CAROLUS SOLAR PV1 FACILITY AND ASSOCIATED INFRASTRUCTURE NORTHERN CAPE PROVINCE

Environmental Impact Assessment Report

August 2022

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PROJECT DETAILS

DEFF Reference	:	14/12/16/3/3/2/2154,2155,2156,2157
Title	:	Environmental Impact Assessment Process: Scoping Report for the Carolus Solar PV1 Facility, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Ansone' Esterhuizen Jo-Anne Thomas
Client	:	Carolus Solar PV1 (Pty) Ltd
Report Status	:	Draft Environmental Impact Assessment Report
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When used as a reference this report should be cited as: Savannah Environmental (2022) Environmental Impact Assessment Report for the Carolus Solar PV1 Facility and associated infrastructure, Northern Cape Province.

PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT

Carolus Solar PV1 (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Scoping & Environmental Impact Assessment for the Carolus Solar PV1 Facility, Northern Cape. The EIA process is being undertaken in accordance with the requirements of the 2014 EIA Regulations promulgated in terms of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Environmental Impact Assessment (EIA) report represents the findings of the EIA process and contains the following chapters:

- **Chapter 1** provides background to the Carolus Solar PV1 Facility project and the environmental impact assessment.
- **Chapter 2** provides a project description of the solar PV and infrastructure associated with the facility.
- **Chapter 3** provides the site selection information and identified project alternatives.
- **Chapter 4** describes the solar energy as a power generation option and provides insight to technologies for solar energy.
- **Chapter 5** outlines strategic regulatory and legal context for energy planning in South Africa and specifically for the proposed facility.
- **Chapter 6** describes the need and desirability of Carolus Solar PV1 Facility.
- **Chapter 7** outlines the process which was followed during the phase EIA phase process.
- **Chapter 8** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 9** provides a description and assessment of the potential issues associated with the proposed Carolus PV and associated infrastructure
- **Chapter 10** provides a description and assessment of the potential cumulative issues associated with the proposed solar PV and associated infrastructure.
- **Chapter 11** presents the conclusions and recommendations based on the findings of the EIA for the Carolus PV Facility.
- **Chapter 12** provides references used to compile the EIA report.

The EIA report will be made available for public review from **12 August 2022 – 13 September 2022** on the Savannah Environmental website (https://savannahsa.com/public-documents/energy-generation). All comments received will be recorded and responded to in a Comments and Responses Report, will be included in Appendix C8 of the final EIA Report.

EXECUTIVE SUMMARY

Carolus Solar PV1 (Pty) Ltd is proposing the development of a Photovoltaic (PV) Solar Energy Facility and associated infrastructure located on a site approximately 10km east of De Aar within the Emthanjeni Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. A study area consisting of the Remaining Extent of the Farm Carolus en Bittje No.5. is being considered for the solar PV facility. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 250MW and will be known as the Carolus Solar PV1 Facility.

A preferred project site with an extent of ~2350ha has been identified by the developer as a technically suitable area for the development of the Carolus Solar PV1 Facility.

The infrastructure associated with the solar PV facility, including all associated infrastructure will include:

- Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology
- Inverters and transformers
- Cabling between the panels
- Battery Energy Storage System (BESS)
- Laydown areas, construction camps, site offices
- 12m wide Access Road and entrance gate to the project site and switching station
- 6m wide internal distribution roads
- Operations and Maintenance Building, Site Offices, Ablutions with conservancy tanks, Storage Warehouse, workshop, Guard House
- Onsite IPP substation, including all necessary electrical and auxiliary equipment required at the collector substation that serves that solar facility. This would include transformer, switchyard/bay, control building, fences etc

The facility will be connected to the national electricity grid via the following infrastructure (to be assessed in a separate Basic Assessment Report):

- Onsite Switching Station (SwS), adjacent to the IPP substation (SS).
- A 132kV Overhead Power Line (OHPL) from the SwS connecting back to a Main Transmission Substation (MTS). There is an MTS proposed on either the farm Vetlaagte (i.e., Vetlaagte MTS) or the farm Carolus en Bietjie (i.e., Carolus en Bietjie MTS). Two separate EA processes are currently underway to authorise the two MTS's and it is uncertain at this stage as to which MTS will be authorised and used to connect these projects.
- The development of the Carolus Solar PV1 Facility may require the following at the above-mentioned MTSs:
  - an extension of the 132kV Busbar.
  - an extension of the 400kV Busbar
  - an additional 400/132kV Transformer to be added
  - a new 132kV Feeder Bay

Carolus Solar PV1 (Pty) Ltd has confirmed that the project site is particularly suitable for solar energy development from a technical perspective due to the strength of the prevailing solar resources, access to the electricity grid, compatibility with the current land use and land availability.

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The Carolus Solar PV1 Facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Carolus Solar PV1 Facility facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer

Procurement (REIPPP) Programme or a similar programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP), with the Carolus Solar PV1 Facility facility set to inject up to 100MW into the national grid.

From a regional perspective, the area within the Northern Cape identified for the project is considered favorable for the development of a commercial solar PV by virtue of prevailing climatic conditions, relief, the extent of the affected properties, the availability of a direct grid connection (i.e., a point of connection of the national grid) and the availability of land on which the development.

Evaluation of the Carolus Solar PV1 Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-L** provide a detailed assessment of the potential impacts that may result from the development of the Carolus Solar PV1 Facility. This chapter concludes the environmental assessment of the solar PV facility by providing a summary of the results and conclusions of the assessment of both the project site and development footprint for the Carolus Solar PV1 Facility. In so doing, it draws on the information gathered as part of the EIA process, the knowledge gained by the environmental specialists and the EAP and presents a combined and informed opinion of the environmental impacts associated with the project.

No environmental fatal flaws or unacceptable impacts were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of sensitive features within the development footprint as specified by the specialists.

The potential environmental impacts associated with the Carolus Solar PV1 Facility identified and assessed through the EIA process include:

» Impacts on ecology, flora, and fauna.
» Impacts on aquatic ecology.
» Impacts on avifauna.
» Impacts on land use, soils, and agricultural potential.
» Impacts on heritage resources, including archaeology, palaeontology, and the cultural landscape.
» Visual impacts on the area imposed by the components of the facility.
» Positive and negative socio- economic impacts.
» Traffic impacts, including increased pressure on the existing road network.

Impacts on Ecology

The aim of the Biodiversity Impact Assessment was to provide information to guide the risk of the proposed Carolus Solar PV1 Facility to the ecosystems affected by its development and their inherent fauna and flora.

Based on the latest available ecologically relevant spatial data the following information is pertinent to the project area:

- » It is recognised as an Ecological Support Area as per the Northern Cape Critical Biodiversity Areas spatial database.
- » The Combined Terrestrial Biodiversity Theme Sensitivity was rated as 'Very High' according to the Environmental Screening Tool;
- » The Ecosystem Protection Level for the vegetation type associated with the development footprint is regarded as Not Protected; and
- » It is regarded as an Upstream Management Area according to the NFEPA database.

The habitat physiognomy within the development area is diverse and, based on the fauna components recorded within the development area and proximal landscape, the area provides important ecosystem services, particularly with regards to the maintenance of dynamic soil properties and pollination services. The SEI of the development area was determined to vary from 'Very Low' to 'Very High' based on the high likelihood of occurrence for NT species, the extent of the area considered and its connectivity to natural areas within the landscape, and the low resilience of the vegetation type. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

Impacts on Aquatic Ecology

The topography of the proposed Carolus PV1 development area has a gentle gradient that drains to the centre of the PV1 area with no obvious drainage system, however the area does drain eastwards into the Brak River. Additionally, portions of the 132 kV powerline traverses an ephemeral drainage line as well as an instream dam at the same location. Impacts would therefore be expected directly within the tributary network through the physical loss of drainage features as well as damage to the remaining habitat.

Impacts include changes to the hydrological regime such as alteration of surface run-off patterns, runoff velocities and or volumes associated with vegetation clearing, earthworks, levelling, soil stockpiling and the establishment of infrastructure (powerline pylons, BESS and substation) and road network. This would include watercourse crossing infrastructure for the powerline maintenance road and potential watercourse crossing infrastructure within the Carolus PV1 development area. The presence of solar panels and associated compacted road network increases hard surfaces within the catchment, resulting in an increase in runoff during high precipitation events and may be significant if poorly designed stormwater management infrastructure is implemented. The aforementioned alterations will have a direct result on the sediment movement and drainage characteristics both locally within the influenced tributaries and associated downslope areas such the Brak River. Altered surface run-off patterns, runoff velocities and or volumes above the natural flow regime of the ephemeral drainage lines is expected to cause potentially extensive damage to the bed and banks through erosion and scouring with associated sedimentation of instream habitat. Powerline pylons constructed within the tributaries and associated

marginal zones will result in direct loss or the disturbance of watercourse habitat with associated alteration of hydrology. In turn, habitat disturbance may degrade habitat quality and produce watercourse and surrounding corridor (Ecological Support Area) fragmentation. A negative shift in the biotic integrity of the tributaries would be expected based on the severity of alterations or losses. It should be taken into account that the Karoo may take decades to rehabilitate, therefore rehabilitation may be challenging, highlighting the need to avoid disturbance of these areas.

It is important to highlight that these arid climate systems receive majority of their rainfall during short rainfall events and only present surface flow for limited time periods. Some rainfall events can be considered as massive with resultant flooding. Therefore, careful consideration should be given to the hydrology of these systems with special attention given to stormwater and watercourse crossing designs (likely unnecessary – no road shapefiles available) and resultant discharge velocities.

These disturbances will be the greatest during the construction phase as the related disturbances could result in direct loss and/or damage, while to a lesser degree in the operation phase (i.e. as and when maintenance occurs).

Desktop information associated with the proposed Carolus Solar PV1 development indicates that the indirectly affected downstream Brak River system and directly associated ephemeral tributaries within the project area have sensitivity to modification. These systems serve as ESAs, CBAs and important NFEPA upstream management areas. The desktop PES of the Brak River SQR is moderately modified (class C), and that of the Western tributary SQR is largely natural (class B) with an associated ecological importance and sensitivity of moderate and low, respectively.

The Recommended Ecological Category (REC) to be maintained is a class B which can be achieved through the responsible management of the tributary network and associated catchment.

The June 2022 dry season survey undertaken for this assessment found limited surface water within the ephemeral drainage features. Surface water was present in the Brak River and in a tributary to the east of project area with limited water quality impacts recorded. The EC was however elevated above the RWQOs within the Brak River downstream of the project area at site Brak Down, indicating likely catchment influence and/or high background levels. No water was present in the Western Tributary system.

The watercourses presented present flat floodplain habitat features with no clear banks or riparian features which is typical for watercourses in an arid region. These ecosystems and adjacent terrestrial habitat was dominated by open natural land and largely unmodified, with some influence from land use activities within their catchment. Despite their current level of modification and ephemeral nature, the watercourses are sensitive to further modification as these systems do provide drinking opportunities (in times of rainfall) and habitat for foraging, nesting and refugia for terrestrial biota and avifauna. Therefore, the watercourses in the project area are regarded as sensitive environments in relation to changes in habitat integrity, flow and water quality requiring avoidance from the project related disturbance activities and maintenance of baseline conditions.

The aquatic features presented in this report require a buffer of 50 m and are to be treated as a no-go zone and avoided as far as is feasible. Ensuring aquatic features and buffers are intact increases the

resilience of a watercourse to future disturbances. These buffers would ensure adequate ecological integrity maintenance adjacent to the proposed solar facilities.

Impacts on Avifauna

The impacts of solar PV facilities on avifauna are not well understood, particularly in the South African context. Nevertheless, the low and very low classification of the site ecological importance for avifaunal SCCs as assessed through this EIA reduces the overall risk of significant impacts to the local avifaunal community by the proposed development, despite any gaps that may exist in our current understanding of potential impacts.

The Species Assessment Guideline states areas identified to be of low SEI development activities of medium to high impact are acceptable following the implementation of appropriate minimisation and restoration mitigation measures. The proposed Pixley Park Renewable Energy Project will have a range of potential pre-mitigation impacts on priority avifauna ranging from low to high, which is expected to be reduced to medium and low with the appropriate mitigation. No fatal flaws were discovered during the investigations. Based on the impact assessment conducted for the Carolus Solar PV Facility (including cumulative impacts) it is the avifaunal specialist's informed opinion that the proposed development will not have a significant negative impact on the viability or persistence of SCC populations in the area following the implementation of mitigation measures. The proposed Carolus Solar PV Facility is therefore acceptable and can be approved from an avifaunal perspective.

In addition to the mitigation measures outlined for each potential impact, the requirement for post-construction/operational phase monitoring is to be included in the Environmental Management Programme (EMPr). This is necessary to determine the actual impacts of the proposed development, determine if additional mitigation is required and learn about impacts and improve future assessments. The activity monitoring methods and data collection should replicate those employed during pre-construction monitoring as closely as possible in terms of effort and timing and should follow any additional recommendations of the latest best-practice guidelines available at the time.

Impacts on Land Use, Soil and Agricultural Potential

It is the specialist's opinion that the baseline findings do not concur with the land capabilities identified by means of the DAFF (2017) desktop findings in regard to land capability sensitivities. No "High" land capability sensitivities were identified within proximity to any of the proposed activities. Considering the lack of sensitivity and the measures put in place in regard to stormwater management and erosion control, it is the specialist's opinion that all activities will have an acceptable impact on agricultural productivity. Furthermore, no measures in regard to moving components in their micro-setting were required to avoid or minimise fragmentation and disturbances of agricultural activities.

The most sensitive soil forms that can be expected within the assessment corridor is the Hutton and Oakleaf soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with "Very Low to Moderate" sensitivities, which correlates with the requirements for a compliance statement only.

The available climate can limit crop production significantly. The harsh climatic conditions are associated with low annual rainfall and high evapotranspiration potential demands of the area. The area is not favourable for most cropping practices.

It is worth noting that, additional baseline soil field assessments can give a better and informed understanding of the proposed project area soil, land potential classes with minimal limitations. It is the specialist's opinion that the proposed solar renewable energy project based on the DAFF (2017) land capability sensitivity of the areas will have limited impact on the agricultural production ability of the land. Additionally, the proposed activities for the Carolus solar facility and associated infrastructure will not result in the segregation of any high production agricultural land. The available areas with high crop field boundary sensitivity (DEA Screening Tool, 2022) are located outside the proposed project area as well. Therefore, the proposed Carolus solar renewable energy project development and associated infrastructure may be favourably considered.

Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage on the flat, grassy plains with higher sensitivities in the immediate areas on and surrounding the dolerite outcrops. The results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and are therefore not archaeologically significant.

The public consultation process will be undertaken by the EAP during the EIA. No heritage-related comments have been received to-date. SAHRA is required to comment on this HIA and make recommendations prior to the granting of the Environmental Authorisation.

The assessment of the cultural landscape indicated that the project will have a low impact on the cultural landscape. The general mitigation measures for renewable energy development in areas of cultural landscape significance as proposed by Sarah Winter, (2021) as well as Lavin (2021) will still result in a marginal reduction of impact. Analysis of the findings of the SEIA for this project further reveals that the social and economic benefit for the region outweighs the need for conservation of cultural resources.

The overall impact of the Carolus Solar PV1 Facility on the heritage resources identified during this assessment is considered as acceptable after the recommendations have been implemented and therefore, impacts can be mitigated to acceptable levels allowing for the development to be authorised.

Visual Impacts

The construction and operation of the proposed Carolus PV1 facility and its associated infrastructure may have a visual impact on the study area, especially within a 1km radius (and potentially up to a radius of 3km) of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The combined visual impact or cumulative visual impact of up to four solar energy facilities (i.e. the proposed Carolus PV1, and the other 3 proposed PV facilities that form part of Pixley Park) is expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of PV arrays visible) to exposed receptors, especially those located within a 3km radius, is expected to be

greater than it would be for a single solar energy facility. The cumulative visual impact is however still expected to be within acceptable limits, due to the limited potential sensitive visual receptors.

Overall, the significance of the visual impacts is expected to range from **moderate** to **low** as a result of the generally undeveloped character of the landscape and the remote location of the project infrastructure. There are a very limited number of potential sensitive visual receptors within a 3km radius of the proposed structures, although the possibility does exist for visitors to the region to venture into closer proximity to the PV facility structures. These observers may consider visual exposure to this type of infrastructure to be intrusive.

A number of mitigation measures have been proposed. Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the PV facility and associated infrastructure would be considered to be acceptable from a visual impact perspective and can therefore be authorised.

Socio-economic Impacts

The findings of the SIA indicate that the development of the proposed 250 MW Carolus PV SEF and associated infrastructure will create employment and business opportunities for locals in the ELM during both the construction and operational phase of the project. All of the potential negative impacts, with the exception of the impact on sense of place, can also be effectively mitigated.

The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the report should be implemented in order to maximise the potential benefits. The significance of this impact is rated as **High Positive**. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives. The establishment of the proposed 250 MW Carolus PV SEF and associated infrastructure including a BESS is therefore supported by the findings of the SIA.

Recommendations

Based on the information presented in the SEIA report, it is concluded that the net positive impacts associated with the development and operation of the proposed solar energy facility are expected to outweigh the net negative effects. The project is also envisaged to have a positive stimulus on the local economy and employment creation, leading to the economy's diversification and a small reduction in the unemployment rate. The project should therefore be considered for development. It should, however, be acknowledged that any negative impacts would be largely borne by the farms in the

immediate vicinity and households residing on them, whilst the positive impacts will be largely concentrated in the local and national economies. Due to this imbalance, it is recommended that the mitigation measures suggested being strictly adhered to. Application of these mitigation measures will ensure that the negative impacts on the nearby farms and businesses are minimised and that the distribution of the potential benefits of the project are more balanced.

Impacts on Traffic

The Traffic Impact Assessment report for the EIA stage addressed key issues and alternatives to be considered for the proposed Pixley Park Solar Cluster:

- The preferred Port of Entry for imported components is the Port of Ngqura.
- The proposed access road located off the N10 is deemed a suitable access road as it is an existing gravel road i.e. less expensive to upgrade and/or maintain. However, the Client should note that application for wayleaves and permits should be made to the railway authority (Transnet) well in advance of construction commencing, with specific reference to the railway crossing at the Hydra Substation. The rail authority (Transnet) might also withhold approval.
- The current condition and suitability of the main access road from the R389 should be determined as an alternative route should wayleave approval not be granted by the rail authority.
- It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage.
- The construction phase traffic, although significant, will be temporary and can be mitigated to an acceptable level.
- During operation, it is expected that staff and security will periodically visit each of the facilities. It is assumed that approximately 30 full-time employees will be stationed on each of the four sites. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- The construction and decommissioning phases of the development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e. the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network and impacts are considered to have low significance.

The potential mitigation measures mentioned in the construction phase are:

- Dust suppression
- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.
- A "dry run" of the preferred route.
- Design and maintenance of internal roads.
- If required, any low hanging overhead lines (lower than 5.1m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.

The potential mitigation measures mentioned in the operational phase are:

- Staff and general (maintenance) trips should occur outside of peak traffic periods as far as possible.
- The provision of water storage tanks and/or boreholes.
- Water bowsers trips should occur outside of peak traffic periods as far as possible.
- Spread the cleaning of the panels over a week.
- Using a larger water bowser.

The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e., the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

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 Pixley Solar PV Cluster are acceptable with the implementation of the recommended mitigation measures and can therefore be authorised.

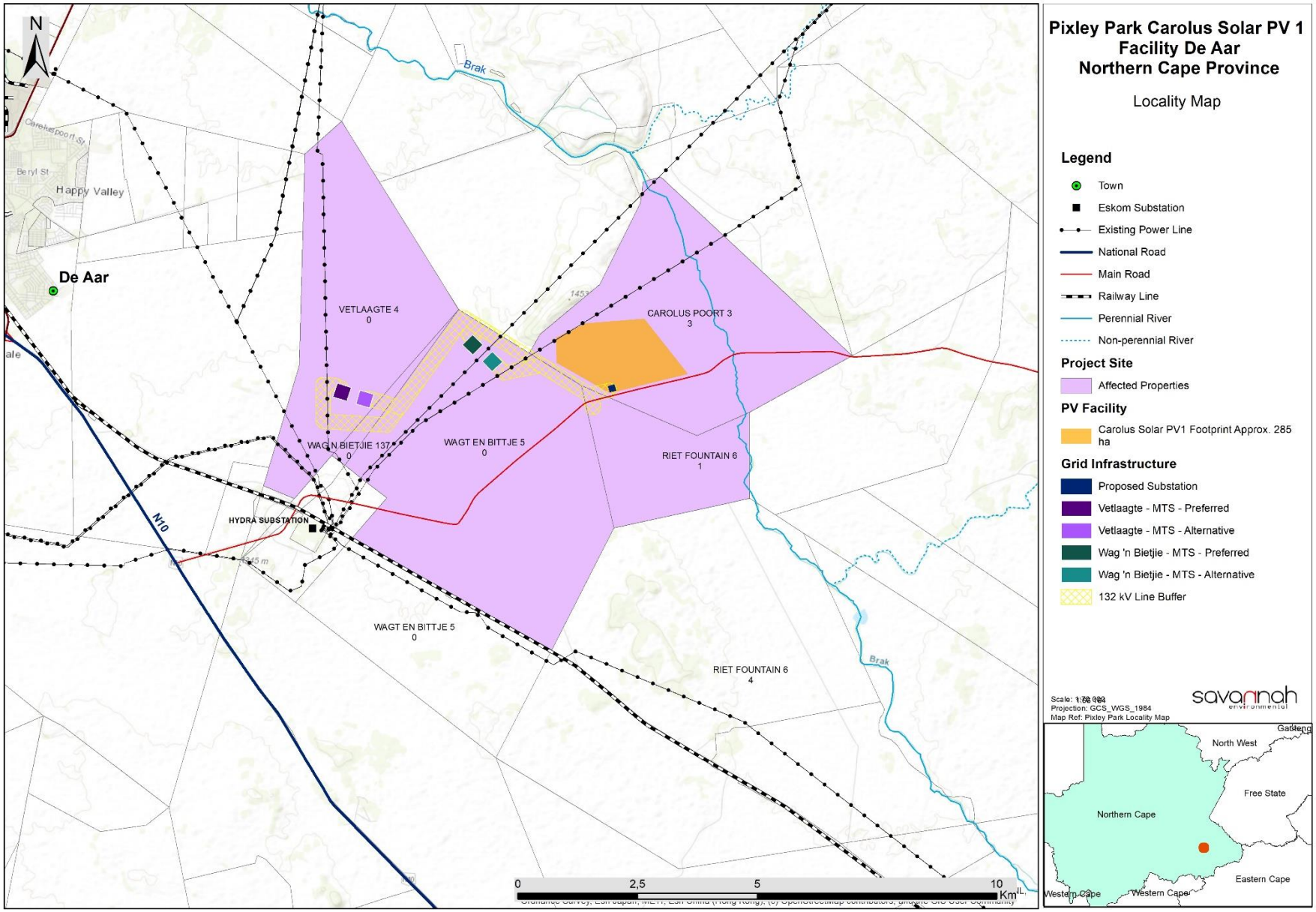

Figure 1: Locality map of the project site within which the Carolus Solar PV1 Facility facility is proposed to be developed **(Appendix O)**

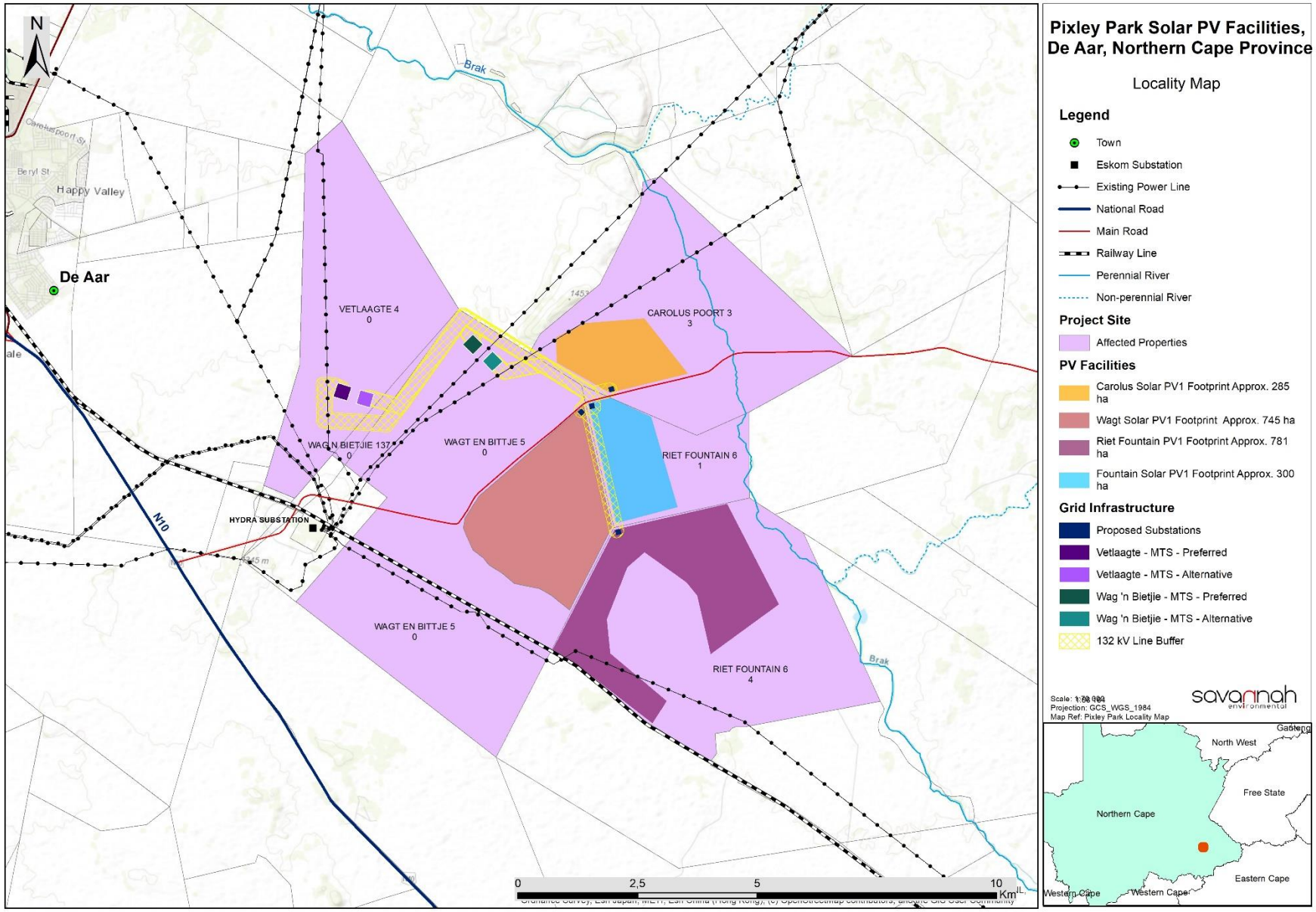

Figure 2: The proposed cluster of renewable energy facilities that the Carolus Solar PV1 Facility forms part of **(Appendix O)**

1. Environmental Permitting Requirements

The Carolus Solar PV1 Facility and its associated infrastructure trigger the need for following environmental permit:

An Environmental Authorisation (EA) from the National Department of Forestry, Fisheries, and the Environment (DFFE), in consultation with the Provincial Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARD & LR), in accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations (GNR 326), 2014, as amended.

Savannah Environmental has been appointed as the Independent Environmental Assessment Practitioner (EAP) in accordance with NEMA and Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326) to undertake the required S&EIA in support of the application for Environmental Authorisation (EA) and the public participation process for the project, in order to identify and assess all potential environmental impacts associated with the proposed solar PV and recommend appropriate mitigation measures in an Environmental Management Programme (EMPr).

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be fore warned of potential environmental issues and allows for the resolution of issues reported on in the Scoping and EIA Reports as well as a dialogue with Interested and Affected Parties (I&APs). Comprehensive, independent environmental specialist studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. The EIA process being undertaken for the proposed general waste disposal site comprises two phases – i.e., Scoping and Impact Assessment - and involves the identification and assessment of environmental impacts through

» The Scoping Phase includes the identification of potential issues associated with the project through a desktop study (considering existing information), limited field work and consultation with interested and affected parties and key stakeholders. This phase considered the broader project site in order to identify and delineate any environmental fatal flaws, no-go and / or sensitive areas. Following a public review period of the Scoping Report, this phase culminated in the submission of a final Scoping Report and Plan of Study for the EIA to the Competent Authority for consideration and acceptance. The Scoping Report was accepted, and the Plan of Study approved by the DFFE on 27 January 2022.
» The EIA Phase involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considers a proposed development footprint and includes detailed specialist investigations (including field surveys), consideration of feasible alternatives and public consultation. Recommendations of practical and achievable mitigation and management measures are included in an Environmental Management Programme (EMPr) considering all phases of the project. Following the public review period of the EIA Report and EMPr, this phase culminates in the submission of a Final EIA Report and EMPr to authority for review and decsion-making.

2. Facility Layout

The development footprint assessed within this EIA was designed by the project developer in order to respond to and avoid the sensitive environmental and social features located within the development area. This approach ensured the application of the mitigation hierarchy (i.e., avoid, minimise, mitigate and offset) to the Carolus Solar PV1 Facility project, which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the development area.

For the majority of specialists, the impacts associated with the Carolus Solar PV1 Facility facility layout are of low to medium significance post-mitigation and the assessed layout is considered acceptable.

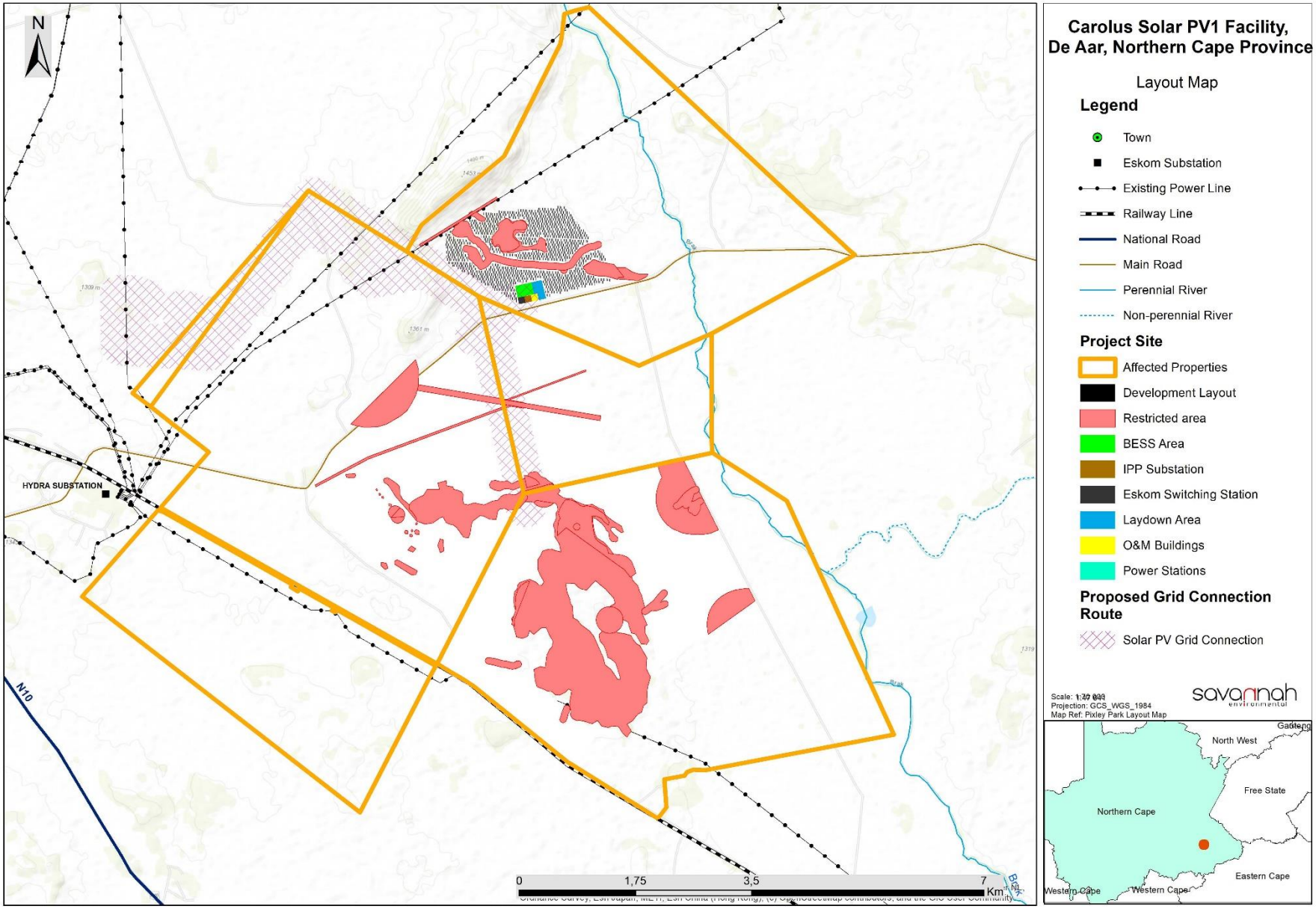

Figure 3: The development footprint, as assessed

Overall Conclusion

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using solar irradiation as the preferred technology, due to the availability of a suitable solar resource. Independent specialists appointed to undertake the assessment of potential impacts associated with the project assessed a larger area in order to inform the best location for the solar facility infrastructure. The Specialists considered desktop data, results from field work, existing literature and the National Web-based Environmental Screening Tool to inform the identification of sensitivities. A proposed layout was designed after provision of sensitivity data by the specialists with the aim of avoiding sensitive areas identified.

Based on the specialist investigations of the larger area, a technically viable development footprint was proposed by the developer and assessed as part of the EIA process. The findings of the assessment of the development footprint undertaken by independent specialists have informed the results of this EIA report. The specialist findings have indicated that there are no identified fatal flaws associated with the implementation of the project within the project site.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level. The project development area is located outside of any protected area and outside of any Critical Biodiversity Areas (CBAs) as defined in the Provincial Conservation Plan. When considering biodiversity and socio-economic benefits and impacts on the affected and surrounding areas, the following is concluded from the specialist studies undertaken within this EIA process.

From a biodiversity perspective, the site is not located within a protected area. The site is located within an extensive ESA 2 area. However, overall, there are no specific long-term impacts likely to be associated with the development of the Carolus Solar PV1 Facility that cannot be reduced to a low significance. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. No sensitivities were identified from an avifauna perspective, and the layout proposed ensures that all aquatic sensitivities identified through the EIA process are avoided and recommended buffer areas are honoured. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e. tier 1 of the mitigation hierarchy). Where impacts could not be avoided, appropriate mitigation has been proposed to minimise impacts. It follows therefore that the project does not adversely impact on the ecological integrity of the area.

In addition, consideration must also be given to the positive and negative socio-economic impact. Impacts on cultural landscape are expected to be low. It must be considered that the addition of the infrastructure of the Carolus Solar PV1 Facility will constitute an additional layer to the cultural landscape. Through the implementation of the economically feasible recommendations as set out in the Heritage impact Assessment and contained in this report it will be possible to preserve older layers of the cultural landscape and in some cases even enhance them through consideration such as the use of older name places in the naming of infrastructure and enhancing local heritage through the incorporation of such structures in project conservation initiatives to name a few.

The Socio-economic Impact Assessment has identified short-term (construction related) impact indicators and operational related socio-economic impact indicators. The assessment of the proposed facility, and its

net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with the Carolus Solar PV1 Facility. All impacts associated with the project can be mitigated to acceptable levels. If the solar facility is not developed (i.e. the 'do nothing alternative implemented), the following positive impacts will not be realised:

- Job creation from the construction and operation phases.
- Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
- Meeting of energy generation mix in a most economic and rapid manner.
- Provision of clean, renewable energy in an area where it is optimally available.

The benefits of the Carolus Solar PV1 Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility. From an economic perspective, both positive and negative impacts are expected.

Based on the conclusions of the specialist studies undertaken, it can be concluded that the development of the Carolus Solar PV1 Facility based on the current layout as provided by the developer will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer within the development envelope, the avoidance of the sensitive environmental features within the project site, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the Carolus Solar PV1 Facility is acceptable within the landscape and can reasonably be authorised. The proposed layout as provided by the developer (**Figure 11.1**) is considered to be the most appropriate from an environmental perspective as it avoids identified sensitivities and recommended buffer areas.

The following infrastructure would be included within an authorisation issued for the project:

- Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology
- Inverters and transformers
- Cabling between the panels
- Battery Energy Storage System (BESS)
- Laydown areas, construction camps, site offices
- 12m wide Access Road and entrance gate to the project site and switching station
- 6m wide internal distribution roads

- Operations and Maintenance Building, Site Offices, Ablutions with conservancy tanks, Storage Warehouse, workshop, Guard House
- Onsite IPP substation, including all necessary electrical and auxiliary equipment required at the IPP substation that serves that solar facility. This would include transformer, switchyard/bay, control building, fences etc
- The facility will be connected to the national electricity grid via the following infrastructure (to be assessed in a separate Basic Assessment Report):
- Onsite Switching Station (SwS), adjacent to the IPP substation (SS).
- A 132kV Overhead Power Line (OHPL) from the SwS connecting back to a Main Transmission Substation (MTS). There is an MTS proposed on either the farm Vetlaagte (i.e., Vetlaagte MTS) or the farm Carolus en Bietjie (i.e., Carolus en Bietjie MTS). Two separate EA processes are currently underway to authorise the two MTS's and it is uncertain at this stage as to which MTS will be authorised and used to connect these projects.
- The development of the Carolus Solar PV1 Facility may require the following at the above-mentioned MTSs:
  - an extension of the 132kV Busbar.
  - an extension of the 400kV Busbar
  - an additional 400/132kV Transformer to be added
  - a new 132kV Feeder Bay

The following key conditions would be required to be included within an authorisation issued for the Carolus Solar PV Facility:

- All mitigation measures detailed within this EIA report, as well as the specialist reports contained within **Appendices D to L** are to be implemented.
- The EMPr as contained within **Appendix M** of this EIA report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Carolus Solar PV1 Facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Following the final design of the Carolus Solar PV1 Facility, a revised layout must be submitted to DFFE for review and approval prior to commencing with construction. No development is permitted within the identified no-go areas as detailed in **Figure 11.1.**
- A pre-construction walk-through of the final layout, including roads and underground cables, should be undertaken before construction commences and adjusted where required to reduce impacts on species of conservation concern and habitats of concern.
- The permitter fence of the facility must have access points for smaller fauna at least every 50m of fence. These should be a minimum of 40cm x 20cm in size and should be orientated both vertically and horizontally.
- The facility must have a detailed runoff and erosion management plan that takes account of the vulnerability of the area to erosion damage. This should be developed with input from a specialist with specific experience in this regard.
- Implement a chance finds procedure for the rescuing of any fossils or heritage resources discovered during construction.
- If any archaeological material or human burials are uncovered during construction activities, work in the immediate area should be halted, the find reported to the heritage authorities and inspected by an

archaeologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.

» Maintain vegetation cover (i.e. either natural or cultivated) immediately adjacent to the actual development footprint, both during construction and operation of the proposed facility.
» Monitor all rehabilitated areas for one year following decommissioning and implement remedial actions as and when required.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DFFE.

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commissioning: Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the solar PV infrastructure installed.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or

whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800.

Indirect impacts: Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

Mitigation hierarchy: The mitigation hierarchy is a framework for managing risks and potential impacts related to biodiversity and ecosystem services. The mitigation hierarchy is used when planning and implementing development projects, to provide a logical and effective approach to protecting and conserving biodiversity and maintaining important ecosystem services. It is a tool to aid in the sustainable management of living, natural resources, which provides a mechanism for making explicit decisions that balance conservation needs with development priorities

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

ACRONYMS

BGIS	Biodiversity Geographic Information System
BOP	Balance of Plant
CBA	Critical Biodiversity Area
DFFE	Department Forestry, Fisheries of the Environment (National)
DWS	Department of Water and Sanitation
CSIR	Council for Scientific and Industrial Research
DM	District Municipality
DMRE	Department of Mineral Resources Energy
EAP	Environmental Assessment Practitioner
EGIS	Environmental Geographic Information System
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EN	Endangered
EP	Equator Principles
ESA	Ecological Support Area
GA	General Authorisation
IBA	Important Bird Area
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IUCN	International Union for Conservation of Nature
I&AP	Interested and Affected Party
Km	Kilometre
kWh	Kilowatt hour
LC	Least Concern
LM	Local Municipality
M	Metre
m^2	Square meters
m^3	Cubic meters
m amsl	Metres Above Mean Sea Level
MW	Megawatts
NDP	National Development Plan
NEMA	National Environmental Management Act (No. 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
NEM:WA	National Environmental Management: Waste Act (No. 59 of 2008)
NFA	National Forests Act (No. 84 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act (No. 25 of 1999)
NT	Near Threatened
NWA	National Water Act (No. 36 of 1998)
ONA	Other Natural Area

PA	Protected Area
PV	Photovoltaic
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
TOPS	Threatened or Protected Species
VU	Vulnerable

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CHAPTER 1 INTRODUCTION

Carolus Solar PV1 (Pty) Ltd, is proposing the development of a Photovoltaic (PV) Solar Energy Facility and associated infrastructure located on a site approximately 10km east of De Aar within the Emthanjeni Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. A study area consisting of The Remaining Portion 3 of the Farm Carolus Poort No.3 is being considered for the solar PV facility **(refer to Figure 1.2)**. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 120MW[1] and will be known as the Carolus Solar PV1 Facility.

The project is planned as part of a larger cluster of proposed renewable energy projects, which includes two (2) additional up to 120MW and one up to 200MW PV facilities (to be known as Riet Fountain Solar PV1, Fountain Solar PV1 and Carolus PV1), and associated grid connection infrastructure.

These projects are proposed by separate Specialist Purpose Vehicles (SPVs)[2], and are assessed through separate Environmental Impact Assessment (EIA) processes, however potential cumulative impacts of the cluster will be assessed. The projects will all connect to the proposed new Vetlaagte Main Transmission Substation (MTS) or the proposed new Wag 'n Bietjie MTS, depending on Eskom requirements. The relative location of the four development areas is indicated in **Figure 1.3**. The grid connection infrastructure for each facility is being assessed through separate Basic Assessment processes.

The PV facility is planned to be located within an area previously authorised for PV project infrastructure[3]. The area has thus previously been thoroughly studied during the previous EIA process (Savannah Environmental, 2012), and substantial information on the area is available. Site-specific studies and assessments to be undertaken within the EIA process will delineate areas of potential sensitivity within the identified project site. Once constraining factors have been confirmed, the layout of the solar PV facility can be planned to minimise social and environmental impacts. A development area of approximately 300 ha has been identified within the study area for the construction and operation of the Carolus Solar PV1 Facility and its associated infrastructure, which is described and evaluated within this EIA Report.

The Carolus Solar PV1 Facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Carolus Solar PV1 Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) programme or similar programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP), with the Carolus Solar PV1 Facility is set to inject up to 120MW into the national grid.

[1] The original capacity of the project has been changed from 100MW in the scoping phase to 120MW in the EIR phase, the footprint of the proposed site has not changed and the developers are opting to utilize the full capacity of the area available whilst still taking into account any environmental sensitivities identified.
[2] The development of the various projects under separate SPVs is in accordance with the DMRE's requirements under the REIPPPP.
[3] DFFE reference numbers 12/12/20/2250/1, 12/12/20/2250/2, 12/12/20/2250/3, 12/12/20/2250/4, and 12/12/20/2250/5

From a regional perspective, the Northern Cape, and particularly the area under investigation, is considered favourable for the development of a commercial solar facility by virtue of prevailing climatic conditions, relief, the extent of the affected properties, the availability of a direct grid connection (i.e., a point of connection of the national grid) and the availability of land on which the development can take place.

1.1 Requirement for an Environmental Impact Assessment Process

Section 24 of South Africa's National Environmental Management Act (No. 107 of 1998) (NEMA) pertains to Environmental Authorisations (EA), and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the Competent Authority (CA). The 2014 Environmental Impact Assessment (EIA) Regulations, as amended (GNR 326) published under NEMA prescribe the process to be followed when applying for Environmental Authorisation (EA), while the Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)) contain those activities which may not commence without EA from the CA.

As the project has the potential to impact on the environment, an Environmental Authorisation (EA) is required from the National Department of Forestry, Fisheries and the Environment (DFFE) subject to the completion of a full Scoping and Environmental Impact Assessment (S&EIA), as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations, as amended (GNR 326).

The need for EA subject to the completion of a full S&EIA is triggered by the inclusion of, amongst others, Activity 1 of Listing Notice 2 (GNR 325)[4], namely:

"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more."

In terms of GNR 779 of 01 July 2016, the National DFFE has been determined as the CA for all projects which relate to the IRP for Electricity (IRP) 2010 – 2030, and any updates thereto. Through the decision-making process, the DFFE will be supported by the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform as the commenting authority.

1.2 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Impact Assessment Report

This Report has been prepared in accordance with the requirements of the EIA Regulations published on 08 December 2014 (and amended on 07 April 2017) promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No 107 of 1998). This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

[4] Refer to **Chapter 6** for a full list of applicable listed activities.

