mad-made dam) is located to the east of the site, outside of the development footprint.
II. A conservation or open space area	×			The southern section of the site overlaps with a CBA 1. Grid connection corridor option 1 overlaps with a CBA 1 and CBA 2. Majority of the site and grid connection corridor option 2 is located within an ESA 1 and ESA 2. The Mispah Game Reserve is located 1.3km to the south of the site.
III. An area that is of cultural importance		×		None.
IV. A site of geological/palaeontological resources significance	×			Outcrops of weathered to well-preserved stromatolites were discovered on the whole development, but less prominent in the south of the development. Examples of exceptionally well preserved oolites were recovered from the centre portion of the development footprint. It is assumed that the same features are located in the surrounding areas of the project.
V. An area of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.
VII. A tourist resort	×			The Wawielpark Holiday Resort is located within 5km from the site.

VIII. A formal or informal settlement	×			Viljoenskroon is located ~28km south-east and Orkney ~7.5km north-west of the project

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 6.3) for more in-depth assessment. An indication is provided of the specialist studies which were conducted and that 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 6.3, as well as the key issues identified as included in sections 6.2.1-6.2.3. The Table 6.2 includes reference to the sections in the respective specialist studies where the details of the in-depth assessment of potential environmental impacts can be obtained.

Table 6.2: 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, Plant and Animal Impact Assessment (Appendix D1)	85 – 95	95 – 98	Same as Impact Assessment
Wetland / Riparian Impact Assessment (Appendix D1)	60 – 70	71 – 73	Same as Impact Assessment
Avifauna Impact Assessment (Appendix D2)	46 – 64	58 – 59 PV Panels 60 – 62 PL	Same as Impact Assessment
Visual Impact Assessment (Appendix D3)	52 – 65	66 – 69	Same as Impact Assessment
Agriculture Compliance Statement (Appendix D4)	13 – 15	16 – 17	20 - 25
Heritage Impact Assessment (Appendix D5)	18 – 23	18 – 23	23 - 24
Palaeontological Impact Assessment (Appendix D6)	35 – 44	41 – 43	45 - 46
Social Impact Assessment (Appendix D7)	68 – 94	94 - 100	Same as Impact Assessment
Traffic Impact Assessment (Appendix D8)	23 – 28	29 – 31	None applicable

Table 6.3: 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) (GNR 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)(b) (GNR 327): *"The development of (ii) infrastructure or structures with a physical footprint of 100 square meters or more (a) within a watercourse or (b) within 32 meters of a watercourse, measured from the edge of a watercourse.*	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	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	• Direct habitat destruction – loss and damage to natural habitats, impact/changes on vegetation & fauna communities, loss of threatened / near-threatened taxa, impact to fauna • Habitat fragmentation – disruption of natural movement patterns • Increased soil erosion and fragmentation – terrestrial ecological changes including establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora • Soil and water pollution • Spread and establishment of alien invasive species • Negative effect of human activities and road mortalities – snaring, killing and hunting of certain faunal		-	S/L	L	D	BR	SL	Yes	• See Table 6.4	M	Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1)

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 (GNR 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 meters 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*	method will depend on the detailed geotechnical analysis. • Construction of access and inside roads/paths – existing paths will be used were reasonably possible. Additionally, the turning circle for trucks will also be taken into consideration. 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.			species, litter and inadequate sanitation, risk of uncontrolled fires										
			Wetland/ Riparian areas	• Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline • Soil compaction and increased sediment transport and erosion • Soil and water pollution • Spread and establishment of alien invasive species		-	S/L	L	D	BR	SL	Yes	• See Table 6.4	M	Wetland / Riparian Impact Assessment (Appendix D1)
			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 6.4	L	Avifaunal Impact Assessment (Appendix D2)
			Air	• Air pollution due to the increase of traffic of construction vehicles and the undertaking of construction activities. • Ecosystem damage due to pollutants and dust	-		S	S	D	CR	NL	Yes	• A speed limit should 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.	L	Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1)
			Soil	• Loss of agricultural potential by occupation of land • Loss of agricultural potential by soil degradation • Enhanced agricultural potential through increased financial security for farming operations	- /+		S	S	Pr	PR	ML	Yes	• See Table 6.4	L	Agriculture Compliance Statement (Appendix D4)

afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare." Activity 56 (ii) (GN.R 327): *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* Activity 1 (GN.R 325): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."* Activity 15 (GN.R 325): *"The clearance of an area of 20 hectares or more of indigenous vegetation."* Activity 4 (b)(i)(ee)(gg) (GN.R 324): *"The development of a road wider than 4 metres with a reserve less than 13,5 metres (b) in the Free State, (i) outside urban areas and within (ee) critical biodiversity areas*				• Improved security against stock theft and other crime										
			Existing services infrastructure	• Generation of waste that needs to be accommodated at a licensed landfill site. • Generation of sewage that need to be accommodated by the local sewage plant. • Increase in construction vehicles on existing roads.		-	L	S	D	PR	ML	Yes	-	L	Confirmation from the Local Municipality to provide services
			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 (where used), 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 (e.g. screen and casing lengths, diameters, total depth, etc). • Sampling of monitoring boreholes should be done according to recognised standards.	L	-
			General Environment (risks associated with BESS)	• Mechanical breakdown / Exposure to high temperatures • Fires, electrocutions and spillage of toxic substances into the surrounding environment. • Spillage of hazardous substances into the surrounding environment. • Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas.		-	S	M	Pr	PR	ML	Yes	• Operators are trained and competent to operate the BESS. Training should include the discussion of the following: - Potential impact of electrolyte spills on groundwater; - Suitable disposal of waste and effluent; - Key measures in the EMPr relevant to worker's activities; - How incidents and suggestions for improvement can be reported.	L	-

as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas." <u>Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324):</u> *"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 and within (ee) Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans*, within *(gg) areas within 10 kilometres from*				• 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								• Training records should be kept on file and be made available during audits. • Battery supplier user manuals safety specifications and Material Safety Data Sheets (MSDS) are filed on site at all times. • Compile method statements for approval by the Technical/SHEQ Manager for the operation and management and replacement of the battery units / electrolyte for the duration of the project life cycle. Method statements should be kept on site at all times. • Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock. Signage should also specify how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. the inhalation of toxic fumes, etc.). • Firefighting equipment should readily be available at the BESS area and within the site. • Maintain strict access control to the BESS area. • Ensure all maintenance contractors / staff are familiar with the supplier's specifications. • Undertake daily risk assessment prior to the commencement of daily tasks at the BESS. This should consider any aspects which could result in fire or spillage, and appropriate actions should be taken to prevent these.		

national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas and (hh) Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland." <u>Activity 12 (b)(i)(ii)(iv) (GN.R 324):</u> *"The clearance of an area of 300 square metres or more of indigenous vegetation…(b) in the Free State (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 2004, (ii) within critical biodiversity areas identified in bioregional plans and (iv) areas within a watercourse or wetland; or within 100 metres from the edge of*												• Standard Operating Procedures (SOPs) should be made available by the Supplier to ensure that the batteries are handled in accordance with required best practices. • Spill kits must be made available to address any incidents associated with the flow of chemicals from the batteries into the surrounding environment. • The assembly of the batteries on-site should be avoided as far as possible. Activities on-site for the BESS should only be limited to the placement of the container wherein the batteries are placed. • Undertake periodic inspections on the BESS to ensure issues are identified timeously and addressed with the supplier where relevant. • The applicant in consultation with the supplier must compile and implement a Leak and Detection Monitoring Programme during the project life cycle of the BESS. • Batteries must be strictly maintained by the supplier or suitably qualified persons for the duration of the project life cycle. No unauthorised personnel should be allowed to maintain the BESS. • Damaged and used batteries must be removed from site by the supplier or any other suitably qualified professional for recycling or appropriate disposal. • The applicant should obtain a cradle to grave battery management plan from the supplier during the planning and design phase of the system. The		

watercourse or wetland."												plan must be kept on site and adhered to.		
Activity 14(ii)(a)(c)(b)(i)(ff)(hh) (GN.R 324): *"The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; in the (b) Free State Province, (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 and (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve."*		SOCIAL/ECONOMIC ENVIRONMENT	Local unemployment rate	• Direct and indirect employment opportunities and skills development • Economic multiplier effect		+	L/P	S	D	PR	N/A	Yes	• Where reasonable and practical, the SPP service providers should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories	M	Social Impact Assessment (Appendix D7)
			Visual landscape	• Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed Nyarhi SPP	-		L	S	D	PR	ML	Yes	• See Table 6.4	L	Visual Impact Assessment (Appendix D3)
			Traffic volumes	• Traffic Congestion • Increase in traffic volumes • Impact on road safety	-		N	S	D	CR	NL	Yes	• See Table 6.4	M	Traffic Impact Assessment (Appendix D8)
			Health, Safety & other social aspects	• Potential loss of productive farmland • Air/dust pollution. • Impacts on safety and security. • 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. • Impacts on daily movement patterns. • Nuisance impacts • Increased risk of veld fires. • Visual and sense of place impacts		-	L	P	Pr	PR	ML	Yes	• See Table 6.4	L	Social Impact Assessment (Appendix D7)
			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	• See Table 6.4	L	Social Impact Assessment (Appendix D7)

Activity 18 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (b) 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, (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas and (hh) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland."*			Tourism industry	• Since there are no tourism facilities in close proximity to the site, the proposed activities will not have an impact on tourism in the area. The closest tourism facility is the Wawielpark Holiday Resort.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries	-		S	S	U	CR	NL	Yes	• As no sites, features or objects of cultural historic significance have been identified in the project area, there would be no impact as a result of the proposed development. • Any discovered artifacts shall not be removed under any circumstances. Any destruction of a site can only be allowed once a permit is obtained, and the site has been mapped and noted. Permits shall be obtained from the SAHRA should the proposed site affect any world heritage sites or if any heritage sites are to be destroyed or altered.	L	Heritage Impact Assessment (Appendix D5)
			Paleontological Heritage	• Loss of fossil heritage • Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study		-	S	P	L	BR	SL	Yes	• See Table 6.4	M	Paleontological Impact Assessment (Appendix D6)
OPERATIONAL PHASE															
Activity 11(i) (GNR 327): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or*	The key components of the proposed project are described below: • PV Panel Array - To produce 150 MW, the proposed facility will	BIOPHYSICAL ENVIRONMENT	Fauna and Flora	• Direct habitat destruction – loss and damage to natural habitats, impact/changes on vegetation & fauna communities, loss of threatened / near-threatened taxa, impact to fauna		-	S/L	L	D	BR	SL	Yes	• See Table 6.5	M	Terrestrial Biodiversity, Plant and Animal Species Impact Assessment

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)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80*	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			• Habitat fragmentation – disruption of natural movement patterns • Increased soil erosion and fragmentation – terrestrial ecological changes including establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora • Soil and water pollution • Spread and establishment of alien invasive species • Negative effect of human activities and road mortalities – snaring, killing and hunting of certain faunal species, litter and inadequate sanitation, risk of uncontrolled fires										(Appendix D1)
			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 • Collision when flying into power line infrastructure • Electrocution when perched on power line infrastructure		-	S	L	Pr	PR	ML	Yes	• See Table 6.5	M	Avifaunal Impact Assessment (Appendix D2)
			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
			Soil and Agriculture	• Erosion • Enhanced agricultural potential through increased financial security for farming operations • Increased security against stock theft and other crime		-	L	L	D	PR	SL	Yes	• See Table 6.5	L	Agriculture Compliance Statement (Appendix D4)

cubic metres (b) in the Free State (i) outside urban areas and within (ee) Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, within *(gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas and (hh) Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland."*	and this is fed into step up transformers to 132kV. An onsite substation and switching station will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. • <u>Supporting Infrastructure</u> – 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, protection circuitry and Battery Energy Storage Systems (BESS). • <u>Roads</u> – Access will be obtained via an existing gravel road off the Vermaasdrift Road. An internal site road network will also be required to provide access to the solar field and associated infrastructure. • <u>Fencing</u> - For health, safety and security		Groundwater	• Leakage of hazardous materials. The development will comprise of a distribution substation and switching station 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	-
			Wetland/ Riparian areas	• Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline • Soil compaction and increased sediment transport and erosion • Soil and water pollution • Spread and establishment of alien invasive species		-	S/L	L	D	BR	SL	Yes	• See Table 6.5	M	Wetland / Riparian Impact Assessment (Appendix D1)
		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 power line structures. • Visual impacts on observers travelling along the roads and residents at homesteads in close proximity to the power line structures.		-	L	L	Pr	PR	SL	Yes	• See Table 6.5	L	Visual Impact Assessment (Appendix D3)