Requirement	Relevant Section
(a)(i) the details of the EAP who prepared the report and (ii) the expertise of the EAP to carry out EIA procedures; including a curriculum vitae	The details of the EAP and the expertise of the EAP have been included in **Section 1.5**. The Curriculum vitae of the Savannah Environmental team have been included as **Appendix A**.
(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 and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties	The location of the Carolus Solar PV Facility has been included as **Figure 1.1**. The details of the affected properties, including the property names and numbers, as well as the SG-codes are included in **Table 1.1**.
(c) a plan which locates the proposed activity or activities applied for 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	A locality map illustrating the location of the Carolus Solar PV Facility has been included in **Figure 1.1**. The centre point co-ordinates of the project site are included in **Table 1.1**.

This Report consists of twelve chapters, which include:

- **Chapter 1** provides background to the Carolus Solar PV Facility project and the environmental impact assessment process.
- **Chapter 2** provides a project description of the solar PV facility and infrastructure associated with the facility.
- **Chapter 3** provides the site selection information and identified project alternatives.
- **Chapter 4** describes the solar energy as a power generation option and provides insight to technologies for solar energy.
- **Chapter 5** outlines strategic regulatory and legal context for energy planning in South Africa and specifically for the proposed facility.
- **Chapter 6** describes the need and desirability of Carolus Solar PV Facility.
- **Chapter 7** outlines the process which was followed during the phase EIA phase process.
- **Chapter 8** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 9** provides a description and assessment of the potential impacts associated with the proposed Carolus Solar PV Facility and associated infrastructure.
- **Chapter 10** provides a description and assessment of the potential cumulative issues associated with the proposed solar PV facility and associated infrastructure.
- **Chapter 11** presents the conclusions and recommendations based on the findings of the EIA for the Carolus Solar PV Facility.
- **Chapter 12** provides references used to compile the EIA report.

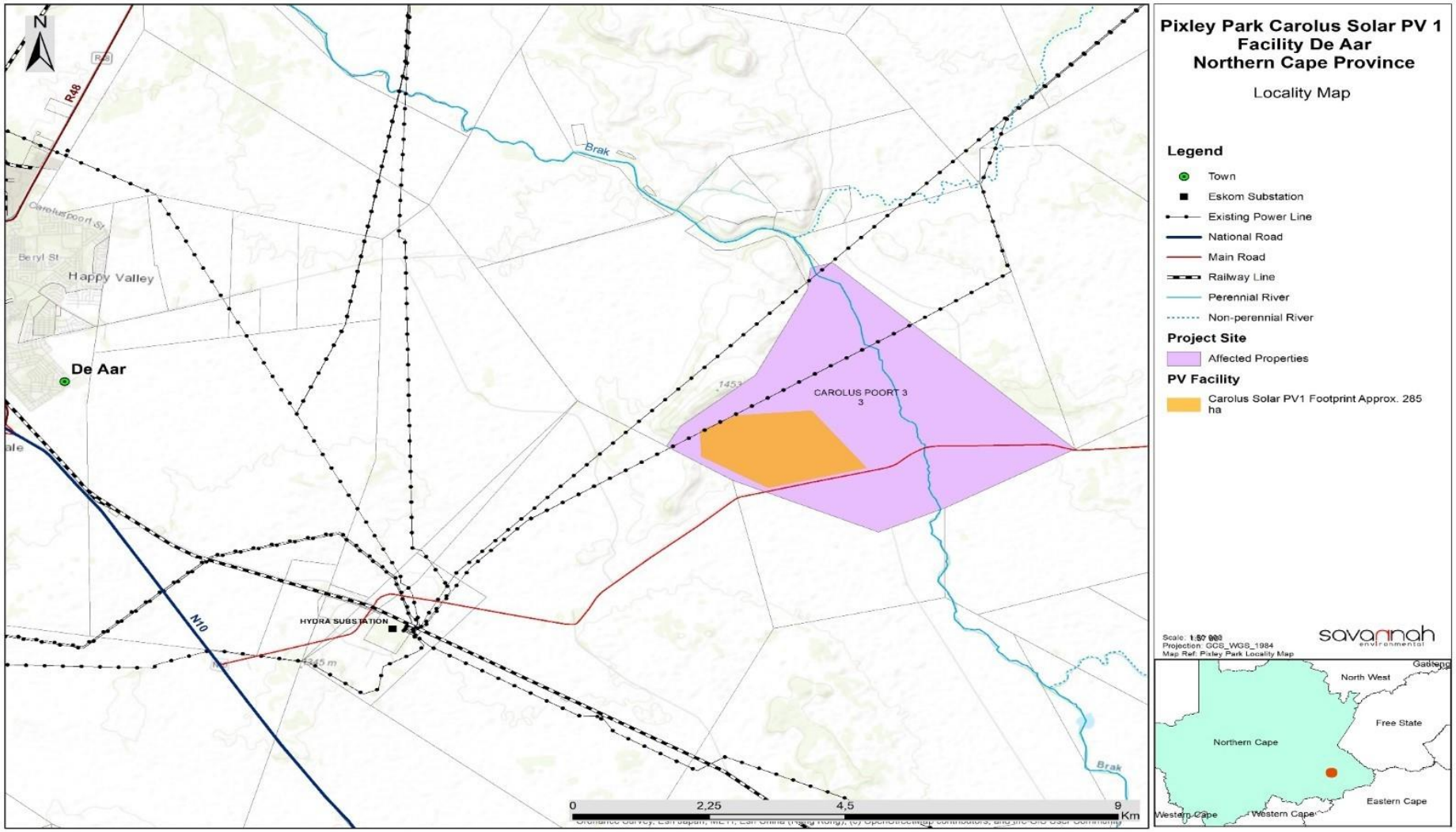


Figure 1.1: Locality map illustrating the location of the Carolus Solar PV Facility project site on Remaining Portion 3 of the Farm Carolus Poort No.3 (refer to **Appendix N** for A3 map).

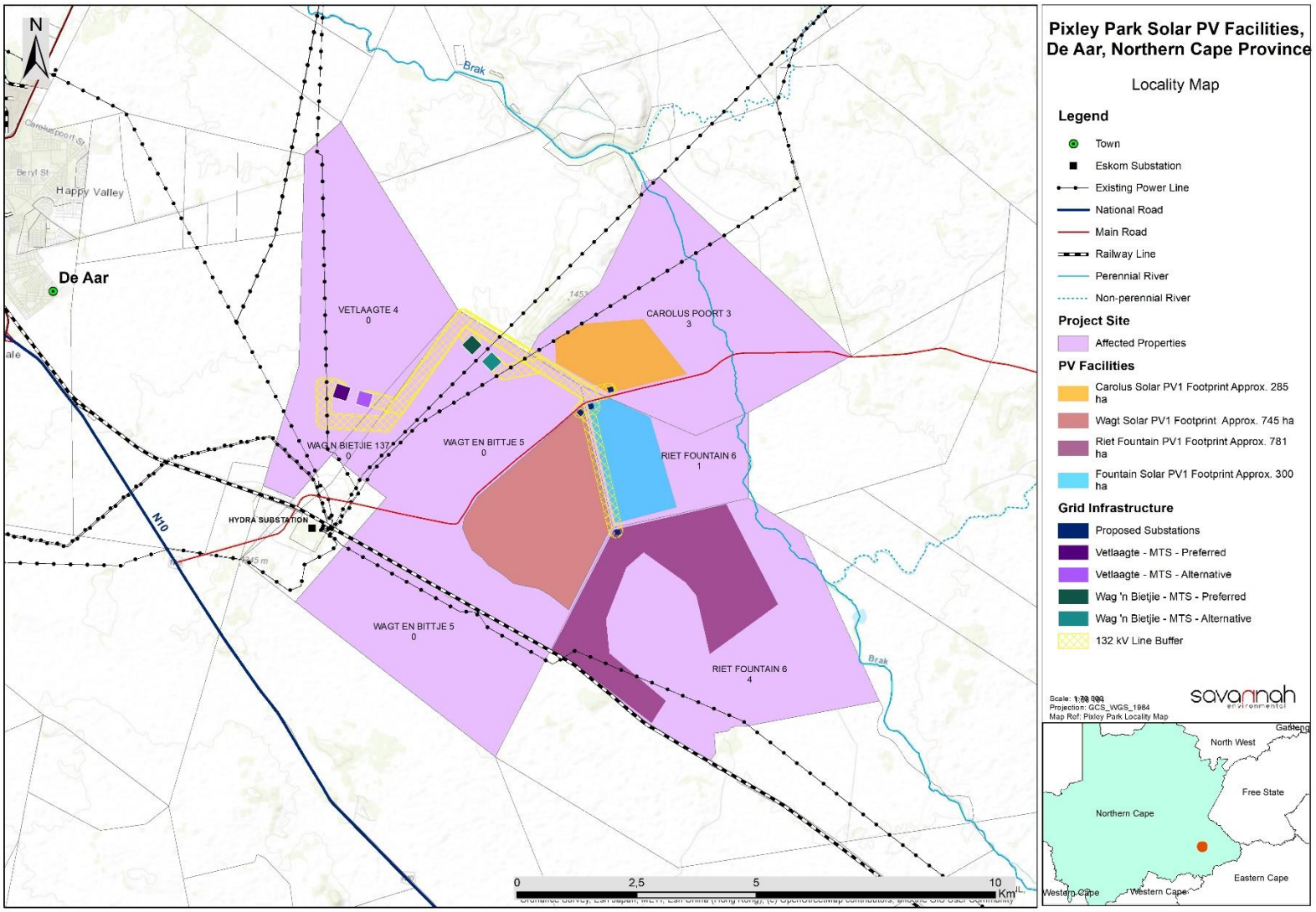


Figure 1.2: Locality map illustrating the cluster of proposed renewable energy facilities that the Carolus Solar PV Facility forms part of (refer to Appendix N for A3 map).

1.3 Project Overview

The project site has been identified by the applicant as a technically feasible site which has the potential for the development of a solar PV facility, including a Battery Energy Storage System (BESS). A development area of approximately 300ha has been identified within the project site for the development of Carolus Solar PV1 Facility.

During the Scoping Phase, the full extent of the development area was considered by the specialist assessments, with the aim of determining the suitability from an environmental and social perspective and identifying areas that should be avoided in development planning. Based on the specialist assessments undertaken during the Scoping Phase, areas of environmental sensitivity were identified within the development area. In order to avoid these areas of potential sensitivity and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer identified a suitable development footprint[5] (~approximately 192ha in extent) within the larger development area. Since the development area assessed during the Scoping Phase is larger than the area required for the development footprint, it provides the opportunity for the optimal placement of the infrastructure, ensuring avoidance of major identified environmental sensitivities. An overview of the project development site is provided in **Table 1.1**.

Infrastructure associated with the solar PV facility will include:

- Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology
- Inverters and transformers
- Cabling between the panels
- Battery Energy Storage System (BESS)
- Laydown areas, construction camps, site offices
- 12m wide Access Road and entrance gate to the project site and switching station
- 6m wide internal distribution roads
- Operations and Maintenance Building, Site Offices, Ablutions with conservancy tanks, Storage Warehouse, workshop, Guard House
- Onsite IPP substation, including all necessary electrical and auxiliary equipment required at the IPP substation that serves that solar facility. This would include transformer, switchyard/bay, control building, fences etc

The facility will be connected to the national electricity grid via the following infrastructure (to be assessed in a separate Basic Assessment Report):

- Onsite Switching Station (SwS), adjacent to the IPP substation (SS).
- A 132kV Overhead Power Line (OHPL) from the SwS connecting back to a Main Transmission Substation (MTS). There is an MTS proposed on either the farm Vetlaagte (i.e., Vetlaagte MTS) or the farm Carolus en Bietjie (i.e., Carolus en Bietjie MTS). Two separate EA processes are currently underway to authorise

[5] The development footprint, which is ~192ha in extent, is the defined area (located within the development area) where the PV arrays and other associated infrastructure for the Carolus Solar Pv 1 Facility, Northern Cape facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

the two MTS's and it is uncertain at this stage as to which MTS will be authorised and used to connect these projects.

- The development of the Carolus Solar PV1 Facility may require the following at the above-mentioned MTSs:
  - an extension of the 132kV Busbar.
  - an extension of the 400kV Busbar
  - an additional 400/132kV Transformer to be added
  - a new 132kV Feeder Bay

The overarching objective for the Carolus Solar PV1 Facility is to maximise electricity production through exposure to the available solar resource, while minimising infrastructure, operational and maintenance costs, as well as potential social and environmental impacts. To meet these objectives, local level environmental and planning issues will be assessed through the EIA process with the aid of site-specific specialist studies to delineate areas of sensitivity within the identified project site. This will serve to inform and optimise the design of the solar PV facility.

Table 1.1: Detailed description of the project.

Province	**Northern Cape Province**
District Municipality	Pixley Ka Seme District Municipality
Local Municipality	Emthanjeni Local Municipality
Ward Number (s)	Ward 6
Nearest town(s)	De Aar (~10km east)
Farm name(s) and number(s) of properties affected by the Solar Facility	» Remaining Portion 3 of the Farm Carolus Poort No.3
SG 21 Digit Code (s)	» xx
Current zoning	Agriculture
PV Development Footprint	
PV Development Area	300 hectares
Site Coordinates (centre of affected property)	**-30.700643°, 24.170610°**
Site Coordinates (corner/bend points of development area)	

1.4 Overview of this Environmental Impact Assessment (EIA) Process

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental issues and allows for the resolution of the issues reported on in the Scoping and EIA reports as well as dialogue with interested and affected parties (I&APs).

The EIA process comprises of two (2) phases (i.e. Scoping and Impact Assessment) and involves the identification and assessment of potential environmental impacts through the undertaking of independent specialist studies, as well as public participation. The processes followed in these two phases is as follows:

- The **Scoping Phase** includes the identification of potential issues associated with the project through a desktop study (considering existing information), limited field work, and consultation with interested and affected parties and key stakeholders. This phase considers the broader project site in order to identify

and delineate any environmental fatal flaws, no-go and / or sensitive areas. Following a public review period of the Scoping report, this phase culminates in the submission of a final Scoping Report and Plan of Study for the EIA to the CA for consideration and acceptance.

» The **EIA Phase** involves a detailed assessment of the potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considers a proposed development footprint within the project site and includes detailed specialist investigations as well as public consultation. Following a public review period of the EIA Report, this phase culminates in the submission of a final EIA Report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to the CA for final review and decision-making.

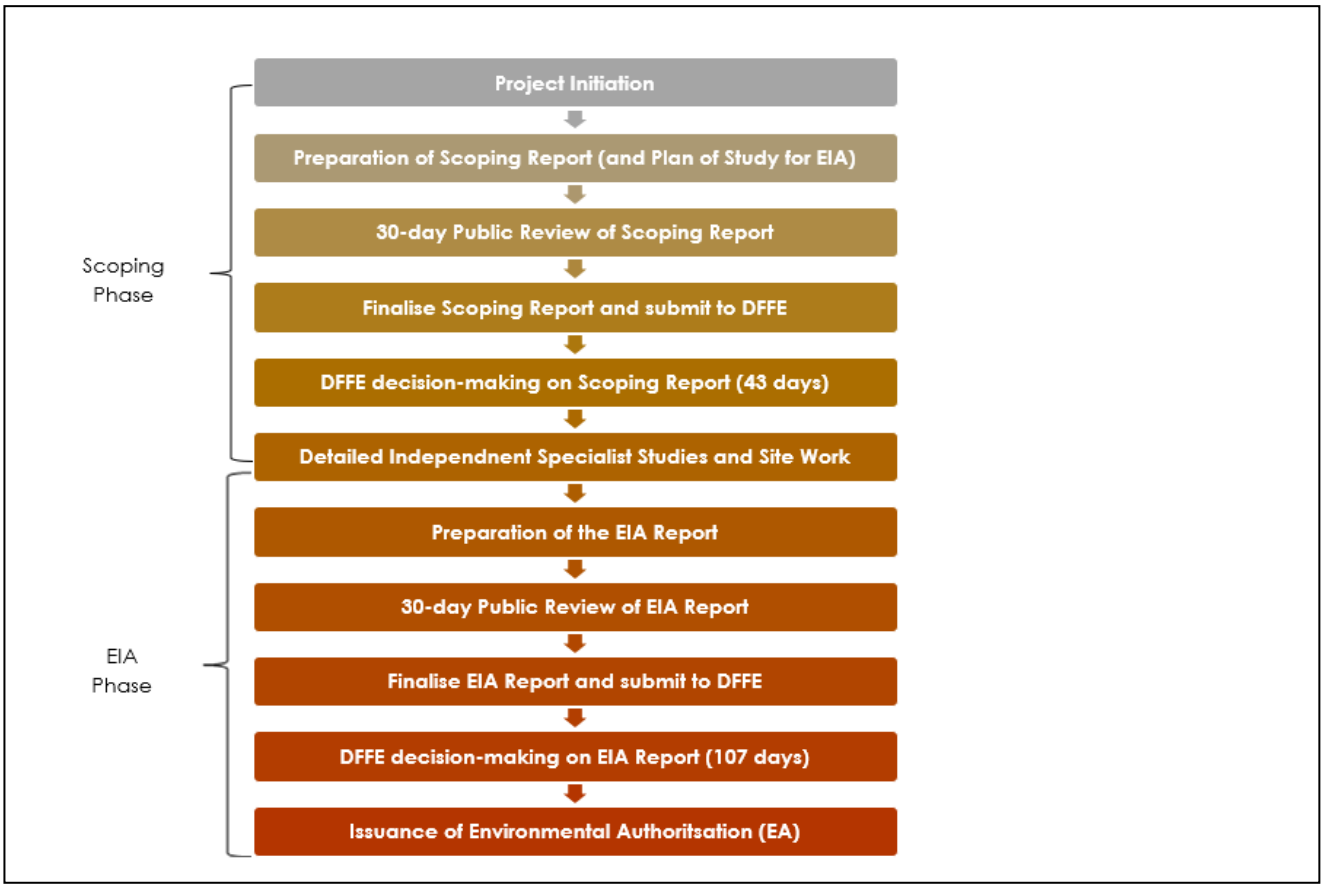


Figure 1.3: Regulated timeframe of an Environmental Impact Assessment (EIA) Process

1.5 Details of Environmental Assessment Practitioner and Expertise to conduct the S&EIA Process

In accordance with Regulation 12 of the 2014 EIA Regulations (GNR 326), the applicant has appointed Savannah Environmental (Pty) Ltd as the independent environmental consultant responsible for managing the Application for EA and supporting Scoping and Environmental Impact Assessment (S&EIA) process; inclusive of comprehensive, independent specialist studies. The application for EA and S&EIA process will be managed in accordance with the requirements of NEMA, the 2014 EIA Regulations (GNR 326), and all other relevant applicable legislation.

Neither Savannah Environmental nor any of its specialists are subsidiaries or are affiliated to the applicant. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed facility.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment, and planning to ensure compliance and evaluate the risk of development, and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.
The Savannah Environmental team for this project includes:

» ***Ansone' Esterhuizen,*** the principal author of this report and the EAP on this project. She is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (2021/3909), and she holds a Bachelor of Arts in Environmental Management and is currently completing her BSc Honours in Environmental Management. She has over 4 years of experience in conducting Environmental Impacts Assessments, public participation, and Environmental Management Programme for a wide range of projects including renewable energy projects. She is responsible for overall compilation of the report, this includes specialists' engagements, reviewing specialists reports and incorporating specialist studies into the Environmental Impact Assessment report and its associated Environmental Management. She is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP), Registration Number (142673)

» ***Jo-Anne Thomas,*** the principal EAP on this project, is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA - 2019/726). She provides technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, Environmental Impact Assessment studies, environmental auditing and monitoring, environmental permitting, public participation, Environmental Management Plans and Programmes, environmental policy, strategy and guideline formulation, and integrated environmental management. Her key focus is on integration of the specialist environmental studies and findings into larger engineering-based projects, strategic assessment, and providing practical and achievable environmental management solutions and mitigation measures. Responsibilities for environmental studies include project management (including client and authority liaison and management of specialist teams); review and manipulation of data; identification and assessment of potential negative environmental impacts and benefits; review of specialist studies; and the identification of mitigation measures.

» ***Nicolene Venter***, is a Board Member of IAPSA (International Association for Public Participation South Africa). She holds a Higher Secretarial Diploma and has over 21 years of experience in public participation, stakeholder engagement, awareness creation processes and facilitation of various meetings (focus group, public meetings, workshops, etc.). She is responsible for project management of public participation processes for a wide range of environmental projects across South Africa and neighbouring countries.

To adequately identify and assess potential environmental impacts associated with the proposed Carolus Solar PV1 Facility, the following specialist sub-consultants have provided input into this scoping report:

Specialist	Area of Expertise
Andrew Husted of The Biodiversity Company	Ecology, Freshwater, and Soils
Chris van Rooyen and Albert Froneman	Avifauna
Lourens du Plessis of LoGIS	Visual
Tony Barbour of Tony Barbour Environmental Consulting	Social

Specialist	Area of Expertise
Jenna Lavin of CTS Heritage	Heritage (including Archaeology Palaeontology and Cultural Landscape)
Adrian Johnston of JG Afrika	Traffic

Appendix A includes the curricula vitae for the environmental assessment practitioners from Savannah Environmental and the specialist consultants.

CHAPTER 2 PROJECT DESCRIPTION

This Chapter provides an overview of the Carolus Solar PV1 Facility and details the project scope which includes the planning/design, construction, operation, and decommissioning activities required for the development. It must be noted that the project description presented in this Chapter may change to some extent based on the outcomes and recommendations of detailed engineering and other technical studies, the findings and recommendations of the EIA and supporting specialist studies, and any licencing, permitting, and legislative requirements.

2.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of the Environmental Impact Assessment Report:

Requirement	Relevant Section
3(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 and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	The location of the proposed project is detailed in Chapter 1, **Table 1.1**, as well as section 2.2.1 below.
3(d)(ii) a description of the scope of the proposed activity, including a description of the activities to be undertaken including associated structures and infrastructure	A description of the activities to be undertaken with the development of project is included in **Table 2.1** and **Table 2.2**.

2.2. Nature and Extent of the Carolus Solar PV1 Facility

Coal-fired power plants currently dominate South Africa's electricity generation capacity. Photovoltaic (PV), wind, biogas, other biofuels, hydropower, landfill gas, geothermal, and centralised solar energy are all examples of renewable energy (RE) that are gaining popularity around the world. Ministerial regulations on renewable energy procurement, such as the National Electricity Integrated Resource Plan (IRP) 2010-2030, have boosted renewable energy growth significantly in South Africa which aligns with the need to facilitate the growing electricity demand within South Africa.

Carolus Solar PV1 (Pty) Ltd has identified the need to promote renewable energy and sustainability within the Northern Cape Province, to aid in the country's targets for renewable energy by proposing the development of a commercial solar facility and associated infrastructure on a site near De Aar to add new capacity to the national electricity grid. From a technical perspective the Northern Cape is considered ideal for the development of solar energy by virtue of the climate and solar conditions, economic viability, availability of infrastructure and land availability for development.

The project is planned as part of a cluster of renewable energy facilities known collectively as Pixley Park, which includes three (3) additional Solar PV Facilities (Carolus Solar PV1, Riet Fountain PV1, and Fountain Solar PV1), and associate individual grid connection infrastructures.

Separate Applications for Environmental Authorisation (EA) have been lodged with the Competent Authority (i.e., DFFE) for each proposed PV facility and grid connection. Furthermore, separate reports (i.e., BA and Scoping and EIA Reports) will be compiled for each project. This is required because each PV project, and its grid connection, requires separate EAs in the name of the bidding project company, to be eligible to tender a project into a particular DMRE bidding round.

2.3. Overview of the Project Site and planned Infrastructure

The project is to be developed on a site located approximately 10km east of De Aar within the Emthanjeni Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. The full extent of the development area (i.e., ~300ha), was considered within the Scoping Phase of the EIA process, within which a development footprint for the Carolus Solar PV1 Facility has been identified from a technical and environmental sensitivity perspective.

The development area Is located on Portion 3 of the Farm Carolus Poort No.3.

The solar PV facility will be developed in a single phase and will have a contracted capacity of up to 120MW. The project will make use of fixed-tilt, single-axis tracking, and/or double-axis tracking PV technology. Monofacial or bifacial panels are both considered within this Scoping Report.

The Carolus Solar PV1 Facility will comprise solar panels which, once installed, will stand less than 5m above ground level. The solar panels will include centralised inverter stations, or string inverters mounted above ground. If centralised inverter stations are used, Mega Volt (MV) distribution transformers are located internally, whereas string inverters are containerised with switchgear. The main transformer capacity varies according to detailed design and project-specific requirements.

A 12m wide access road, entrance gate to the project site and switching station is planned as part of the development. The developer has additionally made provision for 6m wide internal distribution roads within the PV panel area. The project site can be accessed via the N10 which lies west of the development area (refer to **Figure 2.1**), and then via the existing public road (Hydra Substation access road) which cuts across the cluster's development footprint and provides access to the project site and development area (refer to **Figure 2.2**).

Grid connection infrastructure for the PV facility will be located outside the PV development area but within the project site within a 100m corridor. This grid connection infrastructure is to be assessed in a separate Basic Assessment process.

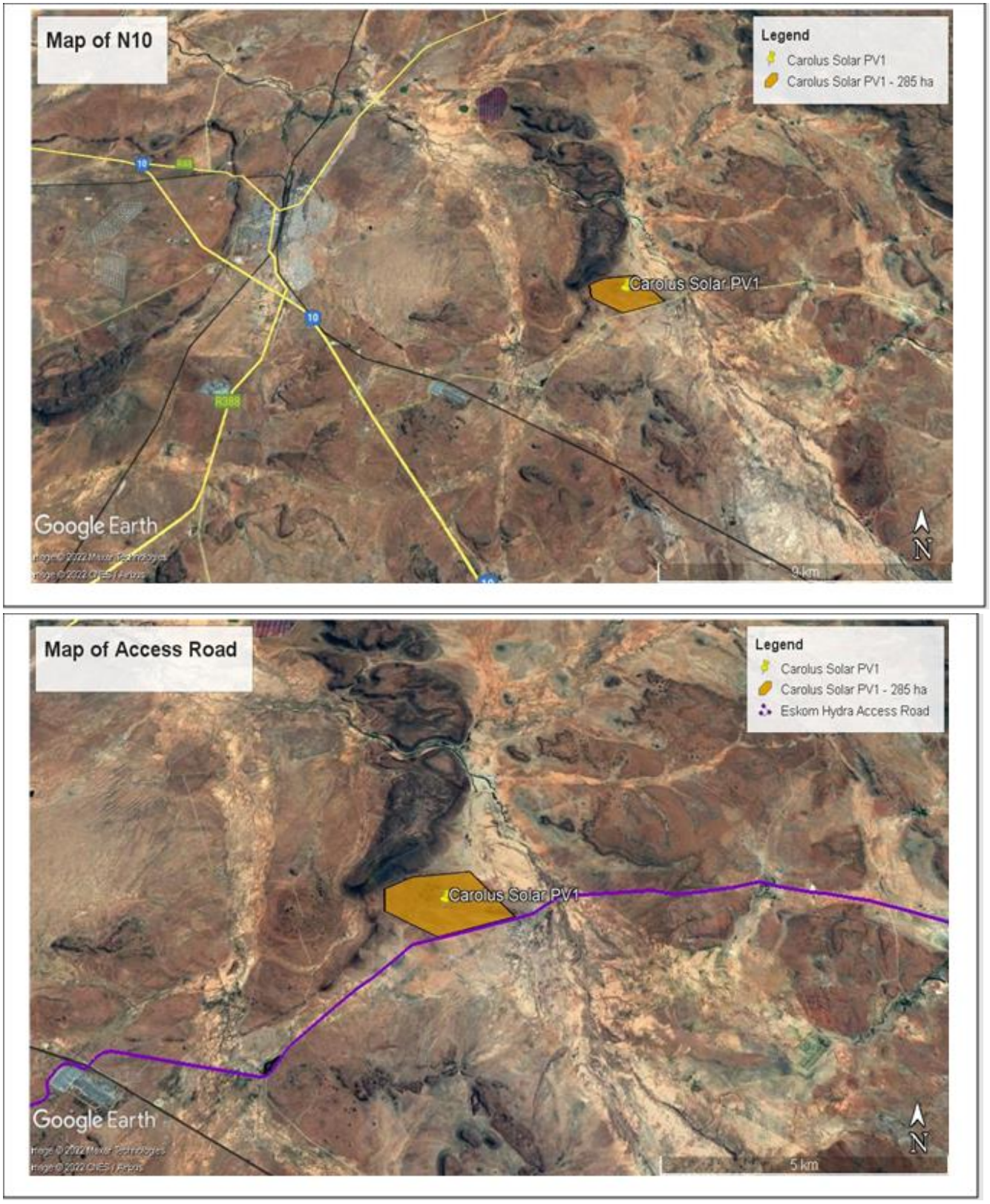


Figure 2.1: Location of the N10 national road in relation to the Carolus Solar PV1 Facility development area (development area in orange).

Figure 2.2: Location of the development area (orange) in relation to the access road which provides direct access to the project site and development area.

The project area is proposed to accommodate both the PV panels and most of the associated infrastructure which is required for such a facility the solar PV facility will include the following:

- Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology
- Inverters and transformers
- Cabling between the panels
- Battery Energy Storage System (BESS)
- Laydown areas, construction camps, site offices
- 12m wide Access Road and entrance gate to the project site and switching station
- 6m wide internal distribution roads
- Operations and Maintenance Building, Site Offices, Ablutions with conservancy tanks, Storage Warehouse, workshop, Guard House
- Onsite IPP substation, including all necessary electrical and auxiliary equipment required at the IPP substation that serves that solar facility. This would include transformer, switchyard/bay, control building, fences etc

The facility will be connected to the national electricity grid via the following infrastructure (to be assessed in a separate Basic Assessment Report):

- Onsite Switching Station (SwS), adjacent to the IPP substation (SS).
- A 132kV Overhead Power Line (OHPL) from the SwS connecting back to a Main Transmission Substation (MTS). There is an MTS proposed on either the farm Vetlaagte (i.e., Vetlaagte MTS) or the farm Carolus en Bietjie (i.e., Carolus en Bietjie MTS). Two separate EA processes are currently underway to authorise the two MTS's and it is uncertain at this stage as to which MTS will be authorised and used to connect these projects.
- The development of the Carolus Solar PV1 Facility may require the following at the above-mentioned MTSs:
    - an extension of the 132kV Busbar.
    - an extension of the 400kV Busbar
    - an additional 400/132kV Transformer to be added
    - a new 132kV Feeder Bay

A summary of the details and dimensions of the planned infrastructure associated with the project is provided in **Table 2.1**

Table 2.1: Details or infrastructures proposed as part of Carolus Solar PV1 Facility. Specific details to be confirmed in the EIA phase.

Infrastructure	Footprint and dimensions
Number of Panels	To be determined in the EIA phase
Panel Height	Up to 5m
Technology	Use of fixed-tilt, single-axis tracking, PV technology. Bifacial panels are being considered.
Contracted Capacity	Up to 120MW
Area occupied by the solar array	~300ha
Area occupied by the on-site facility substation	~ 15ha

Infrastructure	Footprint and dimensions
Capacity of on-site facility substation	33kV/132kV
Area occupied by laydown area	~10 ha
Access and internal roads	Wherever possible, existing access roads will be utilised to access the project site and development area. A 12m wide access road and entrance gate will be part of the development scope. Internal roads of up to 6m in width will be required to access the PV panels and the on-site substation.
Grid Connection Works (IPP) *To be include in this EA application*	A 132kV on-site IPP substation and associated infrastructure will be constructed with a footprint of approximately 50m x 100m
Grid connection Works (Self-build / Eskom) *Authorised under a separate EA, to be handed over to Eskom in future.*	A132kV on-site switching substation (adjacent to the above IPP substation) will be connected to the proposed 400/132kV MTS via overhead cabling with a capacity of up to 132kV. A new 132kV single-circuit power line will run from the switching station to either the proposed Vetlaagte MTS or the proposed Wag n Bietjie MTS. The MTS will be upgraded to include the extension of the 400/132kV Busbar, instillation of a 132kV feeder bay and a new 400/ 132kV Transformer Bay. The 132kV switching substation and the new 132kV single -circuit overhead Power Line will be assessed as part of a separate Basic Assessment process in support of an application for Environmental Authorisation.
Temporary infrastructure	Temporary infrastructure, including laydown areas, hardstand areas and a concrete batching plant, will be required during the construction phase. All areas affected by temporary infrastructure will be rehabilitated following the completion of the construction phase, where it is not required for the operation phase.

Table 2.2 provides details regarding the requirements and the activities to be undertaken during the Carolus Solar PV1 Facility development phases (i.e., construction phase, operation phase and decommissioning phase). **Table 2.3** provides illustrations of technology considered for the solar energy facility and the generation of electricity.

2.4. Project Development Phases Associated with the Carolus Solar PV facility

Table 2.2: Details of the Carolus Solar PV1 Facility project development phases (i.e., construction, operation, and decommissioning)

Construction Phase	
Requirements	» Project receives Environmental Authorisation from the DFFE, preferred bidder allocation granted by DMRE (or other off taker), a generating license issued by NERSA, and a Power Purchase Agreement secured with Eskom (or private entity). » Expected to be 15-18 months for Carolus Solar PV1 Facility. » The construction phase involves installation of the solar PV panels and the structural and electrical infrastructure to make the plant operational. In addition, preparation of the soil and improvement of the access roads would continue for most of the construction phase. » Create direct construction employment opportunities. Approximately 350 employment opportunities will be created. » No on-site labour camps. Employees to be accommodated in the nearby towns such as Richmond and Victoria West and transported to and from site on a daily basis. » Overnight on-site worker presence would be limited to security staff. » Waste removal and sanitation will be undertaken by a suitably qualified sub-contractor. Waste containers, including containers for hazardous waste, will be located at easily accessible locations on site when construction activities are undertaken. » Electricity required for construction activities will be generated by a generator. Where low voltage connections are possible, these will be considered. » Water required for the construction phase will be supplied by the municipality. In addition, and where the Municipality is unable to provide sufficient water, borehole water will be used. Should water availability at the time of construction be limited, water will be transported to site via water tanks. Water will be used for sanitation and potable water on site as well as construction works.
Activities to be undertaken	
Conduct surveys prior to construction	» Including, but not limited to a geotechnical survey, site survey and confirmation of the panel micro-siting footprint, and survey of the on-site IPP substation site to determine and confirm the locations of all associated infrastructure.
Establishment of access roads to the Site	» Internal access roads within the site will be established at the commencement of construction. » Existing access roads will be utilised, where possible, to minimise impact. It is unlikely that access roads will need to be upgraded as part of the proposed development. » Access roads to be established for construction and/or maintenance activities within the development footprint. » Internal service road alignment will be approximately 6m wide. Location is to be determined by the final micro-siting or positioning of the PV panels.

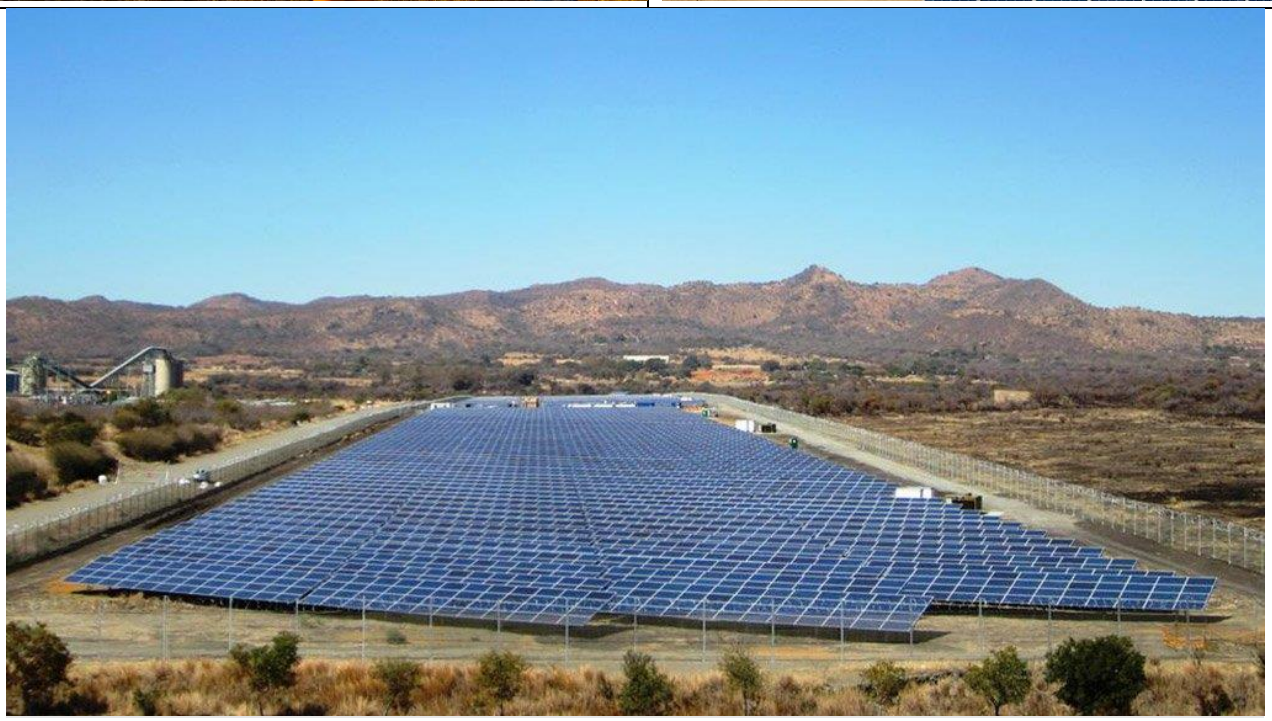
Undertake site preparation	» Including the clearance of vegetation at the footprint of PV panel supports, establishment of the laydown areas, the establishment of internal access roads and excavations for foundations. » Stripping of topsoil to be stockpiled, for use during rehabilitation. » Vegetation clearance to be undertaken in a systematic manner to reduce the risk of exposed ground being subjected erosion. » Include search and rescue of floral species of concern (where required) and the identification and excavation of any sites of cultural/heritage value (where required).
Establishment of laydown areas and batching plant on site	» A laydown area for the storage of PV panels components and civil engineering construction equipment. » The laydown will also accommodate building materials and equipment associated with the construction of buildings. » No borrow pits will be required. Infilling or depositing materials will be sourced from licenced borrow pits within the surrounding areas. » A temporary concrete batching plant of 50m x 50m in extent to facilitate the concrete requirements for foundations, if required.
Construct foundation	» Excavations to be undertaken mechanically. » For PV array installation vertical support posts will be driven into the ground. » Depending on geological conditions, the use of alternative foundations may be considered (e.g., screw pile, helical pile, micropyle or drilled post/piles).
Transport of components and equipment to and within the site	» The components for the solar PV facility and onsite substation will be transported to site by road. Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site. » Some of the components (i.e., substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989) by virtue of the dimensional limitations. » Typical civil engineering construction equipment will need to be brought to the site (e.g., excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the substation and site preparation.
Erect PV Panels and Construct Substation, Invertors and BESS	» For array installation, typically vertical support posts are driven into the ground. Depending on the results of the geotechnical study a different foundation method, such as screw pile, helical pile, micro-pile or drilled post/pile could be used. The posts will hold the support structures (tables) on which PV arrays would be mounted. Brackets attach the PV modules to the tables. » Trenches are dug for the underground AC and DC cabling and the foundations of the inverter enclosures and transformers are prepared. » While cables are being laid and combiner boxes are being installed, the PV tables are erected. » Wire harnesses connect the PV modules to the electrical collection systems. Underground cables and overhead circuits connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure and ultimately the project's on-site substation.

	» This process also involves the installation of the BESS facility.
Connection of PV panels to the substation	» PV arrays to be connected to the on-site substation via underground electrical cables. » Excavation of trenches is required for the installation of the cables. Trenches will be approximately 1.5m deep. » Underground cables are planned to follow the internal access roads, as far as possible. » Onsite substation to be connected to the IPP substation via underground cables.
Establishment of ancillary infrastructure	» Site offices and maintenance buildings, including workshop areas for maintenance and storage will be required. » Establishment will require the clearing of vegetation, levelling, and the excavation of foundations prior to construction.
Connect substation to the power grid	» A new 132kV single circuit power line will run from the onsite IPP substation and the Switching station and tie into the either the proposed Vetlaagte MTS or the proposed Wag n Bietjie MTS.
Undertake site rehabilitation	» Commence with rehabilitation efforts once construction completed in an area, and all construction equipment is removed. » On commissioning, access points to the site not required during the operation phase will be closed and prepared for rehabilitation.
Operation Phase	
Requirements	» Duration will be 20-25 years. » Requirements for security and maintenance of the project. » Employment opportunities relating mainly to operation activities and maintenance. Approximately 15 - 20 full-time employment opportunities will be available during the operation of the solar facility.
Activities to be undertaken	
Operation and Maintenance	» Full time security, maintenance, and control room staff. » All PV panels will be operational except under circumstances of mechanical breakdown, inclement weather conditions, or maintenance activities. » Solar PV to be subject to periodic maintenance and inspection. » It is anticipated that the PV panels will be washed twice a year during operation using clean water with no cleaning products, or non-hazardous biodegradable cleaning products. » Disposal of waste products (e.g., oil) in accordance with relevant waste management legislation. » Areas which were disturbed during the construction phase to be utilised, should a laydown area be required during operation.
Decommissioning Phase	
Requirements	» Decommissioning of the Carolus Solar PV1 facility infrastructure at the end of its economic life. » Potential for repowering of the facility, depending on the condition of the facility at the time. » Expected lifespan of approximately 20 - 25 years (with maintenance) before decommissioning is required. » Decommissioning activities to comply with the legislation relevant at the time.

	» It is expected that the areas of the project site affected by the solar facility infrastructure (development footprint) will revert back to its original land-use (i.e., agriculture) once the Carolus PV facility has reached the end of its economic life and all infrastructure has been decommissioned.
» Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to the site to accommodate the required decommissioning equipment. » Preparation of the site (e.g., laydown areas and construction platform). » Mobilisation of construction equipment.
Disassemble and remove PV panels	» Components to be reused, recycled, or disposed of in accordance with regulatory requirements. » Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. » Concrete will be removed to a depth as defined by an agricultural specialist and the area rehabilitated. » Cables will be excavated and removed, as may be required

It is expected that the areas of the project site affected by the solar facility infrastructure (development footprint) will revert back to their original land-use (i.e. primarily grazing) once the facility has reached the end of its economic life and all infrastructure has been decommissioned.

Table 2.3: Photographs of the construction phase of a solar facility similar to the Carolus PV1 Facility



CHAPTER 3 CONSIDERATION OF ALTERNATIVES

This Chapter provides an overview of the various alternatives considered for Carolus Solar PV1 Facility as part of the Scoping & EIA Process.

3.1. Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

Requirement	Relevant Section
3(g) a motivation for the preferred site, activity, and technology alternative	The identification and motivation for the preferred project site, the development area within the project site, the proposed activity and the proposed technology is included in **sections 3.3.1, 3.3.3 and 3.3.4.**
3(h)(i) details of the development footprint alternative considered	The details of all alternatives considered as part of the Carolus Solar PV are included in **sections 3.3.1 – 3.3.5.**
3(h)(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such	Where no alternatives have been considered, motivation has been included. This is included in **section 3.3**.
3(h)(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report	Refer to **section 3.3.1**. for a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report

3.2. Alternatives Considered during the Scoping/EIA Process

In accordance with the requirements of Appendix 3 of the 2014 Environmental Impact Assessment (EIA) Regulations (GNR 326), reasonable and feasible alternatives including but not limited to site and technology alternatives, as well as the "do-nothing" alternative should be considered. Several other renewable energy facilities are planned within the broader study area, supporting the suitability of the area for renewable energy projects.

The DFFE Guideline for determining alternatives states that the key criteria for consideration when identifying alternatives are that they should be "practicable", "feasible", "relevant", "reasonable" and "viable". Essentially there are two types of alternatives:

» Incrementally different (modifications) alternatives to the project.
» Fundamentally (totally) different alternatives to the project.

In this instance, 'the project' refers to Carolus Solar PV1 Facility, a solar energy facility with capacity of up to 120MW and associated infrastructure proposed to be developed by an Independent Power Producer (IPP) and intended to form part of the DMRE's REIPPP Programme, or another similar programme.

3.2.1 Consideration of Fundamentally Different Alternatives

Fundamentally different alternatives are usually assessed at a strategic level and, as a result, project specific EIAs are therefore limited in scope and ability to address fundamentally different alternatives. At a strategic level, electricity generating alternatives have been addressed as part of the DMRE's current Integrated Resource Plan for Electricity 2010 – 2030 (IRP)[6], and will continue to be addressed as part of future revisions. In this regard, the need for renewable energy power generation (including solar and wind) has been identified as part of the technology mix for power generation in the country in the next 20 years. Of particular relevance to the proposed project is the allocation of 6000MW of new capacity to large-scale PV included in the IRP 2019. The site is considered most suitable for the development of a PV solar energy facility as a result of local irradiation. Therefore, fundamentally different alternatives to the proposed project are not considered within this BA process.

The fundamental energy generation alternatives were assessed and considered within the development of the IRP and the need for the development of renewable energy projects has been defined. Therefore, fundamentally different alternatives to the proposed project are not considered within this EIA process.

3.2.2 Consideration of Incrementally Different Alternatives

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives for:

- The property on which, or location where the activity is proposed to be undertaken.
- The type of activity to be undertaken.
- The design or layout of the activity.
- The technology to be used in the activity.
- The operational aspects of the activity.