	reasons, the facility will be required to be fenced off from the surrounding farm.			• Visual impacts and sense of place impacts associated with the operation phase of Nyarhi SPP.										
			Traffic volumes	• The proposed development will not result in any major traffic impacts during the operational phase.	-		S	L	Po	PR	NL	Yes	• See Table 6.5	L	Traffic Impact Assessment (Appendix D8)
			Health & Safety	• The proposed development will not result in any health and safety impacts during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	N/A
			Positive social impacts	• Direct and indirect employment and skills • development opportunities • Development of non-polluting, renewable energy • infrastructure • Contribution to LED and social upliftment • Potential impacts on tourism	+		N	L	D	PR	NL	Yes	• See Table 6.5	H-L	Social Impact Assessment (Appendix D7)
			Negative social impacts	• Potential impacts on tourism • Impacts associated with the loss of agricultural land. • Visual and sense of place impacts	-		L	L	Pr	PR	SL	Yes	• See Table 6.5	L	Social Impact Assessment (Appendix D7)
			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	• Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries	-		S	S	U	CR	NL	Yes	• As no sites, features or objects of cultural historic significance have been identified in the project area, there would be no impact as a result of the proposed development. • Any discovered artifacts shall not be removed under any circumstances. Any destruction of a site can only be allowed once a permit is obtained, and the site has been mapped and noted. Permits	L	Heritage Impact Assessment (Appendix D5)

													shall be obtained from the SAHRA should the proposed site affect any world heritage sites or if any heritage sites are to be destroyed or altered.		
			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 and Flora	• Direct habitat destruction – loss and damage to natural habitats, impact/changes on vegetation & fauna communities, loss of threatened / near-threatened taxa, impact to fauna • Habitat fragmentation – disruption of natural movement patterns • Increased soil erosion and fragmentation – terrestrial ecological changes including establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora • Soil and water pollution • Spread and establishment of alien invasive species • Negative effect of human activities and road mortalities – snaring, killing and hunting of certain faunal species, litter and inadequate sanitation, risk of uncontrolled fires		-	S/L	L	D	BR	SL	Yes	• 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 will stay operational and maintained and monitored until such a stage is reached where it is no longer necessary.	M	Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1)

													• All the monitoring and reporting on the management and rehabilitation issues to the authorities will continue till rehabilitated areas / closure 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 (Table 6.4).		
			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	• 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. • 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	L	Agricultural Compliance Statement (Appendix D4)

													stockpiled for re-spreading during rehabilitation. • During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.		
			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	Confirmation from the Local Municipality to provide services
			Groundwater	• Pollution due to construction vehicles	-		S	S	Pr	CR	ML	Yes	• 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.	L	-
			Wetland/ Riparian areas	• Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline • Soil compaction and increased sediment transport and erosion • Soil and water pollution • Spread and establishment of alien invasive species		-	S/L	L	D	BR	SL	Yes	• 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 stormwater measures must be maintained	L	Wetland / Riparian Impact Assessment (Appendix D1)

													• Water management facilities will stay operational and maintained and monitored until such a stage is reached where it is no longer necessary. • The development areas will be shaped to make it safe. • All the monitoring and reporting on the management and rehabilitation issues to the authorities will continue till closure of the site 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		
			Visual landscape	• Visual impact of activities on sensitive visual receptors in close proximity to the proposed Nyarhi SPP • 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 Nyarhi SPP it is anticipated that the proposed facility will be refurbished and upgraded to prolong its life. No decommissioning of the facility is proposed.	-		L	S	D	PR	ML	Yes	• See Table 6.4	L	Visual Impact Assessment (Appendix D3)
			Traffic volumes	• Road network will be affected • Increase in traffic influencing traffic congestion and road safety	-		L	S	D	CR	NL	Yes	• See Table 6.6	L	Traffic Impact Assessment

														(Appendix D8)
			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 influx of people in the rural area.	-		L	S	Pr	PR	ML	Yes	• Demarcated routes to be established for construction vehicles to ensure the safety of communities, especially in terms of road safety and communities to be informed of these demarcated routes. • Where dust is generated by trucks passing on gravel roads, dust mitigation must be enforced. • Any infrastructure that would not be decommissioned must be appropriately locked and/or fenced off to ensure that it does not pose any danger to the community. • Components that are dismantled must be recycled / reduced as far as possible.	L	-
			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	• The decommissioning phase must aim to adhere to the relevant noise regulations and limit noise within standard working hours in order to reduce disturbance of dwellings in close proximity to the development.	L	Social Impact Assessment (Appendix D7)
			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. The closest tourism facility is the Wawielpark Holiday Resort.	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	NL	Yes	• Any discovered artifacts shall not be removed under any circumstances. Any destruction of a site can only be allowed once a permit is obtained and the site has been mapped and noted. Permits shall be obtained from the SAHRA	L	Heritage Impact Assessment (Appendix D5)

													should the proposed site affect any world heritage sites or if any heritage sites are to be destroyed or altered.		

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

An Environmental Awareness and Fire Management Plan is included in Appendix I of the EMPr in Appendix F1.

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 were addressed in more detail in the BA report.

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) (GNR 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)(b) (GNR 327): *"The development of (ii) infrastructure or structures with a physical footprint of 100 square meters or more (a) within a watercourse or (b) 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 (GNR 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 meters 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)(gg) (GN.R 324): *"The development of a road wider than 4 metres with a reserve less than 13,5 metres (b) in the Free State, (i) outside urban areas and within (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the*

competent authority or in bioregional plans and (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas."

- Activity 10 (b)(i)(ee)(gg)(hh) (GN.R 324): *"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State (i) outside urban areas and within (ee) Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans*, within *(gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas 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)(iv) (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 2004, (ii) within critical biodiversity areas identified in bioregional plans and (iv) areas within a watercourse or wetland; or within 100 metres from the edge of watercourse or wetland."*

- Activity 14(ii)(a)(c)(b)(i)(ff)(hh) (GN.R 324): *"The development of (ii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; in the (b) Free State Province, (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 and (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve."*

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

During the construction phase minor negative impacts are foreseen over the short term. The latter refers to a period of months. Table 6.4 summarises the potentially most significant impacts and the mitigation measures that are proposed during the construction phase.

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1)	Direct habitat destruction	Negative Very High	Negative Medium	• The removal of indigenous plants should 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 should 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 should be obtained from the relevant authority. • Peripheral impacts around the development footprint sites on the surrounding vegetation of the area should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum, while the rehabilitation of the site should 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. • All development activities should be restricted to specific recommended areas. The Environment Control Officer (ECO) should control these areas. Storage of 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 entire development footprint should 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 should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. 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. • Where holes for poles pose a risk to animal safety, they should 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 should rather 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 should only be used after approval from an ecologist. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. • Monitoring should 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 will occur outside these areas.
	Increased soil erosion and sedimentation	Negative High	Negative Low	• The project should 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. • 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 should 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 and road mortalities	Negative Medium	Negative Low	• No staff should 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 should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around 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 should 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 should be avoided or limited as much as possible.
Wetland / Riparian Impact Assessment (Appendix D1)	Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline	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: o All disturbed surface areas will be re-shaped to resemble the surrounding natural topography. Surfaces will be ripped / scarified, and re-vegetated with indigenous grass species. o As far, as is practical, implement concurrent rehabilitation processes to limit degradation of soil biota. o Terrestrial invasive removal programs must be maintained throughout the proposed development as well as in the aftercare and maintenance phases. • A buffer zone of 32 meters should be implemented around the drainage channels and riparian zone to prevent sediment changes to the channels.

	Soil compaction and increased 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 will 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, must not be allowed. 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 should 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), and stockpiles containing mostly exotic or weedy species should receive specialised handling and should be invasion. Control should begin prior to construction phase considering small populations of invasive species occur around the sites. • Institute strict control over materials brought onto site, which should 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 (stormwater canals), and stockpiles containing mostly exotic or weedy species should receive specialised handling and should be covered for extended periods to inhibit seedling germination of these species. Active management and eradication of exotic / alien plant species should also occur when seedlings are found.
Avifaunal Assessment (Appendix D2)	Displacement of priority avian species from important habitats (PV array and associated infrastructure)	Negative Low	Negative Low	• Limit construction footprint and retain indigenous vegetation wherever possible. • Limit access to remainder of area outside of the construction footprint. • Avoid construction during the breeding season (summer). • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Control noise to minimum.
	Displacement of resident avifauna through increased disturbance (PV array and associated infrastructure)	Negative Medium	Negative Low	• Limit construction footprint and retain indigenous vegetation wherever possible. • Limit access to remainder of area outside of the construction footprint. • Avoid construction during the breeding season (summer). • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Control noise to minimum.

	Loss of important avian habitats (PV array and associated infrastructure)	Negative Medium	Negative Low	• Limit construction footprint. • Limit access to remainder of area outside of the construction footprint. • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Use existing roads as far as possible. • Rehabilitate with indigenous vegetation.
	Displacement of priority avian species from important habitats (Power Line)	Negative Medium	Negative Low	• Limit construction footprint and retain indigenous vegetation wherever possible. • Limit access to remainder of area outside of the construction footprint. • Avoid construction during the breeding season (summer). • Laydown areas to be located only in disturbed zones. • Construct in shortest timeframe. • Control noise to minimum. • Maintain a single access and maintenance road within power line servitude.
	Displacement of resident avifauna through increased disturbance (Power Line)	Negative Low	Negative Low	• None required due to low significance
	Loss of important avian habitats (Power Line)	Negative Low	Negative Low	• None required due to low significance
Agriculture Compliance Statement	Loss of agricultural potential by occupation of land	Negative Low	Negative Low	• No mitigation measures based on the low impact significance. Agricultural land directly occupied by the development infrastructure will become unavailable for agricultural use, with consequent potential loss of agricultural productivity and employment. The site assessment has found

(Appendix D4)				that the soils across the development footprint are unsuitable for the production of cultivated crops because of their shallow depth, and are therefore only suited to grazing. • No further loss occurs in the subsequent project phases.
	Loss of agricultural potential by soil degradation	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. • Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the stormwater run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion. • Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation. • 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.

				• Record GPS positions of all occurrences of below-surface soil disturbance (e.g. excavations). Record the date of topsoil stripping and replacement. Check that topsoil covers the entire disturbed area. • Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. • Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. • During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. • Erosion must be carefully controlled where necessary on topsoiled areas.
	Loss of agricultural potential by dust generation	Negative Low	Negative Low	• Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil.
Heritage Impact Assessment (Appendix D5)	Direct or physical impacts, implying alteration or destruction of heritage features	Negative Low	Negative Low	• Known sites should be clearly marked, so that they can be avoided during construction activities. • The contractors and workers should be notified that archaeological sites might be exposed during the construction activities. • Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer (ECO) shall be notified as soon as possible. • All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the ECO will advise the necessary actions to be taken. • Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and

				• Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the NHRA, Section 51(1).
Palaeontological Impact Assessment (Appendix D6)	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	Negative High	Negative Medium	• The ECO must be made aware that fossils (stromatolites) of the Malmani (Chuniespoort Group, Transvaal Supergroup) has a Very High Palaeontological Significance. • When the Nyarhi Power Plant layout has been established a walkdown of the area must be completed by a qualified Palaeontologist to catalogue and photograph well-preserved stromatolites. This action should take place after initial vegetation clearance but before the ground is levelled for construction. • If a well-preserved stromatolite outcrop falls in the development footprint the stromatolites ought to be cordoned off and a buffer of 30m should be placed around the outcrop. • A representative example of well-preserved stromatolites should be removed and placed near the offices of the PV as an informative example of fossils in the area.
Visual Impact Assessment (Appendix D3)	Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed 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 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.
Social Impact Assessment (Appendix D7)	Direct and indirect employment opportunities and skills development	Positive Low	Positive Medium	Enhancement: • 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 Moqhaka LM, Fezile Dabi 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 effect	Positive Low	Positive Medium	Enhancement: • It is recommended that a local procurement policy is adopted to maximise the benefit to the local economy. • A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g., construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable. • Local procurement is encouraged along with engagement with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible.
	Potential loss of productive farmland	Negative Medium	Negative Low	• The proposed site 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.
	Influx of jobseekers and change in population	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 closest towns and surrounds) to ensure workers can easily access their place of employment and do not need to move closer to the project site. • Working hours should be kept between daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities. • Compile and implement a grievance mechanism. • Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour. • Prevent the recruitment of workers at the project site. • Implement, manage and monitor a grievance mechanism for the recording and management of social issues and complaints. • Establish clear rules and regulations for access to the proposed site. • Appoint a security company and implement appropriate security procedures to ensure that workers do not remain onsite after working hours. • Inform local community organisations and policing forums of construction times and the duration of the construction phase. • Establish procedures for the control and removal of loiterers from the construction site.
	Safety and security impacts	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 Low	• All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. • Heavy vehicles should be inspected regularly to ensure their road worthiness. • Provision of adequate and strategically placed traffic warning signs, that have to be maintained for the duration of the construction phase, and control measures along the Vermaasdrift road and gravel road off the Vermaasdrift roads to warn road users of the construction activities taking

				place for the duration of the construction phase. Warning signs must be always visible, especially at night. • Implement penalties for reckless driving to enforce compliance to traffic rules. • Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work). • The developer and EPC Contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities. • The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if disturbed due to construction activities. • The EPC Contractor must ensure that damage / wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase. • A method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.
	Nuisance impacts (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 implemented around the perimeters of the project site. • Adequate fire-fighting equipment should be provided and readily available on site and all staff should be trained in firefighting and how to use the fire-fighting equipment. • No staff (except security) should be accommodated overnight on site and the contractor should ensure that no open fires are allowed on site. The use of cooking or heating implements should only be used in designated areas. • Contractors need to ensure that any construction related activities that might pose potential fire risks, are done in the designated areas where it is also managed properly. • Precautionary measures need to be taken during high wind conditions or during the winter months when the fields are dry. • The contractor should enter an agreement with the local farmers before the construction phase that any damages or losses during the construction phase related to the risk of fire and that are created by staff during the construction phase, are borne by the contractor.
	Visual and sense of place impacts	Negative Low	Negative Low	• Implement mitigation measures identified in the Visual Impact Assessment (VIA) prepared for the project. • Limit noise generating activities to normal daylight working hours and avoid weekends and public holidays.

				• The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible. • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. • All vehicles must be road-worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits. • Communication, complaints, and grievance channels must be implemented and contact details of the CLO must be provided to the local community in the study area.
Traffic Impact Assessment (Appendix D8)	Increase in traffic volumes, influencing traffic congestion and road safety	Negative Medium	N/A	• Stagger component delivery to site. • Reduce the construction period. • The use of mobile batch plants and quarries in close proximity to the site. • Staff and general trips should occur outside of peak traffic periods. • Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase • All construction vehicles must be roadworthy and drivers must have the relevant licenses for the type of vehicles they are operating. • 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 study area 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) (GNR 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)(i)(ee)(gg)(hh) (GN.R 324): "*The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) in the Free State (i) outside urban areas and within (ee) Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans, within (gg) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas and (hh) Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland*."

Table 6.5 summarised the negative impacts are generally associated with the Nyarhi Solar Power Plant (including other associated infrastructure) and power line, which include impacts on the fauna and flora, soils, geology, surface water, the pressure on existing services infrastructure, and visual impacts. The provision of sustainable services delivery also needs to be confirmed. The operational phase will have a direct positive impact through the provision of employment opportunities for its duration, and the generation of income to the local community

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

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1)	Direct habitat destruction	Negative Very High	Negative Medium	• The removal of indigenous plants should 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 should 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 should be obtained from the relevant authority. • Peripheral impacts around the development footprint sites on the surrounding vegetation of the area should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum. • All operation and maintenance activities should be restricted to specific recommended areas. Storage of equipment, fuel and other materials should be limited to demarcated areas. • Where holes for poles pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. • Poisons for the control of problem animals should rather 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 should only be used after approval from an ecologist. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
	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 maintaining 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. • Operation and maintenance activities must remain within defined areas. No disturbance must occur outside these areas.
	Increased soil erosion and sedimentation	Negative High	Negative Low	• 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 site.

				• Repair all erosion damage as soon as possible to allow for sufficient rehabilitation growth. • Gravel roads 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 site.
	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. • 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 should 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 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 continue throughout the operation phase. • 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. 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 and road mortalities	Negative Medium	Negative Low	• No staff should be accommodated on the site. If practical, construction workers should stay in one of the nearby villages and transported daily to the site.

				• Regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals. • Maintain proper firebreaks around entire development footprint. • Educate workers regarding risks and correct disposal of cigarettes. • A speed limit should 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 should be avoided or limited as much as possible.
Wetland / Riparian Impact Assessment (Appendix D1)	Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline	Negative High	Negative Medium	• 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. • Storage of building/maintenance equipment, fuel and other materials should be limited to demarcated areas. • Demarcate all riparian boundaries with pegs and danger tape.

				• Edge effects, 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: ○ Terrestrial invasive removal programs must be maintained throughout the proposed development as well as in the aftercare and maintenance phases. • A buffer zone of 32 meters should be implemented around the drainage channels and riparian zone to prevent sediment changes to the channels.
	Soil compaction and increased 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. • 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, must not be allowed. It will have a negative impact due to the dispersive/compaction characteristics of soils and its implications on the long term. • 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 should 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. • 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 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), and stockpiles containing mostly exotic or weedy species should receive specialised handling and should be invasion. Control should begin prior to construction phase considering small populations of invasive species occur around the site, and continue throughout the remaining phases of the development. • Institute strict control over materials brought onto site, which should be inspected for seeds and steps taken to eradicate these before transport to the site. • 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 (stormwater canals), and stockpiles containing mostly exotic or weedy species should receive specialised handling

				and should be covered for extended periods to inhibit seedling germination of these species. Active management and eradication of exotic / alien plant species should also occur when seedlings are found.
Avifauna Impact Assessment (Appendix D2)	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.
	Displacement of priority avian species from important habitats (Power Line)	Negative Low	Negative Low	• None required due to low significance.
	Displacement of resident avifauna through increased disturbance (Power Line)	Negative Low	Negative Low	• None required due to low significance.

	Collision when flying into power line infrastructure	Very High Negative	Medium Negative	• Require walk-through after pole positions are determined to demarcate sections requiring bird deterrents/flappers. • Install flappers on all required sections of power line (as directed by avifaunal specialist) on or directly adjacent to site. • Quarterly fatality monitoring and record-keeping throughout project life
	Electrocution when perched on power line infrastructure	High Negative	Medium Negative	• Pole designs to discourage bird perching and to be signed off by avifaunal specialist. • Quarterly fatality monitoring and record-keeping throughout project life.
Agriculture Compliance Statement (Appendix D4)	Loss of agricultural potential by occupation of land	Negative Low	Negative Low	• Maintain the stormwater run-off control system. Monitor erosion and remedy the stormwater control system in the event of any erosion occurring. • Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the stormwater run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring. • Facilitate re-vegetation of denuded areas throughout the site. • Undertake a periodic site inspection to record the progress of all areas that require re-vegetation.

	Increased financial security for farming operations	Low Positive	Low Positive	• No mitigation measures required.
	Impacts on agricultural production and employment	Negative Low	Negative Low	• No mitigation required.
Heritage Impact Assessment (Appendix D5)	Direct or physical impacts, implying alteration or destruction of heritage features	Negative Low	Negative Low	• Known sites should be clearly marked, so that they can be avoided during construction activities. • The contractors and workers should be notified that archaeological sites might be exposed during the construction activities. • Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer (ECO) shall be notified as soon as possible. • All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the ECO will advise the necessary actions to be taken. • Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and • Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the NHRA, Section 51(1).

Visual Impact Assessment (Appendix D3)	Visual impact on observers travelling along the roads and residents at homesteads within a 5km radius of the SPP	Negative Medium	Negative Low	Planning • Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. • Where insufficient natural vegetation exists next to the property, a 'screen' can be planted 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 sensitive visual receptors in close proximity to the proposed facility.	Negative Medium	Negative Low	Planning & Operation • 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.
	Visual impacts of glint and glare on sensitive visual receptors in close proximity to the proposed facility.	Negative Medium Low	N/A	• No mitigation measures are required.
	Visual impacts on observers travelling along the roads and residents at homesteads in close proximity to the power line structures – Option 1	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 impacts on observers travelling along the roads and residents at homesteads in close proximity to the power line structures – Option 2	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 impacts and sense of place impacts associated with the operation phase of Nyarhi SPP	Negative Low	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.
Social Impact Assessment (Appendix D7)	Direct and Indirect employment opportunities and skills development	Positive Low	Positive Medium	Enhancement: • It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. • Vocational training programs should be established to promote the development of skills.
	Development of non-polluting, renewable energy infrastructure	Positive Medium	Positive Medium	• No enhancement identified
	Potential loss of agricultural land	Negative Medium	Negative Low	• The proposed mitigation measures for the construction phase should have been implemented at this stage. • Mitigation measures from the Agricultural Compliance Statement should also be implemented.
	Contribution to Local Economic Development (LED) and social upliftment	Positive Medium	Positive High	Enhancement: • A CNA must be conducted to ensure that the LED and social upliftment programmes proposed by the project are meaningful. • Ongoing communication and reporting are required to ensure that maximum benefit is obtained from the

						programmes identified, and to prevent the possibility for such programmes to be misused. • The programmes should be reviewed on an ongoing basis to ensure that they are best suited to the needs of the community at the time (bearing in mind that these are likely to change over time).
	Impact on tourism	Negative Low	Positive Low	Negative Low	Positive Low	• The impact rating is dependent on how the development is perceived by tourism. In some cases, renewable energy developments can be seen as an addition to the tourist industry in the area (positive low) or it can be viewed as a negative. The rating is subjective. • 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 and sense of place impacts	Negative Low	Negative Low	• To effectively mitigate the visual impact and the impact on sense of place during the operational phase of the proposed SPP, it is suggested that the recommendations made in the Visual Impact Assessment (specialist study) should be followed in this regard
Traffic Impact Assessment (Appendix D8)	The road network will be affected as there will be an increase in traffic, congestion and impact on road safety	Negative Low	N/A	• All operations and maintenance vehicles must be roadworthy and drivers must have the relevant licenses for the type of vehicles they are operating. • All vehicle drivers need to strictly adhere to the rules of the road.

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

Table 6.6: Impacts and the mitigation measures during the decommissioning phase

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1)	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 will stay operational and maintained and monitored until such a stage is reached where it is no longer necessary. • All the monitoring and reporting on the management and rehabilitation issues to the authorities will continue till rehabilitated areas / closure 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 (Table 6.4).
	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	

Wetland / Riparian Impact Assessment (Appendix D1)	Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline	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 stormwater measures must be maintained • Water management facilities will stay operational and maintained and monitored until such a stage is reached where it is no longer necessary. • The development areas will be shaped to make it safe. • All the monitoring and reporting on the management and rehabilitation issues to the authorities will continue till closure of the site 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 compaction and increased sediment transport and erosion	Negative Medium	Negative Low	
	Soil and water pollution	Negative Medium	Negative Low	
	Spread and establishment of alien invasive species	Negative Medium	Negative Low	
Avifauna Impact Assessment (Appendix D2)	Displacement of priority avian species from important habitats (PV facility and power line)	Negative Low	Negative Low	• None required due to low significance
	Displacement of resident avifauna through increased	Negative Low	Negative Low	• None required due to low significance

	disturbance (PV facility and power line)			
Agriculture Compliance Statement (Appendix D4	Loss of agricultural potential by occupation of land	Negative Low	Negative Low	• No mitigation measures.
	Loss of agricultural potential by soil degradation (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. • Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the stormwater run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion. • Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation. • 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.

				• Record GPS positions of all occurrences of below-surface soil disturbance (e.g. excavations). Record the date of topsoil stripping and replacement. Check that topsoil covers the entire disturbed area.
	Loss of agricultural potential by dust generation	Negative Low	Negative Low	• Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil.
Traffic Impact Assessment (Appendix D8)	The road network will be affected as there will be an increase in traffic, congestion and impact on road safety	Negative Low (insignificant)	N/A	• All decommissioning vehicles must be roadworthy and drivers must have the relevant licenses for the type of vehicles they are operating. • All vehicle drivers need to strictly adhere to the rules of the road.

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 Species and Wetland /Riparian Impact Assessments – AGES Limpopo (see Appendix D1)
- Avifaunal Impact Assessment – Agreenco Environmental Projects (see Appendix D2)
- Visual Impact Assessment – Donaway Environmental Consultants (see Appendix D3)
- Agriculture Compliance Statement – Johann Lanz Soil Scientist (see Appendix D4)
- Heritage Impact Assessment – JA van Schalkwyk Heritage Consultants (see Appendix D5)
- Palaeontological Impact Assessment – Banzai Environmental (see Appendix D6)
- Social Impact Assessment – Donaway Environmental Consultants (see Appendix D7)
- Traffic Impact Assessment – BVi Consulting Engineers (see Appendix D8)
- Geotechnical Feasibility Assessment – Geopractica (see Appendix D9)

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 Issue 1: Geotechnical suitability

The geotechnical suitability for the Nyarhi SPP site was determined. The main question had to be addressed was:

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

According to the Geotechnical Feasibility Assessment (Appendix D9) the area along the western section of the site show numerous small to medium size paleo sinkholes (PSH) which are now watering holes for the owner's cattle. Earthworks will be required to fill the PSH's.

Furthermore, in terms of topography, the south eastern area of the site has increased slopes which would require bulk earthworks.

6.3.2 Issue 2: 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 site. 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?"

According to the Heritage Impact Assessment (Appendix D5) cultural landscape qualities of the region are made up of a pre-colonial element consisting of very limited Stone Age and Iron Age occupation, as well as a much later colonial (farmer) component, which also gave rise to an urban and industrial (mining) component.