In addition, the option of not implementing the activity (i.e. the "do-nothing" alternative) must also be considered.

The sections below describe the incrementally different alternatives being considered as part of the Carolus Solar PV1 Facility. Where no alternative is being considered, a motivation has been provided as required by the EIA Regulations, 2014.

3.3. Project Alternatives under Consideration for the Carolus Solar PV1 Facility

Table 3.1 provides an overview of the alternatives being considered as part of the project:

Nature of Alternatives Considered	Description of the Alternatives relating to the Carolus Solar PV1 Facility.
Site-specific and Layout Alternatives	One preferred project site has been identified for the development of the Carolus Solar PV1 Facility due to site specific characteristics such as the solar resource, land availability, topographical considerations, proximity to a viable grid connection and environmental features. The development site is approximately ~300ha in extent which is sufficient for the

[6] The Integrated Resource Plan (IRP) is legislated policy which regulates power generation planning.

Nature of Alternatives Considered	Description of the Alternatives relating to the Carolus Solar PV1 Facility.
	development of a Solar PV facility with a contracted capacity of up to 120MW. A development footprint has been defined within this area considering environmental sensitivities identified through the EIA process.
Activity Alternatives	Only the development of a renewable energy facility is considered by Carolus Solar PV1 (Pty) Ltd. Resulting from the location of the project site and the suitability of the solar resource, only the development of a Solar PV facility is considered feasible considering the natural resources available to the area and the current land-use activities undertaken within the project site. In addition, the development will be in line with the proposed solar cluster proposed.
Technology Alternatives	Only the development of a solar facility is considered due to the characteristics of the site, including the natural resources available. The use of solar PV for the generation of electricity is the most efficient technology for the project site. The use of mono- and bifacial panels is being considered by the developer.
'Do-nothing' Alternative	This is the option to not construct the Carolus Solar PV1 Facility. No impacts (positive or negative) are expected to occur on the social and environmental sensitive features or aspects located within the project site or the surrounds with the implementation of this option. The opportunities associated with the development of the solar facility for the affected area and other surrounding towns in the area will however not be made available.

These alternatives are described in more detail in the sections which follow.

3.3.1. Property or Location Alternatives

The placement of a Solar PV Facility is dependent on several factors, namely, land suitability, climatic conditions (solar irradiation levels), topography, the location and extent of the development area, availability of grid connection infrastructure, and the need and desirability of the project.

The Carolus Solar PV1 Facility is located east of De Aar in the Northern Cape province. The preferred project site for the development of the Solar PV facility was identified through an investigation of prospective sites and properties in the area within the Northern Cape Province. The investigation involved the consideration of specific characteristics within the province and specifically within the areas near De Aar. From a technical perspective the site is considered to be highly favourable to establish a Solar PV Facility due to the following site-specific favourable characteristics:

- Solar resource characteristics (including Global Horizontal Irradiation (GHI)).
- Land availability.
- Land use and geographical and topographical considerations.
- Access to the national grid, including distance and capacity to connect the proposed project to the network.
- Site accessibility; and
- Environmental and social aspects.

The characteristics considered were identified by the developer as the main aspects that play a role in the opportunities and limitations for the development of a Solar PV facility. The characteristics considered, and the results thereof, are discussed in the sections below. The developer considered that should these characteristics not be favourable for the development of a Solar PV facility, then some limitations and

challenges may be expected and potentially hinder such development from a technical and/or economic perspective.

» **National and Provincial and Local Planning Considerations** - Renewable energy is strongly supported at a national, provincial, and local level (refer to Chapter 5 for details). At a national level, the development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to renewable energy. Renewable energy is also supported at a provincial and local municipal level.

» **Solar resource**: The north-western part of South Africa has the highest Global Horizontal Irradiation (GHI), relevant to PV installations and Direct Normal Irradiance (DNI), relevant to CPV and tracking PV installations. Therefore, this section of South Africa is deemed the most suitable for the construction and operation of solar energy facilities as opposed to other areas and provinces within South Africa. For example, coastal regions within KwaZulu-Natal, Eastern Cape and Western Cape mainly have a solar radiation between 1500 kWh/m^2 and 1700 kWh/m^2 per annum, which is not completely feasible for the proposed projects. On the other hand, the Northern Cape (the area with the predominant pink/red shading in **Figure 3.1**) has a solar radiation of between 2000 and 2300 kWh/m^2 per annum, considered the highest solar irradiation values of the country and therefore enables the development of solar energy projects and the successful operation thereof. Based on the solar resource available the proposed site location was identified as being technically feasible.

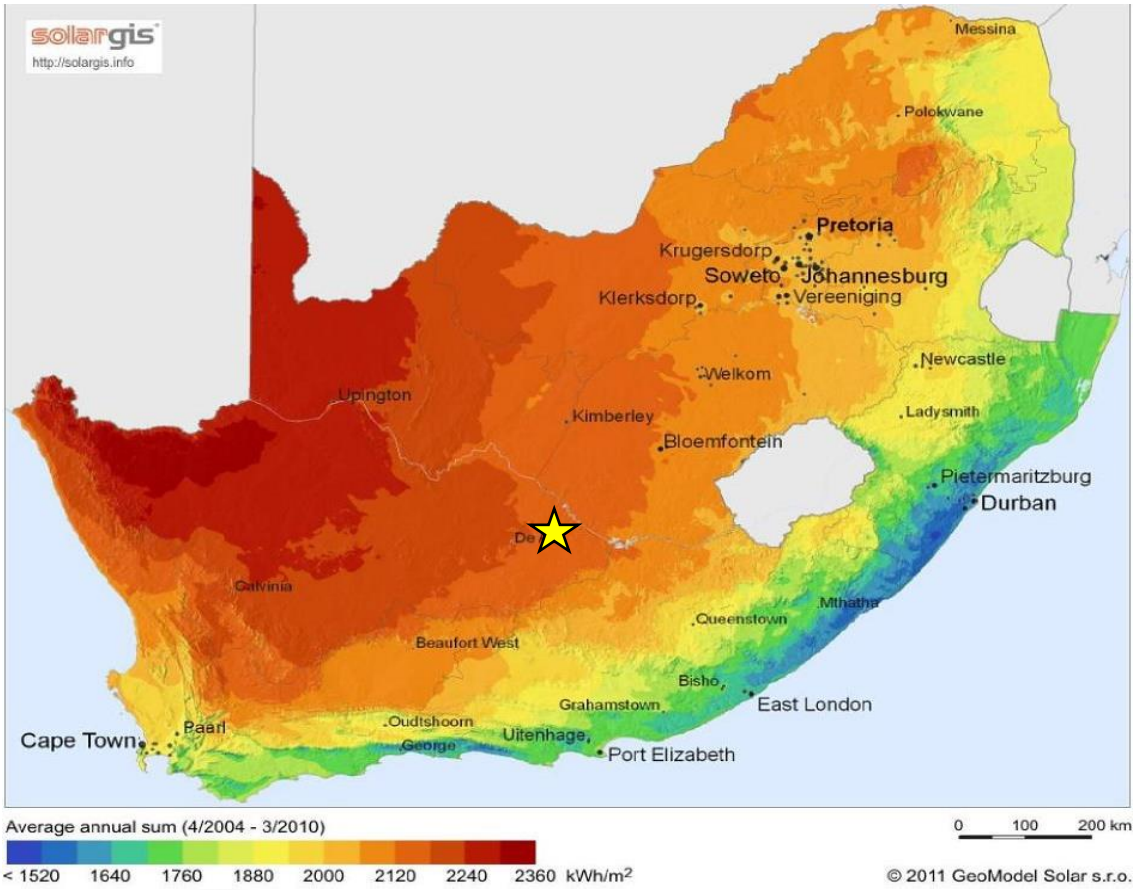


Figure 3.1: Solar irradiation map for South Africa. The proposed Carolus Solar PV1 Facility site is shown by the yellow star on the map. (Source: adapted from GeoModel Solar, 2011).

» **Land availability**: A previous application by a different applicant was undertaken to identify the feasibility for the establishment of a proposed solar PV facility and associated infrastructure within the Northern Cape Province on the same area. This analysis considered various criteria and it was concluded that there was potential to establish a cluster PV development in the De Aar area. **Environmental Authorisation for this proposed development was granted but has since lapsed**, and the option agreements with relevant landowners have been transferred to a new developer and applicant (i.e., Carolus Solar PV1 Pty Ltd), which is undertaking this new EIA process.

To develop the Carolus Solar PV1 Facility with a contracted capacity of up to 120MW, sufficient space is required. The property included in the project site is privately-owned and is available for a development of this nature through agreement with the landowner, and is deemed technically feasible by the project developer for such development to take place. The affected property has an extent of ~600 ha, which was considered by the developer as sufficient for the development of the Carolus Solar PV1 Facility. A preferred development area of ~300 ha within this larger project site has been identified for the location of the Carolus Solar PV1 Facility. An exact development footprint within the development area for the placement of infrastructure has been identified considering environmental constraints and sensitivities, and has been assessed withinthis EIA Report.

» **Landowner Support:** The selection of a site where the landowner is supportive of the development of renewable energy is essential for ensuring the success of the project. The landowner affected by the proposed Carolus Solar PV1 Facility (and those affceted by the larger the Pixley Park cluster development) do not view the development as a conflict with their current land use practices. The support from the landowners for the development to be undertaken on the affected properties has been solidified by the provision of consent for the project to proceed on the property through the signing of consent forms.

» **Land use**: The character of the greater area surrounding the project site can be described as a rural, Karoo landscape characterised by livestock farming. There are several farm dwellings located in the vicinity of the site, including three farm dwellings within the boundary of the site. The land use identified within the greater area surrounding the project site (i.e., livestock farming) is generally preferred for developments of this nature as the livestock farming activities can continue the affected properties in tandem with the operation of the solar facility.

» **Geographical and Topographical Considerations:** The topography in the wider area surrounding the project site is characterised by a largely flat to undulating landscape interspersed with areas of high elevation in the form of hills, koppies, ridges and/or mountains. In the wider area, a range of hilly/mountainous topography with high elevations is present to the south-east and north of the site, respectively. As such, there are very few physical constraints present which would influence the construction and operation of a solar PV facility.

» **Access to the National Electricity Grid**: A key factor in the siting of any power generation project is a viable grid connection. The anticipated grid connection solution (subject to a separate environmental assessment and authorisation process) is a 132kV central IPP substation and a 132kV power line to enable connection to the the new Vetlaagte Main Transmission Substation (MTS) or the new Wag 'n Bietjie MTS. The developer consulted with the Eskom network planners to understand the current capacity of the existing grid connection infrastructure in the area and to identify feasible connection points for the

facility. A small transmission substation (132kV in capacity) is planned as part of the Carolus Solar PV1 Facility which will then tie into one of the two proposed new Main Transmission Substations (MTS) which are still under assessment on the adjacent properties.

» **Site access**: Access to the project site is limited to the Eskom Hydra Road (a provincial public road) running through the Solar PV development Cluster. The project site is situated adjacent to the N10 national road, which links to the hydra road and provides access to the project site and development area. The site is therefore readily accessible for the delivery of project components and equipment during construction.

Based on the above considerations, the Carolus Solar PV1 Facility project site was identified by the developer as being the most technically feasible and viable project site within the broader area for further investigation in support of an application for authorisation. As a result, no property/location alternatives are proposed as part of this Scoping and EIA process.

3.3.2. Design and Layout Alternatives

The overall aim of the facility layout (i.e., development footprint) is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operation, and maintenance costs, and social and environmental impacts.

Following the confirmation of the Carolus Solar PV1 Facility preferred project site as being technically feasible for the development of a PV facility, the developer commenced with the scoping assessment of the site, to evaluate the main constraints and opportunities and determine whether or not there were any potential fatal flaws or significant no-go areas within the site that might compromise or limit the development of the Carolus Solar PV1 Facility and the potential to generate the 120MW. The scoping process included specialist investigation of a broader area based on desktop studies and where possible field assessments.

The purpose of this phase of the project was to identify sensitive and no-go areas, as well as determination of appropriate buffers to be considered within the development of the project layout. The sensitivity spatial data as compiled by the specialist team during the scoping phase for the project site was provided to the applicant. This is a common approach in the development of renewable energy projects in order to inform the placement of infrastructure for further investigation in the EIA process.

Through the integration of the specialist sensitivity data obtained, based on field-survey and desktop studies, the developer designed the layout to avoid areas and features of high environmental sensitivity through the placement of the PV infrastructures. Where avoidance was not possible, the developer provided details of technical mitigation planned to reduce the significance of the potential environmental impacts associated with the project. This has resulted in the consideration of a development footprint as part of the EIA process which is designated to be environmentally appropriate as far as possible.

An overall environmental sensitivity map has been provided in order to illustrate the sensitive environmental features located within the project site which needs to be considered and, in some instances completely avoided by the development footprint in relation to the proposed facility layout (refer to Chapter 8).

3.3.3. Activity Alternatives

Carolus Solar PV1 (Pty) Ltd is a renewable energy project developer and as such is only considering renewable energy activities in accordance with the need for such development within the IRP. Considering the available natural energy resources within the area and the current significant restrictions placed on other natural resources such as water, it is considered that solar PV is the preferred option for the development of a renewable energy facility within the preferred project site.

The project site is located near the towns of Richmond and Victoria West in the Northern Cape Province which has the highest solar irradiation value of approximately 2240 kWh/m2/annum. Based on the solar data confirmed through a meteorological and solar weather station, the available solar resource has been confirmed. Based on available information, it is concluded by the developer that there are a limited number of sites in South Africa with a solar resource considered viable to support the development of a technically and economically feasible solar PV. The project site is therefore considered best suited for the development of a solar PV. In addition, grid connection infrastructure to connect the solar PV to the national grid is present in the surrounding area which enables connection.

Considering the suitability of the project site for the development of a solar PV, the current land-use activities being undertaken within the project site which relate to livestock farming and compatibility thereof, the activity (i.e., the development of a solar PV) is considered to be appropriate. Therefore, not activity alternatives are considered within this EIA Report.

3.3.4. Technology Alternatives

As Carolus Solar PV1 (Pty) Ltd is an IPP, only renewable energy technologies are being considered for the generation of up to 120MW (contracted capacity) of electricity. Considering the local resources available (i.e., wind and solar irradiation) for such technologies, the footprint requirements for such developments, the topography of the project site and the current land use of the project site (i.e., livestock farming), the project site is considered most suitable for the establishment of a solar PV. This area has been identified as a suitable and best location for the proposed solar PV.

Limited technology options are available for solar energy facilities, and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail in the area, so that optimality is obtained by the final site selection. PV technology is the preferred option for implementation on the site in comparison to CSP as it is associated with limited water demand requirements and a lower visual profile.

The Integrated Resource Plan (IRP) 2019, excludes the procurement of power from CSP facilities until 2030; whereas new additional capacity of approximately 6 000MW will be required from solar PV facilities. Therefore, PV technology was identified as being the preferred option for the study area. Solar PV consists of a lower visual profile and limited water requirements when compared to the CSP technology option. Therefore, considering the above, no other technology alternatives are being assessed for development on the proposed site.

When considering PV as a technology choice, several types of panels are available, including *inter alia*:

» Bifacial PV panels
» Monofacial PV panels

- Fixed mounted PV systems (static / fixed-tilt panels).
- Single-axis tracking or double-axis tracking systems (with solar panels that rotate around a defined axis to follow the sun's movement).

The primary difference between PV technologies available relate to the extent of the facility, as well as the height of the facility (visual impacts), however the potential for environmental impacts remains similar in magnitude. Fixed mounted PV systems are able to occupy a smaller extent and have a lower height when compared to tracking PV systems, which require both a larger extent of land, and are taller in height. However, both options are considered to be acceptable for implementation from an environmental perspective.

The PV panels are designed to operate continuously for more than 20 years, mostly unattended and with low maintenance. The impacts associated with the construction, operation, and decommissioning of the facility are anticipated to be the same irrespective of the PV panel selected for implementation. Once environmental constraining factors have been determined through the Scoping and EIA process, Carolus Solar PV1 (Pty) Ltd will consider various solar panel options. The preferred option will be informed by efficiency as well as environmental impact and constraints (such as sensitive biophysical features). The PV panels proposed, will comprise solar panels which once installed, will stand less than 5m above ground level. The solar panels will include centralised inverter stations, or string inverters mounted above ground.

The Battery Energy Storage System (BESS) capacity will depend on technology to be used and total installed capacity of solar, and it is expected to be in the order of 200-600 MW to 200-800 MWh.

3.2.4 The 'Do-Nothing' Alternative

The 'Do-Nothing' alternative is the option of not constructing Carolus Solar PV1 Facility. Should this alternative be selected, there would be no environmental impacts or benefits as a result of construction and operation activities associated with a solar PV facility. The 'do-nothing' alternative will therefore likely result in minimising the cumulative impact on the land, although it is expected that pressure to develop the site for renewable energy purposes will be actively pursued due to the same factors which make the site a viable option for renewable energy development. This alternative is assessed in detail within Chapter 8 of this EIA Report.

CHAPTER 4 SOLAR AS A POWER GENERATION TECHNOLOGY

Environmental pollution and the emission of CO_2 from the combustion of fossil fuels through the implementation of conventional power plants constitute a threat to the environment. The use of fossil fuels is reportedly responsible for ~70% of greenhouse gas emissions worldwide. The approach to addressing climate change needs to include a shift in the way that energy is generated and consumed. Worldwide, many solutions and approaches are being developed to reduce emissions. However, it is important to acknowledge that the most cost-effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project costs, but also indirect project costs such as impacts on the environment. Renewable energy is considered a 'clean source of energy' with the potential to contribute greatly to a more ecologically, socially and economically sustainable future. The challenge however is to ensure that renewable energy projects are able to meet all economic, social and environmental sustainability criteria through the appropriate placement of these facilities.

This chapter explores the use of solar energy as a means of power generation.

4.1. Solar PV Technology

Solar energy facilities, such as those which utilise PV technology use the energy from the sun to generate electricity through a process known as the **Photovoltaic Effect**. Generating electricity using the Photovoltaic Effect is achieved through the use of the following components:

Photovoltaic Modules

PV cells are made of crystalline silicon, the commercially predominant PV technology, that includes materials such as polycrystalline and monocrystalline silicon or thin film modules manufactured from a chemical ink compound. PV cells are arranged in multiples / arrays and placed behind a protective glass sheet to form a PV module (Solar Panel). Each PV cell is positively charged on one side and negatively charged on the opposite side, with electrical conductors attached to either side to form a circuit. This circuit captures the released electrons in the form of an electric current (i.e. Direct Current (DC)). When sunlight hits the PV panels free electrons are released and flow through the panels to produce direct electrical (DC) current. DC then needs to be converted to alternating current (AC) using an inverter before it can be directly fed into the electrical grid.

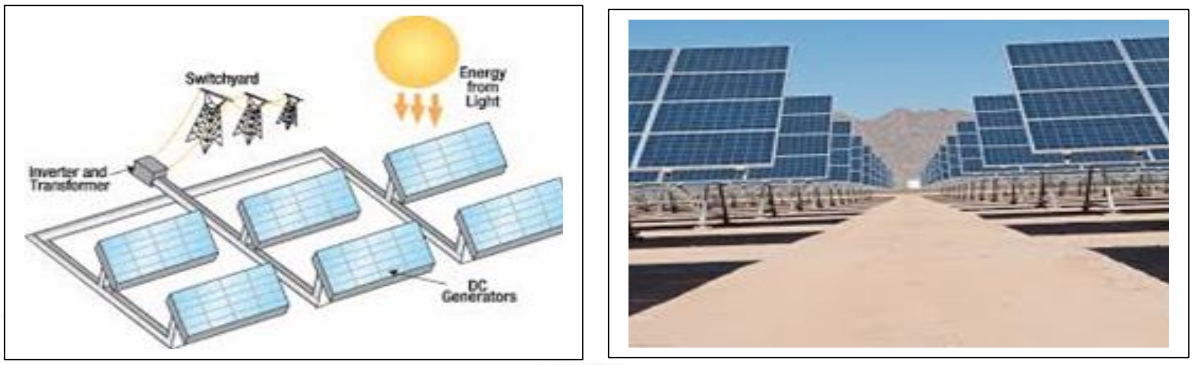


Figure 4.1: Overview of a PV cell, module and array / panel (Source: pveducation.com).

Inverters

Inverters are used to convert electricity produced by the PV panels from DC into AC, to enable the facility to be connected to the national electricity grid. In order to connect a large solar facility such as the one being proposed to the national electricity grid, numerous inverters will be arranged in several arrays to collect, and convert power produced by the facility.

Support Structures

PV panels will be fixed to a support structure. PV panels can either utilise fixed / static support structures, or alternatively they can utilise single or double axis tracking support structures. PV panels which utilise fixed / static support structures are set at an angle (fixed-tilt PV system) so as to optimise the amount of solar irradiation. With fixed / static support structures the angle of the PV panel is dependent on the latitude of the proposed development and may be adjusted to optimise for summer and winter solar radiation characteristics. PV panels which utilise tracking support structures track the movement of the sun throughout the day so as to receive the maximum amount of solar irradiation.

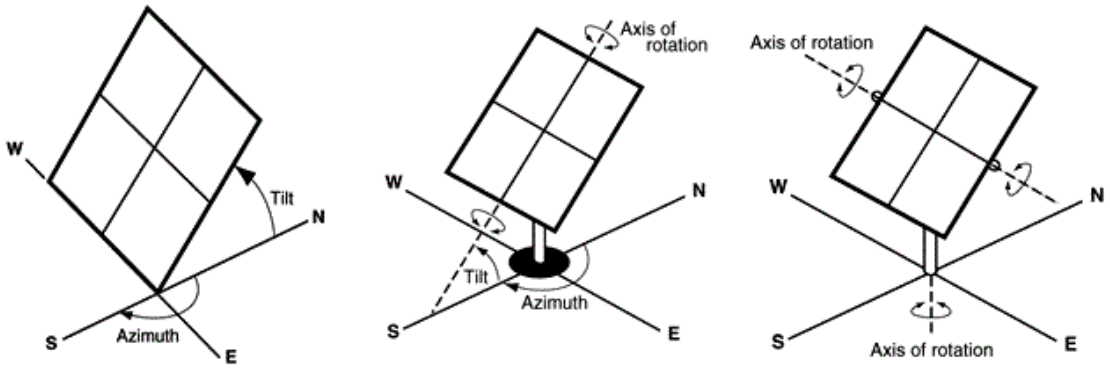


Figure 4.2: Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com)).

PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance.

4.1.1. Bifacial Solar Panel Technology

Carolus Solar PV1 Facility (Pty) Ltd is proposing to use bifacial tracking technology. Bifacial ("two-faced") modules produce solar power from both sides of the panel. Traditional solar panels capture sunlight on one light-absorbing side. The light energy that cannot be captured is simply reflected away. Bifacial solar panels have solar cells on both sides, which enables the panels to absorb light from the back and the front (refer to Figure 4.3). Practically speaking, this means that a bifacial solar panel can absorb light reflected off the ground or another material. In general, more power can be generated from bifacial modules for the same area, without having to increase the development footprint.

The optimum tilt for a bifacial module has to be designed so as to capture a big fraction of the reflected irradiation. Use of trackers is recommended so the modules can track the sun's movement across the sky, enabling them to stay directed to receive the maximum possible sunlight to generate power.

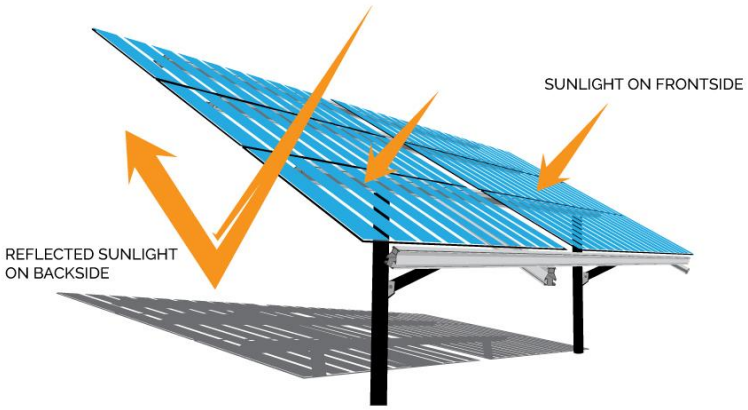


Figure 4.3: Diagram showing how bifacial Solar PV panels work (Source: https://sinovoltaics.com/learning-center/solar-cells/bifacial-solar-modules/)

CHAPTER 5 POLICY AND LEGISLATIVE CONTEXT

This Chapter provides an overview of the policy and legislative context within which the development of a solar PV facility, such as Carolus Solar PV1 Facility, is proposed. It identifies environmental legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process which may be applicable to or have bearing on the proposed project.

5.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

Requirement	Relevant Section
(e) a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.	Chapter 4, as a whole, provides an overview of the policy and legislative context which is considered to be associated with the development of the solar energy facility. The regulatory and planning context has been considered at national, provincial and local levels. A description of the policy and legislative context within which Carolus Solar PV1 Facility is proposed is included in **sections 5.3, 5.4, 5.5** and **5.6.**

5.2 Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the Department of Mineral Resources and Energy (DMRE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as a solar energy facility is illustrated in **Figure 5.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of Carolus Solar PV1 Facility.

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels. As solar energy developments are a multi-sectoral issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process of a solar energy project and the related statutory environmental assessment process.

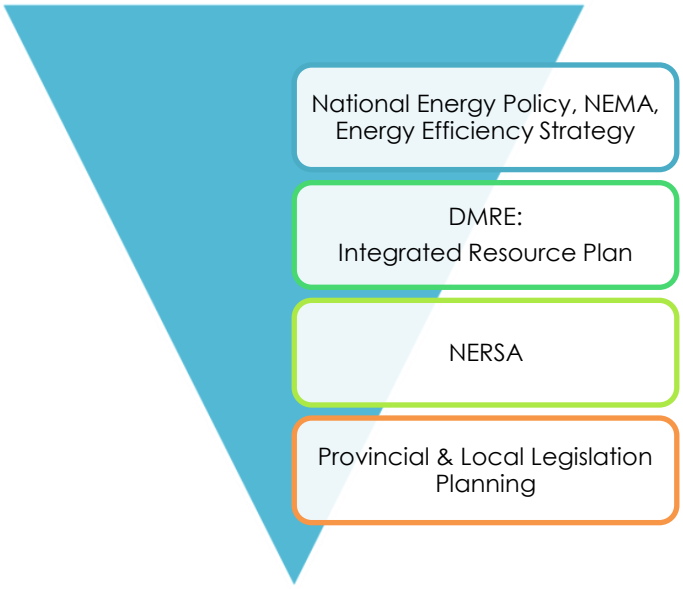


Figure 5.1: Hierarchy of electricity and planning documents

- **Department of Mineral Resources and Energy (DMRE)**: This Department is responsible for policy relating to all energy forms and for compiling and approving the Integrated Resource Plan (IRP) for electricity. Furthermore, the Department is also responsible for granting approvals for the use of land which is contrary to the objects of the Mineral and Petroleum Resource Development Act (Act No. 28 of 2002) (MPRDA) in terms of Section 53 of the Act. Therefore, in terms of the Act, approval from the Minister is required to ensure that proposed activities do not sterilise mineral resources that may occur within the project site and development area.
- **National Energy Regulator of South Africa (NERSA):** NERSA is responsible for regulating all aspects of the electricity sector and will ultimately issue licenses for IPP projects to generate electricity.
- **Department of Forestry, Fisheries, and the Environment (DFFE):** This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations, 2014 (GN R326) as amended. DEA is the Competent Authority for this project (as per GN R779 of 01 July 2016) and is charged with granting the EA for the project under consideration.
- **The South African Heritage Resources Agency (SAHRA):** SAHRA is a statutory organisation established under the National Heritage Resources Act (No. 25 of 1999) (NHRA), as the national administrative body responsible for the protection of South Africa's cultural heritage.
- **South African National Roads Agency Limited (SANRAL)**: This Agency is responsible for the regulation and maintenance of all national road routes.
- **Department of Water and Sanitation (DWS)**: This Department is responsible for effective and efficient water resources management to ensure sustainable economic and social development. This Department is also responsible for evaluating and issuing licenses pertaining to water use (i.e., Water Use Licenses (WUL) and General Authorisation).
- **The Department of Agriculture, Rural Development and Land Reform (DARDLR):** This Department is the custodian of South Africa's agricultural resources and is primarily responsible for the formulation and implementation of policies governing the agriculture sector. Furthermore, the Department is also responsible for issuing permits for the disturbance or destruction of protected tree species listed under Section 15 (1) of the National Forest Act (No. 84 of 1998) (NFA).
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At **Provincial Level**, the main regulatory agencies are:

- **Provincial Government of the Northern Cape – Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARD&LR)**: This Department is the commenting authority for the EIA process for the project and is responsible for issuing of biodiversity and conservation-related permits.
- **Northern Cape Department of Transport, Safety and Liaison:** This Department provides effective co-ordination of crime prevention initiatives, provincial police oversight, traffic management and road safety towards a more secure environment.
- **Ngwao-Boswa Ya Kapa Bokone (NBKB):** This Department identifies, conserves, and manages heritage resources throughout the Northern Cape Province.

At the **Local Level,** the local and district municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape Province, both the local and district municipalities play a role. The local municipality includes the **Emthanjeni local Municipality** which forms part of the **Pixley Ka Seme District Municipality**. In terms of the Municipal Systems Act (No. 32 of 2000), it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

5.3 International Policy and Planning Context

A brief review of the most relevant international policies relevant to the establishment of the Carolus Solar PV1 Facility are provided below in **Table 5.1**. The Carolus Solar PV1 Facility is considered to be aligned with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 5.1: International policies relevant to the Carolus Solar PV1 Facility

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
Constitution of the Republic of South Africa, 1996	Section 24 of the Constitution pertains specifically to the environment. It states that everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts. The undertaking of an EIA process for the proposed project in terms of the requirements of the EIA Regulations, 2014 (as amended) aims to minimise any impacts on the natural and social environment.
National Environmental Management Act (No. 107 of 1998) (NEMA)	This piece of legislation is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. The national environmental management principles state that the social, economic, and environmental impacts of activities, including disadvantages and benefits, must

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA.
National Energy Act (No. 34 of 2008)	The purpose of the National Energy Act (No. 34 of 2008) is 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, while considering environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The National Energy Act also provides for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstocks and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure. The Act provides measures for the furnishing of certain data and information regarding energy demand, supply, and generation, and for establishing an institution to be responsible for promotion of efficient generation and consumption of energy and energy research. The Act provides the legal framework which supports the development of power generation facilities. The Act also provides for licences and registration as the way generation, transmission, distribution, trading and the import and export of electricity are regulated. The development of the Carolus Solar PV1 Facility will have to ensure compliance with this Act as a license for the generation of electricity will be required.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of RE and encouraging new entries into the generation market. The policy states that the advantages of RE include, minimal environmental impacts during operation in comparison with traditional supply technologies, 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. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future.
White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)	The White Paper on Renewable Energy Policy Supplements Government's predominant policy on energy as set out in the White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The policy recognises the potential of RE and aims to create the necessary conditions for the development and commercial implementation of RE technologies. The White Paper on RE sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing RE in South Africa. The country relies heavily on coal to meet its energy needs due to its abundant, and accessible and affordable coal resources. However, significant renewable energy resources that can be sustainable alternatives to fossil fuels, have so far remained largely untapped. The development of additional renewable energy projects will promote the use of the abundant South African renewable energy resources and contribute to long-term energy security and diversification of the energy mix.

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
The Electricity Regulation Act (No. of 2006)	The Electricity Regulation Act of 2006, replaced the Electricity Act (No. 41 of 1987), as amended, except for Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry and introduces the National Energy Regulator (NERSA) as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences and registration as the way the generation, transmission, distribution, trading, and import and export of electricity are regulated.
Integrated Energy Plan (IEP), 2016	The purpose and objectives of the Integrated Energy Plan (IEP) are derived from the National Energy Act (No. 34 of 2008). The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include: » To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector. » To guide the selection of appropriate technologies to meet energy demand (i.e., the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels). » To guide investment in and the development of energy infrastructure in South Africa. » To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors. A draft version of the IEP was released for comment on 25 November 2016. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The development of the IEP is an ongoing continuous process. It is reviewed periodically to consider changes in the macroeconomic environment, developments in new technologies and changes in national priorities and imperatives, amongst others. The 8 key objectives of the integrated energy planning process are as follows: » Objective 1: Ensure security of supply. » Objective 2: Minimise the cost of energy. » Objective 3: Promote the creation of jobs and localisation. » Objective 4: Minimise negative environmental impacts from the energy sector. » Objective 5: Promote the conservation of water. » Objective 6: Diversify supply sources and primary sources of energy. » Objective 7: Promote energy efficiency in the economy. » Objective 8: Increase access to modern energy.
Integrated Resource Plan for Electricity (IRP) 2010-2030	The Integrated Resource Plan (IRP) for electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing, and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation.

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	On 27 August 2018, the then Minister of Energy published a draft IRP which was issued for public comment. The lengthy public participation and consultation process has culminated in the issue of the overdue IRP 2019 which updates the energy forecast from the current period to the year 2030. Since the promulgated IRP 2010, the following capacity developments have taken place: » A total of 6 422MW has been procured thus far under the REIPPP Programme, with 4 724MW being currently operational and made available to the grid[7]. In addition, IPPs have commissioned 1005MW from two (2) Open Cycle Gas Turbines (OCGT) peaking plants; and » Under the Eskom Build Programme, 1 332MW has been procured from the Ingula Pumped Storage Project, 1 588MW and 800MW from the Medupi and Kusile power stations and 120MW from the Sere Wind Farm. Provision has been made for the following new capacity by 2030: » 1 500MW of coal. » 2 500MW of hydro. » 6 000MW of solar PV. » 14 400MW of wind. » 1 860MW of nuclear. » 2 088MW of storage. » 3 000MW of gas/diesel; and » 4 000MW from other distributed generation, co-generation, biomass and landfill technologies. Based on the IRP 2019, 1 474MW has been installed for solar PV facilities, whereas 6422MW has already been procured. In addition, 1 000MW has been allocated per annum for solar PV facilities from 2022 to 2030. This will bring the total installed capacity of solar PV facilities by 2030 to 8 288MW. Therefore, the development of the Carolus Solar PV1 Facility is supported by the IRP 2019.
New Growth Path (NGP) Framework, 23 November 2010	The purpose of the New Growth Path (NGP) Framework is to provide effective strategies towards accelerated job-creation through the development of an equitable economy and sustained growth. The target of the NGP is to create 5 million jobs by 2020; with economic growth and employment creation as the key indicators identified in the NGP. The framework seeks to identify key structural changes in the economy that can improve performance in terms of labour absorption and the composition and rate of growth. To achieve this, government will seek to, amongst other things, identify key areas for large-scale employment creation, because of changes in conditions in South Africa and globally, and to develop a policy package to facilitate employment creation in these areas.
National Development Plan 2030 (2012)	The National Development Plan (NDP) 2030 is a plan prepared by the National Planning Commission in consultation with the South African public which is aimed at eliminating poverty and reducing inequality by 2030. In terms of the Energy Sectors role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes:

[7]http://www.nersa.org.za/wp-content/uploads/2021/05/Monitoring-of-Renewable-Energy-Performance-of-Power-Plants-%E2%80%93-Performance-of-Power-Plants-in-2020

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	» Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. » Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households. » Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. In formulating its vision for the energy sector, the NDP took the IRP 2010 as its point of departure. Therefore, although electricity generation from coal is still seen as part of the energy mix within the NDP, the plan sets out steps that aim to ensure that, by 2030, South Africa's energy system will look very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar, and imported hydroelectricity – will play a much larger role. The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of Carolus Solar PV1 Facility supports the NDP through the development of energy-generating infrastructure which will not lead to the generation of GHGs and will result in economic development and growth of the area surrounding the development area.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Commission (PICC) is integrating and phasing investment plans across 18 Strategic Integrated Projects (SIPs) which have 5 core functions, including to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services, and support the integration of African economies. SIP 8 of the energy SIPs supports the development of RE projects as follows: Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010) and supports bio-fuel production facilities. The development of Carolus Solar PV1 Facility is aligned with SIP 8 as it constitutes a green energy initiative that would contribute clean energy in accordance with the IRP 2010 – 2030.
National Climate Change Response Policy, 2011	The Conference of the Parties (COP) 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. This Agreement is open for signature and subject to ratification, acceptance or approval by States and regional economic integration organisations that are Parties to the Convention from 22 April 2016 to 21 April 2017. Thereafter, this Agreement shall be open for accession from the day following the date on which it is closed for signature. The agreement can only be sanctioned once it has been ratified by 55 countries, representing at least 55% of emissions. South Africa signed the Agreement in April 2016 and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Agreement was promulgated on 04 November 2016, thirty days after the date on

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	which at least 55 Parties to the Convention, which account for at least 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval, or accession with the Depositary. South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business as Usual (BAU) emissions in 2020 and 2025, respectively. The policy provides support for Carolus Solar PV1 Facility, which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
Climate Change Bill, 2018	On 08 June 2018, the Minister of Environmental Affairs published the Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. Carolus Solar PV1 Facility comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.

5.4 National Policy and Planning Context

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, the DMRE initiated the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to procure renewable energy from the private sector in a series of rounds. According to the IPP Procurement Programme overview report (2021), as of March 2021, 6 422MW of renewable energy capacity from 112 independent power producers (IPPs) has been procured in seven bid rounds[8], with 5 078MW from 79 IPP projects operational and made available to the grid[9]. National policies must be considered for the construction and operation of the solar PV facility to ensure that the development is in line with the planning of the country.

A brief review of the most relevant national policies is provided below in **Table 5.2**. The development of Carolus Solar PV1 Facility is considered to align with the aims of these policies, even where contributions to achieving the goals therein are only minor.

Table 5.2: Relevant national legislation and policies for Carolus Solar PV1 Facility

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
Constitution of the Republic of South Africa, 1996	Section 24 of the Constitution pertains specifically to the environment. It states that everyone has the right to an environment that is not harmful to their health or well-

8 Bid windows1, 2 ,3 ,3.5 ,4 and small BW1(1S2) and small BW2(2S2). 2 583 MW of renewable energy capacity was awarded to IPPs in the REIPPPP bid window 5 in October 2021.

[9]https://www.cliffedekkerhofmeyr.com/en/news/publications/2019/Corporate/energy-alert-22-october-The-Integrated-Resource-Plan-2019-A-promising-future-roadmap-for-generation-capacity-in-South-Africa.html

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	being, and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts. The undertaking of an EIA process for the proposed project in terms of the requirements of the EIA Regulations, 2014 (as amended) aims to minimise any impacts on the natural and social environment.
National Environmental Management Act (No. 107 of 1998) (NEMA)	This piece of legislation is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. The national environmental management principles state that the social, economic, and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA.
National Energy Act (No. 34 of 2008)	The purpose of the National Energy Act (No. 34 of 2008) is 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, while considering environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The National Energy Act also provides for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstocks and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure. The Act provides measures for the furnishing of certain data and information regarding energy demand, supply, and generation, and for establishing an institution to be responsible for promotion of efficient generation and consumption of energy and energy research. The Act provides the legal framework which supports the development of power generation facilities. The Act also provides for licences and registration as the way generation, transmission, distribution, trading and the import and export of electricity are regulated. The development of the Carolus Solar PV1 Facility will have to ensure compliance with this Act as a license for the generation of electricity will be required.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of RE and encouraging new entries into the generation market. The policy states that the advantages of RE include, minimal environmental impacts during operation in comparison with traditional supply technologies, generally lower running costs, and high labour intensities. Disadvantages include higher capital costs

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	in some cases, lower energy densities, and lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future.
White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)	The White Paper on Renewable Energy Policy Supplements Government's predominant policy on energy as set out in the White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The policy recognises the potential of RE and aims to create the necessary conditions for the development and commercial implementation of RE technologies. The White Paper on RE sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing RE in South Africa. The country relies heavily on coal to meet its energy needs due to its abundant, and accessible and affordable coal resources. However, significant renewable energy resources that can be sustainable alternatives to fossil fuels, have so far remained largely untapped. The development of additional renewable energy projects will promote the use of the abundant South African renewable energy resources and contribute to long-term energy security and diversification of the energy mix.
The Electricity Regulation Act (No. of 2006)	The Electricity Regulation Act of 2006, replaced the Electricity Act (No. 41 of 1987), as amended, except for Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry and introduces the National Energy Regulator (NERSA) as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences and registration as the way the generation, transmission, distribution, trading, and import and export of electricity are regulated. Schedule 2 of the Electricity Regulation Act provides for exemptions from the obligation in the Act to apply for (and hold) a licence from National Energy Regulator (NERSA).
Integrated Energy Plan (IEP), 2016	The purpose and objectives of the Integrated Energy Plan (IEP) are derived from the National Energy Act (No. 34 of 2008). The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include: » To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector. » To guide the selection of appropriate technologies to meet energy demand (i.e., the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels). » To guide investment in and the development of energy infrastructure in South Africa. » To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors. A draft version of the IEP was released for comment on 25 November 2016. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The development of the IEP is an ongoing continuous process. It is reviewed

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	periodically to consider changes in the macroeconomic environment, developments in new technologies and changes in national priorities and imperatives, amongst others. The 8 key objectives of the integrated energy planning process are as follows: » Objective 1: Ensure security of supply. » Objective 2: Minimise the cost of energy. » Objective 3: Promote the creation of jobs and localisation. » Objective 4: Minimise negative environmental impacts from the energy sector. » Objective 5: Promote the conservation of water. » Objective 6: Diversify supply sources and primary sources of energy. » Objective 7: Promote energy efficiency in the economy. » Objective 8: Increase access to modern energy.
Integrated Resource Plan for Electricity (IRP) 2010-2030	The Integrated Resource Plan (IRP) for electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing, and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. The need for a Just Transition to a sustainable, low carbon and equitable energy system is also recognised. Following the promulgation of the IRP 2010–2030, implementation followed in line with Ministerial Determinations issued under Section 34 of the Electricity Regulation (Act No. 4) of 2006. The Ministerial Determinations give effect to planned infrastructure by facilitating the procurement of the required electricity capacity. On 27 August 2018, the then Minister of Energy published a draft IRP which was issued for public comment. The lengthy public participation and consultation process has culminated in the issue of the overdue IRP 2019 which updates the energy forecast from the current period to the year 2030. Since the promulgated IRP 2010, the following capacity developments have taken place: » A total 6 422 MW under the Renewable Energy Independent Power Producers Programme (REIPPP) has been procured, with 3 876 MW operational and made available to the grid as of 31 March 2021 with 5 078MW from 79 IPP projects operational and made available to the grid . » 2 000MW of generating capacity (comprising various technologies) has been awarded to 8 Independent Power Producers under the RMIPPPP in March 2021. » 2 583MW of electricity in bid window 5 of the REIPPPP, announced on 28 October 2021 (DMRE, 2021). » IPPs have commissioned 1 005 MW from two Open Cycle Gas Turbine (OCGT) peaking plants.

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	» Under the Eskom build programme, the following capacity has been commissioned: » 1 332 MW of Ingula pumped storage, 1 588 MW of Medupi, 800 MW of Kusile and 100 MW of Sere Wind Farm. » 18 000MW of new generation capacity has been committed to, including 5200MW to be procured under bid window 6 of the REIPPPP for which bid submissions are due in September 2022. Provision has been made for the following new capacity by 2030: » 1 500MW of coal. » 2 500MW of hydro. » 6 000MW of solar PV. » 14 400MW of wind. » 1 860MW of nuclear. » 2 088MW of storage. » 3 000MW of gas/diesel; and » 4 000MW from other distributed generation, co-generation, biomass, and landfill technologies. Based on the IRP 2019, 1 474MW has been installed for solar PV facilities, whereas 6422MW has already been procured. In addition, 1 000MW has been allocated per annum for solar PV facilities from 2022 to 2030. This will bring the total installed capacity of solar PV facilities by 2030 to 8 288MW. Therefore, the development of the Carolus Solar PV1 Facility is supported by the IRP 2019.
New Growth Path (NGP) Framework, 23 November 2010	The purpose of the New Growth Path (NGP) Framework is to provide effective strategies towards accelerated job-creation through the development of an equitable economy and sustained growth. The target of the NGP is to create 5 million jobs by 2020; with economic growth and employment creation as the key indicators identified in the NGP. The framework seeks to identify key structural changes in the economy that can improve performance in terms of labour absorption and the composition and rate of growth. To achieve this, government will seek to, amongst other things, identify key areas for large-scale employment creation, as a result of changes in conditions in South Africa and globally, and to develop a policy package to facilitate employment creation in these areas.
National Development Plan 2030 (2012)	The National Development Plan (NDP) 2030 is a plan prepared by the National Planning Commission in consultation with the South African public which is aimed at eliminating poverty and reducing inequality by 2030. In terms of the Energy Sectors role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes: » Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. » Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households. » Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change.