The impacts expected to occur will be of a low significance based on the fact that no sites of cultural significance or value was identified or discovered.

For this proposed project, the assessment has determined that no sites, features or objects of cultural heritage significance occur in the project area, therefore no permits are required from SAHRA or the PHRA. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

From a heritage point of view, it is recommended that the proposed project be allowed to continue on acceptance of the mitigation measures presented and the conditions proposed.

6.3.3 Issue 3: Ecological Impacts

The potential impact of the proposed development on 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 site is surrounded by various mining and agricultural activities. Sections of the site have been excluded from the development footprint due to the presence of areas under pivot irrigation.

According to the Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (Appendix D1), the proposed development activities will modify the vegetation and faunal habitats of the development site to a certain extent varying according to the habitats on the site, although in general the vegetation on site where the development footprint is planned are classified as pristine to slightly degraded. The development footprint contains areas that are variously categorised in terms of their conservation value and ecosystem functioning. Areas of varying ecological sensitivity were identified in the development footprint as indicated in Figure 6.1 below.

It is evident from the distribution of biodiversity, presence of threatened species and sites of scientific interest, that the proposed development has the potential for negative impact on the flora and faunal of the site. This is particularly true of the sensitive vegetation associated with the riverine and wetland ecosystems and the development footprint.

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

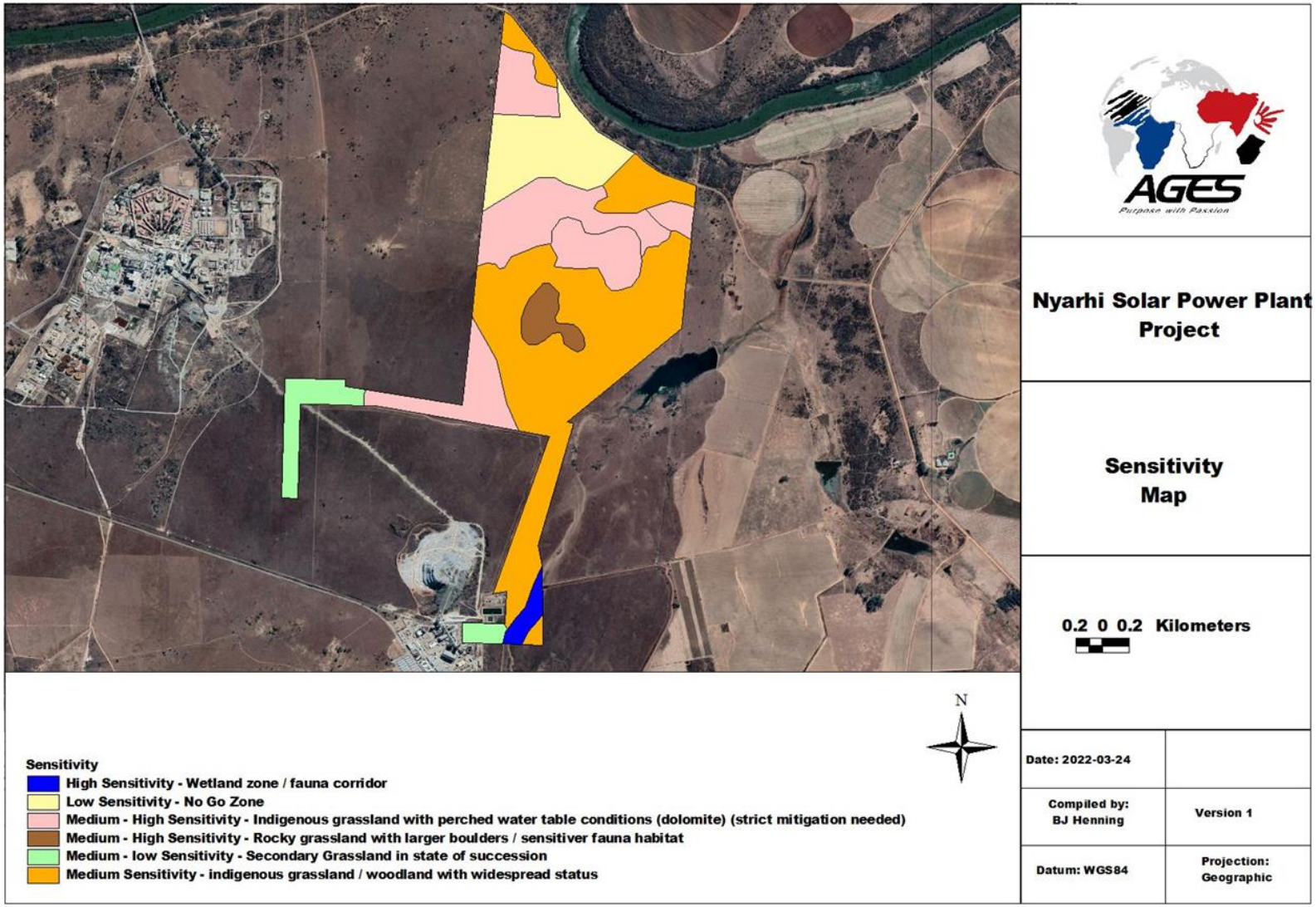


Figure 6.1: Ecological sensitivity map of the development footprint

Many endemic and protected species have been recorded in the region. The mitigation and management measures for the development should highlight the conservation status of these species and note that steps must be undertaken in conjunction with conservation authorities to protect or translocate any populations encountered during project actions. Ecological monitoring is recommended for the construction phase of the development considering the presence of protected trees and potential red data fauna on areas surrounding the site.

The importance of rehabilitation and implementation of mitigation processes to prevent negative impacts on the environment during and after the construction phase of the solar development should be considered a high priority. The proposed site for the development varies from being in a completely modified to slightly degraded state.

The protected plant species *Helichrysum nudifolium* and *Boophane disticha* occur on the site and specific mitigation measures (permit applications, avoidance, relocation) should be implemented to avoid negative impacts on the species.

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

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

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

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

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. Furthermore, the proposed layout plan of the development should be consistent with the sensitivity map, and the impact on the sensitive habitats on site should be kept to a minimum.

Provided that the proposed development (and associated layout plan) is consistent with the ecological sensitivity map and take all the mitigation measures into consideration stipulated in this report, the planned development can be supported.

6.3.4 Issue 4: Wetland / Riparian Impacts

The potential impact of the proposed development on wetlands known to occur on site, had to be determined. The main question which needs to be addressed is:

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

According to the Wetland / Riparian Impact Assessment (Appendix D1), two wetland types were identified namely a valleybottom wetland with channel and an exorheic depression (man-made dam). The floodplain river (Vaal River) 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 water courses are 'Moderately Modified'. Refer to Figure 6.2.

As indicated in Figure 6.2, no wetlands or riparian areas are associated with the solar power plant. Wetlands do however traverse grid connection option 1, which has been identified as the least preferred option for development due to the environmental sensitivity.

The 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.

Specific mitigation measures need to be implemented in the areas surrounding the riparian zones and water courses to prevent any negative impacts.

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

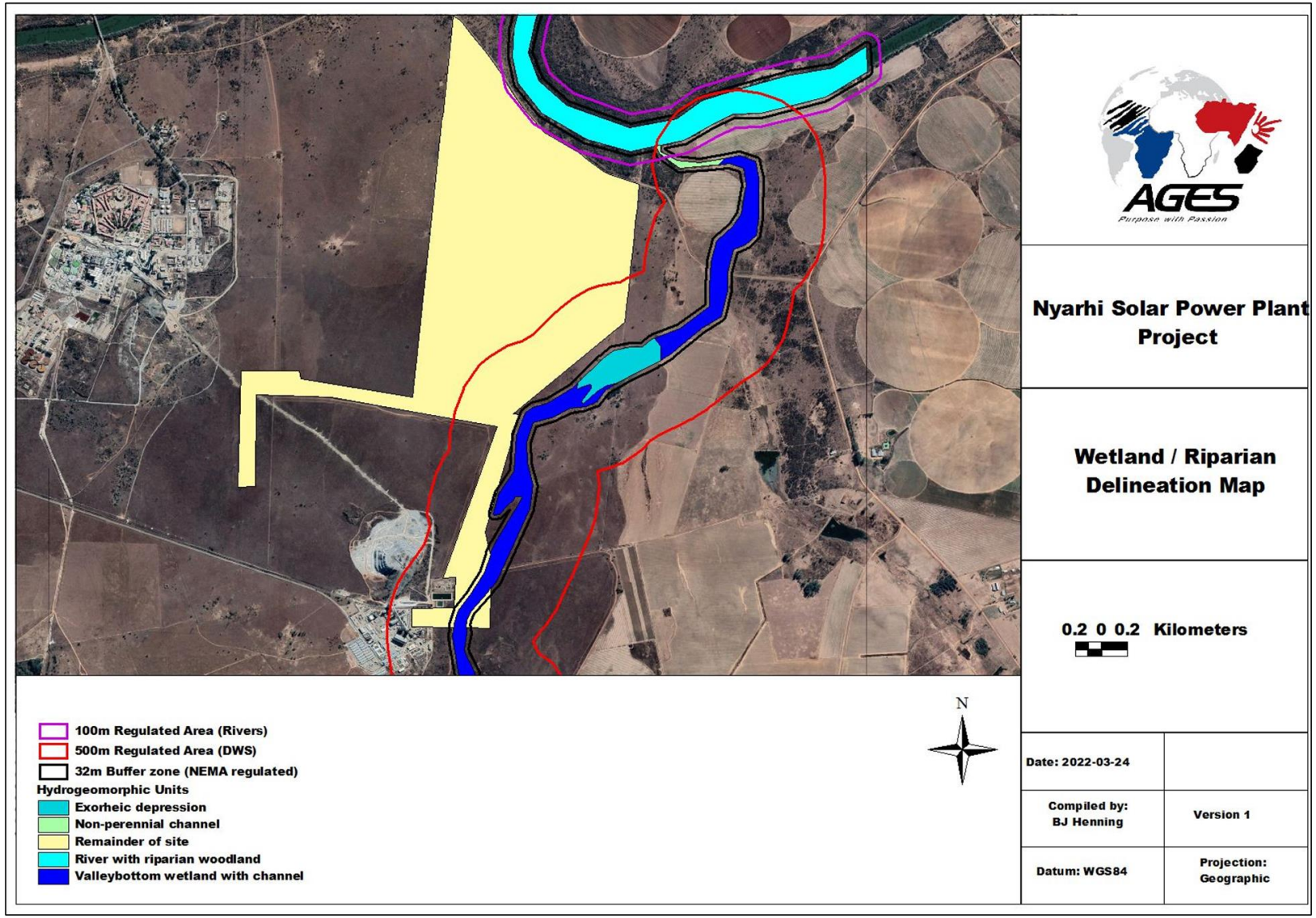


Figure 6.2: Wetland /riparian sensitivity map of the development footprint

6.3.5 Issue 5: 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 Assessment (Appendix D2), the proposed project is situated in an area of moderate avifaunal diversity, however it is adjacent to an important flyway, the Vaal River, and therefore has the potential to impact many large, fast-flying and otherwise powerline-sensitive species. The resident avifauna is also represented by moderate to low species richness and abundance, for which the total transformation of habitat will generate impacts.

There are individual impacts that are relatively high, however most can be effectively mitigated through the implementation of the mitigation measures prescribed by the specialist. The overall mitigated impacts can result in the project having an overall Low-Negative impact rating on avifauna.

Considering the two grid connection options, the avifauna specialist indicates that from an avifaunal perspective, grid connection option 2 is preferred , as this option presents significantly lower long-term impacts, as it is located in relatively intact but unproductive habitat.

Despite some residual impacts, there is no objection, from an avifaunal perspective to the development, should the controls prescribed by the independent specialist be adequately followed, with sufficient monitoring of mitigation effectiveness. If the project is authorised, then a pre-construction winter baseline assessment is recommended, along with post-construction monitoring and throughout the life of the project

6.3.6 Issue 6: 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 what extent will the landscape provides any significant visual absorption capacity"

The construction and operational phase of the proposed Nyarhi SPP and its associated infrastructure will 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 the 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. Several mitigation measures have however been proposed regardless of whether 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 mines. No buffer areas or areas to be avoided are applicable for this development.

Aesthetic issues are subjective, and some people find solar farms and their associated infrastructure pleasant and optimistic while others may find it visually invasive; it is mostly perceived as symbols of energy independence; and local prosperity. The visual impact is also dependant on the land use of an area and the sensitivity thereof in terms of visual impact, such as protected areas, parks and other tourism related activities.

Considering all positive factors of such a development including economic factors, social factors and sustainability factors, especially in 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 has recommended that the project be approved.

6.3.7 Issue 7: 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 was investigated. The main question which needs to be addressed is:

"To what extent will the proposed development compromise (negative impacts) or enhance (positive impacts) current and/or potential future agricultural production?"

The Agriculture Compliance Statement (Appendix D4) states that th proposed development will support agricultural production because it will utilise only land that is unsuitable for crop production, and avoids areas currently under pivot irrigation. It will not have an unacceptable negative impact on the agricultural production capability of the site.

The proposed development will occupy only land that is of limited land capability and is not suitable or used for crop production. There is not a scarcity of such agricultural land in South Africa and its conservation for agricultural production is not therefore a priority.

The amount of agricultural land 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 installation of PV panels will not totally exclude agriculture. The area between and underneath the panels can still be used to 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 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 standard, best practice mitigation management actions.

The proposed development is within a REDZ, which is an area that has specifically been designated within South Africa for the prioritisation of renewable energy development. The designation of the REDZ has taken into account the country's need to balance renewable energy development against the need to ensure the conservation of land required for agricultural production and national food security.

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 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 energy generation.

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

6.3.8 Issue 8: Socio-economic impacts

A Social Impact Assessment has been compiled in order to provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility; to provide a description and assessment of the potential social issues associated with the proposed facility; and the identification of enhancement and mitigation aimed at maximizing opportunities and avoiding and or reducing negative impacts (refer to Appendix D7). The main question which needs to be addressed is:

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

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

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

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

mitigation measures proposed. The significance of such impacts on the local communities can therefore be mitigated.

- The development will introduce employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during operation phase.
- The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases. This positive impact is likely to be compounded by the cumulative impact associated with the development of several other solar facilities within the surrounding area, and because of the project's location within an area which is characterised by high levels of solar irradiation, and which is therefore well suited to the development of commercial solar energy facilities.
- The proposed development also represents an investment in infrastructure for the generation of non-polluting, Renewable Energy, which, when compared to energy generated because of burning polluting fossil fuels, represents a positive social benefit for society.
- When considering Nyarhi SPP, it is also important to consider the cumulative social impacts that may arise with other proposed solar PV projects in the area.
- It should be noted that the perceived benefits associated with the project, which include RE generation and local economic and social development, outweigh the perceived impacts associated with the project.

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

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

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

6.3.9 Issue 9: 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 D6) the Nyarhi Solar Power Plant site is underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani (Chuniespoort Group, Transvaal Supergroup). According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Malmani Subgroup is Very High.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12-13 March 2022. Outcrops of weathered to well-preserved stromatolites were discovered on the whole development, but less prominent in the south of the development. Examples of exceptionally well preserved oolites were recovered from the centre portion of the development footprint. Mitigation of a sample of well-preserved stromatolites and oolites is thus recommended. By implementing mitigation measures the significance of the impact will be reduced to medium. Mitigation should take place after initial vegetation is cleared away but before the ground is levelled for construction. These recommendations should be included in the Environmental Management Plan of the Nyarhi Solar Plant.

The following recommendations have been made by the specialist:

- The ECO must be made aware that fossils (stromatolites) of the Malmani (Chuniespoort Group, Transvaal Supergroup) has a Very High Palaeontological Significance.
- When the Nyarhi Power Plant layout has been established a walkdown of the area must be completed by a qualified Palaeontologist to catalogue and photograph well-preserved stromatolites. This action should take place after initial vegetation clearance but before the ground is levelled for construction.
- If a well-preserved stromatolite outcrop falls in the development footprint the stromatolites ought to be cordoned off and a buffer of 30m should be placed around the outcrop.
- A representative example of well-preserved stromatolites should be removed and placed near the offices of the PV as an informative example of fossils in the area.

It is therefore considered that the proposed development is deemed appropriate and will not lead to detrimental impacts on the palaeontological reserves of the area. Therefore, the construction of the development may be authorised in its whole extent..

6.3.10 Issue 10: 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 D8) has indicated that impact of the construction, operation and decommissioning trip generation, on the future background traffic volumes near the Nyarhi SPP and along transportation routes, are expected to be medium to low.

The access point to the site is situated off an existing gravel road. The formalisation of this access point, to the standard, might be a requirement as part of the wayleave approval of the Free State Department: Police, Roads and Transport.

The development is supported from a transport perspective provided that the recommendations and mitigations contained in this report are adhered to. The impacts associated with the proposed Nyarhi Solar Power Plant are acceptable with the implementation of the recommended mitigation measures and is therefore support from a traffic perspective.

6.3.11 Risk Assessment for battery storage system

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

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

The sensitivity analysis undertaken as part of the BAR focusses on providing an understanding of the environmentally sensitive areas and features identified within the development footprint proposed for the SPP, as well as the grid connection corridor(s). This section considers the findings of each of the independent specialist studies undertaken for the development and describes the sensitive features and areas identified, including the location, the sensitivity rating of the features or areas as well as the associated buffers recommended by the specialist (where a buffer is considered to be relevant). The sensitive areas and features identified are also displayed on the sensitivity map included as Figure H1-H5 of this BA report.

The following points below provide the sensitivity analysis for the Nyarhi Solar Power Plant:

Ecology:

The Terrestrial Biodiversity, Plant and Animal Species Impact Assessment (refer to Appendix D1) has considered the features present within the development footprint and has made the following observations in this regard:

- Most of the natural grassland and woodland areas have a Medium Sensitivity and development can be supported in the area provided certain mitigation measures are implemented. Where the clearance of the vegetation would cause protected plants or other fauna to be removed, permits should be obtained from the relevant authorities.
- The dolomitic grassland areas have a Medium-High sensitivity due to perched water table conditions and protected plant species present. A detailed geotechnical study should be conducted for these areas to confirm further development.
- The rocky outcrop has a Medium-High Sensitivity due to its importance as fauna habitat and potential red listed plant species habitat.
- The wetlands have a high sensitivity and should be preserved as important fauna and flora habitats. The vegetation is mostly in a natural habitat, with all areas in the wetland zone or drainage channels classified as a high sensitivity area 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 (i.e. no-go to development). A 32-meter buffer should 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 plants within 500 meter 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.
- The secondary grasslands in the area have a Medium-low sensitivity due to being in a secondary state of succession.

Refer to Figure 6.1 for the ecological sensitivity map.

Based on the presence of the wetlands within grid connection corridor option 1 this option has been identified as not being suitable for development from an environmental perspective, this option is also not the preferred option from a technical perspective.

Within the remaining areas of the SPP development footprint the specialist has indicated that all areas are appropriate for development, however with some areas requiring the implementation of stricter mitigation and management measures.

Wetlands / Riparian Areas:

The Wetland / Riparian Impact Assessment (refer to Appendix D1) has considered the features present within the development footprint and has made the following observations in this regard:

Two wetland types were identified on the site for the proposed solar development namely:

- Valleybottom wetland without channel.
- Depressions: Exorheic depressions (man-made dams).

The other drainage feature in the surrounding area or within 500 meters of the development footprint site is classified as channels (rivers) with riparian woodland, which is associated with the Vaal River. These are classified as Floodplain Rivers and Non-perennial drainage channels.

No wetland /riparian features are associated with the solar power plant area, however a Valleybottom wetland traverses the southern most section of grid connection option 1. This feature must be avoided by the development (i.e. no-go area) and a buffer of 32 meters must be maintained around the feature. Therefore, grid connection option 2 is nominated as the preferred option from an environmental perspective, which is also the technically preferred option.

With the avoidance of the sensitive wetland features the development can be considered as appropriate from an environmental perspective.

Avifauna:

No specific areas of sensitivity have been identified from an avifauna perspective (Avifauna Impact Assessment, Appendix D2), however, the northern and eastern sections of the site have greater diversity, abundance and richness than the western and southern portions and, therefore, it would be beneficial if the majority of habitat transformation could be centralised to the west and south.

Considering the two grid connection options, the avifauna specialist indicates that from an avifaunal perspective, grid connection option 2 is preferred , as this option presents significantly lower long-term impacts, as it is located in relatively intact but unproductive habitat.

Therefore, from an avifauna perspective, no areas have been identified as no-go for the development of the SPP and associated infrastructure.

Visual:

No specific areas of sensitivity have been identified from a visual perspective (Visual Impact Assessment, Appendix D3). Therefore, from a visual perspective, no areas have been identified as no-go for the development of the SPP and associated infrastructure.

Heritage:

One site, destroyed, shows the remains of face-bricks that were used for the buildings. Two rectangular structures, built with local stone, are located about 80m to the west. These are interpreted as small-stock enclosures that are related to the main structure.

Due to the fact that these features are demolished, they judged to have low significance and are viewed to be sufficiently documented after having been included in the Heritage Impact Assessment report (Appendix D5).

No sites, features or objects of cultural significance from the Stone Age, Iron Age or the historic period were identified on site.

Therefore, no specific features of sensitivity have been identified from a heritage perspective.

Palaeontology:

No palaeontological no-go areas have been identified for the project (Palaeontological Impact Assessment, Appendix D6). However, outcrops of weathered to well-preserved stromatolites were discovered on the whole development footprint, but less prominent in the south of the development. Examples of exceptionally well preserved oolites were recovered from the centre portion of the development footprint. Mitigation of a sample of well-preserved stromatolites and oolites is therefore recommended. By implementing mitigation measures the significance of the impact will be reduced to medium.

Social:

No specific areas of sensitivity have been identified from a social perspective (Social Impact Assessment, Appendix D7). Therefore, from a social perspective, no areas have been identified as no-go for the development of the SPP and associated infrastructure.

Traffic:

No specific areas of sensitivity have been identified from a traffic perspective (Traffic Impact Assessment, Appendix D8). Therefore, from a traffic perspective, no areas/road aspects have been identified as no-go for the development of the SPP and associated infrastructure.

Agriculture:

The agricultural sensitivity of the SPP, and the two grid connection corridor options have been confirmed as being of a **low and medium** sensitivity (Agricultural Compliance Statement, Appendix D9). The site has low agricultural potential due to soil constraints, including shallow soils, which makes the site unsuitable for cultivation, but suitable for grazing. Therefore, the agricultural land use (outside of the irrigated areas) is limited to grazing. No specific areas of sensitivity have been identified by the specialist that needs to be considered for the placement of infrastructure. Therefore, from an agricultural perspective, no areas have been identified as no-go for the development of the SPP and associated infrastructure.

6.5 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 6.7.

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

6.5.1 Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

Table 6.7: The rating system

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

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

1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.

3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.

CUMULATIVE EFFECT

This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

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

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

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.

51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

7 CUMULATIVE EFFECTS ASSESSMENT

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

Appendix 1. (3)(i) An BAR (...) must include-
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts.

7.1 INTRODUCTION

The EIA Regulations (as amended) 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 Basic Assessment Report and for each impact a separate section has been added which discusses any cumulative issues, and where applicable, draws attention to other issues that may contextualise or add value to the interpretation of the impact. 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 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 this cumulative effects analysis generally includes an area of a 30km radius surrounding the proposed development – refer to Figure 7.1 below and Figure G.

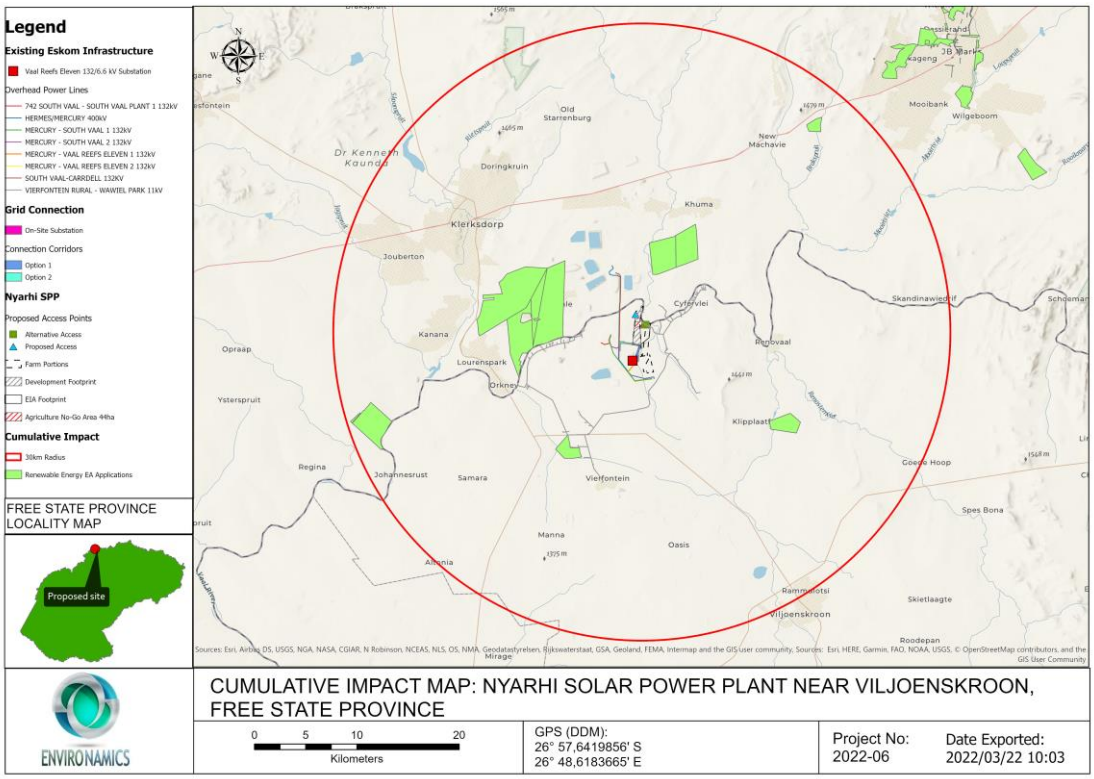


Figure 7.1: Geographic area of evaluation with utility-scale renewable energy generation sites

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 and North West Province. A larger geographic area may be used to analyse cumulative impacts based on the specific temporal or spatial impacts of a resource. For example, the socio-economic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource where it differs from the general area of evaluation described above.