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	In formulating its vision for the energy sector, the NDP took the IRP 2010 as its point of departure. Therefore, although electricity generation from coal is still seen as part of the energy mix within the NDP, the plan sets out steps that aim to ensure that, by 2030, South Africa's energy system will look very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar, and imported hydroelectricity – will play a much larger role. The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of Carolus Solar PV1 Facility supports the NDP through the development of energy-generating infrastructure which will not lead to the generation of GHGs and will result in economic development and growth of the area surrounding the development area.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Commission (PICC) is integrating and phasing investment plans across 18 Strategic Integrated Projects (SIPs) which have 5 core functions, including to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services, and support the integration of African economies. SIP 8 of the energy SIPs supports the development of RE projects as follows: » Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010) and supports bio-fuel production facilities. The development of Carolus Solar PV1 Facility is aligned with SIP 8 as it constitutes a green energy initiative that would contribute clean energy in accordance with the IRP 2010 – 2030.
National Climate Change Response Policy, 2011	The Conference of the Parties (COP) 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. This Agreement is open for signature and subject to ratification, acceptance or approval by States and regional economic integration organisations that are Parties to the Convention from 22 April 2016 to 21 April 2017. Thereafter, this Agreement shall be open for accession from the day following the date on which it is closed for signature. The agreement can only be sanctioned once it has been ratified by 55 countries, representing at least 55% of emissions. South Africa signed the Agreement in April 2016 and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Agreement was promulgated on 04 November 2016, thirty days after the date on which at least 55 Parties to the Convention, which account for at least 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval, or accession with the Depositary. South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020

Relevant legislation or policy	Relevance to Carolus Solar PV1 Facility
	and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business as Usual (BAU) emissions in 2020 and 2025, respectively. The policy provides support for Carolus Solar PV1 Facility, which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
Climate Change Bill, 2018	On 08 June 2018, the Minister of Environmental Affairs published the Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. Carolus Solar PV1 Facility comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.

5.5 Provincial Planning and Context

A brief review of the most relevant provincial policies is provided below in **Table 5.3**. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 5.3: Relevant provincial legislation and policies for Carolus Solar PV1 Facility

Relevant policy	Relevance to Carolus Solar PV1 Facility
Northern Cape Provincial Spatial Development Framework (PSDF) 2012	The Northern Cape Provincial Spatial Development Framework (PSDF) 2012 states that the overarching goal for the province is to enable sustainability through sustainable development. The province considers social and economic development as imperative in order to address the most significant challenge facing the Northern Cape, which is poverty. The PSDF identifies key sectoral strategies and plans which are the key components of the PSDF. Sectoral Strategy 19 refers to a provincial renewable energy strategy. Within the PSDF a policy has been included which states that renewable energy sources (including the utilisation of solar energy) are to comprise 25% of the province's energy generation capacity by 2020. The overall energy objective for the province also includes promoting the development of renewable energy supply schemes which are strategically important for increasing the diversity of domestic energy supply and avoiding energy imports, while also minimising the detrimental environmental impacts. The implementation of sustainable renewable energy is also to be promoted within the province through appropriate financial and fiscal instruments. The development of Carolus Solar PV1 Facility supports the overall energy objective of the province to have 25% of its electricity from renewable energy sources.
Northern Cape Provincial Spatial Development Framework (PSDF) 2018	The review of the Northern Cape PSDF (2018) refers to infrastructure investment and that a balance must be maintained between investments aimed at meeting the social needs of communities and investment aimed at promoting economic development and job creation.

Relevant policy	Relevance to Carolus Solar PV1 Facility
Review - Executive Summary	The Spatial Development Strategy identified in the PSDF for basic infrastructure includes the achieving the provision of green infrastructure which includes renewable energy. As part of the Vision 2040 of the PSDF key opportunities are identified for the province. The strengthening of the development triangle that is formed by the linking of Kimberley, Vryburg, Upington and De Aar. The development triangle sustains a diverse economy with strong mining, agricultural and renewable energy sectors. It is stated in the PSDF that a sustainable and viable economic network must be driven within the development triangle to improve the return of public investment in the province. The development of Carolus Solar PV1 Facility will contribute to the economic network of the province specifically in terms of the renewable sector, albeit it does not fall within the development triangle.
The Northern Cape Climate Change Response Strategy	The key aspects of the Northern Cape Climate Change Response Strategy (NCCCRS) Report are summarised in the MEC's (NCPG: Environment and Nature Conservation) 2011 budget speech: "*The Provincial Climate Change Response Strategy will be underpinned by specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the 3 key Adaptation Sectors, the Industry and Transport alongside the Energy sector as the 3 key Mitigation Sectors with the Disaster Management, Natural Resources and Human Society, livelihoods and Services sectors as 3 remaining key. Sectors to ensure proactive long-term responses to the frequency and intensity of extreme weather events such as flooding and wildfire, with heightened requirements for effective disaster management*". Key points from the MEC address include the NCPG's commitment to develop and implement policy in accordance with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the Northern Cape Province's extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is regarded as an important provincial intervention in addressing climate change. The renewable energy sector, including solar and wind energy (but also biofuels and energy from waste), is explicitly indicated as an important element of the Provincial Climate Change Response Strategy. The development of Carolus Solar PV1 Facility will assist in achieving (although only to a limited extent) the promotion of the provincial green economy of the Northern Cape.
Northern Cape Province Green Document	The NCP Green Document (2017-2018) was prepared by the Northern Cape Department of Economic Development and Tourism and provides an impact assessment of IPPs on the communities in the province located within a 50km radius from existing facilities. The document notes that the NCP is nationally a leader in commercial-scale renewable energy projects. By 2018, a total of 23 IPP projects in the province had been integrated into the national grid. These projects include Solar PV, Concentrated Solar, and Wind Energy Facilities. The document notes that through their economic development obligations, these projects have already made a significant positive contribution to affected communities. Much of the effort has been directed at supporting local education. The document also notes that, as these projects are committed to 20-year minimum lifespans, they collectively hold a tremendous potential for socio-economic upliftment.

Relevant policy	Relevance to Carolus Solar PV1 Facility
	The development of the Carolus Solar PV1 Facility will contribute towards further socio-economic upliftment in the Northern Cape Province.

5.6 Local Policy and Planning Context

The local tiers of government relevant to the Carolus Solar PV1 Facility project are the Emthanjeni Local Municipality and the Pixley Ka Seme District Municipality (PKSDM). Instruments and/or policies at both the district and local level contain objectives which align with the development of the Carolus Solar PV1 Facility. These include, economic growth, job creation, community upliftment and poverty alleviation.

Table 5.4: Relevant district and local legislation and policies for Carolus Solar PV1 Facility

Relevant policy	Relevance to Carolus Solar PV1 Facility
Pixley District Municipality Integrated Development Plan (2019-2020)	The vision for the PKSDM is "Developed and Sustainable District for Future Generations" The mission statement that underpins the vision is: » Supporting our local municipalities to create a home for all in our towns, settlements, and rural areas to render dedicated services. » Providing political and administrative leadership and direction in the development planning process. » Promoting economic growth that is shared across and within communities. » Promoting and enhancing integrated development planning in the operations of our municipalities. » Aligning development initiatives in the district to the National Development Plan. The Strategic Objectives to address the vision that are relevant to the project include the promotion of economic growth in the district and enhancement of service delivery. Chapter 4 of the IDP, Development of Strategies, highlights the key strategies of the PKSDM. The IDP also notes that the growth and development context in the district has also changed radically since 2013 (after it had been stagnant for decades) owing mainly to private and public investments in the area as a hub for renewable energy generation and astronomy. The IDP notes that the economy in the Pixley Ka Seme municipal area is characterised by: » High levels of poverty and low levels of education. » Low levels of development despite the strategic location in terms of the national transport corridors. » High rate of unemployment, poverty, and social grant dependence. » Prone to significant environmental changes owing to long-term structural changes (such as climate change, energy crises and other shifts). Of specific relevance, the IDP highlights the potential for renewable energy to help address some of these challenges. The development of the Carolus Solar PV1 Facility will promote economic development in the Pixley Ka Seme municipal area, thereby assisting in addressing some the challenges faced by the district municipality as detailed in the IDP.
Pixley Ka Seme District Municipality Spatial Development	The SDF notes that the vision for the PKSDM is "Pixley Ka Seme District Municipality, pioneers of development, a home and future for all". The Mission Statement that underpins the vision refers to: » Effective and efficient service delivery.

Relevant policy	Relevance to Carolus Solar PV1 Facility
Framework (SDF) (2017)	» Optimal human and natural resource development. » Local economic growth and development, job creation and poverty alleviation. » A vibrant tourism industry. » To participate in the fight to reduce the infection rate and lessen the impact of HIV/AIDS and other communicable diseases. » A safe, secure and community friendly environment. The SDF identifies the opportunities and constraints associated with the district. An opportunity of relevance to the Carolus Solar PV1 Facility is renewable energy and the development of a renewable energy hub in the region.
Emthanjeni Local Municipality Integrated Development Plan (IDP) (2021 – 2022)	Emthanjeni has in recent time seen the influx of investment in Renewable energy projects and is a potential industrial growth point with ample industrial sites, reasonable prices and tariffs, affordable labour and the necessary infrastructure. The Emthanjeni Local Municipal Integrated Development Plan indicates that the one of the strategic objectives in terms of provision of access to all basic services rendered to residents within the available resources includes renewable energy projects, with a target of 500. The below strategic objectives are aligned with the needs of the communities as these needs reflected mainly on: » Economic Development » Infrastructure Development » Health Services » Youth Development » Housing Delivery » SMME Development » Availability of Agricultural land » Sport and Recreation » Skills development These issues can be addressed by supplier and enterprise development and enterprise development spend linked to the Carolus Solar PV1 Facility.

5.7 Conclusion

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and national level.

CHAPTER 6 NEED AND DESIRABILITY

Appendix 3 of the 2014 EIA Regulations (GNR 326) requires that an EIA Report includes a motivation for the need and desirability of the proposed development, including the need and desirability of the activity in the context of the preferred location. The need and desirability of the development needs to consider whether it is the right time and the right place for locating the type of land-use/activity being proposed. The need and desirability of a proposed development is, therefore, associated with the wise use of land, and should be able to respond to the question such as, but not limited to, what the most sustainable use of the land may be.

This Chapter provides an overview of the need and desirability, and perceived benefits of the project specifically.

6.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

Requirement	Relevant Section
(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;	The need and desirability for the development of Carolus Solar PV1 Facility is included and discussed as a whole within this chapter. The need and desirability for the development of the solar PV facility has been considered from an international, national, regional and site-specific perspective.

6.2 Need and Desirability from an Energy Perspective

Electricity is essential for most human activities and for South Africa's social and economic development. The development of large-scale electricity generation projects contributes towards security of supply and assists in minimising the costs of energy. In order for the benefits associated with electricity to be realised, it needs to be readily available, easily accessible, and affordable. It should also be generated in a sustainable manner, while minimising adverse social and environmental impacts. In addition to energy provision, large-scale electricity generation projects, such as PV facilities, have the ability to contribute positively to the creation of skilled, unskilled, and semi-skilled employment opportunities and mitigate climate change.

An increased supply of electricity within or to an area is also considered beneficial from a development perspective as the availability of electricity and other services can act as a pull factor attracting new development and industry.

6.3 Need and Desirability from an International Perspective

The need and desirability of Carolus Solar PV1 Facility, from an international perspective, can be described through the project's alignment with internationally recognised and adopted agreements, protocols and conventions. South Africa is a signatory to a number of international treaties and initiatives, including the United Nation's Development Programme's (UNDP's) Sustainable Development Goals (SDGs). The SDGs

address global socio-economic challenges such as poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, urbanisation, environment and social justice. The SDGs consist of 17 global goals set by the United Nations. The 17 SDGs are characterised by 169 targets, and 304 indicators.

Goal 7 of the SDGs relates to "Affordable and Clean Energy", with the aim of the goal being to ensure access to affordable, reliable, sustainable and modern energy for all. The following targets and indicators have been set for Goal 7:

Targets		Indicators	
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services.	7.1.1 7.1.2	Proportion of population with access to electricity. Proportion of population with primary reliance on clean fuels and technology.
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix.	7.2.1	Renewable energy share in the total final energy consumption.
7.3	By 2030, double the global rate of improvement in energy efficiency.	7.3.1	Energy intensity measured in terms of primary energy and GDP.
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.	7.A.1	Mobilised amount of United States dollars per year starting in 2020 accountable towards the $100 billion commitment.
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.	7.B.1	Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services.

The development of Carolus Solar PV1 Facility would contribute positively towards Goal 7 of the SDGs through the following:

- By generating up to 120MW (contracted capacity) of affordable and clean energy.
  - A study published by the CSIR on 14 October 2016 ("Cost of new power generators in South Africa Comparative analysis based on recent Independent Power Producer (IPP) announcements", Dr Tobias Bischof-Niemz and Ruan Fourie) which took into consideration the results of the cost prices bid successfully under the Department of Mineral Resources and Energy's Renewable Energy (RE) IPP and Coal Baseload IPP Procurement Programmes, found that solar PV and wind were 40% cheaper than new baseload coal (i.e. R0.62/kWh for PV and wind vs R1.03 for coal).
  - PV technology is one of the cleanest electricity generation technologies, as it does not result in the release of emissions during its operation.
- By contributing towards South Africa's total generation capacity, specifically through the utilisation of renewable energy resources.

The Kyoto Protocol (1997) is also relevant to the need for the development of the Carolus Solar PV1 Facility from an international perspective. The protocol calls for the reduction of South Africa's greenhouse gas emissions

through actively cutting down on using fossil fuels, or by utilising more renewable resources. The development of the Carolus Solar PV1 Facility will add capacity to the renewable energy sector of the country and strengthen the commitment and action plan to achieve the requirements, as set out in the protocol, through the generation of energy without the emission of greenhouse gasses.

6.4 Need and Desirability from a National Perspective

Following the energy crisis in 2008, South African Government started to introduce renewable energy developments on a large scale and further enhanced the promotion of energy efficiency in all sectors to meet the demand of energy while reducing CO_2 emissions and creating jobs10. As a consequence, significant investment in renewable energy and energy efficient technologies is required. Increasing the diversity of South Africa's electricity mix is important, not only for enhancing the crucially important security of supply of the country, but also to support job creation and mitigate climate change.

The National Development Plan (NDP) envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates; that is socially equitable through expanded access to energy at affordable tariffs; and that is environmentally sustainable through reduced emissions and pollution. Historically, coal has provided the primary fuel resource for baseload electricity generation in South Africa. Consequently, Eskom, who is the main electricity generating company in the country, generates approximately 85% of the country's electricity from coal resources (Stats SA, 2016), resulting in a large carbon footprint. Taking into consideration the need to ensure adequate supply of electricity and meet international obligations in terms of addressing climate change, Government has identified the need to diversify the energy mix within the country.

South Africa needs to build about 40 000MW of new generation capacity to meet demand requirements. According to the NDP, 17800MW should be provided by renewable energy projects. To achieve this, the government plans to install a total of 17 700 MW of wind energy, 8 300MW of solar photovoltaic energy, and 600 MW of concentrated solar power by 2030.

Carolus Solar PV1 Facility is proposed in specific response to the requirement for diversification of the country's energy mix to include renewable energy such as solar PV as detailed in the IRP 2019. As a result, the need and desirability of Carolus Solar PV1 Facility from a national perspective can largely be linked from the project's alignment with national government policies, plans, and programmes which have relevance to energy planning and production (as discussed in detail in **Chapter 4**). The following key plans have been developed by National Government to consider South Africa's current energy production, projected future demands, and provides the necessary framework within which energy generation projects can be developed:

» Integrated Energy Plan (IEP)
» Integrated Resource Plan (IRP)

The above-mentioned energy plans have been extensively researched and are updated on an on-going basis to take into consideration changing scenarios, new information, developments in new technologies, and to reflect updated demands and requirements for energy production within the South African context.

[10] https://energypedia.info/wiki/South_Africa_Energy_Situation

These plans form the basis of South Africa's energy generation sector and dictate national priorities for energy production.

The IEP is intended to provide a roadmap of South Africa's future energy landscape and guide future energy infrastructure investments and policy development. The Plan considers the three pillars of sustainable development, and lists the following as the eight key energy planning objectives:

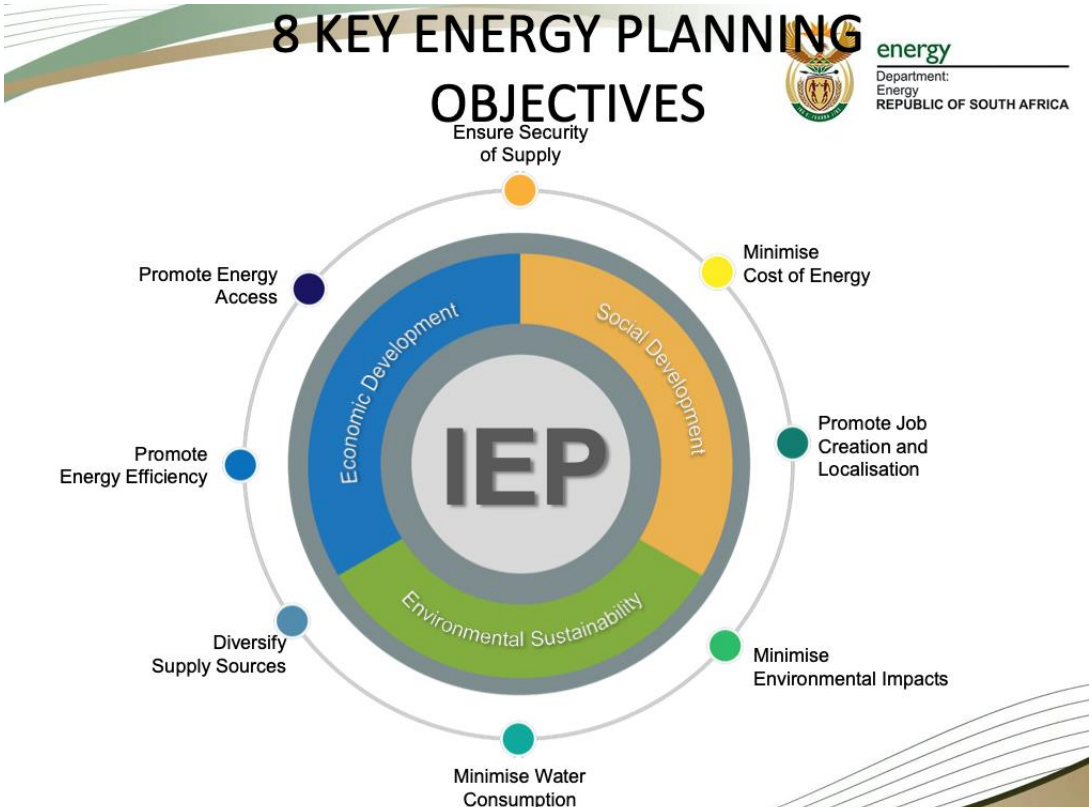


Figure 6.1: Eight key energy objectives as listed in the IEP, 2016 (extract from DOE presentation, December 2016)

The latest iteration of the IEP (25 November 2016) contained the following statement regarding solar power in South Africa:

"*South Africa experiences some of the highest levels of solar radiation in the world and this renewable resource holds great potential for the country. The daily solar radiation in South Africa varies between 4.5 and 6.5 kilowatt hours per square meter (kWh/m²) (16 and 23 megajoules per square meter [MJ/m²]) (Stassen, 1996), compared to about 3.6kWh/m² in parts of the United States and about 2.5kWh/m² in Europe and the United Kingdom. The total area of high radiation in South Africa amounts to approximately 194 000km², including the Northern Cape, which is one of the best solar resource areas in the world. With electricity production per square kilometre of mirror surface in a solar thermal power station being 30.2MW, and just 1% of the high radiation area in the country being made available for solar power generation, the generation potential is approximately 64GW. Solar energy has the potential to contribute quite substantially to South Africa's future energy needs. This would, however, require large investments in transmission lines from the areas of high radiation to the main electricity consumer centres*."

In terms of electricity generation, the IEP states that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources, and includes the following statement regarding solar energy's contribution to the diversified energy mix:

- *Solar should play a much more significant role in the electricity generation mix than it has done historically and constitutes the greatest share of primary energy (in terms of total installed capacity) by 2050. The contribution of solar in the energy mix comprises both CSP and solar PV. Solar PV includes large scale installations for power generation which supply to the grid and individual, off-grid solar home systems and rooftop panels.*
- *Several interventions which could enhance the future solar energy landscape are recommended as follows: –Large scale CSP projects with proven thermal storage technologies and hybridisation / industrial steam application projects should be incentivised in the short to medium term. In the long term, the existing incentives could be extended to promote locally developed CSP technology storage solutions and large-scale solar fuel projects.*
- *A thorough solar resource assessment for South Africa should continue to be undertaken in the Northern Cape Province and extended to other provinces deemed to have high solar radiation levels.*
- *Investments should be made to upgrade the grid in order to accommodate increasing solar and other renewable energy contributions.*

The IRP for Electricity 2010 – 2030 (gazetted in 2019) is a subset of the IEP and constitutes South Africa's current gazetted energy plan. The purpose of the plan is to ensure sustainable electricity development which takes into consideration technical, economic, and social constraints, and identifies investments in the electricity sector which are required to meet the country's forecasted electricity demands at minimum costs. This plan provides for the development of 8288MW of capacity from Solar Photovoltaic energy facilities by 2030, with an annual contribution of 1000MW from 2022.

Provision has been made for new additional capacities in the IRP 2019 (refer to **Table 6.1**).

Table 6.1: Overview of the total installed capacity expected by 2030

IPP Procurement Programme	Technology	MW	Total
Renewables	Wind	17 742MW	31 320MW
	Solar CSP	600MW	
	Solar Photovoltaic	8 288MW	
	Hydro	4 600MW	
Coal	Coal	33 364MW	33 364MW
Nuclear	Nuclear	1 860MW	1 860MW
Gas & Diesel	Gas & Diesel	3 000MW	3 000MW
Other (Distributed Generation, CoGen, Biomass, Landfill)	Other (Distributed Generation, CoGen, Biomass, Landfill)	4 000MW	4 000MW

Renewable resources are valuable in contributing towards electricity generation and diversifying South Africa's electricity mix, while contributing towards South Africa's response to Climate Change. A number of IPP Procurement Programmes have been initiated to secure electricity generated from a range of resources from the private sector (i.e., from Independent Power Producers, or IPPs). Under these Programmes, IPPs are invited to submit proposals for the finance, construction, operation, and maintenance of electricity generation facilities for the purpose of entering into an Implementation Agreement with the DMRE and a Power Purchase Agreement (PPA) with Eskom as the buyer.

Between 2011 and 2021, the South African Government, through its IRP 2010 - 2020, have successfully launched and completed five bidding windows under the REIPPPP[11] (refer to Table **Figure 6.2**[12]).

REIPPPP Bid Windows	1	2	3	3.5	4	4 (additional)	4.5 (expedited)	5	[...13] (up to 2030)	Total
Bid Date	04-Nov-11	05-Mar-12	19-Aug-13	03-Mar-14	17-Aug-14	17-Aug-14	11-Nov-15	16-Aug-21	TBD	-
Pref. Bidders ("PB") announced	07-Dec-11	21-May-12	31-Dec-13	14-Dec-14	16-Apr-15	07-Jun-15		TBD	TBD	-
Financial Close ("FC") - from	19-Jun-12	13-Dec-12	30-Jul-14	01-May-21	30-Apr-18	30-Apr-18		TBD	TBD	-
Years betwen PB annoucement & FC	0.54	0.57	0.58	6.39	3.05	2.90	CANCELLED	TBD	TBD	-
Projects Bid	53	79	93	3	74	-		102	TBD	**404.0**
Projects awarded	28	19	17	2	13	13		TBD	TBD	**92.0**
Capacity offered (MW)	3,625	1,275	1,473	300	1,105	1,170		2,600	[29,000*]	**11,548.0**
Capacity awarded (MW)	1,426	1,040	1,457	200	1,121	1,084		TBD	TBD	**6,327.9**
Total investment ($bn)	6.2	4.2	4.5	1.8	2.0	1.9		TBD	TBD	**20.5**
Avg. Real IRR (ZAR)	17.0%	15.5%	11.0%	13.75%	9.5%	9.5%		[3%-7%*]	TBD	-

*Estimation; TBD – To be Determined

Source: Finergreen

Figure 6.2: Overview of bid windows 1 to 5

Figure 6.2 shows that between 2011 and 2015 (excluding bid window 5), 302 bids were submitted, with around 30% (92) of the projects receiving approval. From those 92 projects, close to 70% (4.41GW) are already in operation, with wind and solar PV projects compromising most of the projects awarded (roughly 86%). In addition, of the 11.5GW of total capacity offered, 6.3GW (roughly 71%) was allocated, with wind and solar PV projects comprising the majority of projects.

Preferred bidders identified under any IPP Procurement Programme, including the REIPPPP, are required to satisfy a number of economic development requirements, including amongst others, job creation, local content, skills development, enterprise and supplier development, and socio-economic development. In addition to electricity generation and supply, IPP Procurement Programmes also contribute positively towards socio-economic development of a region, over and above job creation.

The need for new power generation from solar PV facilities has been identified and assessed by government at a national scale considering the national energy requirements as well as international commitments under the Paris Agreement; therefore, provision has been made for the inclusion of new PV power generation capacity in South Africa's energy mix. The implementation of Carolus Solar PV1 Facility has the potential to contribute positively towards the identified need, while simultaneously contributing to job creation and socio-economic development, identified as a need for the country within the National Development Plan (NDP).

In addition to the policy considerations detailed above, Government has prioritised post COVID-19 turnaround plans in terms of renewable energies within the Just Energy Transition (JET), coupled with key development objectives of the various spheres of government. These policies share the same ideals, such as:

[11]https://www.pv-magazine.com/2021/09/30/reippp-one-of-the-worlds-best-renewable-energy-tenders-but-theres-room-for-improvement/

[12] At the time of publication of this data, Bid Window 5 had been launched, but not completed. 2 583 MW of renewable energy capacity was awarded to IPPs in the REIPPPP bid window 5 in October 2021.

» The utilisation, application and investment in renewable energy resources in South Africa is considered to be an essential means of reducing the carbon footprint of the country,
» Diversifying the national economy,
» Reducing poverty, and
» Providing critical additional energy to that of Eskom.

Government has compiled an Economic Reconstruction and Recovery Plan which was presented to Parliament in October 2020. According to this plan, the economic survey will rely on a massive investment in infrastructure, including energy, telecommunications, ports and rail. The core elements of the Economic Reconstruction and Recovery Plan are as follows:

1. Priority interventions for economic recovery: the plan sets out eight priority interventions that will ignite South Africa's recovery and reconstruction effort. These are the flagship initiatives that all of society will rally around to build a new economy (**Figure 6.3**).
2. Enabling conditions for growth: these are growth-enhancing reforms and other preconditions for an inclusive, competitive and growing economy.
3. Macroeconomic framework: economic reconstruction and recovery requires careful mobilisation of resources to ensure fiscal sustainability.
4. Institutional arrangements: the plan focuses on execution, and is supported by enhanced institutional arrangements to ensure implementation and accountability.

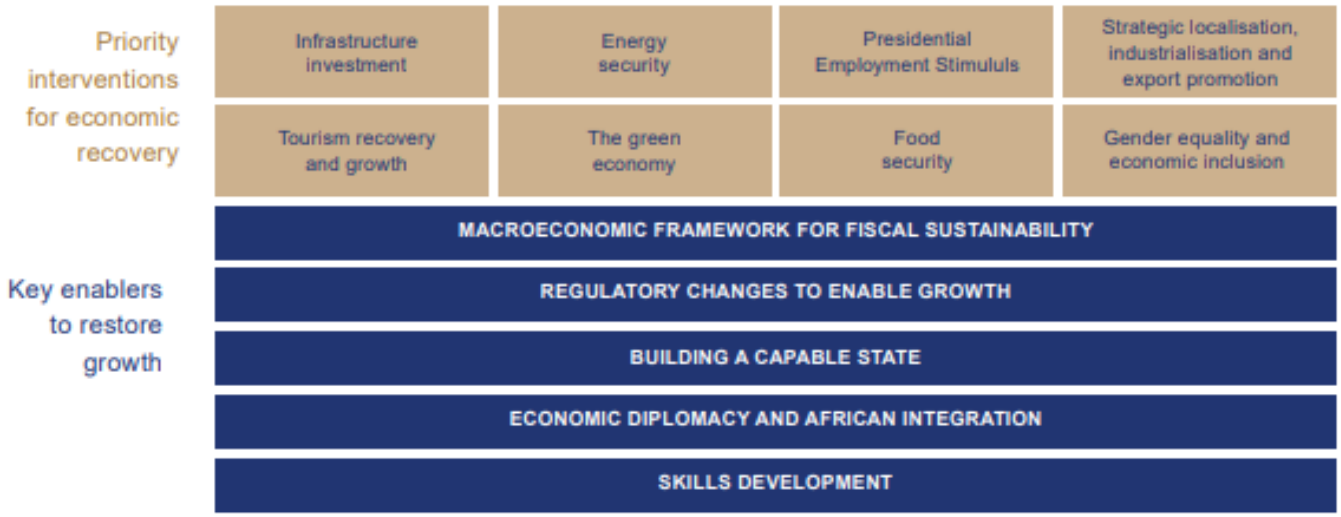


Figure 6.3: Core elements of the Economic Reconstruction and Recovery Plan (source: Building a new economy - Highlights of the Reconstruction and Recovery Plan, Presidency of the Republic of South Africa)

The plan recognises energy security as the most important prerequisite for the recovery agenda and states that renewed investment in a diversified energy mix can be achieved within a short time horizon, while alleviating a crippling energy crisis and facilitating a necessary transition to a less carbon-intensive economy. One of the key commitments of the plan is therefore to implement the IRP 2019 without delay to provide a substantial increase in the contribution of renewable energy sources by 2030, alongside other sources including battery storage, gas and clean coal. The transition to green energy is recognised as contributing towards the realisation of the low-carbon, climate-resilient and inclusive economy envisaged by the National Development Plan.

The South African government has identified the green economy as one of 12 job drivers that could help contribute to creating 5 million additional jobs by 2020. The New Growth Path, in which the sectoral jobs targets are disaggregated, envisages that as many as 300 000 new direct jobs could be created in the areas of natural resource management and renewable energy construction (Department of Energy, 2019). Even though the project will not form part of the REIPPP programme, the Applicant will implement similar social and economic development strategies, including amongst others, job creation, local content, skills development, enterprise and supplier development, and socio-economic development. In addition to electricity generation and supply the project will therefore also contribute positively towards socio-economic development of a region, over and above job creation.

The need for new power generation from solar energy has therefore been identified and assessed by Government at a national scale considering the national energy requirements as well as international commitments to address climate change under the Paris Agreement and reaffirmed at COP26, and provision has been made for the inclusion of new solar power generation capacity in South Africa's energy mix. The implementation of the Carolus Solar PV1 Facility, therefore, has the potential to contribute positively towards the identified national need, while simultaneously contributing to job creation and socio-economic development, which is identified as a need for the country within the National Development Plan. The PV facility will make use of renewable energy technology and would contribute positively towards reducing South Africa's GHG emissions and the Just Energy Transition of the country. In addition, by making use of solar power technology, the project would have reduced water requirements, when compared with some other generation technologies such as coal and gas, in alignment with one of the vision 2030 themes of DWS's National Water Resource Strategy 2 (2013) (i.e. transitioning to a low carbon economy through stimulating renewable energy and retrofitting buildings).

6.4.1. Benefits of Renewable Energy and the Need and Desirability in the South Africa Environment

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

Socio-economic upliftment of local communities: Carolus Solar PV1 Facility has the potential to create much needed employment for unskilled locals during the construction phase. Training opportunities will also be afforded to qualified local people who can be upskilled to undertake certain roles during the construction and operation phases. Some of the challenges facing the Local and District municipalities, as detailed in the IDPs include high rates of unemployment, high levels of poverty, and low levels of development despite the strategic local in terms of the national transport corridors. The Local and District municipalities are therefore in need of economic development, sustainable employment opportunities and growth in personal income levels.

Since inception of the REIPPPP in 2011, approximately 59 071 job years for South African citizens to date have been created.

Carolus Solar PV1 Facility also has the potential to make a positive contribution towards the identified community needs. In terms of the economic development requirements of the REIPPPP, the project will commit benefits to the local community in the form of job creation, localisation, and community ownership. In accordance with the DMRE's bidding requirements of the REIPPP, a percentage of the revenue generated per annum during operation will be made available to local communities through a social beneficiation

scheme. Therefore, the potential for creation of employment and business opportunities, and the opportunity for skills development for local communities is significant. Secondary social benefits can be expected in terms of additional spend in nearby towns due to the increased demand for goods and services. These socio-economic benefits would include an increase in the standard of living for local residents within the area as well as overall financial and economic upliftment.

Increased energy security: Given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. According to CSIR's power sector statistics, South Africa experienced loadshedding for 650 hours in the first half of 2021 (15% of the time) wherein 963GWh of estimated energy was shed (mostly stage 2 load shedding). This is 76% of the total loadshedding experienced during 2020[13]. It is important to note that although extensive load shedding continued during the first half of 2021, record relative variable renewable energy contributions were recorded.

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free, while compared to the continual purchase of fuel for conventional power stations.

According to the IPP Procurement Programme overview report dated 31 March 2021, water savings of 71.7 million kilolitres has been realised by the programme from inception to the date of this publication, of which 4.2 million kilolitres is in the 2021 reporting quarter included in this report.

Exploitation of significant renewable energy resource: At present, valuable renewable resources, including biomass by-products, solar irradiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio in South Africa.

According to the IPP Procurement Programme overview report, as of 31 March 2021, the REIPPPP had made the following significant impacts in terms of energy supply:

- 6 422MW of electricity had been procured from 112 Renewable Energy Independent Power Producers (IPPs) in seven bid rounds[14].
- 5 078 MW of electricity generation capacity from 79 IPP projects has been connected to the national grid.
- 59 761GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational in November 2013. Renewable energy IPPs have proved to be very reliable. Of the 79 projects that have started operations, 67 projects have been operational for longer than a year. The electrical energy generated over the past 12-month period for the 67 projects is 11 679GWh, which is 94% of their annual energy contribution projections of 12 481GWh over a 12-month delivery period. Twenty-six (26) of the 67 projects (39%) have individually exceeded their projections.

[13] https://www.csir.co.za/csir-releases-power-sector-statistics-first-half-2021

[14] Bid windows1, 2 ,3 ,3.5 ,4 and small BW1(1S2) and small BW2(2S2). 2 583 MW of renewable energy capacity was awarded to IPPs in the REIPPPP bid window 5 in October 2021.

In August 2021, Bid Window 5, which had aimed to sign up 2 600MW of power, including 1 600MW of wind and 1 000MW of solar was open. It attracted 102 bids, offering capacity of 9 644MW. 25 Preferred Bidders were selected to provide a total of 2 583MW from wind and solar developments.

Economics: As a result of the excellent resource and competitive procurement processes, both wind power and solar PV power are now proven in South Africa as cheaper forms of energy generation than coal power. They offer excellent value for money to the economy and citizens of South Africa while benefitting society as a whole through the development of clean energy.

The following has been achieved by the IPP programme (March 2021) in terms of investment and economics:

- Investment (equity and debt) to the value of R209.7 billion was attracted in seven bid rounds.
- Socio-economic development contributions of R1.5 billion to date, of which R103.5 million was spent in this 2021 reporting quarter.
- Enterprise development contributions of R463.5 million to date, of which R34.8 million was spent in this 2021 reporting quarter.

Pollution reduction: The release of by-products through the burning of fossil fuels for electricity generation has a particularly hazardous impact on human health and contributes to ecosystem degradation. The use of solar irradiation or wind for power generation is a non-consumptive use of a natural resource which produces zero emissions during its operation.

The overview of the Independent Power Producers Procurement Report (March 2021) indicates that a carbon emission reduction of 60.7 Mton CO_2 has been realised by the IPP programme from inception to date, of which 3.6 Mton is in the 2021 reporting quarter.

Climate friendly development: The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of GHG emissions. South Africa is estimated to currently be responsible for approximately 1% of global GHG emissions (and circa half of those for which Africa is responsible) and is ranked 12th worldwide in terms of per capita carbon dioxide emissions as of 2021. Since its inception, the REIPPPP has achieved carbon emission reductions[15] of 60.7 Mton of CO_2. The development of Carolus Solar PV1 Facility, and the associated electricity generated as a result of the facility, will result in considerable savings on tons of CO_2 emissions.

Support for international agreements: The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol and the Paris Agreement, and for cementing its status as a leading player within the international community.

Employment creation: The development, procurement, installation, maintenance and management of renewable energy facilities have significant potential for job creation and skills development in South Africa. The construction phase will create temporary employment opportunities and the operation phase will create limited full-time employment opportunities.

[15] Carbon emission reduction is calculated based on a displacement of power, from largely coal-based to more environmentally friendly electrical energy generation, using a gross Eskom equivalent emissions factor of 1.015 tons CO_2/MWh.

Acceptability to society: Renewable energy offers a number of tangible benefits to society, including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

Support to a new industry sector: The development of renewable energy offers the opportunity to establish a new industry within the South African economy, which will create jobs and skill local communities which have potential for further renewable energy projects.

Protecting the natural foundations of life for future generations: Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change, thereby securing the natural foundations of life for generations to come; this is the basis of sustainable development.

6.5 Need and Desirability of the project from a Regional Perspective

South Africa's electricity generation mix has historically been dominated by coal. However, up to 2030, a new capacity demand will be driven by the decommissioning of existing coal-fired power stations. A further 24 100MW (**Figure 6.4**) of coal power is expected to be decommissioned in the period 2030 to 2050. Therefore, additional capacity will be required from renewable energy sources.

	Coal	Cost (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	GAS/ Diesel	Other (Distributed Generation, Cogeri, Biomass, Landfill
Current	31715		1860	2100	2912	1474	1980	300	3830	499
2019	2155	-2372	-	-	-	-	244	300	-	Allocation to the intent of the short term capacity and energy gap
2020	1433	-557	-	-	-	114	300	-	-	
2021	1433	-1403	-	-	-	300	818	-	-	
2022	755	-344	-	-	513	400 1000	1600	-	-	
2023	750	-555	-	-	-	1000	1600	-	-	500
2024	1 000	-	1660	-	-	-	1600	-	1000	500
2025	7 000	-	-	-	-	1000	1600	-	-	500
2026	-	-1734	-	-	-	-	1600	-	-	500
2027	750	-547	-	-	-	-	1600	-	2000	500
2028	-	-475	-	-	-	1000	1600	-	-	500
2029	-	-1654	-	-	1575	1000	1600	-	-	500
2030	-	-1656	-	1500	-	1000	1600	-	-	500
Total Installed Capacity by 2030 (MW)	33164		1660	4600	5000	8288	17742	600	6380	-
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	-
% Annual Energy Contribution (% of MWh)	58.3		4.5	0.3	1.2	6.3	17.8	0.6	1.3	-

Figure 6.4: A snapshot of the Energy Mix as per the IRP 2019

6.6 Need and Desirability of the project from a District and Local Perspective

The Strategic Objectives to address Pixley Ka Seme District Municipality and Emthanjeni Local Municipality vision that are relevant to the project include the promotion of economic growth in the district and enhancement of service delivery. Chapter 4 of the Pixley Ka Seme District Municipality Integrated Development Plan, Development of Strategies, highlights the key strategies of the district. The IDP also notes that the growth and development context in the district has also changed radically since 2013 (after it had been stagnant for decades) owing mainly to private and public investments in the area as a hub for renewable energy generation and astronomy. The potential in the area for Renewable Energy developments including the development of the Carolus Solar PV1 Facility will promote economic development in the Pixley Ka Seme District and the Emthanjeni Local Municipality area, thereby assisting in addressing some of the challenges faced locally such as:

» High levels of poverty and low levels of education.
» Low levels of development despite the strategic location in terms of the national transport corridors.
» High rate of unemployment, poverty, and social grant dependence.
» Prone to significant environmental changes owing to long-term structural changes (such as climate change, energy crises and other shifts).

These issues can be addressed by supplier and enterprise development and enterprise development spend linked to the Carolus Solar PV1 Facility.

The official unemployment rate in the Emthanjeni Local municipality in 2011 was 14.0%, while 37.0% were employed, and 44.0% were regarded as not economically active.

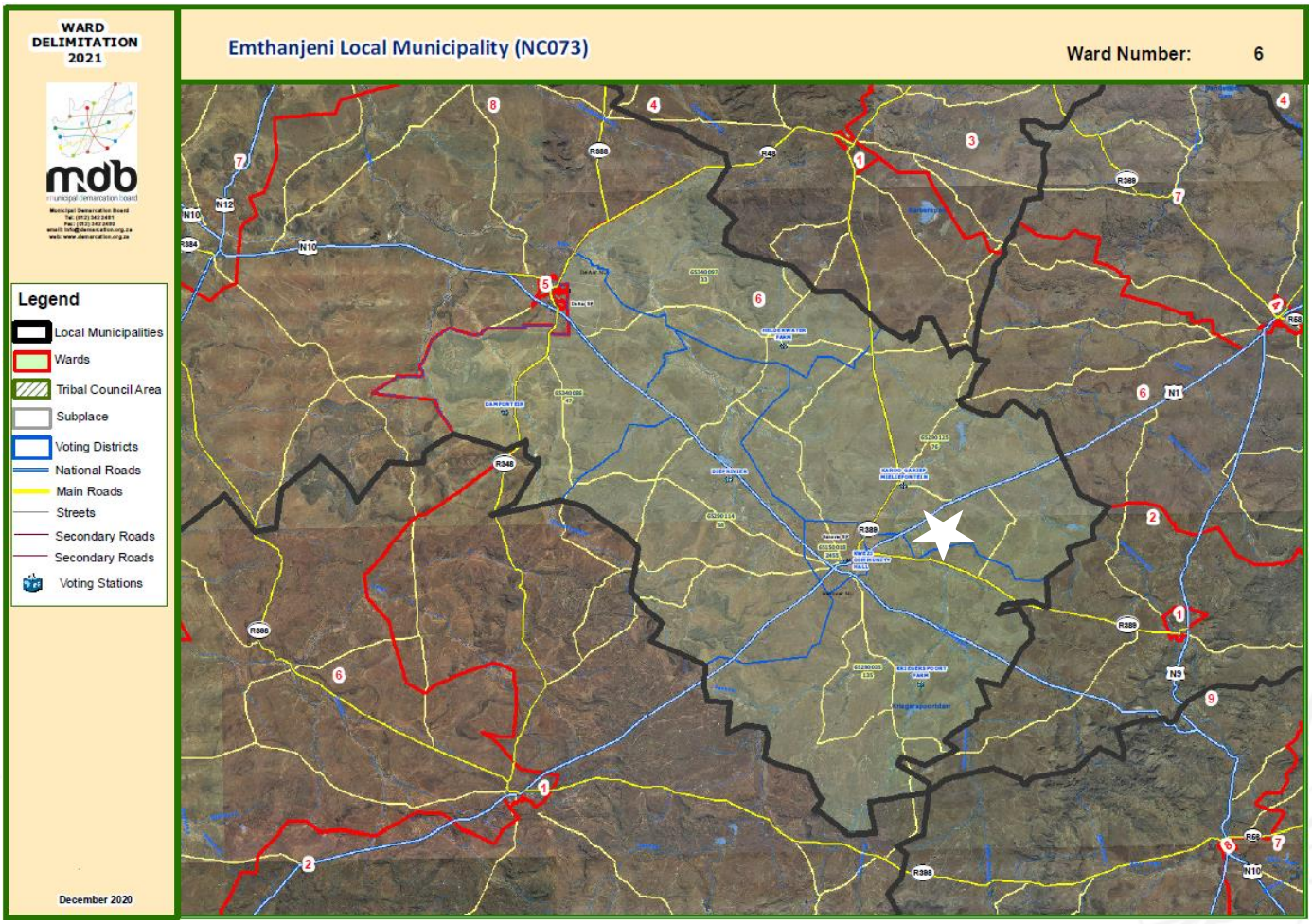


Figure 5.5: A snapshot of the Emthanjeni municipality ward 6 with proposed development site indicated by the white star

The figures for Ward 6 (i.e., the affected ward) in 2011 were 12.0% unemployed, 44.0% employed and 40.0% not economically active. With the development of the Carolus Solar PV1 Facility, secondary social benefits can be expected in terms of additional spend in the nearby towns due to the increased demand for goods and services.

6.7 Receptiveness of the proposed development area for the establishment of Carolus Solar PV1 Facility

The placement of a solar PV facility is strongly dependent on several factors including climatic conditions (solar irradiation levels), topography, the location of the site, and in particular the location in a node for renewable projects, availability of grid connection, the extent of the site and the desirability for the project in the context of the site location and land use, as detailed in chapter 3. From a local level perspective, the project site and development area have specifically been identified by the proponent as being highly desirable from a technical perspective for the development of a solar PV facility.

6.8. Conclusion

From the above, it is clear that the need and desirability for the project is supported from a planning and policy perspective on a national, provincial, district, and local level, as well as from a technical perspective. It is however important to also consider the potential impacts and benefits that the proposed PV facility may have for the affected site and surrounding area from both a biodiversity sustainability perspective and a socio-economic perspective as well as from a cumulative impact perspective. Therefore, it is imperative for the assessment being undertaken for the project to consider this project not only from a policy perspective but also from biodiversity and socio-economic perspective. The aim of the EIA process is to ensure a balance between these three spheres and to ensure that conclusions made regarding the proposed project draw on both the positive and negative consequences of the proposed development, as well as the potential for impacts to be compounded through the development of the PV facility and its associated infrastructure in proximity to other similar developments (i.e. cumulative impact). The potential impacts are identified and assessed in this EIA Report.