7.3 TEMPORAL BOUNDARY OF EVALUATION

A temporal boundary is the timeframe during which the cumulative effects are reasonably expected to occur. The temporal parameters for this cumulative effects analysis are the anticipated lifespan of the proposed project, beginning in 2023 and extending over 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 projects, and projects being proposed in the geographical area of evaluation.

7.4.1 Existing projects in the area

According to the DFFE's database thirteen (13) PV solar plant applications (of which two applications have lapsed) have been submitted to the Department within the geographic area of investigation, – refer to Table 7.1. It should be noted that there is uncertainty with regards to the accuracy and validity of the information obtained from the Departments database as regular updates are not always applied as the status of projects change.

Table 7.1: A summary of related facilities, 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
Paleso SPP[4]	9km	150MW	14/12/16/3/3/1/2365	Basic Assessment	Approved
Siyanda SPP	8km	150MW	14/12/16/3/3/1/2369	Basic Assessment	Approved
Thakadu SPP	1km	150MW	14/1216/3/3/1/2476	Basic Assessment	In Process
Noko SPP	21km	150MW	14/12/16/3/3/1/2474	Basic Assessment	Approved
Kabi Vaalkop PV 3	6km	75 MW	12/12/20/2513/3	Scoping and EIA	Approved
Kabi Vaalkop PV 2	7km	75 MW	12/12/20/2513/2	Scoping and EIA	Approved

[4] Environamics was the EAP responsible for the Basic Assessments for the Paleso, Siyanda, Noko and Thakadu Solar Power Plants.

Kabi Vaalkop PV[5]	7.5km	75 MW	12/12/20/2513/4	Scoping and EIA	Approved
Kabi Vaalkop PV 1	7km	75 MW	12/12/20/2513/1	Scoping and EIA	Approved
Buffels Solar PV 1	5 km	100MW	14/12/16/3/3/2/777	Scoping and EIA	Approved
Buffels Solar PV 2	6 km	100 MW	14/12/16/3/3/2/778	Amendment	Approved
Rietvlei solar	16 km	-	14/12/16/3/3/2/450	Scoping and EIA	Withdrawn/Lapsed
Genesis Orkney Solar (Pty) Ltd	23 km	100MW	14/12/16/3/3/2/954	Scoping and EIA	Approved
Afropulse 538 Pty Ltd	13 km	50MW	12/12/20/2280	BAR	Withdrawn/Lapsed

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

7.4.2 Projects in the foreseeable future

As part of the SEA for Wind and Solar Energy in South Africa, the CSIR and the DFFE mapped the location of all EIA applications submitted within South Africa. According to this database approximately nine (9) applications have been submitted for renewable energy projects within the geographical area of investigation, with six (6) of these being considered valid in terms of an Environmental Authorisation as two (2) applications have lapsed or was withdrawn, one (1) application is only for transmission infrastructure and there is uncertainty regarding the completion of the EIA process for one (1) project which seems to be incorrectly listed on the DFFE database based on the lack of information available for the project. Environamics was the appointed EAP for four (4) other projects in close proximity to the development, which is not yet included in the DFFE database, but is considered in the cumulative impact assessment. The majority of these projects are located in close proximity to Orkney, and to the north of the site considered for the Nyarhi Solar Power Plant.

[5] The application was only for transmission infrastructure (i.e. substation and power lines) and not a PV solar power plant.

7.5 SPECIALIST INFORMATION ON CUMULATIVE EFFECTS

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

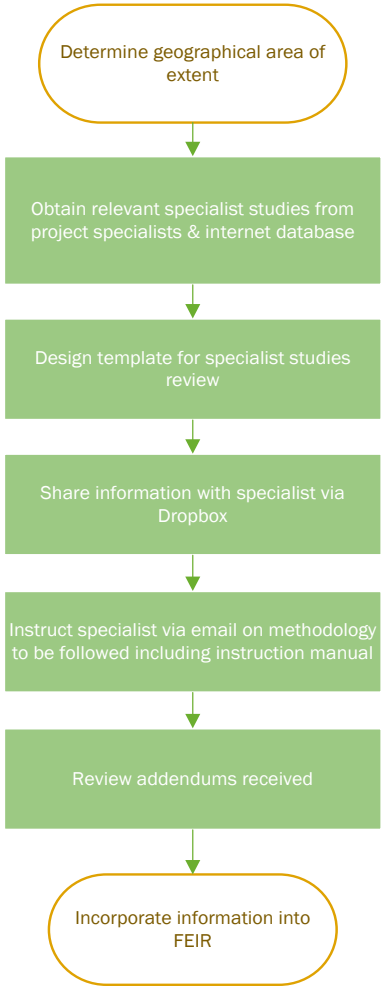


Figure 7.2: Process flow diagram for determining cumulative effects

7.5.1 Soil, Land Capability and Agricultural Potential

According to the Agriculture Compliance Statement (Appendix D4) the most important concept related to 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 agricultural land, with a consequent decrease in agricultural production.

In quantifying the cumulative impact, the area of land taken out of agricultural production (grazing) as a result of all developments (total generation capacity of 1,300 MW) will amount to a total of approximately 3,250 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 1.15% of the surface area. That is within an acceptable limit in terms of loss of grazing land, of which there is no particular scarcity of in the country. This is particularly so when considered within the context of the following point.

In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of lower potential agricultural land in a region which has been designated as a REDZ, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country.

The proposed development poses a low risk in terms of causing soil degradation, which can be adequately and fairly easily managed by standard best practice mitigation management actions included in the EMPr (Appendix F). If the risk for each individual development is low, then the cumulative risk is also low.

Due to 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.

Because of the negligible agricultural impact of grid connection infrastructure, its cumulative impact cannot exceed acceptable levels of change in terms of agricultural land loss, no matter how much grid infrastructure exists. The cumulative impact of the grid infrastructure is therefore also assessed as negligible.

7.5.2 Terrestrial Biodiversity, Plant and Animal Species Impact Assessment

The Terrestrial biodiversity, Plant and Animal Species Impact Assessment (Appendix D1) identified three major categories of impact on biodiversity, which includes that of cumulative impacts. These are:

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

It can be expected that if ecosystem diversity is managed effectively, species and genetic diversity should also be protected.

The specialist has considered the cumulative impacts for all three development phases of the development, which includes construction, operation and decommissioning.

The cumulative impacts expected during construction includes habitat destruction and fragmentation of, soil erosion and sedimentation, dust pollution, spillages of harmful substances, spreading of alien invasive species and negative effect of human activities on fauna and flora and road mortalities on fauna. These impacts are rated as high or medium before the implementation of mitigation measures. With the implementation of the recommended mitigation measures the ratings are reduced to an acceptable level of either medium or low.

During the operation phase the same cumulative impacts have been identified and assessed as mentioned above. These impacts are rated as high or medium before the implementation of mitigation measures. With the implementation of the recommended mitigation measures the ratings are reduced to an acceptable level of either medium or low. The same results are relevant for the decommissioning phase.

Overall, the cumulative impact of the proposed development 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 all solar developments within the area.

7.5.3 Wetland / Riparian Impact Assessment

The Wetland/Riparian Impact Assessment (Appendix D1) has considered an assessment of the cumulative effect that the development will have. Cumulative impacts have been identified for all three development phases of the project, including construction, operation and decommissioning.

The impacts identified for the construction and operation phases are the same and include impacts on the characteristics of the watercourses, soil erosion and sedimentation, spillages of harmful substances that result in water pollution and spreading and establishment of alien invasive species in the wetland features. These impacts are rated as high or medium before the implementation of mitigation measures. With the implementation of the recommended mitigation measures the ratings are reduced to an acceptable level of either medium or low.

During the decommissioning phase the cumulative impacts identified include improvement of habitat through revegetation / succession over time, soil erosion and sedimentation, spreading and establishment of alien invasive species in wetlands and spillages of harmful substances in wetlands. These impacts are rated as medium before the implementation of mitigation measures. With the implementation of the recommended mitigation measures the ratings are reduced to an acceptable level of low.

Overall, the cumulative impact of the proposed development on the wetlands would be low considering that most of the development would avoid the wetland areas according to the guidelines and buffers needed for developments. Large sections of the area have also already been degraded through agricultural activities (crop cultivation, overgrazing etc.), which have altered the pristine state of the wetlands. The low 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.

7.5.4 Avifaunal Assessment

The Avifauna Impact Assessment (Appendix D2) has identified and assessed cumulative impacts associated with the SPP, including the grid connection infrastructure. The impacts assessed includes displacement of priority avian species from important habitats, displacement of resident avifauna, loss of important avian habitats, collisions when flying into power line infrastructure and electrocutions when perched on power line infrastructure.

Cumulative impacts associated with displacement of priority avian species from important habitats scored High-Negative, as did the cumulative loss of important avian habitats whilst the cumulative displacement of resident avifauna scored Medium-Negative. These results are specific to the SPP.

In terms of the power line Cumulative impacts associated with displacement of priority avian species from important habitats scored High-Negative, whilst the cumulative displacement of resident avifauna scored Medium-Negative. Cumulative impacts associated with power line collisions and electrocutions scored Very High-Negative.

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 the Nyarhi Solar Power Plant 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), focussing the development on already disturbed zones, 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 representing the Vaal Reefs Dolomite Sinkhole Woodland after decommissioning.

An alternative would be to create a buffer of acceptable size (proposed 25%), where no development takes place and where intact habitats are present but this is not possible for the Nyarhi Solar Power Plant as it is surrounded by transformed habitats or proposed development. Buffers are not necessarily feasible due to their small size and large ‘edge effect’.

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 29% to an acceptable low-negative score, and would reduce the cumulative impacts of loss of important avian habitats by 33% to medium-negative.

Implementing successful mitigations along the power line should reduce the impact rating for cumulative displacement of resident avifauna by 19% down to an acceptable low-negative score, however cumulative displacement of priority avian species would reduce by 28% but would still be in the medium-negative category.

7.5.5 Social Impact Assessment

The Social Impact Assessment (Appendix D7) indicates that the potential for cumulative impacts to occur as a result of the surrounding projects, agricultural and mining activities are likely. Potential cumulative impacts identified for the project include positive impacts on the economy, business development, and employment, as well as negative impacts such as an influx of jobseekers and change in the area's sense of place.

Nyarhi 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 Nyarhi SPP alone.

While the development of a single solar power project may not result in a major influx of people into an area, the development of 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 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.

The positive cumulative impacts will be of a medium significance and the negative cumulative impacts will also be of a medium significance.

7.5.6 Visual Impact Assessment

The Visual Impact Assessment (Appendix D3) indicates that the proposed development is located in a close proximity of existing Eskom power infrastructure and mines and will have a cumulative impact on viewers. Other SPPs are also proposed in the area and the potential for cumulative impacts to occur as a result of the projects is therefore likely. The visual landscape mainly consists of agricultural and mining developments. Permanent residents of the area might be desensitised to industrial development due the large number of mining developments, thus, the PV plant will "blend" in with the area. The location of the SPPs within the REDZ will contribute to the consolidation of SPP structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region.

The significance of the cumulative visual impacts is medium.

7.5.7 Heritage Impact Assessment

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 Nyarhi Solar Power Plant project is located in an area with a very low presence of heritage sites and features.

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

The cultural heritage profile of the larger region is very low. Most frequently found are stone artefacts, mostly dating to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016). In addition to the Stone Age profile, there is also the Iron Age element. However, this is located well outside the 30km radius, in the Vredefort Dome area and north of Klerksdorp. The colonial period manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines. For the purpose of this review, heritage sites located in urban areas have been excluded.

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

7.5.8 Paleontological Impact Assessment

In general, development activity in the area is focused on agriculture and mining. It is quite possible that future solar farm developments may take place within the general area. The SPPs are all underlain by similar geology and therefore the Impact on these developments will be similar.

The palaeontological cumulative impacts have been assessed as being of a high significance, but can reduced to an acceptable level of medium significance with the implementation of appropriate mitigation measures.

7.5.9 Traffic Impact Assessment

The Traffic Impact Assessment (Appendix D6) indicates that depending on the timing of the other nearby renewable energy projects, where construction in particular could overlap, the 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 Nyarhi 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. Specific VECs have been identified with reference to the Solar Project (Table 6.2), which relates to the biophysical and socio-economic environments. Table 7.2 indicates the potential cumulative effects VECs and the rationale for inclusion/exclusion.

Table 7.2: Potential Cumulative Effects for the proposed project

	Valued Ecosystem Components (VECs)	Rationale for Inclusion / Exclusion	Level of Cumulative Effect
Construction Phase			
Terrestrial Biodiversity, Plant and Animal Species Impact Assessment	Habitat destruction and Fragmentation	Clearing of vegetation for construction of infrastructure, access roads etc. will be undertaken	- Medium
	Soil erosion and sedimentation	Topsoil and subsoil stripping, exposure of soils to wind and rain during construction causing erosion and sedimentation in wetlands will occur due to the construction activities	- Low
	Dust pollution	Exposure of soils to rainfall and wind during construction will result in dust pollution	- Medium
	Spillages of harmful substances	The operation and presence of heavy machinery and vehicle movement on site results in a risk for spillages	- Low

	Spreading of alien invasive species	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance, may result in the establishment and spreading of alien invasive species	- Low
	Negative effect of human activities on fauna and flora and road mortalities on fauna	Construction of infrastructure and the use of access roads etc. will have a negative effect on fauna and flora	- Low
Wetland / Riparian Assessment	Impact on the characteristics of the watercourse i.e. flow regime, habitat, biota, water quality and geomorphology due to construction within floodline zone (road crossings etc.)	Clearing of vegetation for construction of infrastructure, access roads etc. may result in an impact or change to the characteristics of water features present	- Medium
	Soil erosion and sedimentation	Topsoil and subsoil stripping, exposure of soils to wind and rain during construction causing erosion and sedimentation in wetlands is expected where these sensitive water features are present The use of heavy machinery during the construction 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 side of the road. 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.	- Medium

	Water pollution of the wetland features through 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 (heavy machinery and vehicle movement on site). 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 in wetland features	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 the mitigation measures proposed will reduce the overall impact of the development.	- Low
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 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	Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries and indirect impacts, e.g. restriction of access or visual intrusion concerning the broader environment.	The cultural heritage profile of the larger region is very low. Most frequently found are stone artefacts, mostly dating to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016). In addition to the Stone Age profile, there is also the Iron Age element. However, this is located well outside the 30km radius, in the Vredefort Dome area and north of Klerksdorp. The colonial period manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines. For the purpose of this review, heritage sites located in urban areas have been excluded. For the project area, the impacts to heritage sites are expected to be of medium significance. However, this can be ameliorated by implementing mitigation measures, include isolating sites, relocating sites (e.g. burials) and excavating or sampling any significant archaeological material found to occur within the project area. The chances of further such material being found, however, are considered to be negligible. After mitigation, the overall impact significance would therefore be low.	- Low

Palaeontological Impact Assessment	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	In general, development activity in the area is focused on agriculture and mining. It is quite possible that future solar farm developments may take place within the general area. The SPPs are all underlain by similar geology and therefore the Impact on these developments will be similar. Outcrops of weathered to well-preserved stromatolites were discovered on the whole development footprint.	- Medium
Social Impact Assessment	Impacts of employment opportunities, business opportunities and skills development	Nyarhi 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 Nyarhi SPP alone.	+ Medium
	Impact of 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 employment opportunities and higher standards of living. It is exceedingly difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring.	- Medium

Traffic Impact Study	Overall increase in traffic during the lifetime of the different renewable energy facilities, located within a 30 km radius from the Nyarhi Solar Power Plant	Depending on the timing of the other nearby renewable energy projects, where construction in particular could overlap, the 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 cumulative impact and significance of the various nearby renewable energy projects is considered to have a low/ negligible impact	- Low
Operational Phase			
Terrestrial Biodiversity, Plant and Animal Species Impact Assessment	Habitat destruction and Fragmentation	Clearing of vegetation for as part of operation and maintenance	- Medium
	Soil erosion and sedimentation	Increased hardened surfaces around infrastructure and exposed areas	- Low
	Dust pollution	Vehicle movement on site for maintenance	- Medium
	Spillages of harmful substances	Vehicle movement on site for maintenance	- Low
	Spreading of alien invasive species	Vehicle movement on site for maintenance	- Low
	Road mortalities of fauna / impact of human activities on site	Vehicle movement on site for maintenance	- Low
Wetland / Riparian Assessment	Impact on the characteristics of the watercourse i.e. flow regime, habitat, biota, water quality and geomorphology due to construction within floodline zone	Clearing of vegetation for operation and maintenance of support infrastructure, access roads etc.	- Medium
	Soil erosion and sedimentation	Increased hardened surfaces around infrastructure and exposed areas during operation	- Low

	Spread and establishment of alien invasive species	Continued movement of personnel and vehicles on and off the site for maintenance, 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 the mitigation measures proposed will reduce the overall impact of the development.	- Medium
	Spillages of harmful substances (water pollution)	Vehicle movement on site for maintenance purposes, as well as equipment	- Low
Avifaunal Impact Assessment	Collisions when flying into power line infrastructure	Collisions with power line infrastructure leading to injury or loss of avian life are cumulative impacts due to the large number of planned solar developments and the associated power lines in a 30 km radius.	- Medium
	Electrocutions when perched on power line infrastructure	Electrocutions when perched on power line infrastructure are cumulative impacts due to the large number of planned solar developments and associated power lines in a 30 km radius.	- Medium
Visual Impact Assessment	Visual impacts related to the SPP and power line	The anticipated cumulative visual impact of the proposed SPP is expected to include the change in sense of place, as well as the precedent being set for SPP in the area where currently there is only a precedent for agricultural and mining related activities. Due to the number of mines in the area, the scenic quality of the region is low, further construction and operation of the SPP in the area is likely to have a negative impact.	- Medium
Heritage Impact Assessment	Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries and indirect impacts, e.g. restriction of access or visual intrusion	The cultural heritage profile of the larger region is very low. Most frequently found are stone artefacts, mostly dating to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016). In addition to the Stone Age profile, there is also the Iron Age element.	- Low

	concerning the broader environment.	However, this is located well outside the 30km radius, in the Vredefort Dome area and north of Klerksdorp. The colonial period manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines. For the purpose of this review, heritage sites located in urban areas have been excluded. For the project area, the impacts to heritage sites are expected to be of medium significance. However, this can be ameliorated by implementing mitigation measures, include isolating sites, relocating sites (e.g. burials) and excavating or sampling any significant archaeological material found to occur within the project area. The chances of further such material being found, however, are considered to be negligible. After mitigation, the overall impact significance would therefore be low.	
Decommissioning Phase			
Terrestrial Biodiversity, Plant and Animal Species Impact Assessment	Improvement of habitat through revegetation / succession over time	Rehabilitation of site	- Low
	Soil erosion and sedimentation	Demolition of infrastructure / rehabilitation of site	- Low
	Spreading and establishment of alien invasive species	Demolition of infrastructure / rehabilitation of site	- Low
	Habitat degradation due to dust	Demolition of infrastructure / rehabilitation of site	- Medium
	Spillages of harmful substances	Vehicle movement on site for rehabilitation	- Low
	Road mortalities of fauna / impact of human activities on site	Vehicle movement on site for rehabilitation	- Low
Wetland / Riparian Assessment	Improvement of habitat through revegetation / succession over time	Rehabilitation of site	- Low
	Soil erosion and sedimentation	Demolition of infrastructure / rehabilitation of site	- Low

	Spreading and establishment of alien invasive species in wetlands	Demolition of infrastructure / rehabilitation of site	- Medium
	Spillages of harmful substances in wetlands	Vehicle movement on site for rehabilitation	- Low
Visual Impact Assessment	Visual Intrusion	The decommissioning of the PV plant and 132kV power line may increase the cumulative visual impact together with farming activities and people using the existing gravel roads adjacent to site increasing the amount of dust generated. Dust control and housekeeping will be the main factors to consider.	- Low
Other	Generation of waste	An additional demand on municipal services could result in significant cumulative impacts with regards to the availability of landfill space.	- Medium

7.7 CONCLUSION

This chapter of the Basic Assessment Report 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. All cumulative impacts will be of a medium or low significance.

The potential most significant cumulative impacts relate to:

- <u>Cumulative effects during construction phase:</u>
  - Habitat destruction and Fragmentation (- Medium)
  - Dust pollution (- Medium)
  - Impact on the characteristics of the watercourse i.e. flow regime, habitat, biota, water quality and geomorphology due to construction within floodline zone (road crossings etc.) (- Medium)
  - Soil erosion and sedimentation (- Medium)
  - Displacement of priority avian species from important habitats (- Medium)
  - Loss of important avian habitats (- Medium)
  - Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study (- 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)
- Dust pollution (- Medium)
- Impact on the characteristics of the watercourse i.e. flow regime, habitat, biota, water quality and geomorphology due to construction within floodline zone (- Medium)
- Spread and establishment of alien invasive species (- Medium)
- Avifauna collisions when flying into power line infrastructure (- Medium)
- Electrocutions when perched on power line infrastructure (- Medium)
- Visual intrusion (- Medium)

➢ Cumulative effects during the decommissioning phase:

- Habitat degradation due to dust (- Medium)
- Spreading and establishment of alien invasive species in wetlands (- Medium)
- Generation of waste (- Medium)

The cumulative impact for the proposed development is medium to low and no high, unacceptable impacts related to the project is 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 renewable energy, it may be preferable to incur a higher cumulative loss in such a region as this one (which has already been degraded by mining and agricultural activities), than to lose land with a higher environmental value elsewhere in the country. Also, the 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 BAR (...) 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, impact management measures from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;

(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;

(o) 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 final BA report. The ratings provided gives an indication of the impact significance with the implementation of the recommended mitigation measures.

- Impacts during construction phase:
  - Direct habitat destruction (- Medium)
  - Habitat fragmentation (- Medium)
  - Increased soil erosion and sedimentation (- Low)
  - Soil and water pollution (- Low)
  - Air pollution (- Low)
  - Spread and establishment of alien invasive species (- Low)
  - Negative effect of human activities and road mortalities (- Low)

- Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline (- Medium)
- Soil compaction and increased sediment transport and erosion (- Low)
- Displacement of priority avian species from important habitats (- Low)
- Displacement of resident avifauna through increased disturbance (- Low)
- Loss of important avian habitats (- Low)
- Loss of agricultural potential by occupation of land (- Low)
- Loss of agricultural potential by soil degradation (- Low)
- Loss of agricultural potential by dust generation (- Low)
- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries (- Low)
- Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study (- Medium)
- Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed SPP (- Low)
- Direct and indirect employment opportunities and skills development (+ Medium)
- Economic Multiplier effect (+ Medium)
- Potential loss of productive farmland (- Low)
- Influx of jobseekers and change in population (- Low)
- Safety and security impacts (- Low)
- Impacts on daily living and movement patterns (- Low)
- Nuisance impacts (noise and dust) (- Low)
- Increased risk of potential veld fires (- Low)
- Visual and sense of place impacts (- Low)
- Increase in traffic volumes, influencing traffic congestion and road safety (- Low)

➢ <u>Impacts during the operational phase:</u>

- Direct habitat destruction (- Medium)
- Habitat fragmentation (- Medium)
- Increased soil erosion and sedimentation (- Low)
- Soil and water pollution (- Low)

- Air pollution (- Low)
- Spread and establishment of alien invasive species (- Low)
- Negative effect of human activities and road mortalities (- Low)
- Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline (- Medium)
- Soil compaction and increased sediment transport and erosion (- Low)
- Displacement of priority avian species from important habitats (- Low)
- Displacement of resident avifauna through increased disturbance (- Low)
- Collisions with PV panels leading to injury or loss of avian life (- Low)
- Collision when flying into power line infrastructure (- Medium)
- Electrocution when perched on power line infrastructure (- Medium)
- Loss of agricultural potential by occupation of land (- Low)
- Increased financial security for farming operations (+ Low)
- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries (- Low)
- Visual impact on observers travelling along the roads and residents at homesteads within a 5km radius of the SPP (- Low)
- Visual impact on observers travelling along the roads and residents at homesteads within a 5-10km radius of the SPP (- Low)
- Visual impacts of lighting at night on sensitive visual receptors in close proximity to the proposed facility (- Low)
- Visual impacts of glint and glare on sensitive visual receptors in close proximity to the proposed facility (- Low)
- Visual impacts on observers travelling along the roads and residents at homesteads in close proximity to the power line structures (- Low)
- Visual impacts and sense of place impacts associated with the operation phase of Nyarhi SPP (- Low)
- Direct and Indirect employment opportunities and skills development (+ Medium)
- Development of non-polluting, renewable energy infrastructure (+ Medium)
- Contribution to Local Economic Development (LED) and social upliftment (+ High)
- Impact on tourism (+/- Low)

- The road network will be affected as there will be an increase in traffic, congestion and impact on road safety (- Low)

➢ Impacts during the decommissioning phase:

- Improvement of habitat through revegetation / succession over time (+ Medium)
- Soil erosion and sedimentation (- Low)
- Spreading and establishment of alien invasive species (- Low)
- Habitat degradation due to dust (- Low)
- Spillages of harmful substances (- Low)
- Road mortalities of fauna / impact of human activities on site (- Low)
- Impact on the characteristics of the watercourse – i.e. flow regime, habitat, biota, water quality and geomorphology due to disturbance within the floodline (- Medium)
- Soil compaction and increased sediment transport and erosion (- Low)
- Soil and water pollution (- Low)
- Loss of agricultural potential by soil degradation (erosion) (- Low)
- The road network will be affected as there will be an increase in traffic, congestion and impact on road safety (- Low)

➢ The cumulative impact for the proposed development is medium to low and no high, unacceptable impacts related to the project is expected. The cumulative impacts will not result in large scale changes and impacts on the environment.