CHAPTER 7 APPROACH TO UNDERTAKING THE EIA PROCESS

In terms of the EIA Regulations of December 2014 (as amended) published in terms of the NEMA (Act No. 107 of 1998) as amended, the construction and operation of Carolus Solar PV1 Facility is a listed activity requiring Environmental Authorisation (EA). The application for EA is required to be supported by a Scoping & Environmental Impact Assessment (EIA) process based on the contracted capacity of the facility being 120MW and Activity 1 of Listing Notice 2 (GNR 325) being triggered.

An EIA process refers to the process undertaken in accordance with the requirements of the relevant EIA Regulations (the 2014 EIA Regulations (GNR 326), as amended), which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project or activity. The EIA process comprises two main phases: i.e., **Scoping** and **EIA Phase**, and is illustrated in Figure 6.1 Public Participation forms an important component of the process and is undertaken throughout both phases.

Figure 6.1: The Phases of an Environmental Impact Assessment (EIA) Process

7.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

Requirement	Relevant Section
(d)(i) a description of the scope of the proposed activity, including 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.	All listed activities triggered and applied for are included in **Section 6.2**.
(g)(ii) details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs.	The public participation process followed throughout the EIA process of Carolus Solar PV1 Facility is included in **Section 6.5.2** and copies of the supporting documents and inputs are included in **Appendix C**.

Requirement	Relevant Section
(g)(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.	The main issues raised through the undertaking of the public participation process including consultation with I&APs are included in the Comments and Responses Report in **Appendix C8**.
(g)(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;	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 are included in **Section 6.5.3**.

7.2 Relevant legislative permitting requirements

The legislative permitting requirements applicable to Carolus Solar PV1 Facility, as identified at this stage in the process and considered within this EIA process, are described in more detail under the respective sub-headings. Additional permitting requirements applicable to the project are detailed within **Section 6.6**.

7.2.1 National Environmental Management Act (No. 107 of 1998) (NEMA)

NEMA (No. 107 of 1998) is South Africa's key piece of national environmental legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with listed activities must be considered, investigated, assessed and reported on to the Competent Authority (the decision-maker) charged by NEMA with granting of the relevant Environmental Authorisation (EA). Due to the fact that Carolus Solar PV1 Facility is a power generation project and relates to the IRP for Electricity 2010 – 2030, the National Department of Forestry, Fisheries and the Environment (DFFE) has been determined as the Competent Authority (CA) in terms of GNR 779 of 01 July 2016. The Provincial Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARD & LR) is a Commenting Authority on the project.

The need to comply with the requirements of the EIA Regulations published under NEMA ensures that developers are provided the opportunity to consider the potential environmental impacts of their activities early in the project development process, and also allows for an assessment to be made as to whether environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the Competent Authority with sufficient information in order for an informed decision to be taken regarding the Application for EA.

The EIA process being conducted for Carolus Solar PV1 Facility is being undertaken in accordance with Section 24(5) of the NEMA, which defines the procedure to be followed in applying for EA, and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the competent authority. Listed Activities are activities identified in terms of Section 24 of the NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the competent authority subject to the completion of an environmental assessment process (either a Basic Assessment (BA) or full Scoping and EIA).

Table 7.1 details the listed activities in terms of the EIA Regulations, 2014 (as amended) that apply to Carolus Solar PV1 Facility, and for which an application for Environmental Authorisation has been submitted to the

DFFE. The table also includes a description of the specific project activities that relate to the applicable listed activities.

Table 7.1: Listed activities identified in terms of the Listing Notices (GNR 327, 325 and 324).

Notice Number	Activity Number	Description of listed activity
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	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 275kV or more. ***Internal electrical infrastructure required to connect the PV facility to the grid connection infrastructure will consist of a 132kV IPP substation.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	12(ii)(a)(c)	The development of – (ii) Infrastructure or structures with a physical footprint of 100 square metres or more Where such development occurs- a) within a watercourse or c) within 32 meters of a watercourse, measured from the edge of a watercourse ***The proposed development will require the establishment of infrastructures within a physical footprint exceeding 100 square metres within a watercourse or within 32 metres of a watercourse identified within the project area.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	14	The development and related operation of facilities and 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. ***The development of the project will require the construction and operation of facilities and infrastructure for the storage and handling of dangerous goods (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the on-site substation where such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	19 (ii)	The infilling or depositing of any material of more than 10 cubic meters 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 (i)watercourse. ***Some parts of the development area are located within watercourses and will require the removal of approximately 10 cubic metres of soil and rock from the watercourses during the construction phase.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	24 (ii)	The development of a road – (ii) with a reserve wider than 13.5m, or where no reserve exists where the road is wider than 8m. ***The construction of the solar PV facility will require the construction of new access roads up to 12m in width to provide access to the facility.***

Notice Number	Activity Number	Description of listed activity
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	28 (ii)	Residential, mixed, retail, commercial, industrial, or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare. ***The total area to be developed for the Carolus Solar PV1 Facility is greater than 1ha and occurs outside an urban area in an area currently zoned for agriculture. The total extent of the development area, within which the development footprint will be located is ~300ha.***
Listing Notice 2 (GNR 325) 08 December 2014 (as amended)	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, ***The project comprises a renewable energy generation facility, which will utilise solar power technology and will have a generating capacity of up to 120MW.***
Listing Notice 2 (GNR 325) 08 December 2014 (as amended)	15	The clearance of an area of 20ha or more of indigenous vegetation[16]. ***The facility is located on agricultural land where the predominant land use is livestock grazing and is therefore likely to comprise indigenous vegetation. The project would therefore result in the clearance of indigenous vegetation within an area in excess of 20ha for the development infrastructure.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended	4(g)(ii) (ee)	The development of a road wider than 4 meters with a reserve less than 13,5 meters. **g. Northern Cape** ii. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. ***The* development of the PV facility requires the construction of main access roads of up to 12m wide and internal distribution roads up to 6m wide outside of an urban area, and within a Critical Biodiversity Area (CBA).**
Listing Notice 3 (GNR 324) 08 December 2014 (as amended	10(g)(ii)(iii)	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 meters

[16] "Indigenous vegetation" as defined by the 2014 EIA Regulations (GNR 326) refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

Notice Number	Activity Number	Description of listed activity
		g. Northern Cape ii. Areas within a watercourse or wetland; or within 100 meters from the edge of a watercourse or wetland. iii. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans ***Some parts of the development area are located within CBA1. The development of Carolus Solar PV1 Facility will require the storage and handling of a dangerous good with a capacity of 80 cubic meters within CBA areas.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended	12(g)(ii)	The clearance of an area of 300 square meters or more of indigenous vegetation **g. Northern cape** ii. Within critical biodiversity areas identified in bioregional plans. ***The development of the Carolus Solar PV1 Facility will require the clearance of more than 300 square meters of indigenous vegetation within areas classified as CBA.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended	14(ii)(a)(c)(g)(ii) ff)	The development of— (ii) infrastructure or structures with a physical footprint of 10 square meters or more. where such development occurs— (a) within a watercourse. (c) within 32 meters of a watercourse, measured from the edge of a watercourse; **g. Northern Cape** ii. Outside urban areas: (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans ***Some parts of the development area are located within CBA1. The development of Carolus Solar PV1 Facility will require the development of infrastructure within 32m of a watercourse, outside urban areas and within areas classified as CBA.***

7.2.2 National Water Act (No. 36 of 1998) (NWA)

In accordance with the provisions of the National Water Act (No. 36 of 1998) (NWA), all water uses must be licensed with the Competent Authority (i.e. the Regional Department of Human Settlement, Water and Sanitation (DHSWS) or the relevant Catchment Management Agency (CMA)). Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation.

In terms of the NFEPA (2011) and the NBAs 2018 National Wetlands Map 5 no wetlands are located within the extent of the project area. However, areas classified as rivers are extensive throughout the project.

Table 7.2 contains Water Uses associated with the proposed project and identified in terms of the NWA which require licensing either in the form of a General Authorisation (GA), or in the form of a Water Use License (WUL). The table also includes a description of those project activities which relate to the applicable Water Uses.

Table 7.2: List of Water Uses published under Section 21 of NWA, as amended.

Notice No.	Activity No.	Description of Water Use
NWA (No. 36 of 1998)	Section 21 (c)	Impeding or diverting the flow of water in a watercourse ***The development area considered for the establishment of the Carolus Solar PV1 Facility has no wetlands located within the extent of the project area, however there are areas classified as rivers throughout the project development area, that might be affected by the activities pertaining to the establishment of the solar PV facility. This will be confirmed during the EIA phase.***
NWA (No. 36 of 1998)	Section 21 (i)	Altering the bed, banks, course or characteristics of a watercourse. ***The development area considered for the establishment of the Carolus Solar PV1 Facility has no wetlands located within the extent of the project area, however there are areas classified as rivers throughout the project development area, that might be affected by the activities pertaining to the establishment of the solar PV facility. This will be confirmed during the EIA phase.***

In the event that the flow of water in the watercourses is affected and the bed, banks or course characteristics are altered then a water use authorisation would be required. This will need to be in accordance with the requirements of the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals (GN R267), or a GA registered in accordance with the requirements of Revision of General Authorisation. The process of applying for a WUL or GA registration will only be completed once a positive EA has been received and the project selected as Preferred Bidder. This is in line with the requirements of the Department of Water and Sanitation (DWS).

7.2.3 National Heritage Resources Act (No. 25 of 1999) (NHRA)

The National Heritage Resources Act (No. 25 of 1999) (NHRA) provides an integrated system which allows for the management of national heritage resources, and to empower civil society to conserve heritage resources for future generations. Section 38 of NHRA provides a list of activities which potentially require the undertaking of a Heritage Impact Assessment.

Section 38: Heritage Resources Management

1). Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –

a. the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

b. the construction of a bridge or similar structure exceeding 50m in length;

c. any development or other activity which will change the character of a site –

i). exceeding 5 000m² in extent; or

ii). involving three or more existing erven or subdivisions thereof; or

iii). involving three or more erven or divisions thereof which have been consolidated within the past five years; or

iv). the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed development, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the South African Heritage Resources Agency (SAHRA) Permit Regulations (GNR 668).

7.3 Overview of the Scoping and EIA (S&EIA) Process being undertaken for Carolus Solar PV1 Facility

In terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notices (Listing Notice 1 (GNR 327) and Listing Notice 2 (GNR 325) the development of Carolus Solar PV1 Facility requires EA from DFFE subject to the completion of a full Scoping and Environmental Impact Assessment (S&EIA), as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326). The need for a full S&EIA process to be conducted in support of the application for EA is based on listed activities triggered which are contained within Listing Notice 2 (GNR 325).

The S&EIA process is to be undertaken in two phases as follows:

» The **Scoping Phase** includes the identification and description of potential issues associated with the project through a desktop study and consultation with I&APs and key stakeholders through a Public

Participation process. The entire development area and development envelope are considered within this process. Through this study, areas of sensitivity within the broader site are identified and delineated in order to identify any environmental fatal flaws, and environmentally sensitive, or no-go areas which need to be considered. In accordance with Regulation 21(1) of the 2014 EIA Regulations (GNR 326) this Scoping Report prepared for the project will be subject to a 30-day review and comment period during which any Interested and Affected Party (I&AP) or Authority are invited to review and provide comment on the findings (refer to **Figure 6.2**). Following the completion of this review period, a Final Scoping Report which incorporates all comments received during the 30-day public review and comment period, will be prepared and submitted to DFFE for its consideration. Following its receipt of the Final Scoping Report DFFE has 43 days within which to either accept the Scoping Report, and advise the applicant to proceed or continue with the tasks contemplated in the Plan of Study for EIA, or refuse the Application for EA in the event that the proposed activity is in conflict with a prohibition contained in legislation, or the Scoping Report does not substantially comply with Appendix 2 of the 2014 EIA Regulations (GNR 326).

» The **EIA Phase** involves a detailed assessment of potentially significant positive and negative direct, indirect, and cumulative impacts identified during the Scoping Phase. This phase includes detailed specialist investigations and a Public Participation process, and results in the compilation of an EIA Report and Environmental Management Programme (EMPr). In accordance with Regulation 23(1)(a) of the 2014 EIA Regulations (GNR 326) the EIA Report and EMPr prepared for the project will also be subject to a 30-day public review and comment period during which members of the public, I&APs, and authorities will be invited to review and provide comment on the EIA Report and EMPr. Following the conclusion of this review period a Final EIA Report and EMPr which incorporates all comments received during the 30-day review and comments period, will be prepared and submitted to DFFE for its consideration. Following its receipt of the Final EIA Report and EMPr, DFFE has 107 days within which to either grant or refuse the EA.

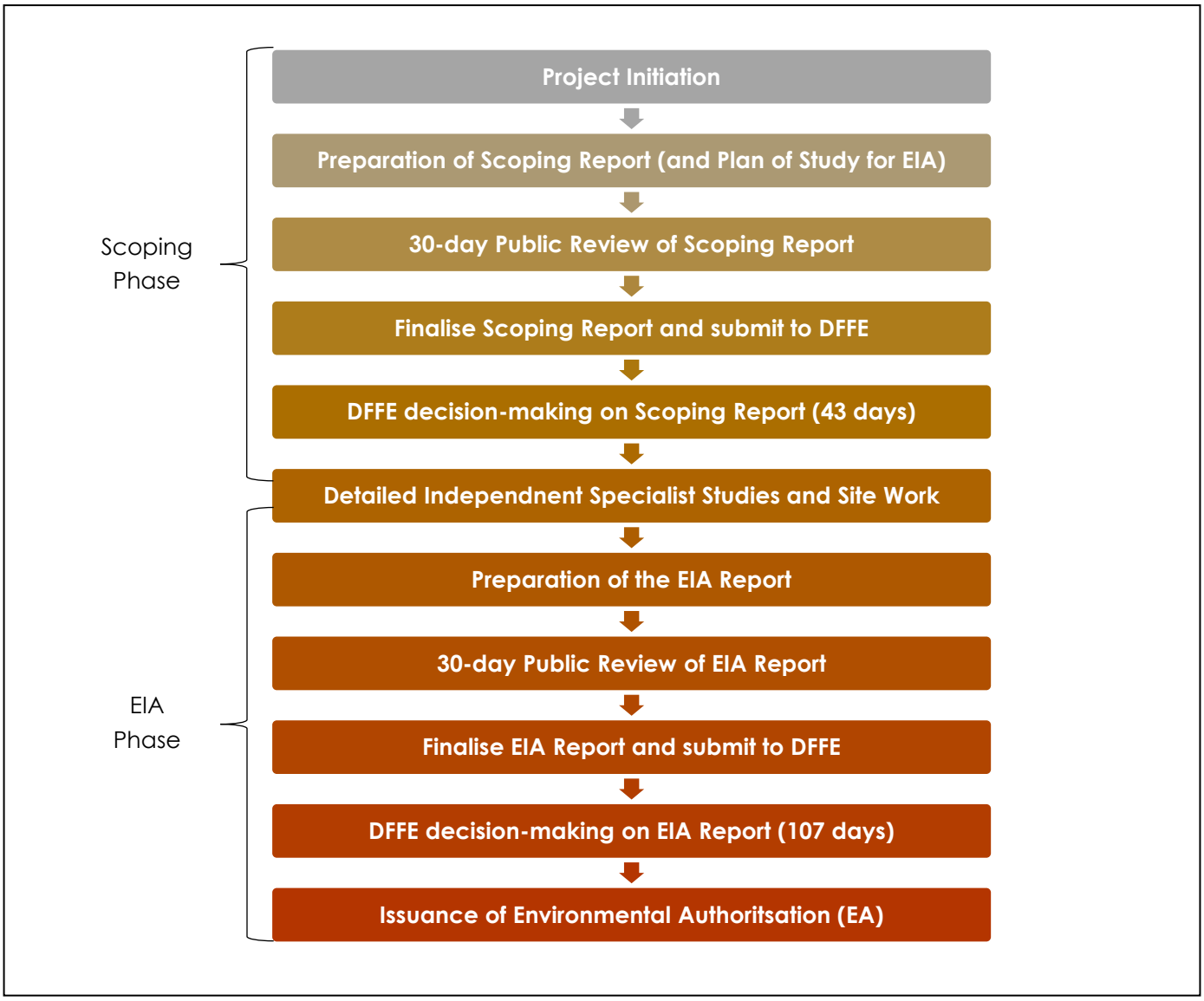


Figure 6.2: Regulated timeframe of an Environmental Impact Assessment (EIA) Process

7.4 Objectives of the Scoping Phase

This Scoping Report documents the evaluation of potential environmental impacts of Carolus Solar PV1 Facility and forms part of the EIA process being conducted in support of an Application for EA for the project. The Scoping Phase has been conducted in accordance with the requirements of the 2014 EIA Regulations (GNR 326), and therefore aims to:

- Identify and evaluate potential environmental (biophysical and social) impacts and benefits of all phases of the proposed development (including design, construction, operation and decommissioning) within the broader project site and development area through a review of existing baseline data, including specialist studies which were undertaken within the project area.
- Identify potentially sensitive environmental features and areas within the broader project site and development area in order to inform the preliminary design process of the facility.
- Define the scope of studies to be undertaken during the EIA process.

» Provide the authorities with sufficient information in order to make a decision regarding the scope of issues to be addressed in the EIA Phase, as well as regarding the scope and extent of specialist studies that will be required to be undertaken.

The following objectives of the Scoping Phase (in accordance with Appendix 2 of the 2014 EIA Regulations (GNR 326)) have been met, through the undertaking of a consultative process.

» The identification of relevant policies and legislation regarding the activities to be undertaken have been identified and considered within this Scoping Report.
» Activities to be undertaken for the development of Carolus Solar PV1 Facility have been identified and motivated in terms of the need and desirability for the activities to take place.
» Potential impacts associated with the undertaking of the identified activities and technology have been identified and described.
» Identification of areas of high sensitivity to be avoided by the preferred development envelope.
» Preferred areas for the development in the form of a development envelope, which are areas associated with low to medium environmental sensitivity, have been identified within the development area through a desktop level impact assessment process and on-going consultative process. Areas of high sensitivity (i.e. the north, north-western and southern portions of the development area) have been avoided by the development envelope which will be assessed within the EIA Phase, within which the development footprint will be placed.
» Key issues associated with the project to be addressed during the EIA Phase for further detailed study and ground-truthing have been identified and listed within this Scoping Report.
» The level of assessment, expertise and the extent of further consultation to be undertaken in the EIA Phase of the process, with the aim of determining the extent of impacts associated with the activities through the life cycle of the project (i.e. construction, operation and decommissioning), have been identified and included within this Scoping Report.

7.5 Overview of the Scoping Phase

Key tasks undertaken within the Scoping Phase include:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Submission of the completed Application for EA to the competent authority (DFFE) in terms of Regulations 5 and 16 of the 2014 EIA Regulations (GNR 326).
» Undertaking a public participation process (in line with the approved public participation plan submitted to DFFE) in accordance with Chapter 6 of GNR326, and the Department of Environmental Affairs (2017), Public Participation guidelines in terms of NEMA EIA Regulations, Department of Environmental Affairs, Pretoria, South Africa (hereinafter referred to as "the Guidelines") in order to identify issues and concerns associated with the proposed project.
» Undertaking of independent specialist studies in accordance with Appendix 6 of the EIA Regulations, 2014 (GNR326), as amended, and the requirements of the Specialist Protocols published in Regulation GNR 320, issued 20 March 2020 and GNR 1150 of 30 October 2020, where relevant, as well as other relevant guidelines.
» Preparation of a Scoping Report and Plan of Study for EIA in accordance with the requirements of Appendix 2 of the 2014 EIA Regulations (GNR 326).

- Preparation of a Comments and Response (C&R) Report detailing all comments raised by I&APs and responses provided as part of the Scoping Phase.
- Submission of a Final Scoping Report, including a Plan of Study for the EIA, to DFFE for review and approval.

7.5.1 Authority Consultation and Application for Authorisation in terms of the 2014 EIA Regulations (as amended)

In terms of GNR 779 of 1 July 2016, the National DFFE has been determined as the competent authority for all projects which relate to the IRP and any updates thereto. As the project is proposed within Northern Cape Province, the Northern Cape DAEARD & LR is the provincial commenting authority for the project. Consultation with these authorities is being undertaken throughout the Scoping Phase. To date, this consultation has included the following:

- Submission of a pre-application meeting request form, together with the public participation plan to the DFFE via email for approval on **02 September 2021**. Following submission of the public participation plan, the DFFE provided approval of the submitted PP Plan via email on **15 September 2021**, and no pre-application meeting was considered necessary (refer to **Appendix C9**).
- Submission of the Application for Environmental Authorisation to the DFFE via the use of the DFFE Novell Filr System.
- Submission of the Scoping Report for review and comment by:
  - The competent and commenting authorities.
  - State departments that administer laws relating to a matter affecting the environment relevant to an Application for EA.
  - Organs of State which have jurisdiction in respect of the activity to which the application relates.

The submissions, as listed above, were undertaken electronically, as required by the DFFE (in line with the directions for new Applications for Environmental Authorisations provided for in GNR650 of 05 June 2020). A record of all authority correspondence undertaken during the Scoping Phase is included in **Appendix B**.

7.5.2 Public Participation Process

Public participation is an essential and regulatory requirement for an environmental authorisation process and is guided by Regulations 41 to 44 of the EIA Regulations 2014 (GN R326) (as amended). The purpose of public participation is clearly outlined in Regulation 40 of the EIA Regulations 2014 (GN R326) (as amended) and is being followed for this proposed project.

The Public Participation Process for Carolus Solar PV1 Facility has been run in tandem with the public consultation for Moriri Solar PV Facility and Kwana Solar PV Facility, located adjacent to the site. The benefit to the stakeholder is that all information relevant to all related applications has been made available for review together, and not only for comments to be raised across the three applications at one time, but also provided a complete picture of the potential for impacts and/or benefits related to the suite of projects located in close proximity to one another.

The Public Participation Process undertaken for Carolus Solar PV1 Facility considers the restrictions and limitations imposed by Government through section 27 (2) of the Disaster Management Act (Act No. 57 of 2002) of 2002 and the Directions issued by the Minister of Forestry, Fisheries and the Environment (DFFE) in

terms of consultations with I&APs. A Public Participation Plan was prepared and submitted to DFFE for approval. Approval of the Plan was provided by the DFFE Case Officer via email **15 September 2021** (**Appendix B**).

The traditional means and opportunities available for the undertaking of public participation will still be covered and implemented as part of the public participation plan considering the current limitations. Alternative means of undertaking consultation have been designed and implemented by Savannah Environmental to ensure that I&APs are afforded sufficient opportunity to access project information and raise comments on the project through an interactive web-based platform (i.e. online stakeholder engagement platform) readily available and accessible to any person registering their interest in the project, and ensures that the public participation process is undertaken in line with Regulations 41 to 44 of the EIA Regulations, 2014, as amended. The Public Participation Plan (**Appendix C9**) considers the limitations applied by the Disaster Management Act Regulations prohibiting the gathering of people, as well as limitations which certain I&APs may have in terms of access to computers and internet as well as access to public spaces which may not be open for operation that inhibits access to hard copy documentation. The online stakeholder engagement platform implemented by Savannah Environmental for the project allowed the EAP to visually present details regarding the project as well as consultation documentation, including project maps and plans, presentations, and posters. The platform also contains the Scoping Report available for review. The use of an online tool enables stakeholders and I&APs to explore the project-specific content in their own time, and still enables them to participate in a meaningful way in the consultation process. Where parties do not have access to electronic systems to access the project information, opportunity for them to engage with the project team is facilitated through alternative means, such as consultation with the Ward Councillor, community representatives or one-on-one engagement, where the relevant Regulations to minimise, risks associated with COVID-19 can be adhered to.

The sharing of information forms the basis of the public participation process and offers the opportunity for I&APs to become actively involved in the EIA process from the outset. The public participation process is designed to provide sufficient and accessible information to I&APs in an objective manner. The public participation process affords I&APs opportunities to provide input into and receive information regarding the EIA process in the following ways:

» During the **Scoping Phase**:
  * provide an opportunity to submit comments regarding the project;
  * assist in identifying reasonable and feasible alternatives, where required;
  * identify issues of concern and suggestions for enhanced
  * contribute relevant local information and knowledge to the environmental assessment;
  * allow registered I&APs to verify that their comments have been recorded, considered and addressed, where applicable, in the environmental investigations;
  * foster trust and co-operation;
  * generate a sense of joint responsibility and ownership of the environment;
  * comment on the findings of the Scoping Phase results; and
  * Identify issues of concern and suggestions for enhanced benefits.

» During the **EIA Phase**:
  * contribute relevant local information and knowledge to the environmental assessment;
  * verify that issues have been considered in the environmental investigations as far as possible as identified within the Scoping Phase;

- comment on the findings of the environmental assessments; and
- attend a Focus Group Meeting to be conducted for the project.

» During the **decision-making phase**:
- to advise I&APs of the outcome of the competent authority's decision, and how and by when the decision can be appealed.

The Public Participation process therefore aims to ensure that:
» Information containing all relevant facts in respect of the application is made available to potential stakeholders and I&APs for their review;
» The information presented during the public participation process is presented in such a manner, i.e. local language and technical issues, that it avoids the possible alienation of the public and prevents them from participating;
» Public participation is facilitated in such a manner that I&APs are provided with a reasonable opportunity to comment on the project;
» A variety of mechanisms are provided to I&APs to correspond and submit their comments i.e. fax, post, email, telephone, text message (SMS and WhatsApp); and
» An adequate review period is provided for I&APs to comment on the findings of the Scoping and EIA Reports.

In terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, as amended, the following key public participation tasks are required to be undertaken:
» Fix a notice board at a place conspicuous to the public at the boundary or on the fence of—
  (i) the site where the activity to which the application relates is or is to be undertaken; and
  (ii) any alternative site mentioned in the application.
» Give written notice to:
  (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
  (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
  (v) the municipality which has jurisdiction in the area;
  (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
  (vii) any other party as required by the competent authority.
» Place an advertisement in one local newspaper.
» Open and maintain a register of I&APs and Organs of State.
» Release of a Scoping Report for a 30-day review and comment period.
» Prepare a Comments and Responses (C&R) report which documents the comments received on the EIA process and during the 30-day review and comment period of the Scoping Report and the responses provided by the project team.

In compliance with the requirements of Chapter 6: Public Participation of the EIA Regulations, 2014 (as amended), and the approved Public Participation Plan, the following summarises the key public participation activities implemented. The schematic below provides an overview of the tools that are

available to I&APs and stakeholders to access project information and interact with the public participation team to obtain project information and resolve any queries that may arise, and to meet the requirements for public participation.

i. Stakeholder identification and register of I&APs	•Register as an I&AP on the online platfrom via completion of a form and provison of contact information, by responding to an advert, or sending a 'please call me' which will be responded to •State interest in the project •Receive all project related information via email or other appropriate means.
ii. Advertisments and notifications	•Advertisements, site notices and/or radio live reads and notifications provide information and details on where to access project information •Notifications regarding the EIA proceses and availability of project reports for public review to be sent via email, post or SMS notifications
iii. Public Involvement and consultation	•Virtual presentations (both English and Afrikaans) available via the online platform •Availability of project information via the online platform or other appropriate means. •An opportunity for I&APs and stakeholders to request virtual meetings with the project team.
iv. Comment on the Scoping and EIA Reports	•Availability of the project reports via the online platform for 30-day comment period •Submission of comments via email or post to the PP team •Comments recorded and responded to, as part of the process
v. Identification and recording of comments	•Comments and Responses Report, including all comments received throughout the process to be included in the reporting.

i. Stakeholder identification and Register of Interested and Affected Parties

42. A proponent or applicant must ensure the opening and maintenance of a register of I&APs and submit such a register to the competent authority, which register must contain the names, contact details and addresses of –
    (a) All persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;
    (b) All persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; and

(c) All organs of state which have jurisdiction in respect of the activity to which the application relates.

I&APs have been identified through a process of networking and referral, obtaining information from Savannah Environmental's existing stakeholder database, liaison with potentially affected parties in the greater surrounding area and a registration process involving the completion of a reply form. Key stakeholders and affected and surrounding landowners have been identified and registered on the project database. Other stakeholders are required to formally register their interest in the project through either directly contacting the Savannah Environmental Public Participation team via phone, text message (SMS and WhatsApp), email or fax, or registering their interest via the online stakeholder engagement platform. An initial list of key stakeholders identified and registered is listed in **Table 6.3**.

Table 6.3: Initial list of Stakeholders identified for the inclusion in the project database during the public participation process for Carolus Solar PV1 Facility

National Government Departments
Department of Forestry, Fisheries, and the Environment (DFFE)
Department of Mineral Resources and Energy (DMRE)
Department of Agriculture, Land Reform, and Rural Development (DALRRD)
Department of Water and Sanitation (DHSWS)
Government Bodies and State-Owned Companies
Air Traffic Navigation Services (ATNS)
Co-Operative Governance & Traditional Affairs
Eskom Holdings SOC Limited
National Energy Regulator of South Africa (NERSA)
South African Civil Aviation Authority (CAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
South African Radio Astronomy Observatory (SARAO)
South African Weather Services (SAWS)
Telkom SA SOC Limited
Transnet SA SOC Limited
Provincial Government Departments
Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARD&LR)
Northern Cape Department of Economic Development and Tourism
Northern Cape Department of Roads and Public Works
Ngwao Boswa Kapa Bokone (NBKB) – provincial Heritage Authority
Local Government Departments
Pixley Ka Seme District Municipality
Emthanjeni Local Municipality – including the Ward Councillor, ward committee members
Commenting Stakeholders
Agri SA and Agri Northern Cape
Birdlife South Africa
Endangered Wildlife Trust (EWT)
National Khoi Council
National SA San Council

Wildlife and Environment Society of South Africa (WESSA)
Landowners
Affected landowners, tenants, and occupiers
Neighbouring landowners, tenants, and occupiers

As per Regulation 42 of the EIA Regulations, 2014 (as amended), all relevant stakeholder and I&AP information has been recorded within a register of I&APs (refer to **Appendix C1** for a listing of the recorded parties). In addition to the above-mentioned EIA Regulations, point 4.1 of the Public Participation Guidelines has also been followed. The register of I&APs contains the names[17] of:

- all persons who requested to be registered on the database through the use of the online stakeholder engagement platform or in writing and disclosed their interest in the project;
- all Organs of State which hold jurisdiction in respect of the activity to which the application relates; and
- all persons who submitted written comments or attended virtual meetings (or in-person consultation where sanitary conditions can be maintained) and viewed the narrated presentations on the Savannah Environmental online platform during the public participation process.

I&APs have been encouraged to register their interest in the EIA process from the onset of the project, and the identification and registration of I&APs will be on-going for the duration of the EIA process. The database of I&APs will be updated throughout the EIA process and will act as a record of all I&APs involved in the public participation process.

ii. Advertisements and Notifications

40.(2)(a)	Fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of – (i) The site where the activity to which the application or proposed application relates is or is to be undertaken; and (ii) Any alternative site.
40.(2)(b)	Giving written notice, in any of the manners provided for in section 47Dof the Act, to – (i) The occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (ii) Owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (iii) The municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area; (iv) The municipality which has jurisdiction in the area; (v) Any organ of state having jurisdiction in respect of any aspect of the activity; and (vi) Any other party as required by the competent authority.
40.(2)(c)	Placing an advertisement in – (i) One local newspaper; or (ii) Any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;
40.(2)(d)	Placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in

[17] Contact details and addresses have not been included in the I&AP database as this information is protected by the Protection of Personal Information Act (No 4 of 2013).

	which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii); and
40.(2)(e)	Using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desirous of but unable to participate in the process due to – (i) Illiteracy; (ii) Disability; or (iii) Any other disadvantage.

The EIA process was announced with an invitation to the Organs of State, potentially affected and neighbouring landowners and general public to register as I&APs and to actively participate in the process. This was achieved via the following:

- Compilation of a background information document (BID) (refer to **Appendix C3**) providing technical and environmental details on the project and how to become involved in the EIA process. The BID and the process notification letter announcing the EIA process, notifying Organs of State, potentially affected and neighbouring landowners, as well as registered stakeholders/IAPs of Carolus Solar PV1 Facility, and providing background information of the project and inviting I&APs to register on the project's database were distributed via email on **XX 2021**. The evidence of the distribution is contained in **Appendix C** of the Scoping Report. The BID is also available electronically on the Savannah Environmental website (http://www.savannahsa.com/public-documents/energy-generation/ /).
- Placement of site notices announcing the EIA process at visible points along the boundary of the development area (i.e. the boundaries of the affected property), in accordance with the requirements of the EIA Regulations on **28 - 29 September 2021**. Photographs and the GPS co-ordinates of the site notices are contained in **Appendix C2** of the Scoping Report.
- Placement of the process advert in The Echo Newspaper on 23 September 2021 announcing the proposed Carolus Solar PV1 Facility development.
- Placement of an advertisement in the De Aar Echo Newspaper (in English) on **23 September 2021** at the commencement of the EIA process. This advert:
  - Announced the project and the associated EIA process.
  - Provided details of how I&APs can become involved in the EIA process, including details of the public participation consultant.
  - Provided all relevant details to access the Savannah Environmental online stakeholder engagement platform.
- A copy of the newspaper advert, as sent to the newspaper and the newspaper advert tear sheet is included in **Appendix C2** of the Scoping Report.
- The Scoping Report has been made available for review by I&APs for a 30-day review and comment period from **XX 2021** to **XX 2021**. The full Scoping Report is available on the Savannah Environmental website. The evidence of distribution of the Scoping Report will be included in the Final Scoping Report, which will be submitted to the DFFE.

iii. Public Involvement and Consultation

In order to accommodate the varying needs of stakeholders and I&APs within the surrounding area, as well as capture their views, comments, issues and concerns regarding the project, various opportunities have been and will continue to be provided to I&APs to note their comments and issues. I&APs are being consulted through the following means:

Table 6.4: Public involvement for Carolus Solar PV1 Facility

Activity	Date
Announcement of the EIA process in one local newspaper: De Aar Echo Newspaper (English advertisement)	23 September 2021
Distribution of the BID, process notification letters and stakeholder reply form announcing the EIA process and inviting I&APs to register on the project database. The BID and electronic reply form was also made available on the online stakeholder engagement platform.	
Placement of site notices at the project site, including placement of further notices in the town of Richmond.	**28 – 30 September 2021**
Announcement of the availability of the Scoping Report for a 30-day review and comment period, including details on how to access the Scoping Report via the online stakeholder engagement platform, in one provincial newspaper: XX Newspaper (Afrikaans advertisement)	XX 2021
Radio Live Read by RSG regarding the Scoping report comment period, and the details of how to get involved and how contact with Savannah Environmental can be made.	XX 2021
Distribution of notification letters announcing the availability of the Scoping Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups.	XX 2021
30-day review and comment period of the Scoping Report.	XX 2021 – XX 2021
Virtual meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group: » Landowners » Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations). » Where an I&AP does not have access to a computer and/or internet to participate in a virtual meeting telephonic discussions (including WhatsApp video call) will be set-up and minuted for inclusion. The preferred language of the I&AP has been considered when setting up these discussions. » Direct in-person consultation will only take place in limited numbers and where sanitary conditions can be maintained at all times.	To be held during the 30-day review and comment period
On-going consultation (i.e. telephone liaison; e-mail communication) with all I&APs.	Throughout the EIA process

iv. Registered I&APs entitled to Comment on the Scoping Report

43.(1) A registered I&AP 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.

(2) In order to give effect to section 24O of the Act, any State department that administers a law relating to a matter affecting the environment must be requested, subject to regulation 7(2), to comment within 30 days.

44.(1) The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.

(2) Where a person desires but is unable to access written comments as contemplated in subregulation (1) due to –

(a) A lack of skills to read or write;
(b) Disability; or
(c) Any other disadvantage;

Reasonable alternative methods of recording comments must be provided for.

I&APs registered on the database have been notified by means of a notification letter of the release of the Scoping Report for a 30-day review and comment period, invited to provide comment on the Scoping Report, and informed of the manner in which, and timeframe within which such comment must be made. The report has been made available in soft copies to I&APs due to restrictions and limitations on public spaces and limitations in ensuring sanitary conditions of hard copy documents during the national state of disaster related to COVID-19. No hard copies of the report have been made available for review and comment in accordance with the approved public participation plan. Hard copies can however be made available on request where sanitary conditions can be maintained.

The Scoping Report has also been made available on the Savannah Environmental website (i.e. online stakeholder engagement platform) (https://www.savannahsa.com/public-documents/energy-generation/-solar-development/). The notification was distributed prior to commencement of the 30-day review and comment period, on **XX 2021**. Where I&APs are not able to provide written comments (including SMS and WhatsApp), other means of consultation, such as telephonic discussions are used to provide the I&APs with a platform to verbally raise their concerns and comments on the proposed development.

All comments raised as part of the discussions and written comments submitted during the 30-day review and comment period will recorded and included in **Appendix C6** and **Appendix C7** of the Scoping Report.

v. <u>Identification and Recording of Comments</u>

Comments raised by I&APs over the duration of the Scoping Phase will be synthesised into a Comments and Responses (C&R) Report which will be included in **Appendix C8** of the Final Scoping Report. These will include comments raised through the use of the Savannah Environmental online stakeholder engagement platform and any other written comments received. The C&R Report will include detailed responses from members of the EIA project team and/or the project proponent to the issues and comments raised during the public participation process.

Meeting notes of all the telephonic discussions and virtual meetings conducted during the 30-day review and comment period of the Scoping Report will be included in **Appendix C7**.

7.6. Outcomes of the DFFE Web-Based Screening Tool

In terms of GN R960 (promulgated on 5 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the national web based environmental

screening tool is compulsory for the submission of applications in terms of Regulations 19 and 21 of the EIA Regulations.

The requirement for the submission of a Screening Report (included as **Appendix P** of the Scoping Report) for the Carolus Solar PV1 Facility is applicable as it triggers Regulation 19 of the EIA Regulations, 2014, as amended. **Table 6.5** provides a summary of the specialist assessments identified in terms of the screening tool and responses to each assessment from the project team considering the development area under consideration.

Table 6.5: Sensitivity ratings from the DFFE's web-based online Screening Tool associated with the development of the Carolus Solar PV1 Facility.

Specialist Assessment	Sensitivity Rating as per the Screening Tool (relating to the need for the study)	Project Team Response
Agricultural Impact Assessment	Medium	The scoping study is included in this Scoping Report as Appendix E. Based on the outcome of the desktop analysis of available data, it has been concluded that the impacts to soils and agriculture will be further assessed during the EIA phase.
Landscape/Visual Impact Assessment	Very high	A Visual scoping study is included as Appendix H in this Scoping Report. The fact that some components of the proposed PV facility and Associated Infrastructure may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 3km buffer zone from the facility need to be identified and the severity of the visual impact assessed within the EIA phase.
Archaeological and Cultural Heritage Impact Assessment	Low	A Heritage Screening (which covers both archaeological and cultural aspects of the project site) is included in this Scoping Report as Appendix G. Heritage impacts will be further assessed during the EIA phase.
Palaeontology Impact Assessment	Very High	A Heritage Screening (which covers palaeontological aspects of the project site) is included in this Scoping Report as Appendix G. Paleontological impacts will be further assessed during the EIA phase.
Terrestrial Biodiversity Impact Assessment	Very high	An Ecological scoping study (including flora and fauna) has been undertaken for the and is included as Appendix D of the Scoping Report.
Aquatic Biodiversity Impact Assessment	Very high	An Aquatic scoping study has been undertaken for the project and is included as Appendix D of the Scoping Report.
Avian Assessment	Low	There was no need to undertake an avifauna assessment in the area.
Defence Assessment	Low	A defence of military base is not located within close proximity to the development.
RFI Assessment	Very High	The project site under consideration for the development of the Carolus Solar PV1 Facility PV is located within an area that is classified as Less than 18 km form a Weather Radar installation, therefore the South African Radio

Specialist Assessment	Sensitivity Rating as per the Screening Tool (relating to the need for the study)	Project Team Response
		Astronomy Observatory (SARAO) will be consulted during the 30-day review and comment period of the Scoping Report to provide written comment on the proposed development.
Plant Species Assessment	Low	An Ecological scoping study (including flora and fauna) has been undertaken for the project and is included as Appendix D of the Scoping Report. Based on the outcomes of the desktop study and available data, it has been indicated that the development area falls within the areas identified as Low to Medium-Low Sensitivity. The impacts will be further assessed during the EIA phase.
Animal Species Assessment	High	
Traffic Scoping Assessment	The screening report does not indicate a rating for this theme.	A Traffic Scoping Assessment has been undertaken for the project and is included as Appendix J of the Scoping Report.
Social Assessment	The screening report does not indicate a rating for this theme.	A Social Scoping Assessment has been undertaken and is included in the Scoping Report as Appendix I.

7.6.1.Evaluation of Issues Identified through the Scoping Process

Direct, indirect, and cumulative environmental impacts associated with the project identified during the Scoping Phase have been evaluated through consideration of existing information available for the Carolus Solar PV1 Facility development area.

In order to evaluate issues and assign an order of priority, the following methodology was used to identify the characteristics of each potential issue/impact:

- The ***nature***, which includes a description of what causes the impact, what will be affected and how it will be affected.
- The ***extent***, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional or national.
- Identify ***sensitive receptors*** that may be impacted on by the proposed development and the types of impacts that are most likely to occur.
- The ***significance*** of potential impacts in terms of the requirements of the 2014 EIA Regulations (including (nature, significance, consequence, extent, duration and probability of the impacts, the degree to which these impacts:
  (a) Can be reversed;
  (b) May cause irreplaceable loss of resources; and
  (c) Can be avoided, managed or mitigated.
- Identify the potential impacts that will be considered further in the EIA Phase through detailed investigations.

The evaluation of the proposed project resulted in a description of the nature, significance, consequence, extent, duration and probability of the identified issues, as well as recommendations regarding further studies required within the EIA Phase.

7.6.2. Finalisation of the Scoping Report

The final stage of the Scoping Phase entails the recording and capturing of comments received from stakeholders and I&APs on the Scoping Report in order to finalise the Scoping Report for submission to DFFE for decision-making. All written comments received will be addressed within the C&R Report (**Appendix C8**).

7.7. Assumptions and Limitations of the EIA Process

The following assumptions and limitations are applicable to the EIA process of Carolus Solar PV1 Facility:

- All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
- It is assumed that the development area for the solar PV facility identified by the developer represents a technically suitable site for the establishment of Carolus Solar PV1 Facility which is based on the design undertaken by technical consultants for the project.
- The development footprint (the area that will be affected during the operation phase) will include the footprint for the PV facility and associated infrastructure (i.e. internal access roads, and the BESS).
- The Scoping Phase evaluation of impacts has been largely based on desktop studies as well as the findings of studies which have been completed previously for this specific site. This information has been used to inform this Scoping report and will be verified by specialists in the EIA phase to assess the project development footprint for Carolus Solar PV1 Facility.

7.8. Legislation and Guidelines that have informed the preparation of this Scoping Report

The following legislation and guidelines have informed the scope and content of this Scoping Report:

- National Environmental Management Act (Act No. 107 of 1998);
- EIA Regulations of December 2014, published under Chapter 5 of NEMA (as amended);
- Department of Environmental Affairs (2017), Public Participation guidelines in terms of NEMA EIA Regulations.
- Department of Environmental Affairs (2017), Integrated Environmental Management Guideline: Guideline on Need and Desirability.
- Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation; and
- International guidelines – the Equator Principles, the IFC Performance Standards, the Sustainable Development Goals, World Bank Environmental and Social Framework, and the and World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues addressed and assessed in this Scoping Report. A review of legislative requirements applicable to the proposed project is provided in **Table 6.5**.