8.2 SENSITIVITY ANALYSIS SUMMARY AND SITE-SPECIFIC CONDITIONS

The sensitivity analysis has guided the developer in optimising the final layout of the Nyarhi 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 Appendix H for the final layout map which avoids the areas required to be conserved.

The main features to be avoided are related to wetlands, heritage and palaeontology. No wetland /riparian features are associated with the solar power plant area, however a valleybottom wetland traverses the southern most section of grid connection option 1. This feature must be avoided by the development (i.e. no-go area) and a buffer of 32 meters must be maintained around the feature. Therefore, grid connection option 2 is nominated as the preferred option from an environmental perspective, which is also the technically preferred option. These areas have been avoided by the proposed final layout as per Appendix H.

One heritage site, destroyed, shows the remains of face-bricks that were used for the buildings. Two rectangular structures, built with local stone, are located about 80m to the west. These are interpreted as small-stock enclosures that are related to the main structure.

Due to the fact that these features are demolished, they judged to have low significance and are viewed to be sufficiently documented after having been included in the Heritage Impact Assessment report (Appendix D5).

No palaeontological no-go areas have been identified for the project. However, outcrops of weathered to well-preserved stromatolites were discovered on the whole development footprint, but less prominent in the south of the development. Examples of exceptionally well preserved oolites were recovered from the centre portion of the development footprint. Mitigation of a sample of well-preserved stromatolites and oolites is therefore recommended. These areas are however not considered to be no-go to development.

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 F1-F4.

8.3 TECHNICAL DETAILS OF THE PROPOSED INFRASTRUCTURE TO BE AUTHORISED

- PV Panel Array - To produce up to 100MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the yield.

- Wiring to Central Inverters - Sections of the PV array will be wired to 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 via the proposed power line. Whilst Nyarhi 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 via a loop-in loop-out line connection into the South Vaal – Cardell 132 kV Line or Mercury – South Vaal 132 kV Line or alternatively connect into the existing Vaal Reefs Eleven 132/6.6 kV Substation through a direct connection. The Project will inject up to 100MW into the National Grid. The installed capacity will be approximately 100MW.

  Two grid connection corridor alternatives, each with a width of between 100m and 250m, have been identified for the assessment and placement of the power line (i.e., the power line will be developed within one of the two proposed corridors).

  The grid connection corridor located directly to the south of the SPP site is Option 1. This corridor will connect the SPP into the existing Vaal Reefs Eleven Substation. The length of this option is ~2.4km.

  The grid connection corridor located to south-west of the SPP site (referred to as Option 2) will connect the SPP into either the existing Mercury-South Vaal 132kV

(maximum length of power line: 1,22km) or the South Vaal-Carrdell 132kV (maximum length of power line:1,18km). This is the preferred alternative from a development and technical perspective based on feedback received by the developer from Eskom.

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4 m underground as far as practically possible.
- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on site:
    - - Office (~200 m²);
    - Switch gear and relay room (~400 m²);
    - Staff lockers and changing room (~200 m²); and
    - Security control (~60 m²)
- Battery Energy Storage System – A 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 an existing gravel road to the north of the site, off the Vermaasdrift Road. An internal site road network will also be required, with a width of between 6 m and 12 m, 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 properties. 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 BA report. In terms of the legal requirements it is concluded that:

- All key consultees have been consulted as required by Chapter 6 of the EIA Regulations (as amended)
- The Basic Assessment process has been conducted as required by the EIA Regulations (as amended), Regulations 19 and Appendix 1.
- The EMPr was compiled in conjunction with the Generic EMPr for overhead electricity transmission and distribution infrastructure as per Government Notice 435, which was published in Government Gazette 42323 on 22 March 2019.
- The EMPr was compiled in conjunction with the Generic EMPr for the development of the associated substation infrastructure for transmission and distribution of electricity as per Government Notice 435, which was published in Government Gazette 42323 on 22 March 2019.

- The EMPr was compiled for the Nyarhi Solar Power Plant as per Appendix 4 of the EIA Regulations (GN.R. 326), published in Government Gazette 40772 on 07 April 2017.
- The proposed mitigation measures will be sufficient to mitigate the identified impacts to an acceptable level, no impacts of a high significance are relevant following the implementation of the recommended mitigation measures.
- Option 2 of the grid connection corridor 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 BA report the EAP is confident that all key environmental issues were identified, assessed and mitigation measures recommended for. These key issues have been adequately assessed during the BA process to provide the competent 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 and land. All negative environmental impacts can further be effectively mitigated through the proposed mitigation measures. Based on the contents of the report it is proposed that an environmental authorisation be issued, which states (amongst other general conditions) that the Nyarhi Solar Power Plant and associated infrastructure on Portion 1 of the Farm Die Hoek No. 114, Portion 1 of the farm Doornkom-oost No. 447 and farm Doornplaats No. 559, Registration Division Viljoenskroon, Free State Province be approved subject to the following conditions:

- Implementation of the proposed mitigation measures set out in the EMPr(s).
- 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(s) should not be neglected and a copy of the EMPr(s) should be made available onsite at all times.
- Option 2 of the grid connection corridors must be developed based on the acceptable environmental sensitivity and it being preferred from a technical perspective.
- The wetlands, and the recommended 32m buffer must be avoided and no disturbance must take place within these areas.
- A detailed Geotechnical Assessment must be undertaken for the development footprint, with specific focus on areas with dolomite grassland, as part of the micro-siting of the layout.

- When the Nyarhi Power Plant layout has been established a walkdown of the area must be completed by a qualified Palaeontologist to catalogue and photograph well-preserved stromatolites. This action should take place after initial vegetation clearance but before the ground is levelled for construction.
- If a well-preserved stromatolite outcrop falls in the development footprint the stromatolites ought to be cordoned off and a buffer of 30m should be placed around the outcrop.
- A representative example of well-preserved stromatolites should be removed and placed near the offices of the PV as an informative example of fossils in the area.
- 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.
- An avifauna pre-construction winter baseline assessment is strongly recommended, along with post-construction monitoring and throughout the life of the project.

We trust that the department finds the report in order and eagerly await your comment and input in this regard.

Lisa Opperman

Environamics - Environmental Consultants

9 REFERENCES

ANON. nd. Guidelines for Environmental Impact Assessments. http://redlist.sanbi.org/eiaguidelines.php

ACTS see SOUTH AFRICA

BODEN, T.A., G. MARLAND, and R.J. ANDRES. 2011. Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A.

BOTHA, L. 2022. Traffic Impact Study for the transportation of Solar Energy Equipment to the Nyarhi Solar Power Plant near Orkney / Vierfontein, Free State Province

BOTHA, M. 2022. Visual Impact Assessment – The Proposed Nyarhi Solar Power Plant near Viljoenskroon, Free State Province.

BOTHA, M. 2022. Social Impact Assessment - The Proposed Nyarhi Solar Power Plant near Viljoenskroon, Free State Province.

BUTLER, E. 2022. Palaeontological Impact Assessment for The Proposed Nyarhi Solar Power Plant near Viljoenskroon, Free State Province.

CONSTITUTION *see* SOUTH AFRICA. 1996.

DEPARTMENT OF ENERGY (DoE). Integrated Resource Plan 2010-2030

DEPARTMENT OF MINERALS AND ENERGY (DME). 2003. White Paper on Renewable Energy.

DIVYA, K.C. AND ØSTERGAARD, J., 2009. Battery energy storage technology for power systems—An overview. *Electric power systems research*, *79*(4), pp.511-520.

ENERGY BLOG. 2015. Energy Blog – Project Database. [Web:] http://www.energy.org.za/knowledge-tools/project-database?search=project lookup&task=search [Date of assess: 28 September 2015].

FEZILE DABI DISTRICT MUNICIPALITY. Fezile Dabi District Municipality Integrated Development Plan for 2021-2022.

FIRST SOLAR. 2011. PV Technology comparison.

HAAGNER, A.S.H. 2022. Proposed Nyarhi Solar Power Plant Specialist Avifaunal Assessment.

HENNING, BJ. 2022. Terrestrial Biodiversity Impact Assessment (Including Plant And Animal Species Assessment) for the proposed development of the Nyarhi Solar Power Plant (SPP) and Powerline within the Moqhaka Local Municipality, Fezile Dabi District Municipality, Free State Province

HENNING, BJ. 2022. Wetland / Riparian Impact Assessment (Including Plant And Animal Species Assessment) for the proposed development of the Nyarhi Solar Power Plant (SPP) and Powerline within the Moqhaka Local Municipality, Fezile Dabi District Municipality, Free State Province

LANZ, J. 2022. Site Verification and Agricultural Compliance Statement for the Proposed Nyarhi Solar Power Plant near Viljoenskroon, Free State Province.

MOQHAKA LOCAL MUNICIPALITY. Moqhaka Local Municipality Integrated Development Plan for 2020 – 2021.

MUCINA, L. AND RUTHERFORD, M.C. 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

NATIONAL DEPARTMENT OF AGRICULTURE. 2006. Development and Application of a Land Capability Classification System for South Africa.

NERSA. 2009. South Africa Renewable Energy Feed-in Tariff (REFIT) – Regulatory Guidelines.

SANBI. 2016. Guidelines for Environmental Impact Assessments. [Web:] http://redlist.sanbi.org/eiaguidelines.php. Date of access: 26 April 2016.

SOLARGIS. 2021. Global Horizontal Irradiation (GHI). [Web:] https://globalsolaratlas. info/ download/south-africa [Date of access: 04 May 2021].

SOUTH AFRICA(a). 1998. The Conservation of Agricultural Resources Act, No. 85 of 1983. Pretoria: Government Printer.

SOUTH AFRICA. 1996. Constitution of the Republic of South Africa as adopted by the Constitutional Assembly on 8 May 1996 and as amended on 11 October 1996. (B34B-96.) (ISBN: 0-260-20716-7.)

SOUTH AFRICA(a). 1998. The National Environmental Management Act, No. 107 of 1998. Pretoria: Government Printer.

SOUTH AFRICA(b). 1998. The National Water Act, No. 36 of 1998. Pretoria: Government Printer.

SOUTH AFRICA. 1999. The National Heritage Resources Act, No. 25 of 1999. Pretoria: Government Printer.

SOUTH AFRICA. 2004. The National Environment Management: Air Quality Act, No. 39 of 2004. Pretoria: Government Printer.

SOUTH AFRICA(a). 2008. The National Energy Act, No. 34 of 2008. Pretoria: Government Printer.

SOUTH AFRICA(b). 2008. The National Environmental Management: Waste Act, No. 59 of 2008. Pretoria: Government Printer.

SOUTH AFRICA. Minister in the Presidence: Planning. 2009. *Medium Term Strategic Framework. – A Framework to guide Governments Programme in the Electoral Mandate Period 2009-2014*.

SOUTH AFRICA. 2010. Regulations in terms of Chapter 5 of the National Environmental Management Act, 1998. (GNR. 543, 544 and 545. 2010.). Pretoria: Government Printer.

SWINGLER, S. 2006. Statistics on Underground Cable in Transmission networks, Final Report of CIGRE Working Group B1.07.

THE MESOTHELIOMA CENTRE. 2016. Mesothelioma in South Africa. [Web:] http://www.asbestos.com/mesothelioma/south-africa/. [Date of access: 27 June 2016].

VAN SCHALKWYK, J. 2022. Cultural Heritage Impact Assessment: The Proposed Narhi Solar Power Plant Near Viljoenskroon, Free State Province..

WORLD BANK GROUP. 2006. The Equator Principles.