Table 6.5: Relevant legislative permitting requirements applicable to Carolus Solar PV1 Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
Constitution of the Republic of South Africa (No. 108 of 1996)	In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that: "*Everyone has the right –* » *To an environment that is not harmful to their health or well-being, and* » *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* ∗ *Prevent pollution and ecological degradation,* ∗ *Promote conservation, and* ∗ *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*."	Applicable to all authorities	There are no permitting requirements associated with this Act. The application of the Environmental Right however implies that environmental impacts associated with proposed developments are considered separately and cumulatively. It is also important to note that the "right to an environment clause" includes the notion that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development.
National Environmental Management Act (No 107 of 1998) (NEMA)	The 2014 EIA Regulations have been promulgated in terms of Chapter 5 of NEMA. Listed activities which may not commence without EA are identified within the Listing Notices (GNR 327, GNR 325 and GNR 324) which form part of these Regulations (GNR 326). In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. Considering the capacity of the proposed Carolus Solar PV1 Facility project (i.e. contracted capacity of 120MW) and the triggering of Activity 1 of Listing Notice 2 (GNR 325) a full	DFFE – Competent Authority Northern Cape DAEARD&LR – Commenting Authority	The listed activities triggered by the proposed project have been identified and are being assessed as part of the EIA process currently underway for the project. The EIA process will culminate in the submission of a Final EIA Report to DFFE for review and decision-making.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Scoping and EIA process is required in support of the Application for EA.		
National Environmental Management Act (No 107 of 1998) (NEMA)	In terms of the "Duty of Care and Remediation of Environmental Damage" provision in Section 28(1) of NEMA every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. In terms of NEMA, it is the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	DFFE Northern Cape DAEARD&LR	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application through the consideration of potential cumulative, direct, and indirect impacts. It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (No. 73 of 1989) (ECA)	The Noise Control Regulations in terms of Section 25 of the ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, North West, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. The Noise Control Regulations cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties. In terms of the Noise Control Regulations, no person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof (Regulation 04).	DFFE Northern Cape DAEARD&LR Ubuntu Local Municipality	Noise impacts are expected to be associated with the construction phase of the project. Considering the location of the development area in relation to residential areas and provided that appropriate mitigation measures are implemented, construction noise is unlikely to present a significant intrusion to the local community. There is therefore no requirement for a noise permit in terms of the legislation.
National Water Act (No. 36 of 1998) (NWA)	A water use listed under Section 21 of the NWA must be licensed with the Regional DWS, unless it is listed in Schedule 1 of the NWA (i.e. is an existing lawful use), is permissible under	Regional Department of Human Settlement, Water and Sanitation	Areas classified as rivers are extensive throughout the project area for Carolus Solar PV1 Facility as identified in the Aquatic

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	a GA, or if a responsible authority waives the need for a licence. Water use is defined broadly, and includes consumptive and non-consumptive water uses, taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. Consumptive water uses may include taking water from a water resource (Section 21(a)) and storing water (Section 21(b)). Non-consumptive water uses may include impeding or diverting of flow in a water course (Section 21(c)), and altering of bed, banks or characteristics of a watercourse (Section 21(i)).		Scoping Assessment (**Appendix G**). As a result, a water use authorisation for the project may be required from the DHSWS. The process to be undertaken will only be confirmed and completed once a positive EA has been received and the project selected as Preferred Bidder by the DMRE or private offtaker. This is in line with the requirements from the DHSWS.
Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)	In accordance with the provisions of the MPRDA a mining permit is required in accordance with Section 27(6) of the Act where a mineral in question is to be mined, including the mining of materials from a borrow pit. Section 53 of the MPRDA states that any person who intends to use the surface of any land in any way which may be contrary to any object of the Act, or which is likely to impede any such object must apply to the Minister for approval in the prescribed manner.	Department of Mineral Resources and Energy (DMRE)	Any person who wishes to apply for a mining permit in accordance with Section 27(6) must simultaneously apply for an Environmental Authorisation in terms of NEMA. No borrow pits are expected to be required for the construction of the project, and as a result a mining permit or EA in this regard is not required to be obtained. In terms of Section 53 of the MPRDA approval is required from the Minister of Mineral Resources and Energy to ensure that the proposed development does not sterilise a mineral resource that might occur on site.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM:AQA)	The National Dust Control Regulations (GNR 827) published under Section 32 of NEM:AQA prescribe the general measures for the control of dust in all areas, and provide a standard for acceptable dustfall rates for residential and non-residential areas. In accordance with the Regulations (GNR 827) any person who conducts any activity in such a way as to give rise to dust in quantities and concentrations that may exceed the dustfall standard set out in Regulation 03 must, upon receipt of a notice from the air quality officer, implement a dustfall monitoring programme. Any person who has exceeded the dustfall standard set out in Regulation 03 must, within three months after submission of the dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval.	Northern Cape DAEARD&LR / Pixley KA Seme District Municipality	In the event that the project results in the generation of excessive levels of dust the possibility could exist that a dustfall monitoring programme would be required for the project, in which case dustfall monitoring results from the dustfall monitoring programme would need to be included in a dust monitoring report, and a dust management plan would need to be developed.
National Heritage Resources Act (No. 25 of 1999) (NHRA)	Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance. Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites. Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority. Section 38 of the NHRA lists activities which require developers or any person who intends to undertake a listed activity to notify the responsible heritage resources authority and furnish	South African Heritage Resources Agency (SAHRA) Ngwao Boswa Kapa Bokone (NBKB) – provincial heritage authority	A Heritage Impact Assessment will be undertaken for the project as per the requirements Section 38 of the NHRA. The Heritage Impact Assessment will be made available in the EIA Phase. Should a heritage resource be impacted upon, a permit may be required from SAHRA or Ngwao Boswa Kapa Bokone (NBKB) in accordance with of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	it with details regarding the location, nature, and extent of the proposed development. Section 44 of the NHRA requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction.		
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 53 of NEM:BA provides for the MEC / Minister to identify any process or activity in such a listed ecosystem as a threatening process. Three government notices have been published in terms of Section 56(1) of NEM:BA as follows: » Commencement of TOPS Regulations, 2007 (GNR 150). » Lists of critically endangered, vulnerable and protected species (GNR 151). » TOPS Regulations (GNR 152). It provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (NEM:BA: National list of ecosystems that are threatened and in need of protection, (Government Gazette 37596, GNR 324), 29 April 2014).	DFFE Northern Cape DAEARD&LR	Under NEM:BA, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species. An Ecological Impact Assessment will be undertaken as part of the EIA Phase to identify the presence of any listed protected species present on site which will require a permit.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Chapter 5 of NEM:BA pertains to alien and invasive species, and states that a person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7 of NEM:BA, and that a permit may only be issued after a prescribed assessment of risks and potential impacts on biodiversity is carried out. Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864).	DFFE Northern Cape DAEAR&LR	An Ecological Impact Assessment will be undertaken as part of the EIA Phase to identify the presence of any alien and invasive species present on site.
Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA)	Section 05 of CARA provides for the prohibition of the spreading of weeds. Regulation 15 of GN R1048 published under CARA provides for the classification of categories of weeds and invader plants, and restrictions in terms of where these species may occur. Regulation 15E of GN R1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species.	Department of Agriculture, Land Reform and Rural Development (DALRD)	CARA will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies need to be developed and implemented. In addition, a weed control and management plan must be implemented. In terms of Regulation 15E (GN R1048) where Category 1, 2 or 3 plants occur a land user is required to control such plants by means of one or more of the following methods: » Uprooting, felling, cutting or burning. » Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer. » Biological control carried out in accordance with the stipulations of the Agricultural Pests Act (No. 36 of 1983), the ECA and any other applicable legislation.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			» Any other method of treatment recognised by the executive officer that has as its object the control of plants concerned, subject to the provisions of sub-regulation 4. » A combination of one or more of the methods prescribed, save that biological control reserves and areas where biological control agents are effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective.
National Forests Act (No. 84 of 1998) (NFA)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. Notice of the List of Protected Tree Species under the National Forests Act (No. 84 of 1998) was published in GNR 734. The prohibitions provide that "no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister".	Department of Agriculture, Land Reform and Rural Development (DALRD)	A licence is required for the removal of protected trees. It is therefore necessary to conduct a survey that will determine the number and relevant details pertaining to protected tree species present in the development footprint for the submission of relevant permits to authorities prior to the disturbance of these individuals. An Ecological Impact Assessment will be undertaken as part of the EIA Phase to identify the presence of any protected trees present on site which will require a permit.
National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA)	Chapter 4 of the NVFFA places a duty on owners to prepare and maintain firebreaks, the procedure in this regard, and the role of adjoining owners and the fire protection association. Provision is also made for the making of firebreaks on the international boundary of the Republic of South Africa. The applicant must ensure that firebreaks are wide and long enough to have a reasonable chance of preventing a	DFFE	While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of Carolus Solar PV1 Facility, in terms of the preparation and maintenance of firebreaks, and the need to provide

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	veldfire from spreading to or from neighbouring land, it does not cause soil erosion, and it is reasonably free of inflammable material capable of carrying a veldfire across it. Chapter 5 of the Act places a duty on all owners to acquire equipment and have available personnel to fight fires. Every owner on whose land a veldfire may start or burn or from whose land it may spread must have such equipment, protective clothing and trained personnel for extinguishing fires, and ensure that in his or her absence responsible persons are present on or near his or her land who, in the event of fire, will extinguish the fire or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant fire protection association, if any.		appropriate equipment and trained personnel for firefighting purposes.
Hazardous Substances Act (No. 15 of 1973) (HAS)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger, to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance » Group IV: any electronic product, and » Group V: any radioactive material.	Department of Health (DoH)	It is necessary to identify and list all Group I, II, III, and IV hazardous substances that may be on site and in what operational context they are used, stored or handled. If applicable, a license would be required to be obtained from the DoH.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of NEM:WA (GNR 912), a BA or EIA is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » Any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise, and » Pollution of the environment and harm to health are prevented.	DFFE – Hazardous Waste Northern Cape DAEARD&LR – General Waste	No waste listed activities are triggered by Carolus Solar PV1 Facility, therefore, no Waste Management License is required to be obtained. General and hazardous waste handling, storage and disposal will be required during construction and operation. The National Norms and Standards for the Storage of Waste (GNR 926) published under Section 7(1)(c) of NEM:WA will need to be considered in this regard.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Road Traffic Act (No. 93 of 1996) (NRTA)	The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	South African National Roads Agency (SANRAL) – national roads Northern Cape Department of Transport, Safety and Liaison	An abnormal load / vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits required for vehicles carrying abnormally heavy or abnormally dimensioned loads and transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the on-site substation and BESS components may not meet specified dimensional limitations (height and width) which will require a permit.
	Provincial Policies / Legislation		
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project:	Northern Cape DAEARD&LR	A collection/destruction permit must be obtained from Northern Cape DAEARD&LR for the removal of any protected plant or animal species found on site. Should these species be confirmed within the development footprint during any phase of the project, permits will be required.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species; The Act provides lists of protected species for the Province.		An Ecological Impact Assessment will be undertaken as part of the EIA Phase to identify the presence of any listed species present on site which will require a permit.

7.8.1 Best Practice Guidelines Birds & Solar Energy (2017)

The Best Practice Guidelines Birds & Solar Energy (2017) proposed by the Birds and Renewable Energy Specialist Group (BARESG) (convened by BirdLife South Africa and the Endangered Wildlife Trust) contain guidelines for assessing and monitoring the impact of solar generation facilities on birds in Southern Africa. The guidelines recognise the impact that solar energy may have on birds, through for example the alteration of habitat, the displacement of populations from preferred habitat, and collision and burn mortality associated with elements of solar hardware and ancillary infrastructure; and the fact that the nature and implications of these effects are poorly understood.

The guidelines are aimed at Environmental Assessment Practitioners (EAPs), avifaunal specialists, developers and regulators and propose a tiered assessment process, including:

(i) Preliminary avifaunal assessment – an initial assessment of the likely avifauna in the area and possible impacts, preferably informed by a brief site visit and by collation of available data; also including the design of a site-specific survey and monitoring project should this be deemed necessary.
(ii) Data collection – further accumulation and consolidation of the relevant avian data, possibly including the execution of baseline data collection work (as specified by the preliminary assessment), intended to inform the avian impact study.
(iii) Impact assessment – a full assessment of the likely impacts and available mitigation options, based on the results of systematic and quantified monitoring if this was deemed a requisite at preliminary assessment.
(iv) Monitoring – repetition of baseline data collection, plus the collection of mortality data. This helps to develop a complete before and after picture of impacts, and to determine if proposed mitigation measures are implemented and are effective, or require further refinement. Monitoring may only be necessary for projects with the potential for significant negative impacts on birds (i.e. large area affected and / or vulnerable species present).

In terms of the guidelines the quantity and quality of baseline data required to inform the assessment process at each site should be set in terms of the size of the site and the predicted impacts of the solar technology in question, the anticipated sensitivity of the local avifauna (for example, the diversity and relative abundance of priority species present, proximity to important flyways, wetlands or other focal sites) and the amount of existing data available for the area.

Data collection could vary from a single, short field visit (Regime 1, for e.g. at a small or medium sized site with low avifaunal sensitivity), to a series of multi-day survey periods, including the collection of various forms of data describing avian abundance, distribution and movement and spread over 12 months (Regime 3, for e.g. at a large developments located in a sensitive habitat, or which otherwise may have significant impacts on avifauna). **Table 6.6** is taken from the best practise guidelines and provides a summary of the recommended assessment regimes in relation to proposed solar energy technology, project size, and likely risk).

Table 5.3: Recommended avian assessment regimes in relation to proposed solar energy technology, project size, and known impact risks.

Type of technology*	Size**	Avifaunal Sensitivity***		
		Low	Medium	High
All except CSP power tower	Small (< 30ha)	Regime 1	Regime 1	Regime 2
	Medium (30 – 150ha)	Regime 1	Regime 2	Regime 2
	Large (> 150ha)	Regime 2****	Regime 2	Regime 3
CSP power tower	All	Regime 3		

Regime 1: One site visit (peak season); minimum 1 – 5 days.
Regime 2: Pre- and post-construction; minimum 2 – 3 x 3 – 5 days over 6 months (including peak season); carcass searches.
Regime 3: Pre- and post-construction; minimum 4 – 5 x 4 – 8 days over 12 months, carcass searches.

* Different technologies may carry different intrinsic levels of risk, which should be taken into account in impact significance ratings

** For multi-phased projects, the aggregate footprint of all the phases should be used. At 3ha per MW, Small = < 10MW, Medium = 10 – 50MW, Large = > 50MW.

*** The avifaunal sensitivity is based on the number of priority species present, or potentially present, the regional, national or global importance of the affected area for these species (both individually and collectively), and the perceived susceptibility of these species (both individually and collectively) to the anticipated impacts of development. For example, an area would be considered to be of high avifaunal sensitivity if one or more of the following is found (or suspected to occur) within the broader impact zone:

1) Avifaunal habitat (e.g. a wetlands, nesting or roost sites) of regional or national significance.
2) A population of a priority species that is of regional or national significance.
3) A bird movement corridor that is of regional or national significance.
4) A protected area and / or Important Bird and Biodiversity Area.

An area would be considered to be of medium avifaunal sensitivity if it does not qualify as high avifaunal sensitivity, but one or more of the following is found (or suspected to occur) within the broader impact zone

1) Avifaunal habitat (e.g. a wetland, nesting or roost sites) of local significance.
2) A locally significant population of a priority species.
3) A locally significant bird movement corridor.

An area would be considered to be of low avifaunal sensitivity if it is does not meet any of the above criteria.

**** Regime 1 may be applied to some large sites, but only in instances where there is abundant existing data to support the assessment of low sensitivity.

Bird distribution patterns fluctuate widely in response to environmental conditions (e.g. local rainfall patterns, nomadism, migration patterns, seasonality), meaning that a composition noted at a particular moment in time will differ during another time period at the same locality. For this reason, the PV transects are counted 4 times in Spring and then again 4 times in Autumn. The spring survey has already been conducted and the findings has been used to inform the avifauna scoping report completed for the scoping phase. The result from the Autumn season bird monitoring will be used to inform both the development footprint as well as Avifauna Impact Assessment report to be completed for the EIA phase.

7.8.2 The IFC Environmental Health and Safety (EHS) Guidelines

The IFC EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The following IFC EHS Guidelines have relevance to the proposed project:

» IFC EHS General Guidelines

» IFC Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants

The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines, however no Industry Sector EHS Guidelines have been developed for PV solar power to date. The application of the General EHS Guidelines should be tailored to the hazards and risks associated with a project, and should take into consideration site-specific variables which may be applicable, such as host country context, assimilative capacity of the environment, and other project factors. In instances where host country regulations differ from the standards presented in the EHS Guidelines, whichever is the more stringent of the two in this regard should be applied.

The General EHS Guidelines include consideration of the following:

» Environmental:
  * Air Emissions and Ambient Air Quality
  * Energy Conservation
  * Wastewater and Ambient Water Quality
  * Water Conservation
  * Hazardous Materials Management
  * Waste Management
  * Noise
  * Contaminated Land
» Occupational Health and Safety:
  * General Facility Design and Operation
  * Communication and Training
  * Physical Hazards
  * Chemical Hazards
  * Biological Hazards
  * Radiological Hazards
  * Personal Protective Equipment (PPE)
  * Special Hazard Environments
  * Monitoring
» Community Health and Safety:
  * Water Quality and Availability
  * Structural Safety of Project Infrastructure
  * Life and Fire Safety (L&FS)
  * Traffic Safety
  * Transport of Hazardous Materials
  * Disease Prevention
  * Emergency Preparedness and Response
» Construction and Decommissioning:
  * Environment
  * Occupational Health & Safety
  * Community Health & Safety

7.8.3. IFC's Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (2015)

While no Industry Sector EHS Guidelines have been developed for PV Solar Power, the IFC has published a Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (IFC, 2015). Chapter 8 of the Project Developer's Guide pertains to Permits, Licensing and Environmental Considerations, and states that in order to deliver a project which will be acceptable to international lending institutions, environmental and social assessments should be carried out in accordance with the requirements of the key international standards and principles, namely the Equator Principles and IFC's Performance Standards (IFC PS).

Some of the key environmental considerations for solar PV power plants contained within the Project Developer's Guide include:

- Construction phase impacts (i.e. OHS, temporary air emissions from dust and vehicle emissions, noise related to excavation, construction and vehicle transit, solid waste generation and wastewater generation from temporary building sites and worker accommodation).
- Water usage (i.e. the cumulative water use requirements).
- Land matters (i.e. land acquisition procedures and the avoidance or proper mitigation of involuntary land acquisition / resettlement).
- Landscape and visual impacts (i.e. the visibility of the solar panels within the wider landscape and associated impacts on landscape designations, character types and surrounding communities).
- Ecology and natural resources (i.e. habitat loss / fragmentation, impacts on designated areas and disturbance or displacement of protected or vulnerable species).
- Cultural heritage (i.e. impacts on the setting of designated sites or direct impacts on below-ground archaeological deposits as a result of ground disturbance during construction).
- Transport and access (i.e. impacts of transportation of materials and personnel).
- Drainage / flooding (i.e. flood risk associated with the site).
- Consultation and disclosure (i.e. consultating with key authorities, statutory bodies, affected communities and other relevant stakeholders as early as possible).
- Environmental and Social Management Plan (ESMP) (i.e. compile an ESMP to ensure that mitigation measures for relevant impacts are identified and incorporated into project construction procedures and contracts).

CHAPTER 8 DESCRIPTION OF THE RECEIVING ENVIRONMENT

This chapter provides a description of the environment that may be affected by the development of the Carolus Solar PV1 facility. This information is provided in order to assist the reader in understanding the possible effects of the project on the environment within which it is proposed to be developed. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, Carolus Solar PV1 facility have been described. This information has been sourced from both existing information available for the area as well as collected field data by specialist consultants and aims to provide the context within which this EIA process is being conducted. The full impact assessments undertaken by the independent specialists, including details of the affected environment, are attached as included in **Appendices D – M**.

8.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of the Environmental Impact Assessment Report:

Requirement	Relevant Section
(h)(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	The environmental attributes associated with the development of Carolus Solar PV1 Facility is included as a whole within this chapter. The environmental attributes that are assessed within this chapter includes the following: » The regional setting of the broader study area indicates the geographical aspects associated with Carolus Solar PV1 Facility. This is included in **Section 8.2**. » The climatic conditions for the Richmond area have been included in **Section 8.3**. » The biophysical characteristics of the project site and the surrounding areas are included in **Section 8.4**. The characteristics considered are topography and terrain, geology, soils and agricultural potential and the ecological profile which includes the vegetation patterns, listed plant species, critical biodiversity areas and broad-scale processes, freshwater resources, terrestrial fauna and avifauna. » The heritage and cultural aspects (including archaeology, cultural landscape and palaeontology) has been included in **Section 8.5**. » The social and socio-economic characteristics associated with the broader study area and the project site has been included in **Section 8.6** » The visual quality, land-use and settlement patterns of the affected environment has been included in **Section 8.7** » The current traffic conditions for the area surrounding the project have been included in **Section 8.8**

8.2. Regional Setting

The Carolus Solar PV1 Facility development area is located approximately 10km east of De Aar, within the Emthanjeni Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

The Northern Cape Province is in the north-western extent of South Africa and constitutes South Africa's largest province, occupying an area of 372 889km² in extent, equivalent to nearly a third (30.5%) of the country's total land mass. It is also South Africa's most sparsely populated province with a population of

1 193 780, and a population density of 3.1/km². The capital city is Kimberley, and other important towns include Upington, Springbok, Kuruman, De Aar and Sutherland. It is bordered by the Western Cape, and Eastern Cape provinces to the south and south-east, Free State, and Northwest provinces to the east, Botswana, and Namibia, to the north, and the Atlantic Ocean to the west. The Northern Cape is the only South African province which borders Namibia and plays an important role in terms of providing linkages between Namibia and the rest of South Africa. The Orange River, which is South Africa's largest river, is a significant feature and is also the main source of water in the province, while also constituting the international border between South Africa and Namibia.

The Northern Cape is rich in minerals including alluvial diamonds, iron ore, asbestos, manganese, fluorspar, semi-precious stones, and marble. The mining sector in the province is the largest contributor of the provincial Gross Domestic Product (GDP) and of a great importance to South Africa as it produces ~37% of the country's diamonds, 44% of its zinc, 70% of its silver, 84% of its iron ore, 93% of its lead and 99% of its manganese.

The province has fertile agricultural land in the Orange River Valley, especially at Upington, Kakamas and Keimoes, where grapes and fruit are cultivated intensively. The interior Karoo relies on sheep farming, while the karakul-pelt industry is one of the most important in the Gordonia District of Upington. Wheat, fruit, peanuts, maize, and cotton are produced at the Vaalharts Irrigation Scheme near Warrenton. The agricultural sector employs approximately 19.5% of the total formally employed individuals. The sector is also experiencing significant growth in value-added activities, including game-farming, while food production and processing for the local and export markets is also growing significantly (PGDS, July 2011). Furthermore, approximately 96% of the land in the province is used for livestock and game farming, while only approximately 2% is used for crop farming, mainly under irrigation in the Orange River Valley and the Vaalharts Irrigation Scheme.

The Northern Cape offers unique tourism opportunities including wildlife conservation destinations, natural features, historic sites, festivals, cultural sites, star gazing, adventure tourism, agricultural tourism, ecotourism, game farms, and hunting areas, etc. The province is home to the Richtersveld Botanical and Landscape World Heritage Site, which comprises a United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site under the World Heritage Convention. The province also includes to two (2) Trans frontier National Parks, namely the Kgalagadi Trans frontier Park, and the Richtersveld /Ai-Ais Trans frontier Park, as well as five (5) national parks and six (6) provincial reserves. In addition, the province plays a significant role in South Africa's science and technology sector, as it is home to the Square Kilometre Array (SKA), the Southern African Large Telescope (SALT), and the Karoo Array Telescope (Meerkat). In addition, the Augrabies National Park, a major tourist destination in the province is located 120km east of Upington near the town of Kakamas.

The capital city of the Northern Cape Province is Kimberley. Other important towns include Upington, Springbok, Kuruman and De Aar. The province is rich in minerals and has fertile agricultural land in the Orange River Valley. The interior Karoo relies on sheep farming, while the karakul-pelt industry is one of the most important in the Gordonia District of Upington. The Northern Cape Province comprises six (5) district municipalities, namely, Frances Baard, John Taolo Gaetsewe, Namakwa, ZF Mgcawu and Pixley ka Seme Alfred Nzo (refer to **Figure 8.1**), which contain twenty-six local municipalities collectively.

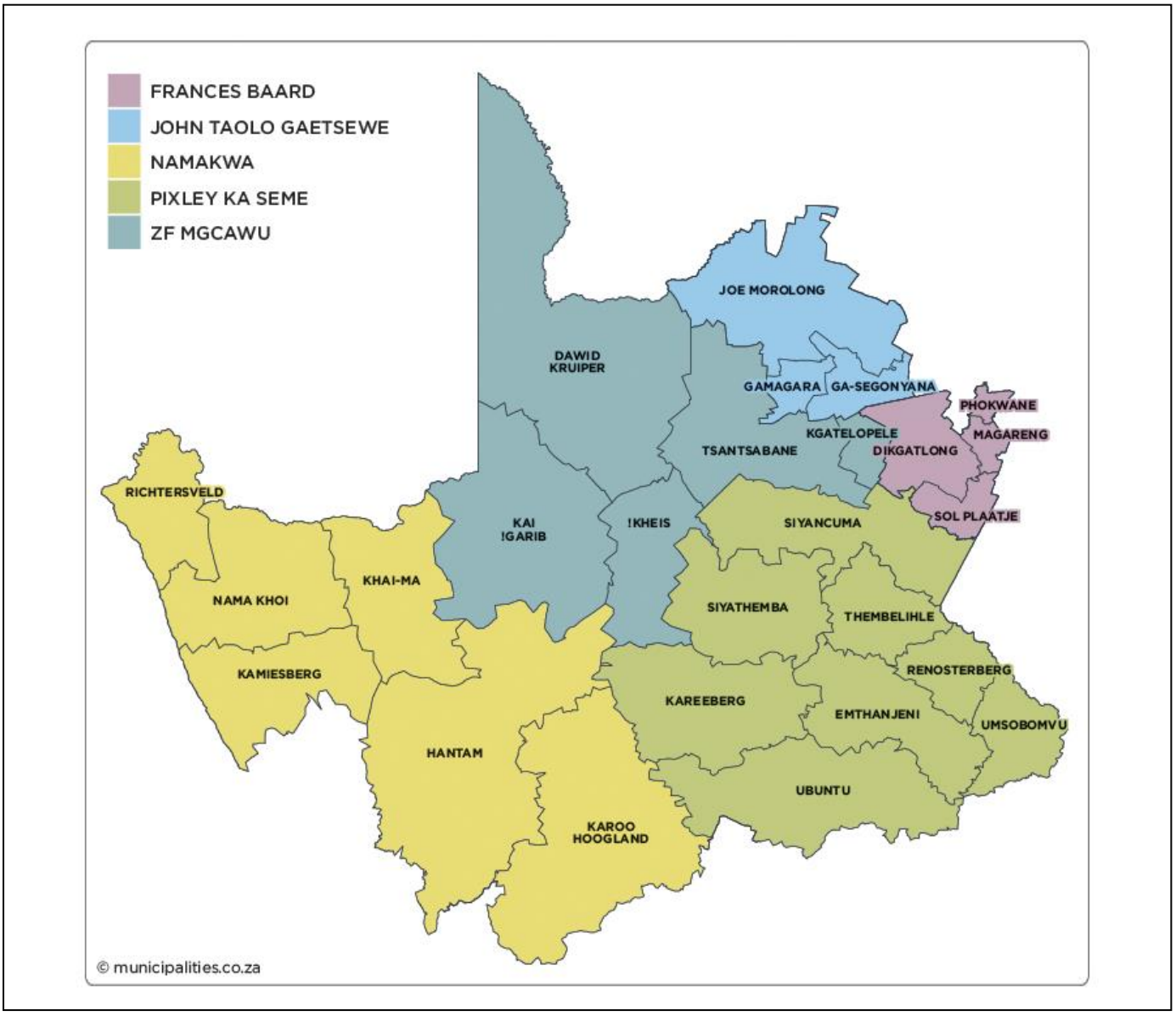


Figure 8.1: District municipalities of the Northern Cape (Source: Municipalities of South Africa)

The Pixley Ka Seme District Municipality (DM) is situated in the south-eastern extent of the Northern Cape Province and is a Category C municipality. It shares its borders with three other provinces, namely the Free State to the east, the Eastern Cape to the south-east, and the Western Cape to the south-west. It is the second-largest district of the five in the province but makes up almost a third of its geographical area. The district is made up of eight local municipalities: Ubuntu, Umsobomvu, Emthanjeni, Kareeberg, Renosterberg, Thembelihle, Siyathemba and Siyancuma (refer to **Figure 8.2**). Its main town is De Aar. According to StatsSA 2011 and the Community Survey 2016, the Pixley ka Seme District Municipality's population sits at 195 595. The main economic sectors in the Pixley ka Seme District Municipality are community services (26.6%), agriculture (16.6%), transport (15.1%), trade (12.9%), finance (12.8%), electricity (8.0%), construction (3.3%), manufacturing (3.2%), and mining (2.6%).

Figure 8.2: Local Municipalities of the Pixley Ka Seme DM (Source: Municipalities of South Africa)

The broader project site for the establishment of the Carolus Solar PV1 Facility and associated infrastructure is located within the Emthanjeni Local Municipality. The Emthanjeni Local Municipality is a Category B municipality within the Pixley Ka Seme District in the Northern Cape Province. It is bordered by all the other local municipalities as it is central within the district, the Western Cape Provinces in the south, the Eastern Cape in the east. Its location is approximately 300 km south-west of Kimberley, 440 km south-east of Upington, 300 km north-east of Beaufort-West and 300 km south-west of Bloemfontein. The land area comprises 11% of the district land area and 3% of the province. It represents approximately 23% of the district population.

The Emthanjeni Local Municipality covers an area of ~ 13 486km², making it one of the averaged eight local municipalities that make up the district. Cities and/or towns within the municipality include De Aar, Hanover, and Britstown. The agricultural sector is the main economic sector in the Local Municipality. According to census 2011, the population grew from 42 356 in 2011 to 44 100 in 2016, indicating an annual population growth rate of 1.6%.

Areas surrounding the project site are generally sparsely populated, with the highest concentration of people living in the town of De Aar. The project site and the areas surrounding the site consist of a landscape

that can be described as remote due to its considerable distance from any major metropolitan centres or populated areas. The scarcity of water and other natural resources has influenced settlement within this region, keeping numbers low, and distribution limited to the availability of water. Settlements, where they occur, are usually rural homesteads or farm dwellings.

The project site is situated directly adjacent to the N10 national road. The R389 are located directly through the proposed development area, providing direct access to the project site. The gravel main access road (R389) provides direct access to the project site and the development area and will used to access the project site and development area during the project lifecycle.

8.3. Climatic Conditions

The project area is considered to have a semi-arid (local steppe) climate that receives limited rainfall. This region's rainfall peaks during autumn months, especially March. The Mean Annual Precipitation (MAP) ranges from 190 to 400 mm with the mean minimum and maximum monthly temperatures for Britstown being -3.6 ℃ and 38.9 ℃ for July and January respectively. These arid climate systems receive majority of their rainfall during short rainfall events and likely present surface flow for limited time periods while some rainfall events can be considered as immense with resultant flooding.

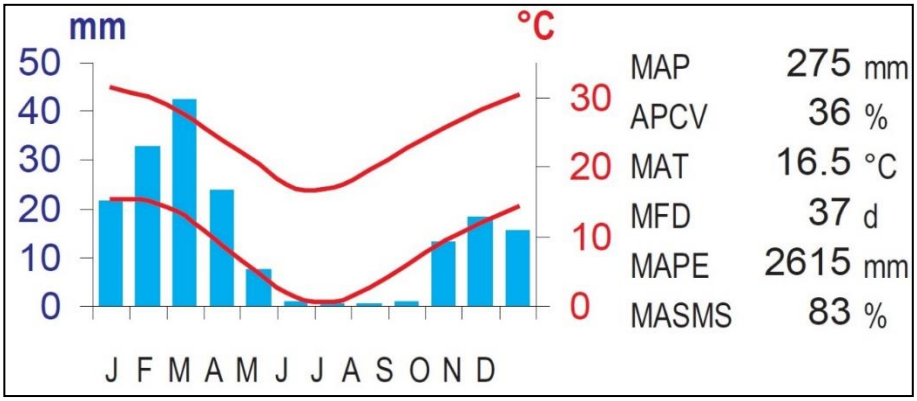


Figure 8.3: Climate graph for Richmond area, Northern Cape Province within which the proposed project site is located

8.4. Biophysical Characteristics of the Study Area and Development Area

The following section provides an overview and description of the biophysical characteristics of the study area and has been informed by specialist studies (**Appendix D-L**) undertaken for this EIA Report.

8.4.1. Topographical profile

The slope percentage of the project area has been calculated and is illustrated bellow. Most of the project area is characterised by a slope percentage between 0 and 20%, with some smaller patches within the project area characterised by a slope percentage in excess of 66%. This illustration indicates a non-uniform topography with alternating hills and steep cliffs surrounding flatter areas at high elevation. The DEM of the project area indicates an elevation between 1 245 to 1 462 Metres Above Sea Level (MASL).

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire),

which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees (refer to **Figure 8.4**).

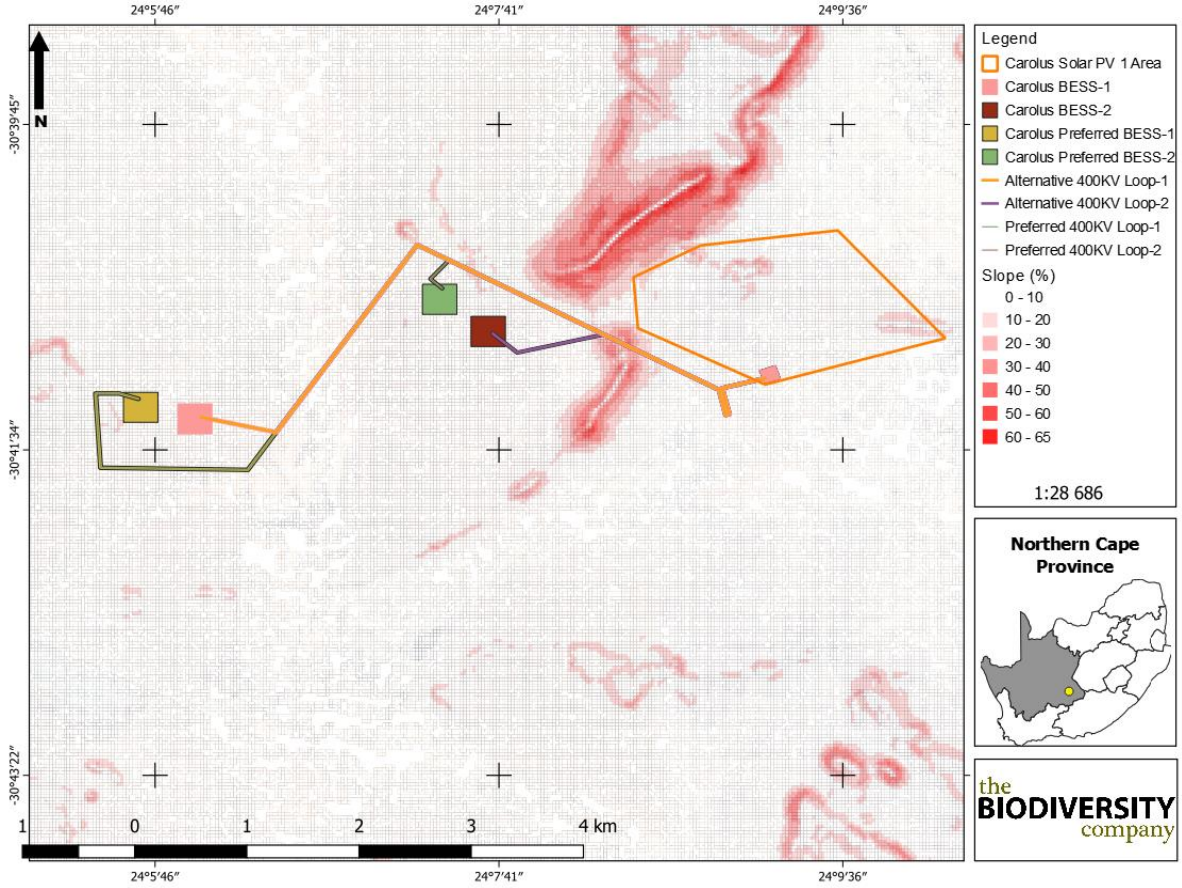


Figure 8.4: Slope percentage calculated for the development area within which the Carolus Solar PV1 facility is proposed

8.4.2. Geology, Soils and Agricultural Potential

i. Geological profile

The geology of this area is characterised by the Volksrust Formation shales as well as the Prince Albert Formation and the Dwyka Group diamictites (Mucina and Rutherford, 2006). The Jurassic Karoo Dolerite sills and sheets support the vegetation in this area soils varying from shallow to deep. Red and yellow-brown apedal soils are common in this region with the Ae, Fc and Ag land types prominently featuring.

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ae 137, Ae 138, Ae 140, Ib 47 and Fb 72 land types. The Ae land types are characterized with Hutton, Oakleaf and Mispah soil forms according to the Soil Classification Working Group, (1991) with the possibility of other soils and bare rocky areas. The Ae land type consists of red to yellow apedal soils which are freely drained. The soils tend to have a high base status and are deeper than 300 mm. The Fb land type consists of Glenrosa and/or Mispah soil forms with the possibility of other soils occurring throughout. Lime is generally

present within the entire landscape. The Ib land type consists of miscellaneous land classes including rocky areas with miscellaneous soils. The land terrain units for the featured Ae 137 to 140 land types.

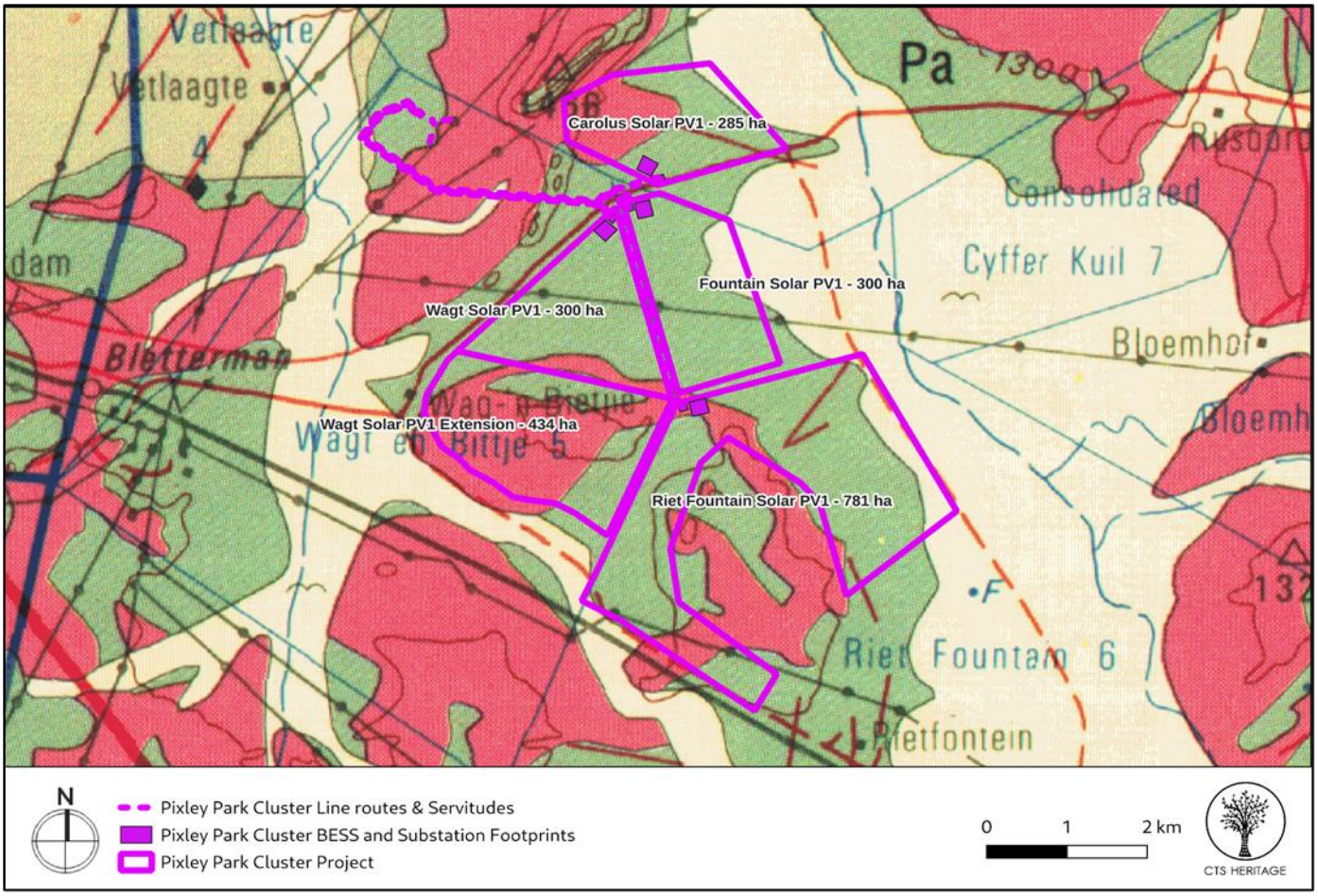


Figure 8.5: *Extracted from the Council for GeoSciences Map 3024 for Colesburg indicating that the development area is underlain by Jd: Jurassic Dolerite (red), Pt (lighter green): Tierberg Formation of the Ecca Group and Pa (darker green): Adelaide Subgroup of the Beaufort Group*

ii. Soils forms, Land type, Land Capability, and agricultural potential of the project site

Existing soil information was obtained from the Land Type database (Land Type Survey Staff, 1972 – 2006). A land type is an area with similar climate, topography and soil distribution patterns which can be demarcated on a scale of 1:250 000.

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ae 137, 138, 139 and 140 as well as the Ib 47 and Fb 72 land types (refer to **Figure 8.6**). The Ae land type consists of red, yellow apedal soils which are freely drained. The soils tend to have a high base status and is deeper than 300 mm. The Fb land type consists of Glenrosa and/or Mispah soil forms with the possibility of other soils occurring throughout. Lime is generally present within the entire landscape. The Ib land type consists of miscellaneous land classes including rocky areas with miscellaneous soils.

Considering the occurrence of various soil forms that are commonly associated with high land capabilities, it is likely that areas with high land capability sensitivity do occur within the project area. However, due to the poor climatic capability, the ultimate land potential is more likely to be low.

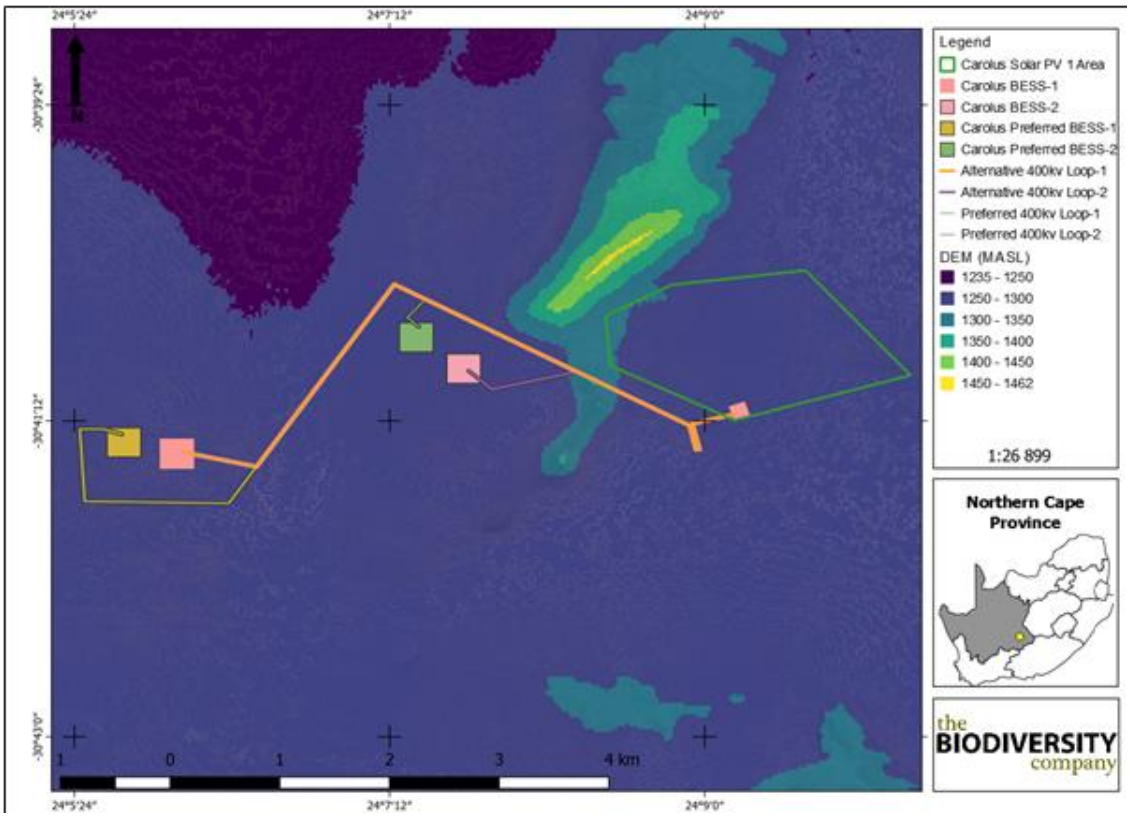


Figure 8.6: *Land Types present within the project area*

8.4.3. Land Use

The landscape associated with the site is a typical Karoo landscape consisting of dolerite koppies and ridges separated by valley bottoms. The land uses surrounding the project area predominantly includes farming (grazing) activities between natural (open – predominantly mountainous areas) land situated between the aforementioned watercourses. Land use within a catchment influences the ecological integrity of the associated watercourses. Due to the limited land and water use modification within the project related catchment areas, the SQRs were considered largely natural to moderately modified at a desktop level (DWS, 2014). Ephemeral watercourses of the arid regions such as the Karoo are typically dependent on groundwater discharge and are particularly vulnerable to changes in hydrology and are known to be slow to recover from any impacts.

The two major aspects determining the status of the SQRs are water quality and habitat conditions. The physico-chemical (water quality) modifications within the two SQRs have been rated as small with low volumes of return water (effluent) input expected from the agricultural and urban activities (altered land use) present in the catchment areas. Modifications to instream/riparian/wetland habitat continuity, and flow modification were rated to range from small to large within the two SQRs. Additionally, the habitat diversity classes of the SQRs were rated as very low with a low diversity of fish (*Enteromius anoplus* - Chubbyhead Barb and *Labeo umbratus* – Moggel) and macroinvertebrate species expected within these systems. Despite this these taxa maintain a moderate sensitivity to altered flows and water quality, highlighting the need for the project to limit impacts to these aspects.

The proposed Photovoltaic (PV) Solar Energy Facility and associated infrastructure development is located approximately 12 km east of De Aar within the Emthanjeni Local Municipality in the Northern Cape Province.

The area is immediately north-east of the hydra substation and approximately 8 km north of the N10 Highway. The surrounding land use includes nature or game reserves, wool production, mountainous areas, agricultural activities predominantly livestock farming and watercourses.

The land uses surrounding the project area predominantly includes farming (grazing) activities between natural (open – predominantly mountainous areas) land situated between the aforementioned watercourses. Land use within a catchment influences the ecological integrity of the associated watercourses. Due to the limited land and water use modification within the project related catchment areas, the SQRs were considered largely natural to moderately modified at a desktop level (DWS, 2014). Ephemeral watercourses of the arid regions such as the Karoo are typically dependent on groundwater discharge and are particularly vulnerable to changes in hydrology and are known to be slow to recover from any impacts.

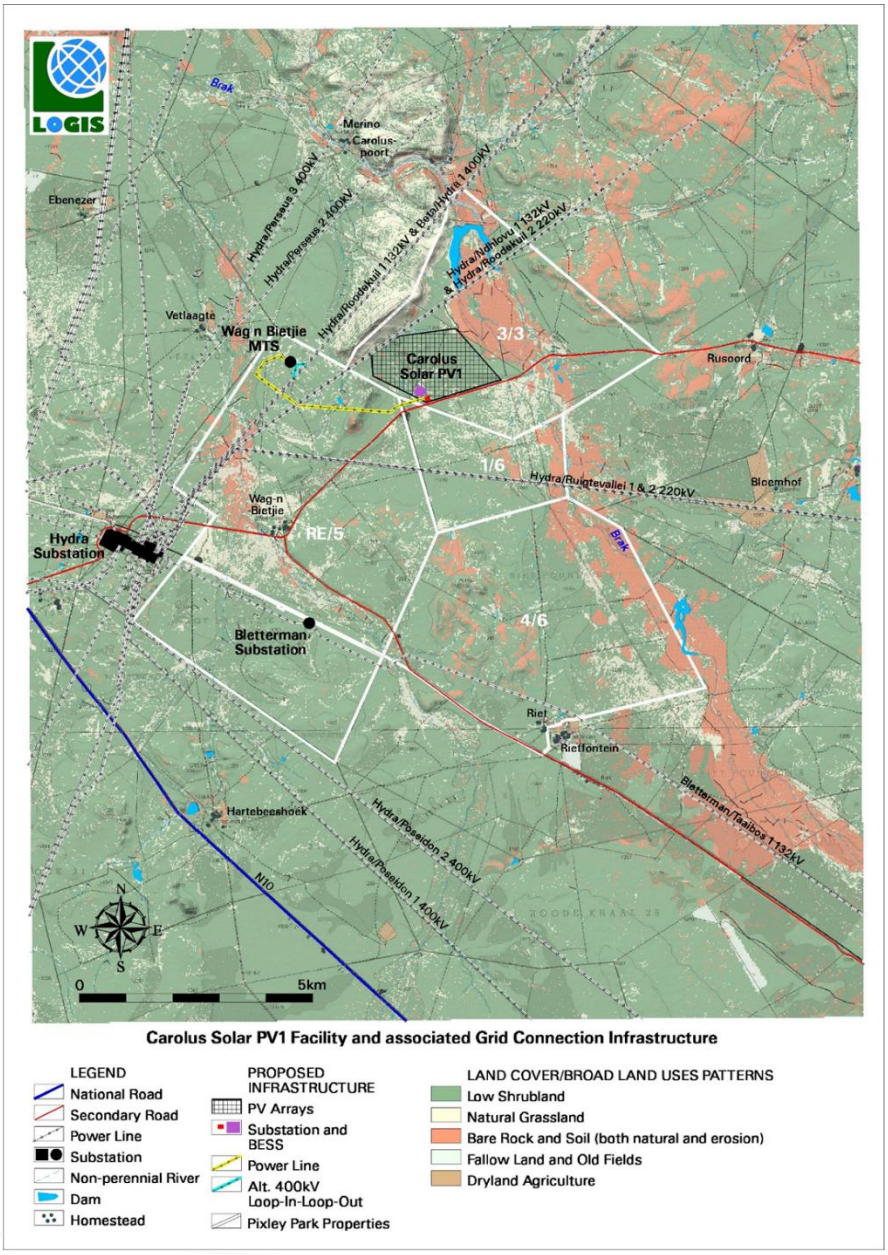


Figure 8.7: Land cover and broad land use patterns.

Fifteen land capabilities have been digitised by (DAFF, 2017) across South Africa, of which eight potential land capability classes are located within the proposed footprint area's assessment corridors, including;

- Land Capability 1 to 5 (Very Low to Low Sensitivity); and
- Land Capability 6 to 8 (Low to Moderate Sensitivity).

The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project focus area, which is covered by "Very Low" to "Low" sensitivities. Some patches are characterised by "Moderate Low to Moderate" sensitivities In the assessment area, there is no segregation of agricultural lands or crop fields with high potentials from all the infrastructure, (i.e., powerlines, proposed alternative routes, solar substation and BESS facilities). The available crop fields boundary areas with high sensitivity following the DEA Screening Tool (2022) are found outside the project area. It is also worth noting that, there are limitations on the actual soil properties distribution and field occurrence as the baseline soil assessment results were not presented. Such soil properties are important in the determination of the soil field land capability classes required for the land potential classes (i.e., combination of climate capability level and land capability class). The "Very Low to Moderate" sensitivities fall within the DAFF, (2017) requirements for a compliance statement report only. It is the specialist`s recommendation that, the proposed Carolus solar renewable energy facility and associated infrastructure will have limited effects based on the desktop sensitivities and potentials from the DAFF, (2017). Therefore, the project may be favourably considered.

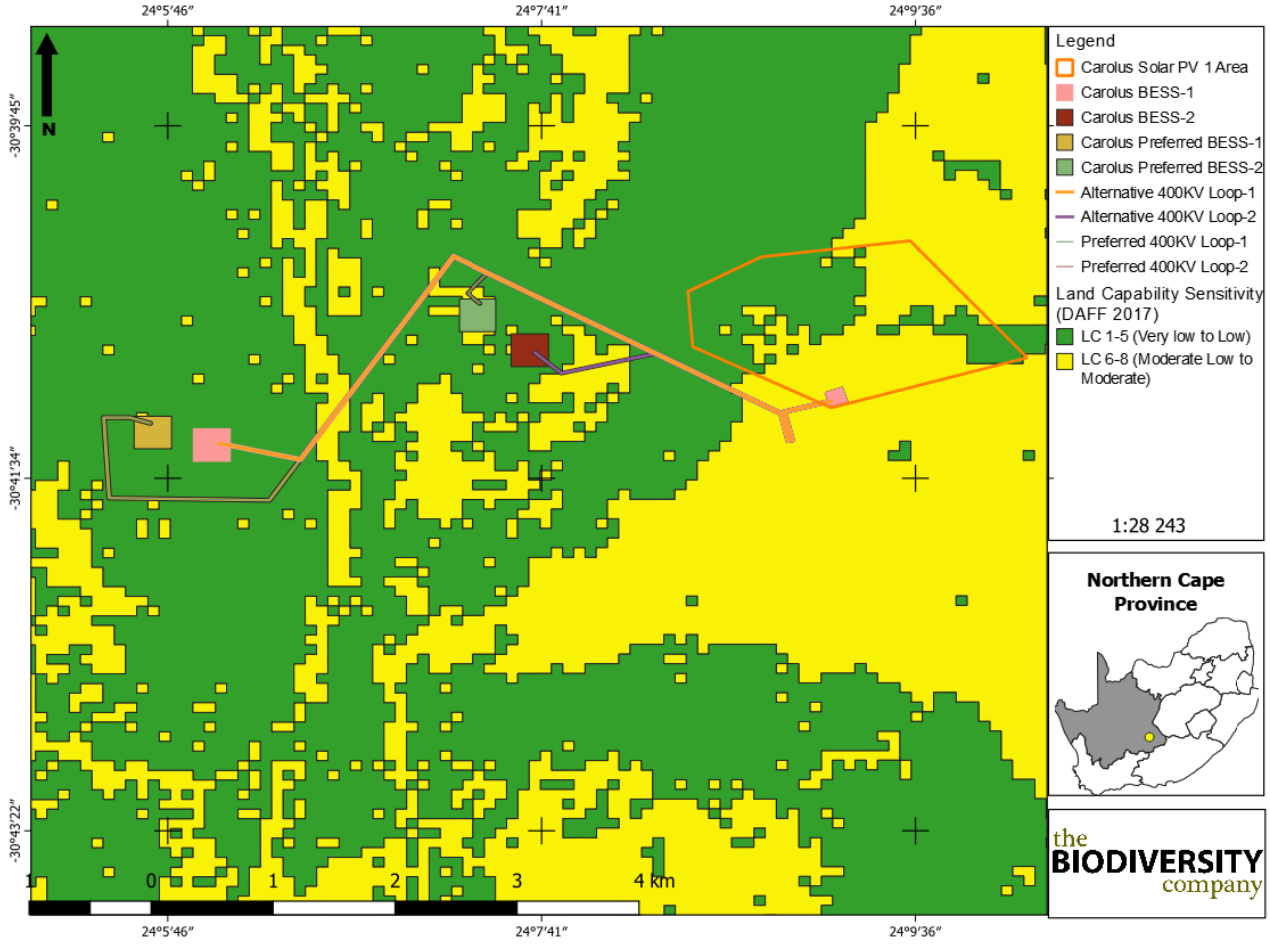


Figure 8.7: Land capability sensitivity of the development area.

8.4.4. Ecological Profile of the Study Area and the Development Area

i. Broad-Scale Vegetation Patterns

The proposed Carolus Solar PV1 Facility PAOI is situated within two biomes, the Grassland and Nama Karoo biomes. The Nama Karoo Biome, which is a large, landlocked region on the central plateau of the western half of South Africa and extends into south-eastern Namibia. This is an arid biome with majority of the river systems being non-perennial. Apart from the Orange River and the few permanent streams in the southwest that originate in higher-rainfall neighbouring areas, the limited number of perennial streams that originate in the Nama-Karoo are restricted to the more mesic east. The low precipitation is unreliable (coefficient of variation of annual rainfall up to 40%) and droughts are unpredictable and prolonged. The unpredictable rainfall impedes the dominance of leaf succulents and is too dry in summer for dominance by perennial grasses alone, and the soils are generally too shallow, and the rainfall is too low for trees. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism. Despite relatively low floristic diversity, the Nama-Karoo vegetation has a high diversity of plant life forms. These include co-occurring ephemerals, annuals, geophytes, C3 and C4 grasses, succulents, deciduous and evergreen chamaephytes and trees. This is probably a consequence of an ecotonal and climatically unstable nature of the region.

Scattered rocky hills, mesas and inselbergs are distinctive features of an otherwise relatively homogeneous landscape. These features are either capped by or wholly comprised of dolerite, which is a fine- to medium-grained dark, intrusive igneous rock. The surrounding plains and lowland habitats are dominated by shale and sandstone, which is a fine- to medium-grained sedimentary rock. Due to their structure, these features provide greater heterogeneity in habitat and microclimate than the surrounding plains and therefore, support higher species richness and diversity (Petersen *et al*, 2020). Species richness and relative cover of the varying plant growth forms are driven by gradients of a combination soil, environmental and climatic parameters. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism.

The Grassland biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

- Seasonal precipitation; and
- The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees. On a fine-scale vegetation type, the project area overlaps with Besemkaree Koppies Shrubland and Northern Upper Karoo.

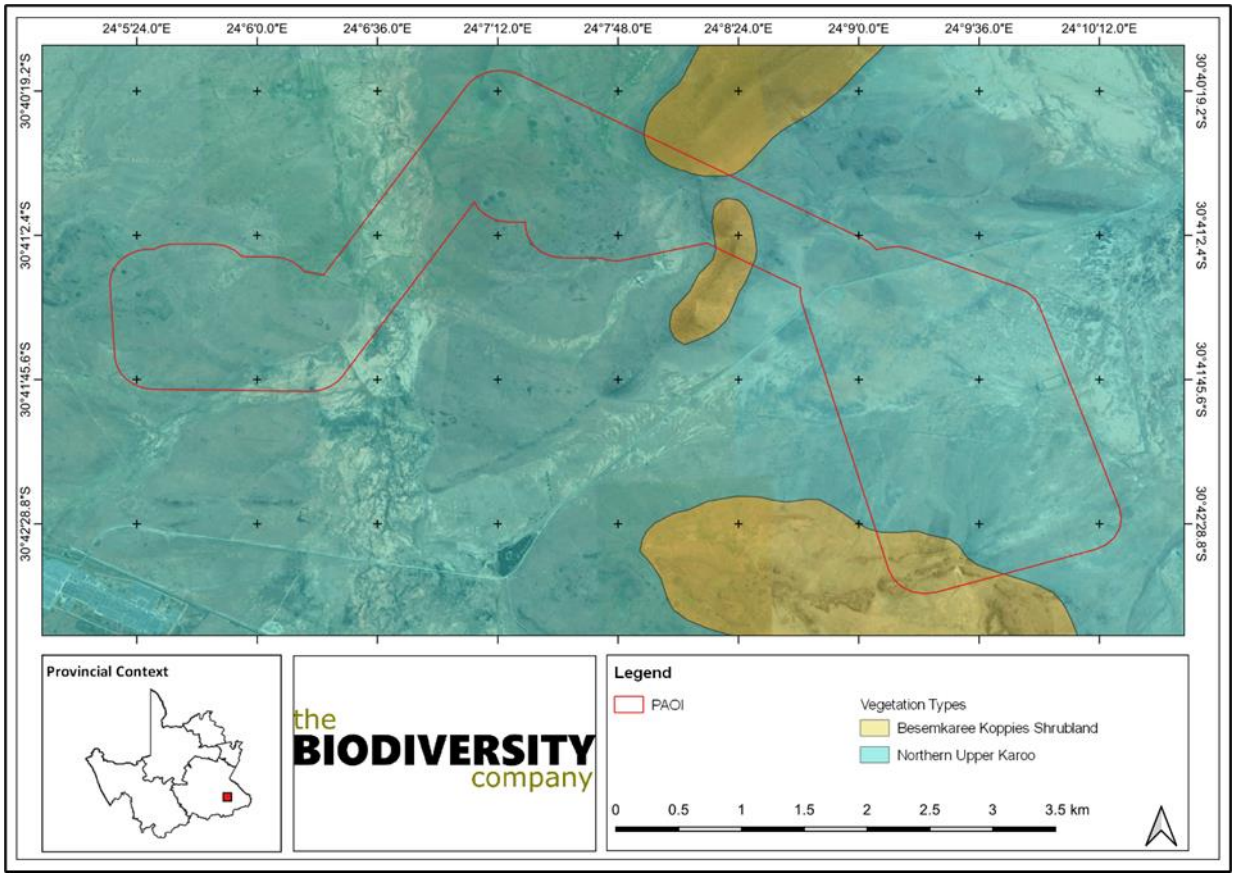


Figure 8.8: Map illustrating the vegetation types associated with the proposed Carolus Solar PV1 Facility

On a fine-scale vegetation type, the project area overlaps with Besemkaree Koppies Shrubland and Northern Upper Karoo.

Northern Upper Karoo

Distribution:
Nama Karoo Biome, which is a large, landlocked region on the central plateau of the western half of South Africa and extends into south-eastern Namibia. This is an arid biome with majority of the river systems being non-perennial. Apart from the Orange River and the few permanent streams in the southwest that originate in higher-rainfall neighbouring areas, the limited number of perennial streams that originate in the Nama-Karoo are restricted to the more mesic east. The low precipitation is unreliable (coefficient of variation of annual rainfall up to 40%) and droughts are unpredictable and prolonged. The unpredictable rainfall impedes the dominance of leaf succulents and is too dry in summer for dominance by perennial grasses alone, and the soils are generally too shallow, and the rainfall is too low for trees. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism.

Vegetation and Landscape Features:
Flat to gently sloping dominated by dwarf shrubs and grasses. Comprising of Shales of the Volksrust Formation and to a lesser extent the Prince Albert Formation (both Ecca Group) as well as Dwyka Group diamictites form the underlying geology. Jurassic Karoo Dolerite sills and sheets support this vegetation complex in places. Wide stretches of land are covered by superficial deposits including calcretes of the

Kalahari Group. Soils are variable from shallow to deep, red, yellow, apedal, freely drained soils to very shallow Glenrosa and Mispah forms.

Important Taxa:

- **Tall Shrubs**: *Lycium cinereum, L. horridum, L. oxycarpum.*
- **Low Shrubs:** *Chrysocoma ciliata, Gnidia polycephala, Pentzia calcarea, P. globosa, P. incana, P. spinescens, Berkheya annectens, Eriocephalus ericoides subsp. ericoides, E. glandulosus, E. spinescens, Euryops asparagoides, Felicia muricata, Osteospermum leptolobum, O. spinescens, Selago geniculata, S. saxatilis.*
- **Succulent Shrubs**: Hertia pallens, Salsola calluna, S. glabrescens, S. rabieana, S. tuberculata, Zygophyllum flexuosum.
- **Semi-parasitic Shrub**: *Thesium hystrix. Herbs: Dicoma capensis, Gazania krebsiana, Hermannia comosa, Indigofera alternans, Lessertia pauciflora, Radyera urens, Sesamum capense, Sutera pinnatifida, Tribulus terrestris, Vahlia capensis.*
- ***Succulent Herb**: Psilocaulon coriarium. Geophytic*
- **Herb**: *Moraea pallida.*
- **Graminoids**: *Aristida adscensionis, A. congesta, A. diffusa, Enneapogon desvauxii, Eragrostis lehmanniana, E. obtusa, E. truncata, Sporobolus fimbriatus, Stipagrostis obtusa, Eragrostis bicolor, E. porosa, Fingerhuthia africana, Heteropogon contortus, Stipagrostis ciliata, Themeda triandra, Tragus berteronianus, T. koelerioides, T. racemosus.*

Biogeographically Important Taxa

- **Herb:** *Convolvulus boedeckerianus.*
- **Tall Shrub:** *Gymnosporia szyszylowiczii subsp. namibiensis.*

Endemic Taxa

- **Succulent Shrubs**: *Lithops hookeri, Stomatium pluridens.*
- **Low Shrubs**: *Atriplex spongiosa, Galenia exigua.*
- **Herb**: *Manulea deserticola.*

Conservation

No portion conserved in statutory conservation areas. About 4% has been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by building of dams. Areas of human settlements are increasing in the north-eastern part of this vegetation type. Prosopis glandulosa, regarded as one of the most important invasive alien plants in South Africa, is widely distributed in this vegetation type.

This vegetating type dominates the low-lying areas of the project site. As this vegetation type is widespread throughout the region and largely untransformed the floral species found on the site are not at significant risk of negative impact from the development

Besemkaree Koppies Shrubland

Distribution:

Northern Cape, Free State and Eastern Cape Provinces: On plains of Eastern Upper Karoo (between Richmond and Middelburg in the south and the Orange River) and within dry grasslands of the southern and central Free State. Extensive dolerite-dominated landscapes along the upper Orange River belong to this unit as well. Extends northwards to around Fauresmith in the northwest and to the Wepener District in the northeast. Altitude 1120– 1680 m.

Vegetation and Landscape Features:

Slopes of koppies, butts and tafelbergs covered by two-layered karroid shrubland. The lower (closed-canopy) layer is dominated by dwarf small-leaved shrubs and, especially in high precipitation years, also by abundant grasses, while the upper (loose canopy) layer is dominated by tall shrubs. Dolerite koppies and sills embedded within Karoo Supergroup sediments. The dolerite dykes and sills are igneous intrusions that are the result of extensive volcanic activity, which accompanied the break-up of Gondwana in the Jurassic. In places the slopes of mesas and butts carrying this vegetation type have a mixed geology where dolerites occur together with sandstones and mudstones of the Ecca and Beaufort Groups.

Important Taxa:

- **Small Trees:** *Cussonia paniculata, Ziziphus mucronata.*
- ***Tall Shrubs**: Diospyros austro-africana, Euclea crispa subsp. ovata, Olea europaea subsp. cuspidata, Searsia burchellii, S. ciliata, S. erosa, Buddleja saligna, Diospyros lycioides subsp. lycioides, Ehretia rigida, Grewia occidentalis, Gymnosporia polyacantha, Tarchonanthus minor.*
- **Low Shrubs:** *Asparagus suaveolens, Chrysocoma ciliata Diospyros pallens, Eriocephalus ericoides, E. spinescens, Euryops empetrifolius, Felicia filifolia subsp. filifolia, F. muricata, Helichrysum dregeanum, H. lucilioides, Hermannia multiflora, H. vestita, Lantana rugosa, Limeum aethiopicum, Lycium cinereum, Melolobium candicans, M. microphyllum.*
- **Succulent Shrubs:** *Aloe broomii, Chasmatophyllum musculinum, C. verdoorniae, Cotyledon orbiculata var. dactylopsis, Pachypodium succulentum. Graminoids: Aristida adscensionis, A. congesta, A. diffusa, Cenchrus ciliaris, Cymbopogon caesius, Cynodon incompletus, Digitaria eriantha, Eragrostis curvula, E. lehmanniana, Heteropogon contortus, Setaria lindenbergiana, Cymbopogon pospischilii, Enneapogon scoparius, Eragrostis chloromelas, E. obtusa, Eustachys paspaloides, Fingerhuthia africana, Hyparrhenia hirta, Sporobolus fimbriatus.*
- **Herbs***: Convolvulus sagittatus, Dianthus caespitosus subsp. caespitosus, Gazania krebsiana subsp. krebsiana, Hibiscus pusillus, Indigofera alternans, I. rhytidocarpa, Lepidium africanum subsp. africanum, Pollichia campestris. Herbaceous Climber: Argyrolobium lanceolatum.*
- **Geophytic Herbs***: Albuca setosa, Asplenium cordatum, Cheilanthes bergiana, C. eckloniana, Freesia andersoniae, Haemanthus humilis subsp. humilis, Oxalis depressa, Pellaea calomelanos.*
- **Succulent Herbs***: Aloe grandidentata, Crassula nudicaulis, Duvalia caespitosa, Euphorbia pulvinata, Huernia piersii, Stapelia grandiflora, S. olivacea, Tridentea gemmiflora.*

Endemic Taxa:

- **Small Tree***: Cussonia sp. nov. (P.J. du Preez 3666 BLFU)*.
- **Succulent Shrubs***: Euphorbia crassipes, Neohenricia sibbettii, N. spiculata.*

Conservation:

About 5% statutorily conserved in the Rolfontein, Tussen Die Riviere, Oviston, Gariep Dam, Caledon, and Kalkfontein Dam Nature Reserves. In addition, a small patch is also protected in the private Vulture Conservation Area. About 3% of the area has been lost through building of dams. Erosion varies from low to high.

This karoo unit occurs on the slopes and plateau areas on tafelbergs. As this vegetation type is widespread and largely untransformed the floral species found on the site are not at significant risk of negative impact from the development.

ii. Conservation Status of Broad Vegetation Types

Based on a scientific approach used at national level by the South African National Biodiversity Institute (SANBI), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation compared to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area is still intact compared to various thresholds. On a national scale the thresholds are as depicted in **Table 8.1** below, as decided by best available scientific approaches.

The conservation target is 28% and about 5% statutorily conserved in the Rolfontein, Tussen Die Riviere, Oviston, Gariep Dam, Caledon and Kalkfontein Dam Nature Reserves. Additionally, there is a small patch that is protected in the private Vulture Conservation Area. About 3% of the area has been transformed due to dams. Erosion varies from low to high (Mucina & Rutherford, 2006).

Table 8.1: Conservation status of different vegetation types occurring in the project site

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver *et al.* 2005 ; Mucina *et al.*, 2006	**National Ecosystem List (NEM:BA)**
Norther Upper Karoo	21	0	4	Least Threatened	Not listed
Besemkaree Koppies Shrubland	28	5	3	Least Threatened	Not listed

Determining ecosystem status (Driver *et al.*, 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)		
80–100	least threatened	LT
60–80	vulnerable	VU
*BT–60	endangered	EN
0–*BT	critically endangered	CR

According to scientific literature (Driver *et al.*, 2005; Mucina *et al.*, 2006), as shown in **Table 8.1**, both vegetation types are listed as Least Threatened.

The National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection based on rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in scientific literature.

Neither vegetation types are listed in the National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011).

iv. Protected Areas and Proposed Protected Areas

This is an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. The PAOI overlaps with NP and PP ecosystems

The proposed Carolus Solar PV1 Facility is not located within a protected area, nor does it overlap with any NPAES Focus Areas (**Error! Reference source not found.**). The De Aar Nature Reserve is located approximately 11 km to the west, thereby located outside the 5 km buffer zone. The Senqu Caledon NPAES Focus Area is located approximately 10 km to the north-east. The proposed development is therefore unlikely to negatively impact the ecological condition of these landscape features.

v. Listed Plant Species

The POSA database indicates that 116 species of indigenous plants are expected to occur within the project area and surrounding landscape. Appendix D provides the list of species and their respective conservation status and endemism. None of the species expected are species of conservation concern (SCC).

vi. Plants Protected in terms of the National Environmental Management: Biodiversity Act and the Northern Cape Conservation Act

No plant species protected under the National Environmental Management: Biodiversity Act (No. 10 of 2004) were identified on site. However, several have a geographical distribution that includes the project site. No plant species protected under the Northern Cape Nature Conservation Act (No. 9 of 2009) were identified on site. There is a possibility that there may be additional protected plant species present on site that were not detected during the field survey.

vii. Trees Protected in Terms of the National Forests Act

The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire, and grazing maintain the grass dominance and prevent the establishment of trees.

viii. Critical Biodiversity Areas

Figure 8.9. illustrates that the proposed development overlaps with an Ecological Support Area. The nature of the development, i.e., a solar cluster and associated infrastructure, will lead to destruction of the ESA and consequently, the footprint area will be no longer congruent with an ESA.
The adjacent landscape to the east is classified as a CBA1 and CBA2. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic.

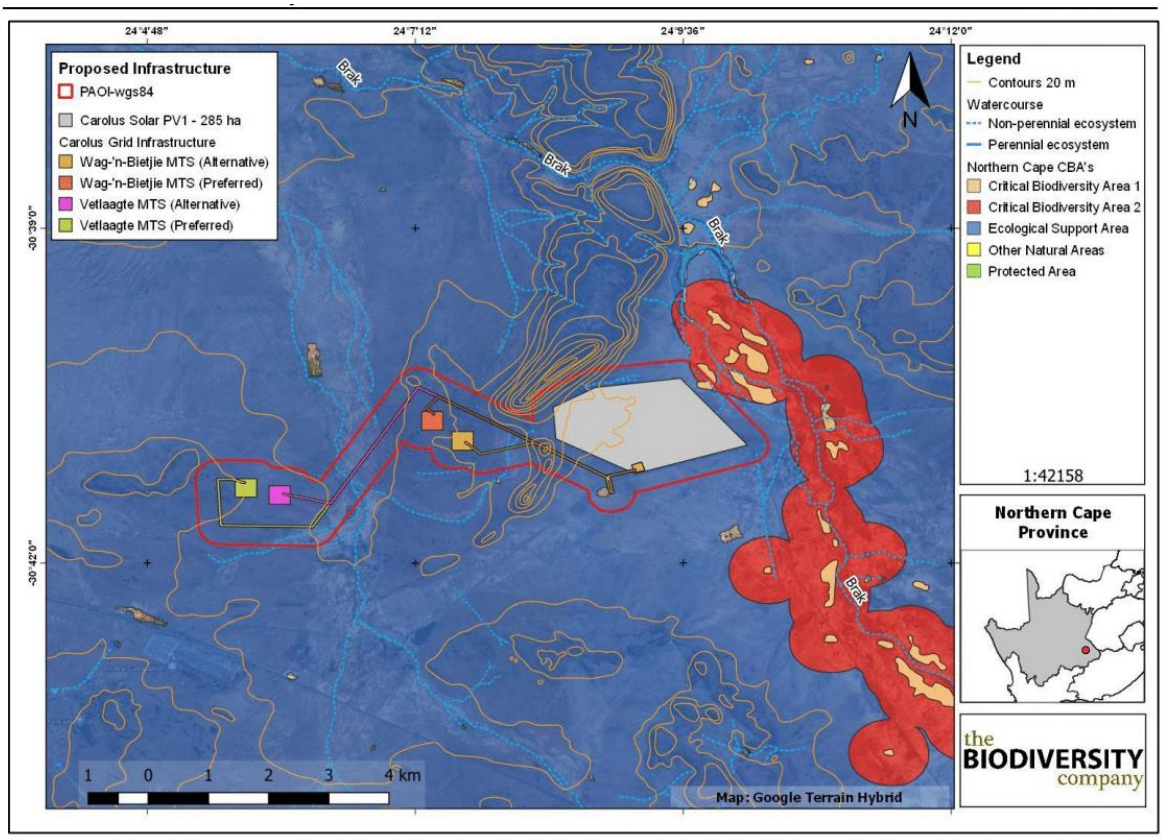


Figure 8.9: Critical Biodiversity Areas (CBAs), as per the 2016 Northern Cape Critical Biodiversity Area Map, located within the Carolus Solar PV1 Facility project site

ix. <u>Wetlands and Freshwater Resources</u>

Catchment

The proposed Carolus Solar PV1 Facility is located within the Brak River Catchment (Secondary Catchment D6). The project area does not overlap with any wetland or river systems that were assessed as part of the SAIIAE. However, there are minor drainage lines traversing the project that drain into the Brak River. The Brak River is near the project area, and the associated reach classified as EN. Wetlands within the surrounding landscape are classified as CR. The NFEPA database indicates that the wetlands within the surrounding landscape are not important for maintaining threatened biodiversity or support large numbers of waterbirds.

National Freshwater Ecosystem Priority Area Status

To better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals.

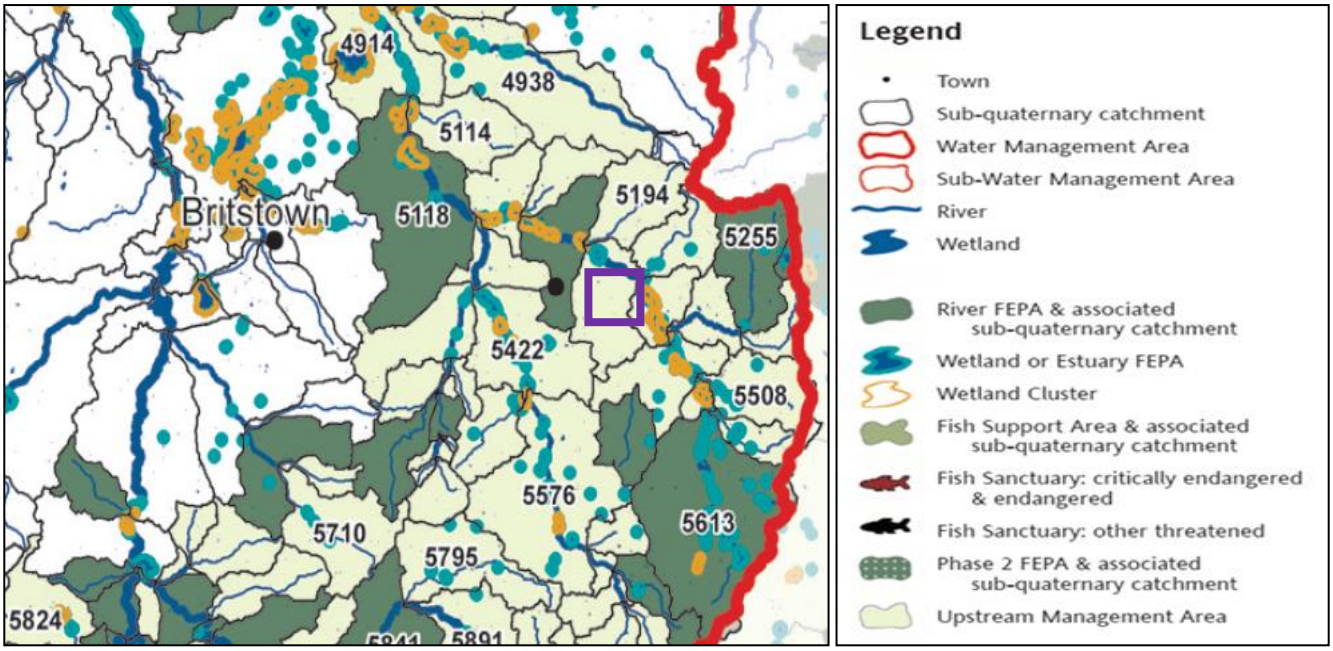


Figure 8.10 As presented by the purple square, the Brak (D62D-5391) and Brak tributary (D62D-5332) river reaches are considered as important upstream management areas as per NFEPAs designation. Based on imagery and the listed NFEPA biodiversity features, the project area presented channelled valley bottom wetland characteristics, which is typical for the gentle sloped reaches of many river systems.

National Wetland Map 5

The NWA sets out to ensure that water resources are used, managed, and controlled in such a way that they benefit all users. To achieve this, the Act has prescribed a series of measures such as Resource Water Quality Objectives (RWQOs) to ensure comprehensive protection of water resources so that they can be used sustainably (DWA, 2011).

In absence of a designated RWQO biophysical node for the Brak Quaternary Catchment D62D for the project area, the RWQOs for the downstream orange River catchment was referred to for river monitoring data (DWAF, 2009). The Brak River drains into the Orange River near site OS08 (Hydro ID D7H008) on the Orange River at Prieska (Orange River Quaternary Catchment D72A) (DWAF, 2009). The Present Ecological Status (PES) of OS08 is moderately modified (class C), while the Recommended Ecological Category (REC) to be maintained is a largely natural (class B). The Ecological Importance and Sensitivity Category for this catchment is rated as Moderate.

The project area activities should be aligned with the RWQOs for the Orange WMA to limit impacts to local watercourses while maintaining biodiversity goals for the directly associated Brak River catchment and those watercourses downstream of the project area.

Aquatic Ecosystems

This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the National Biodiversity Assessment (NBA) 2018. National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) 2018. According to the SAIIAE dataset, several wetland areas were identified in the general project area, which included several rivers. The wetland units were

largely indirectly associated with the project (outside of the 500 m regulated area) warranting no further ecological assessment of the wetland systems for this project, with emphasis rather afforded to the aquatic assessment of the rivers possibly at risk from the proposed project infrastructure.

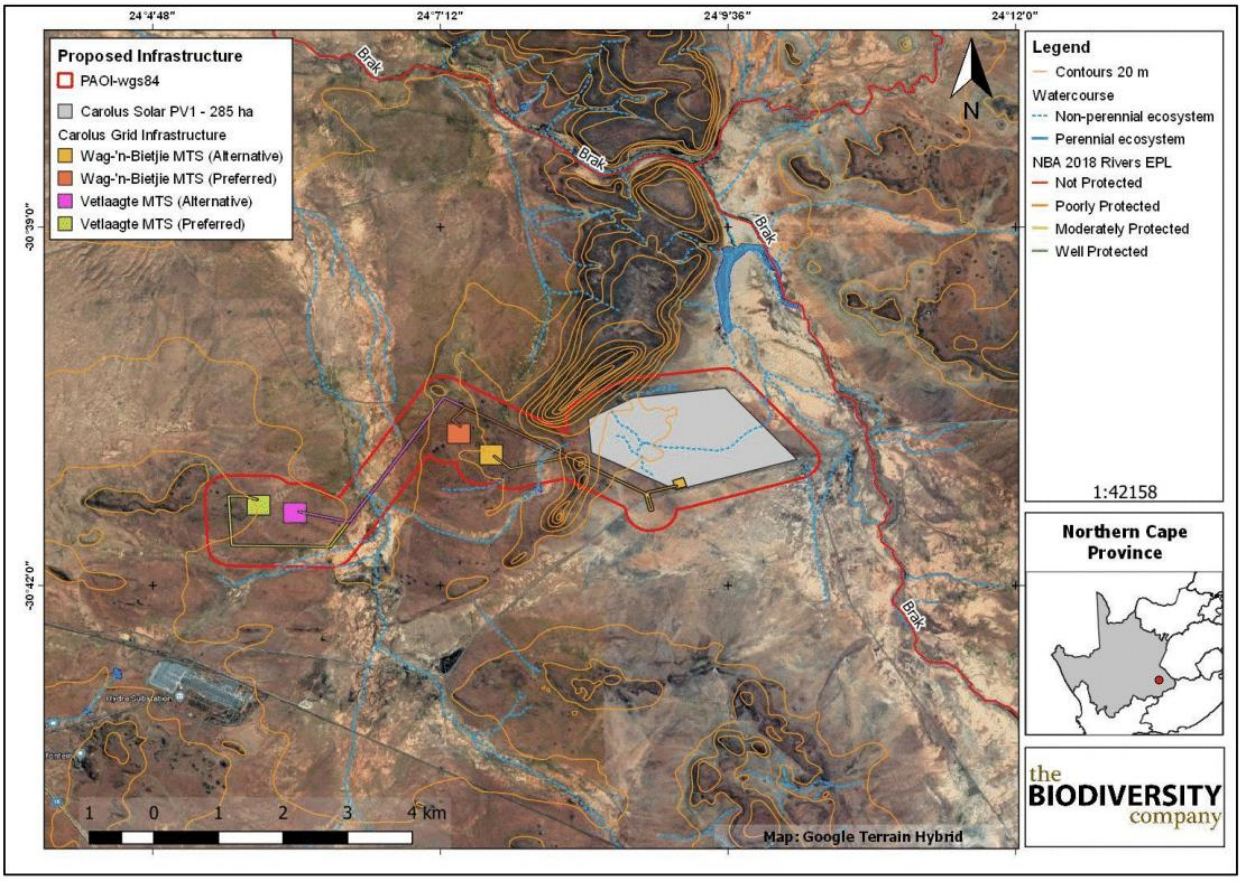


Figure 8.11: Map of the riverine ecological protection level associated with the project area

x. Terrestrial Fauna Communities in the Study Area

Mammals

The semi-arid area south of De Aar is known for a low diversity of mammals firstly related to the lack of open water and secondly the long history of farming in the region. The impact of the sheep farming is that the migration corridors of larger mammals were restricted and over time, many species have been lost to the area. In recent years with the increase in hunting, some farmers have reintroduced some of the mammals that were previously present in the area. The obvious threat of predators to livestock further contributes to the low diversity of mammals occurring in the area. The IUCN Red List Spatial Data lists 51 mammal species that could be expected to occur within the area. This list excludes large mammal species that are limited to protected areas. Three (3) of these expected species are regarded as SCC.

Table 8.3: Mammal Species of Conservation Concern (SCC) that are expected to occur within the proposed Carolus Solar PV1 Facility

Family	***Genus and species name***	**Common name**	**Conservation status**
Felidae	*Felis nigripes*	Black-footed Cat	Vulnerable

Felidae	*Panthera pardus*	leopard	Vulnerable
Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	Not Threatened

Amphibians

Based on the IUCN Red List Spatial Data and Amphibian Map database, 10 amphibian species are expected to occur within the project area. One of the species is regarded as a SCC.

Table 8.4: Amphibian Species of Conservation Concern (SCC) that are expected to occur within the proposed Carolus Solar PV1 Facility

Family	*Genus and species name*	Common name	Conservation status
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bullfrog	Least Concern

Reptiles

Based on the IUCN Red List Spatial Data and the Reptile MAP database, 19 reptile species are expected to occur within the area. One (1) is regarded as a SCC. This can be a result of the recent extensive drought and modified landscape (grazing and vegetation modification) associated with the agricultural activities. There are no species listed as red data for the area.

Table 8.5: List of expected reptiles on the area of the proposed development

Family	*Genus and species name*	Common name	Conservation status
Testudinidae	*Psammobates tentorius verroxii*	Verrox's Tent Tortoise	Least Concern

8.5. Avifauna

8.5.1. Important Bird and Biodiversity Areas (IBA)

This IBA contributes significantly to the conservation of large terrestrial birds and raptors. These include Blue Crane Anthropoides paradiseus, Ludwig's Bustard Neotis ludwigii, Kori Bustard Ardeotis kori, Blue Korhaan Eupodotis caerulescens, Black Stork Ciconia nigra, Secretarybird Sagittarius serpentarius, Martial Eagle Polemaetus bellicosus, Verreauxs' Eagle Aquila verreauxii and Tawny Eagle Aquila rapax.

A total of 289 bird species are known to occur in the IBA. IBA trigger species that could potentially occur in the Project Site are the following:

- Blue Crane (Globally Vulnerable, Regionally Near-threatened)
- Blue Korhaan (Globally Near-threatened)
- Martial Eagle (Globally and regionally Endangered)
- Verreaux's Eagle (Regionally Vulnerable)
- Ludwig's Bustard (Globally and Regionally Endangered)
- Secretarybird (Globally Endangered, Regionally Vulnerable)

8.5.2. Avifauna Micro-habitats

The Project Site falls within the Platberg-Karoo Conservancy Important Bird Area (Marnewick et al. 2015). The Platberg–Karoo Conservancy IBA covers the entire districts of De Aar, Philipstown and Hanover, including suburban towns. The landscape consists of extensive flat to gently undulating plains that are broken by dolerite hills and flat-topped inselbergs. The ephemeral Brak River flows in an arc from south-east to north-

west, eventually feeding into the orange River basin. Other ephemeral rivers include the Hondeblaf, Seekoei, Elandsfontein and Ongers rivers with a network of tributaries. Vanderkloof Dam is on the north-eastern boundary (Marnewick et al. 2015). This IBA is in the Nama Karoo and Grassland Biomes. The eastern Nama Karoo has the highest rainfall of all the Nama Karoo vegetation types and is thus ecotonal to grassland, with a complex mix of grass- and shrub-dominated vegetation types (Marnewick et al. 2015).

The land is used primarily for livestock grazing and agriculture. Commercial livestock farming is mostly extensive wool and mutton production, with some cattle and game farming. Less than 5% of this IBA is cultivated under dry-land or irrigated conditions and includes lucerne and prickly pear Opuntia ficus-indica orchards (Marnewick et al. 2015).

Nama Karoo Shrubland

The main vegetation type within the development areas consists of Karoo shrubland with a strong grassy component.

Drainage Lines and Wetlands

There is a large riverine and wetland system in the north/north-eastern corner of the Project Site. This habitat feature is most likely very important feeding, breeding, and nesting habitat for several priority and non-priority species, especially waterbirds. It should be noted that this riverine system falls outside of the proposed Development Areas.

Water Reservoirs and Dams

Surface water is of specific importance to avifauna in this arid Project Site. The Project Site contains man-made dams (earthen dams) and water reservoirs. Boreholes with open water troughs are important sources of surface water for priority avifauna for drinking and bathing.

Alien Trees

The Project Site is generally devoid of trees, except for isolated clumps of trees at homesteads and boreholes, where a mixture of alien and indigenous trees is growing. The trees could attract a variety of bird species for the purposes of nesting and roosting.

High Voltage Lines

High voltage lines are an important potential roosting and breeding substrate for large raptors in the Karoo (Jenkins et al. 2013). A high voltage line bisects the Project Site. There is increasing evidence that vultures are using high voltage lines in the Karoo (personal observation), mostly in the non-breeding season (January to March), and that they could be encountered anywhere in the broader area.

Rocky Ridges

The Project Site contains one prominent ridge (koppie) known as Rietfontein in the south-eastern corner of the Project Site, which rises to a height of 1352 m/asl. There is also a prominent ridgeline in the north-west of the Project Site (Wachteenbeetje 1466 m/asl). There are a number of other ridges in the broader area too. Ridges provide important habitat for several bird species, especially certain raptors, who use these areas for foraging.

8.5.3. Bird Community within the Surrounding Area and the Project Site

The SABAP2 data indicates that a total of 162 species could potentially occur within the broader area where the project is located. Of these, 76 are classified as priority species for solar developments. Of the 76 priority species, 45 have a medium to high probability of occurring regularly in the Project Site, and 21 of the priority species were recorded during the field monitoring surveys. Five Red Data species were recorded during the site surveys, namely Cape Vulture (Globally and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered), Secretarybird (Globally Endangered, Regionally Vulnerable), and Tawny Eagle (Globally Vulnerable, Regionally Endangered).

Table 2 below lists all the priority species that are likely to occur regularly and the possible impact on the respective species by the proposed solar energy infrastructure

8.5.4. Site specific collision risk rating

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001).

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa. Refer to Figure **8.12**.

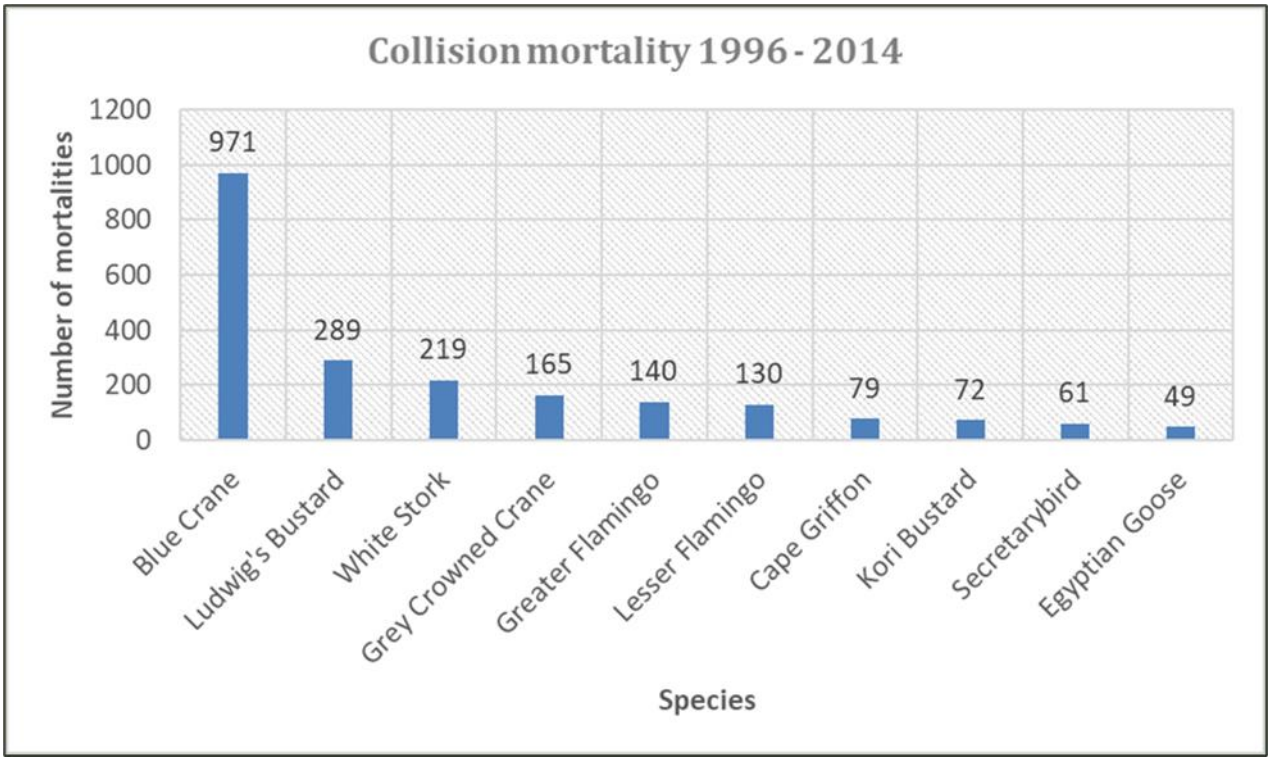


Figure 8.12: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

Table 8.7: Priority species potentially occurring at the development area (Red List species are shaded) (where **NT = Near threatened, VU = Vulnerable** and **EN = Endangered**

Species name	Scientific name	SABAP2 Reporting Rate (%)		Global Conservation Status	Regional Conservation Status	Endemic (SA)	Recorded during monitoring	Likelihood of regular occurrence in Project Site	Nama Karoo shrub	Drainage lines and wetlands	Water reservoirs and dams	High voltage lines	Alien trees	Rocky ridges	Solar - Collisions with solar panels	Solar - Displacement: Disturbance (breeding)	Solar - Displacement: Habitat transformation	Solar - Entanglement in fences	Substations - Electrocution	Powerline - Collision
		Full protocol	Ad hoc protocol																	
African Sacred Ibis	*Threskiornis aethiopicus*	55,0	3,4	-	-			H		x	x									x
Amur Falcon	*Falco amurensis*	15,0	6,9	-	-		x	M	x			x	x	x			x		x	
Black Stork	*Ciconia nigra*	10,0	0,0	-	VU			M		x	x			x						x
Black-chested Snake Eagle	*Circaetus pectoralis*	5,0	0,0	-	-			M	x			x	x				x		x	
Black-headed Heron	*Ardea melanocephala*	20,0	0,0	-	-			M		x	x		x				x		x	x
Blacksmith Lapwing	*Vanellus armatus*	55,0	3,4	-	-			H		x	x				x					
Black-winged Kite	*Elanus caeruleus*	10,0	0,0	-	-			M	x			x	x	x			x		x	
Black-winged Stilt	*Himantopus himantopus*	35,0	6,9	-	-			M		x	x				x					
Blue Crane	*Grus paradisea*	45,0	6,9	VU	NT			H	x	x						x	x	x		x
Blue Korhaan	*Eupodotis caerulescens*	15,0	6,9	NT	LC	x		M	x						x	x	x	x		x
Booted Eagle	*Hieraaetus pennatus*	15,0	3,4	-	-		x	M	x			x	x	x			x		x	
Cape Teal	*Anas capensis*	15,0	0,0	-	-			M		x	x				x					x
Cape Vulture	*Gyps coprotheres*	5,0	0,0	EN	EN		x	M	x		x	x		x		x	x		x	x
Cape White-eye	*Zosterops virens*	20,0	0,0	-	-	x		M					x							
Common Buzzard	*Buteo buteo*	10,0	6,9	-	-			M	x		x	x	x	x		x	x		x	

Common Greenshank	*Tringa nebularia*	15,0	0,0	-	-			M		x	x				x					
Common Moorhen	*Gallinula chloropus*	25,0	0,0	-	-			M		x	x				x					
Egyptian Goose	*Alopochen aegyptiaca*	60,0	13,8	-	-		x	H		x	x	x	x		x		x		x	x
Fiscal Flycatcher	*Melaenornis silens*	15,0	6,9	-	-	x		M					x							
Glossy Ibis	*Plegadis falcinellus*	30,0	0,0	-	-			M		x	x				x					x
Greater Kestrel	*Falco rupicoloides*	10,0	17,2	-	-		x	M	x			x	x	x		x	x		x	
Grey Heron	*Ardea cinerea*	20,0	0,0	-	-			M		x	x				x					x
Jackal Buzzard	*Buteo rufofuscus*	10,0	10,3	-	-	x	x	H	x			x	x	x		x	x		x	
Karoo Lark	*Calendulauda albescens*	10,0	0,0	-	-	x		M	x						x	x	x			
Karoo Prinia	*Prinia maculosa*	25,0	3,4	-	-	x	x	M	x	x					x	x	x			
Karoo Thrush	*Turdus smithi*	50,0	3,4	-	-	x		M					x				x			
Lanner Falcon	*Falco biarmicus*	10,0	3,4	-	VU		x	M	x		x	x	x	x		x	x		x	
Large-billed Lark	*Galerida magnirostris*	30,0	13,8	-	-	x	x	H	x						x	x	x			
Lesser Kestrel	*Falco naumanni*	55,0	6,9	-	-		x	H	x			x	x	x			x		x	
Little Stint	*Calidris minuta*	10,0	0,0	-	-			M		x	x				x					
Ludwig's Bustard	*Neotis ludwigii*	25,0	0,0	EN	EN			M	x							x	x	x		x
Martial Eagle	*Polemaetus bellicosus*	5,0	3,4	EN	EN		x	M	x		x	x	x	x			x		x	
Pale Chanting Goshawk	*Melierax canorus*	50,0	13,8	-	-		x	H	x			x	x	x			x		x	
Pied Avocet	*Recurvirostra avosetta*	20,0	0,0	-	-			M		x	x				x					
Pied Starling	*Lamprotornis bicolor*	40,0	6,9	-	-	x		H	x		x		x		x	x	x			
Rock Kestrel	*Falco rupicolus*	20,0	3,4	-	-			M	x					x		x	x		x	
Ruff	*Calidris pugnax*	15,0	0,0	-	-			M		x	x				x					
Secretarybird	*Sagittarius serpentarius*	5,0	10,3	EN	VU		x	M	x		x					x	x	x		x
Sickle-winged Chat	*Emarginata sinuata*	10,0	6,9	-	-	x	x	M	x						x	x	x			
South African Cliff Swallow	*Petrochelidon spilodera*	40,0	0,0	-	-	x		H	x								x			
South African Shelduck	*Tadorna cana*	30,0	6,9	-	-			H		x	x				x					x
Spotted Eagle-Owl	*Bubo africanus*	5,0	0,0	-	-			M		x			x	x	x	x	x	x	x	
Spur-winged Goose	*Plectropterus gambensis*	35,0	3,4	-	-		x	M		x	x				x		x			x
Three-banded Plover	*Charadrius tricollaris*	45,0	6,9	-	-			H		x	x				x					
Yellow-billed Duck	*Anas undulata*	20,0	3,4	-	-		x	M		x	x				x					x

8.6. Integrated Heritage including Archaeology, Palaeontology and the Cultural Landscape

The area proposed for the Carolus Solar PV1 Facility is located approximately 10km east of De Aar, along the N10. De Aar was originally established on the Farm "De Aar." The name means "the artery," a reference to its underground water supply. The Cape Government Railways were founded in 1872, and the route that the government chose for the line to connect the Kimberley diamond fields to Cape Town on the coast, ran directly through De Aar. Because of its central location, the government also selected the location for a junction between this first railway line, and the other Cape railway networks further east, in 1881. In 1899 two brothers who ran a trading store and hotel at the junction, Isaac, and Wulf Friedlander, purchased the farm of De Aar. Following the Anglo Boer War, the Friedlander brothers surveyed the land for the establishment of a town. The municipality was created a year later in 1900.

8.6.1. Archaeology

As part of the 2012 process for approval of the Vetlaagte Solar Energy Facility located immediately adjacent to the proposed development area, Kruger conducted a detailed Heritage Impact Assessment of the area. According to Kruger (2012), "During the survey, widespread Middle Stone Age (MSA) material, including characteristic formal MSA stone tools such as points, blades and scrapers were documented in the survey area along a north-south oriented drainage on the (western) periphery of the property. The lithic remains occur in three large scatters and, almost without exception, in low lying areas along non-perennial drainage lines and wetland areas where precipitation and groundwater have exposed the stone tools, originally deposited on a decomposed calcrete rock layer approximately 30cm sub surface. Preliminary examinations of some of the lithics indicated that a number of flakes displayed facetted platforms, characteristic of the MSA." Part of the study area for the Wag 'n Bietjie development assessed in this report is located within the drainage described above. It is therefore likely that the proposed development will impact on significant MSA archaeology. Kruger (2012) also documented historical period remains, "specifically the old Vetlaagte homestead with restored farmhouse, outbuildings, midden and labourers quarters, as well as a dilapidated dam wall constructed in the drainage line east of the farmstead are present on the property. The date of construction of the farm house is denoted by a year count ("1930") on the front gable of the structure. The entire farmstead is situated in an area excluded from the solar farm development. A small family graveyard, associated with the farmstead at Vetlaagte, also occurs in the exclusion zone about 100m north of the farm house."

In his assessment of areas adjacent to this proposed development, Orton (2012) found that "All the archaeological finds on Badenhorst Dam Farm were pre-colonial, but nevertheless, different types were present. This farm also had areas with artefacts best described as being 'background scatter'. The grass cover, however, meant that fewer such areas were identified. Most were in open, silty patches that clearly hold water in the rainy season…"

Orton (2012) found LSA artefacts associated with the ridge running through the property that he assessed, and MSA artefacts from a pan-like area. He noted that "the artefacts in the flatter areas here appeared to be of much lower density and far fewer occurrences were recorded. However, stone artefact scatters with spatial integrity were more common. These were predominantly LSA and very much focused on the rocky ridges crossing the farm." Orton (2012) noted that the spatially constrained scatters of artefacts that he identified "are almost certain to indicate places where people camped and the durable stone artefacts are now all that remains as evidence. It is also notable that their locations are not random – they are placed on level areas and saddles along the ridges.

One of these LSA scatters, DAR2011/019 (#026) included a thumbnail scraper indicative of a mid- to late Holocene age. Some of the artefacts here were very black and shiny indicating recent flaking and deposition." Orton (2012) also identified a number of piled stone structures. These appeared to be concentrated on one particular dolerite ridge and, unlike those from elsewhere in the Karoo, only one may have been a kraal. He determined that these structures are likely to be pre-colonial in age as similar piles have been recorded in an almost certain pre-colonial context in the Seacow River valley (Hart 1989). Orton (2012) also identified a number of engraved rocks that date to the LSA and historical times. All of Orton's findings (2012) are mapped in Figure 3 and 3b. While these resources fall outside of this development area, they give an indication of the likely archaeological sensitivity of the development area under consideration in this assessment. A recent field assessment on an adjacent farm conducted by CTS Heritage found that "The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage." The report goes on to note that "Two sites warranted protection with an interesting scatter of Still Bay tools on top of a dolerite outcrop with excellent views of the surrounding area. It is highly unlikely this area will be developed and it is recommended that infrastructure is not placed on this outcrop. Another site was found warranting a IIIB rating with pottery, bone and an extensive stone tool assemblage amongst the dolerite outcrops on the eastern end of the property. Again, this site has been demarcated as sensitive and the project team has been advised to avoid this area when finalising the layouts.

A minimum buffer of 100m is recommended from this site (Wag n Bietjie 014). The rest of the observations are typical of the area and are ubiquitously distributed in low densities of less than 5 artefacts per observation." Similar heritage resources are likely to be located within the area proposed for development.

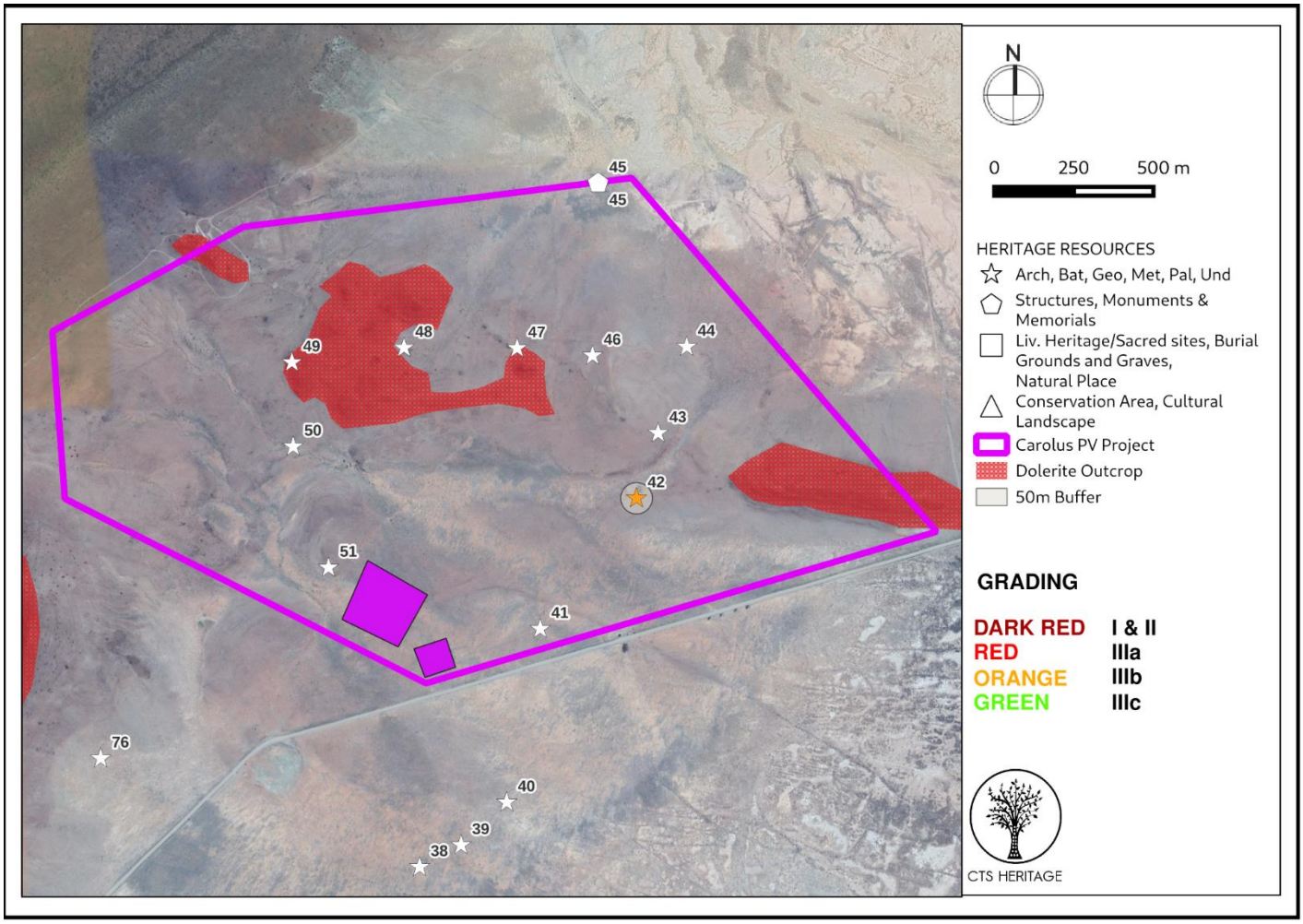


Figure 8.14: Map of archaeological heritage resources identified within the proposed development area

Table 8.10: Artefacts identified during the field assessment of the development area for the Carolus Solar PV1 Facility

POINT ID	Photograph	Period	Description	Co-ordinates		Grading	Mitigation

8.6.2. Palaeontology

According to the SAHRIS Palaeosensitivity Map, the area proposed for development is underlain by sediments of moderate, high, and very high paleontological sensitivity. The Council for GeoSciences Map 3024 for Colesburg, states that the development area is underlain by Jurassic Dolerite, the Tierberg Formation of the Ecca Group and the Adelaide Subgroup of the Beaufort Group as well as Quaternary sands associated with the drainage lines.

As part of the process completed in 2012 for the approved neighbouring Vetlaagte Solar Energy Facility, a field-based palaeontological assessment was undertaken. In this assessment it was found that the potentially fossiliferous sediments of the Late Palaeozoic Karoo Supergroup (Ecca and Lower Beaufort Groups) that underlie the study area are almost entirely mantled in a thick layer of superficial deposits of probable Pleistocene to Recent age. These include various soils, gravels and – at least in some areas - a well-developed calcrete hardpan. The upper Ecca Group bedrocks in the northern portion of the study area contain locally abundant fossil wood (of palaeontological interest for dating and palaeoenvironmental studies), as well as low diversity non-marine trace fossil assemblages typical of the Waterford Formation, rather than the Tierberg Formation as mapped. No vertebrate fossils and only scattered woody plant impressions of the Permian Glossopteris Flora were observed within the Lower Beaufort Group rocks that are very poorly exposed in the southern portion of the Vetlaagte study area. Trace fossils, silicified wood and rare vertebrate remains (therapsids, parareptiles) of the Middle Permian Pristerognathus Assemblage Zone have recently been recorded from this succession in the De Aar region (Almond 2010b). Extensive dolerite sills and dykes of the Early Jurassic Karoo Dolerite Suite intruding the Karoo Supergroup sediments are entirely unfossiliferous, as are rare intrusive kimberlite pipe rocks of Cretaceous age.

Based on the information from the survey as referred to above the construction of new access roads and transmission lines in this region are likewise considered to be of low significance as far as fossil heritage is concerned. In view of the overall low significance of the proposed development on palaeontological heritage resources, it is concluded that no further palaeontological heritage studies or specialist mitigation are required for these small PV projects, pending the exposure of any substantial fossil remains (e.g., vertebrate bones and teeth, large blocks of petrified wood) during the construction phase."

Figure 8.13: Palaeosensitivity map indicating fossil sensitivity underlying the study area, including the development area for the Carolus Solar PV1 facility.

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and some do contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils. Almond (2010) found no fossils of significance during his site visit to Vetlaagte, and the Wag 'n Bietjie farm has the same lithology. It is unknown what lies below the surface.
Based on previous surveys in the area, the presence of superficial deposits (probable Pleistocene to Recent age) covering the fossiliferous sediments (Ecca and Beaufort Groups), as well as the extensive network of intrusive dolerite dykes and sills that bake (thermally metamorphose) adjacent mudrocks, it is anticipated that the impact of the development will mainly be **LOW to MODERATE.**

Figure 8.16: Map of palaeontological heritage resources within the proposed development area

8.6.3. Cultural Landscape

In common with much of Bushmanland, the project area is a flat expanse of relatively flat terrain but with many ephemeral drainage lines visible on aerial photography. From the specialist analysis that have been done it can be suggested that vegetation cover is likely to be always very sparse with the ground surface openly visible in terms of expected heritage resources.

Bushmanland is well known for the vast expanses of gravel that occur in places and which frequently contain stone artefacts in varying densities (Beaumont, 1995). Such material is referred to as 'background scatter' and is invariably of very limited significance. development area as "characterised by flat undulating Karoo vegetation comprised of relatively sparse scrub and grasses, with dolerite hills in the surrounding landscape.

Large portions of the land are currently devoted to livestock farming but several solar energy facilities are to be constructed on farms around De Aar. Shallow soils cover a combination of calcrete, shale and dolerite substrates, and large sections in the landscape are exposed to sheet erosion, specifically along low lying areas and drainage lines. Dolerite and sandstone are present, while exotic rocks occur in the gravel of the Orange Riverbed and terraces. These provided suitable material for stone tool production during the Earlier, Middle and Later Stone Ages.

The town of De Aar only dates to 1903, just after the cessation of the 1899-1902 Anglo-Boer War, farms were given out and surveyed in the 1800s. The railway junction dates to 1881 when Cape Town and Kimberley were linked by rail after diamonds were discovered at the latter town. It was very important to the British during the Anglo-Boer War since railway lines from Cape Town and Port Elizabeth joined here and extended on through Kimberly to Mafikeng). De Aar was also the site of the first use of wireless telegraphy in South Africa where the British employed it to maintain communications between their various columns operating in the area. The town was laid out around the railway junction on the farm De Aar which was purchased in 1889 by Isaac and Wolf Friedlander, who ran a trading store and hotel at the railway junction. After the war, the brothers established the town. Two Provincial Heritage Sites occur in De Aar. These are the "Olive Schreiner house" and the "St Paul's Church". At least one other building is listed (SAHRA, n.d.). Many of the older buildings in the town are early 20th century, including some art deco, but most of the structures date to the mid- to late 20th century.

8.7 Visual Quality

The study area occurs on land that ranges in elevation from approximately 1 170m (in the south-western corner of the study area) to 1 830m (at the top of the mountains to the east). The terrain surrounding the site is predominantly flat to the east and the west, with a ridge traversing the centre of the site from the N1 national road to the south, up to the Kamberg Mountain to the north.

The proposed development site itself is located at an average elevation of 1 364m above sea level. The overall terrain morphological description of the study area is described as *undulating plains* (lowlands), with *ridges*, *hills,* and *mountains*.

The majority of the study area is sparsely populated (less than 1 person per km^2). The study area consists of a landscape that can be described as remote due to its considerable distance from any major metropolitan centres or populated areas. Settlements, where they occur, are usually rural homesteads or farm dwellings.

The photographs below aid in describing the general environment within the study area and surrounding the proposed project infrastructure.

	
Topography and vegetation of the region. *Note the hills in the background and flat landscape in the middle and foreground*	The Hydra Substation in the west of the study area.
	
Power line infrastructure along the N10 national road.	Landscape character of the study area showing undeveloped wide-open spaces interspersed with power lines.

Figure 8.14: Photographs showing the general environment within the area.

8.7.1 Potential Visual Exposure

The viewshed analysis was undertaken from a representative number of vantage points within the development footprint at an offset of 5m above ground level. This was done to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels, inverters, and BESS) associated with the facility.

- The visual exposure for the Carolus PV1 Facility would largely extend to the south-east, along the Brak River floodplain.
- Visual exposure to the north-west is shielded by the hills and ridges located adjacent to the proposed development footprint.
- Exposure to the south and north-east is similarly obstructed by higher–lying ground at these localities.
- The PV facility may be highly visible within a 1km radius of the proposed development. There are no residences (homesteads) located within this zone. Observers travelling along this road will be exposed to the project infrastructure.

- Within a 3 – 6km radius, the visual exposure is more scattered and interrupted due to the undulating nature of the topography.
- At distances exceeding 6km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer.

In general terms it is envisaged that the structures, where visible from shorter distances (e.g., less than 1km and potentially up to 3km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a visual impact. This may include residents of the farm dwellings mentioned above, as well as observers travelling along the roads in closer proximity to the facility.

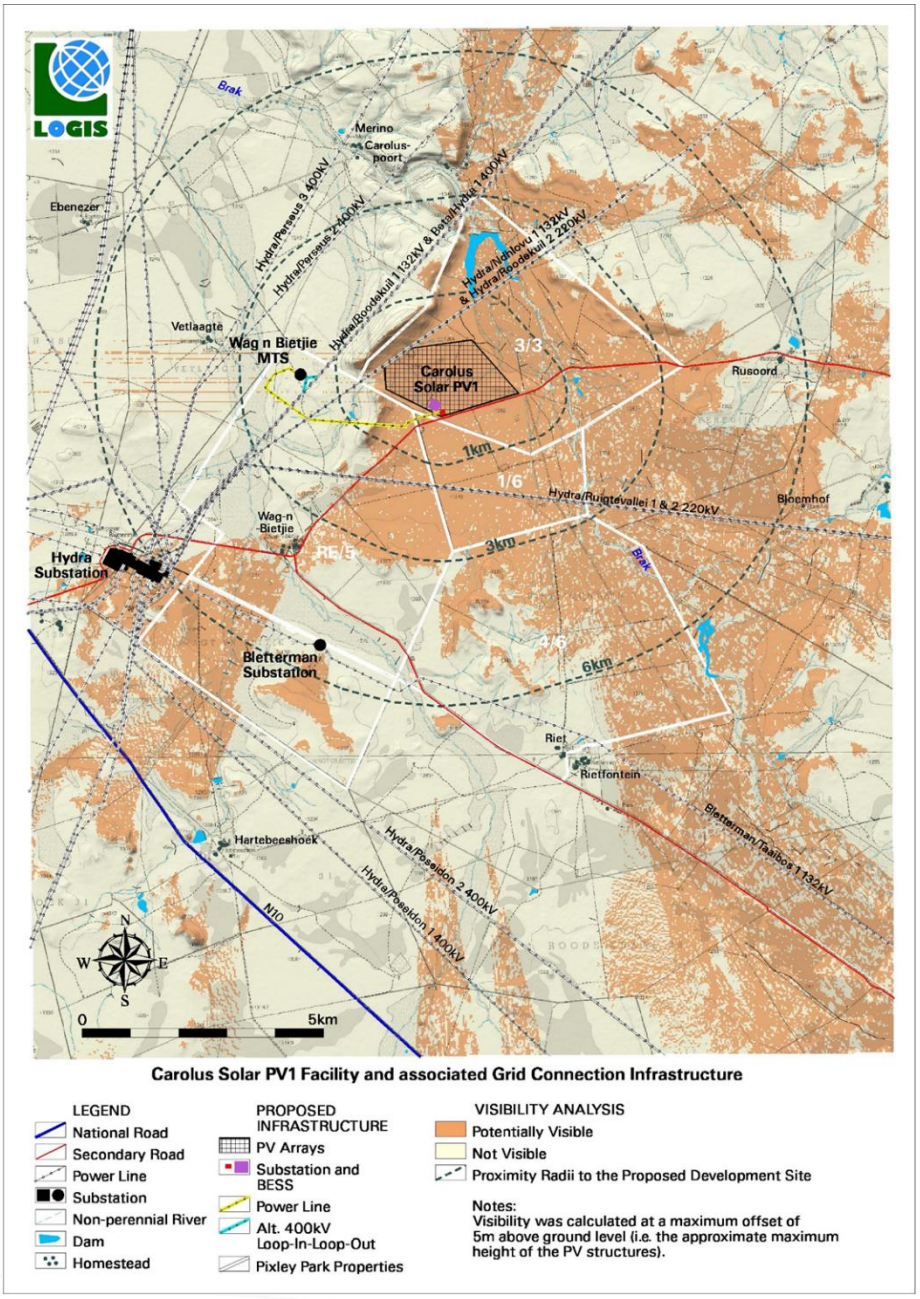


Figure 7.15: *Map indicating the preliminary visual exposure*

8.7 Traffic Conditions

It is assumed that the transformer will be manufactured locally in South Africa and be transported from the Johannesburg area to site. As the transformer will be transported with an abnormal load vehicle, the route planning needs a more detailed investigation of the feasible routes considering any limitations due to existing road features. Furthermore, a load of abnormal dimensions may cause an obstruction and danger to other traffic and therefore the transformers need to be transported as far as possible on roads that are wide enough for general traffic to pass. It is expected that the transformers can be transported to site via the same route used for normal loads.

There are several bridges and culverts along this route, which need to be confirmed for load bearing and height clearances. The road is straight and will pass through towns such as Bloemfontein and Hanover en route to the site. According to the desktop study, all turning movements along the route are manageable for the abnormal vehicle. However, there are several alternative routes which can be investigated if the above route or sections of the route should not be feasible.

The proposed main access road to the sites is an existing gravel road, known as Hydra Road, with an east-west orientation, located between the R389 in the east and the N10 in the west, as shown in green in Figure 7.16. The proposed main access road will link to individual site access roads.

The **proposed main access road to the development is deemed suitable** as it is an existing road. The existing road is surfaced between the turn-off at the N10 up to the Hydra Substation. The road crosses the railway line via an at-grade level crossing from where it continues east as a gravel road.

The application for wayleaves and permits should be made to the railway authority (Transnet) well in advance of construction commencing. Special safety measures e.g., access booms might be required to protect drivers of vehicles from oncoming railway traffic, especially in instances of poor visibility and increased traffic flow.

Should the railway authority not grant permission for the level crossing to be used during construction and operational phases, accessing the sites from the east via the R389 can be considered as an alternative access road. However, the condition of the road is unknown, and it is recommended that a site visit be conducted to determine the suitability thereof.

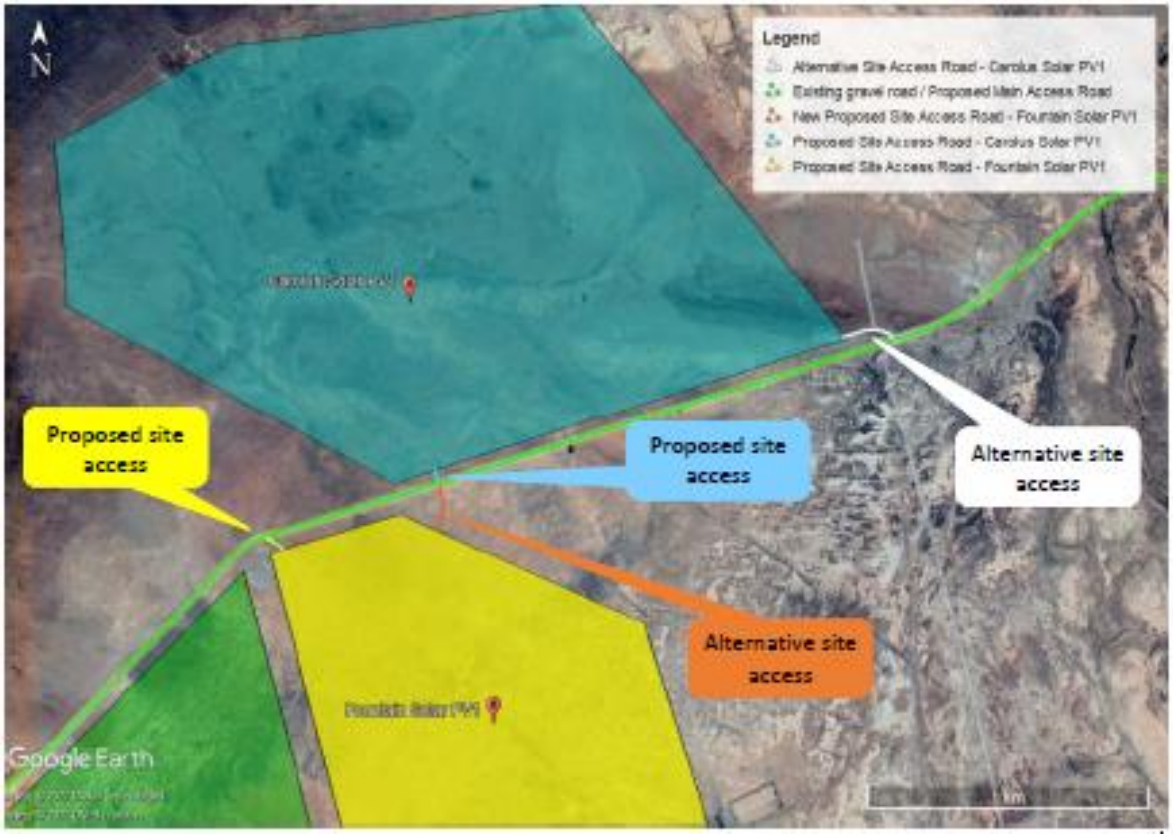


Figure 8.17: Proposed access point to the project site

8.8 Socio-Economic Broader Area

8.8.1 Profile of the Broader Area

The study area is located within the Emthanjeni Local Municipality (ELM), which falls within the Pixley ka Seme District Municipality (PKSDM) in the Northern Cape Province. De Aar is the administrative seat of the EML and PKSDM. The site is located within Ward 6 in the ELM.

Population

The population of the ELM in 2016 was 45 404. Of this total, 36.4% were under the age of 18, 57.9% were between 18 and 64, and the remaining 5.8% were 65 and older. The ELM therefore has a relatively large young population.

In terms of race groups, Coloureds made up 60.9% of the population, followed by Black Africans (32%) and Whites (6.9%). The main first language spoken in the ELM was Afrikaans (69.6%), followed by IsiXhosa (26.5%) and English (0.9%).

The population of Ward 6 in 2011 was 5 784. Of this total, 36.3% were under the age of 18, 58% were between 18 and 64, and the remaining 5.7% were 65 and older. Like the ELM, Ward 6 also had a relatively large young population. In terms of race groups, Coloureds made up 46.4% of the population, followed by Black Africans (45.2%) and Whites (7.3%). The main first language spoken in the Ward 6 was Afrikaans (56.2%), followed by IsiXhosa (32.3%) and English (2.1%).

The high percentage of young people in both the ELM and Ward 6 means that a large percentage of the population is dependent on a smaller productive sector. The dependency ratio for the ELM (2011) was 60.4%. The higher dependency ratio reflects the limited employment opportunities in the area and represent a significant risk to the district and local municipality. The high dependency ratio also highlights the importance to maximising local employment opportunities and the key role played by training and skills development programmes.

Employment

The official unemployment figure in 2011 for the ELM was 14.5%. The figures also indicate that most of the population are not economically active, namely 43.7%. These figures are like the official unemployment rate for the Northern Cape Province (14.5%) and Pixley ka Seme District (14.8%). This reflects the limited employment opportunities in the area, which in turn are reflected in the low income and high poverty levels. Given the impact of COVID-19 pandemic, the unemployment levels are likely to be higher in 2021. The figures for Ward 6 were 11.7% (unemployed) and 44% of the economically active population being employed.

Education

In terms of education levels, the percentage of the population over 20 years of age in the ELM with no schooling was 17.4% in 2011, compared to 7.9% for the Northern Cape Province and 11.9% for the district. The percentage of the population over the age of 20 with matric was 28.3%, compared to 29.1% for the province and 25.3% for the district. Only 1.5% and 1.4% of the population over the age of 20 years in the ELM had an undergraduate and postgraduate qualification, respectively. The relatively poor education levels in the ELM pose a potential challenge to the implementation of an effective training and skills development programme for local community members. The figures for Ward 6 (2011) were 16.4% with no schooling, 18.6% with matric and 1.9% and 1.3% with an undergraduate and postgraduate degree respectively

8.8.2 Profile of the Immediate Affected Area

The Pixely Park PV cluster is located approximately 10 km to the west of De Aar. The southern boundary of the site borders onto the railway line to Nouport to the south west which then links up with Port Elizabeth to the south. The N10 which links De Aar to Port Elizabeth is located ~ 3km to the south of the site. The large, Eskom Hydra substation is located immediately to the west of the site. Other towns in the area are Philipstown, 35km to the north east, Britstown, 58km to the west and Hanover, 47km to the south of the site (Figure 3.5).

De Aar, which means "the artery", was founded in 1904, and is the second most important railway junction in the country. Rail lines linking Gauteng, Cape Town, Port Elizabeth and Namibia all pass through the town. The decline of the railway sector over the last 20 years has impacted negatively on the towns economy. De Aar also has the largest abattoir in the Southern Hemisphere and supplies all the major centres throughout the entire country with the famous "Karoo" lamb and mutton. Apart from meat production, the sheep farms around De Aar are also major suppliers of wool. The town is total dependant on boreholes for its water supply. The landscape associated with the site is a typical Karoo landscape consisting of dolerite koppies and ridges separated by valley bottoms. The land uses are linked to livestock farming, specifically sheep farming.

The N10 national road traverses the study area from the N1 national road (near Hanover) to De Aar. The areas sense of place is also impacted by rail infrastructure, with De Aar representing the second most important railway junction in South Africa. Railway lines run from the north, west, south and the south east, converging in the town. These lines include both freight and passenger lines.

Other industrial infrastructure within the study area includes the Hydra (to the west of the proposed Pixley Park properties) and Bletterman Substations (Photograph 3.2). The Hydra Substation Road provides access to the Pixley Park properties from the N10 national road. There are a large number of overhead transmission lines associated the substations. These include:

- Hydra/Perseus 2 and 3 400kV.
- Beta/Hydra 1 400kV.
- Hydra/Ndhlovu 1 132kV.
- Hydra/Roodekuil 1 132kV.
- Hydra/Roodekuil 2 220kV.
- Hydra/Ruigtevallei 1 and 2 220kV.
- Bletterman/Taaibos 1 132kV.
- Hydra/Poseidon 1 and 2 400kV.

CHAPTER 9 ASSESSMENT OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the Carolus Solar PV1 facility and associated infrastructure. This assessment has considered the construction of a solar facility with a contracted capacity of up to 120MW, within a development footprint of approximately 781 ha. The development footprint includes the following infrastructure:

- Solar PV array comprising PV modules and mounting structures.
- Inverters and transformers.
- Cabling between the panels.
- 33/132kV onsite facility substation.
- Cabling from the onsite substation to the collector substation (either underground or overhead).
- Electrical and auxiliary equipment required at the collector substation that serves the solar energy facility, including switchyard/bay, control building, fences, etc.
- Battery Energy Storage System (BESS).
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Laydown areas.
- Access roads and internal distribution roads.

The full extent of the project site and development footprint (~781 ha) was considered through the Scoping/EIA phase by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desk-top evaluations and detailed field surveys. The identification of a development footprint for the solar facility within the project site was undertaken by the developer through consideration of the sensitive environmental features and areas and application of a mitigation hierarchy which aimed at avoidance as the first level of mitigation. The specialist assessments undertaken as part of this EIA process have considered the entire project site and development envelope, as well as the proposed development footprint (refer to **Figure 8.1**) which was provided by the developer.

The sections which follow provide a summary of the specialist input for each field of study in terms of the impacts which are expected to occur, the significance of the impacts, the opportunity for mitigation of the impacts to an acceptable level and the appropriate mitigation measures recommended for the reduction of the impact significance. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Therefore, these impacts are not considered separately within this chapter. This section of the report must be read together with the detailed specialist studies contained in **Appendix D** to **L**.

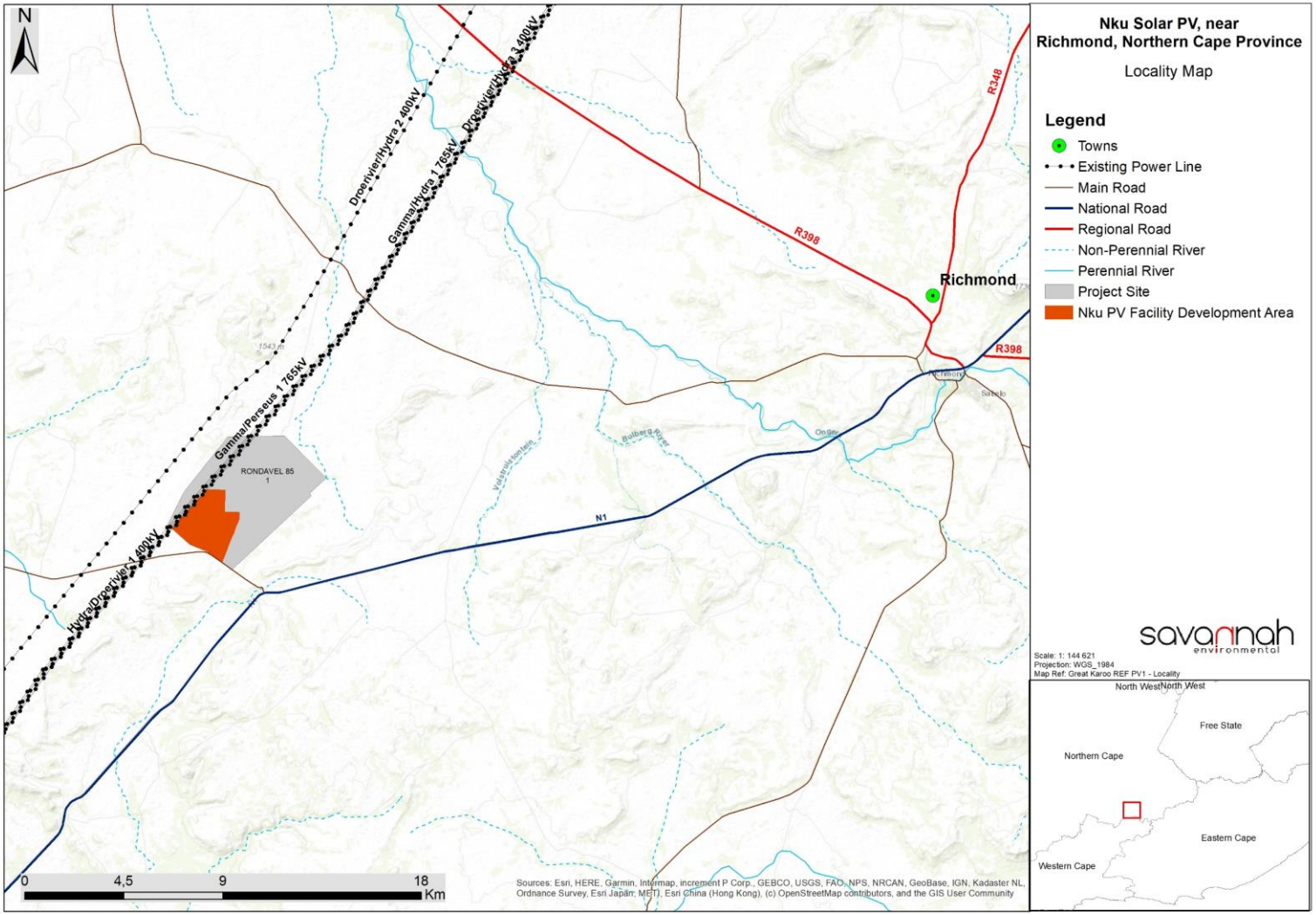


Figure 8.1: Map showing the proposed development footprint for the Carolus Solar PV1 Facility and associated infrastructure within the larger area considered as part of this EIA process (refer to **Appendix N** for A3 maps).

The development of the Carolus Solar PV1 Facility will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of access roads; a temporary laydown area and facility infrastructure; construction of foundations involving excavations, the transportation of components/construction equipment to site, manoeuvring and operating vehicles for unloading and installation of equipment; laying cabling; and commissioning of new equipment and site rehabilitation. The construction phase for the facility is estimated at 30 months.

» *Operation* – will include the operation of the solar PV energy facility and the generation of electricity, which will be fed into the national grid via the authorised on-site substation via underground cables and connect to the national electricity grid. The operation phase of the facility is expected to be approximately 25 years (with maintenance).

» *Decommissioning* – depending on the economic viability of the SEF, the length of the operation phase may be extended beyond a 25-year period. At the end of the project's life, decommissioning will include site preparation, disassembling of the components of the PV facility its associated infrastructure, clearance of the relevant infrastructure at the PV panel area, and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities; however, in certain instances decommissioning impacts have been considered separately.

9.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 3: : Scope of Assessment and Content of Environmental Impact Assessment Report:

Requirement	Relevant Section
3(h)(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.	The impacts and risk associated with the development of the Carolus Solar PV1 Facility, including the nature, significance, consequence, extent, duration and probability of the impacts and the degree to which the impact can be reversed and cause an irreplaceable loss of resources are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2 and 9.11.2.**
3(h)(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	The positive and negative impacts associated with the development of the Carolus Solar PV1 Facility are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2 and 9.11.2.**
3(h)(viii) the possible mitigation measures that could be applied and the level of residual risk.	The mitigation measures that can be applied to the impacts associated with the Carolus Solar PV1 Facility are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2 and 9.11.2.**
3(i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including (i) a description of all environmental issues and risks that were identified during the environmental impact	A description of all environmental impacts identified for the Carolus Solar PV1 Facility during the EIA process, and the extent to which the impact significance can be reduced through the implementation of the recommended mitigation measures provided by the

Requirement	Relevant Section
assessment 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,.	specialists are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2 and 9.11.2.**
3(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 avoided, managed or mitigated.	An assessment of each impact associated with the development of the Carolus Solar PV1 Facility, including the nature and significance, the extent and duration, the probability, the reversibility, and the potential loss of irreplaceable resources, as well as the degree to which the significance of the impacts can be mitigated are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2 and 9.11.2.**
3(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr.	Mitigation measures recommended by the various specialists for the reduction of the impact significance are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2 and 9.11.2.**

9.2. Quantification of Areas of Disturbance on the Site

The development footprint of the PV facility and associated infrastructure will be approximately 781ha. This area will include infrastructure such as PV modules and mounting structures, Inverters and transformers, BESS, temporary and permanent laydown area, site offices and maintenance buildings, including workshop areas for maintenance and storage and site and internal access roads. The area that will be occupied by the electrical and auxiliary equipment will be 100m x 100m. The maximum area of disturbance is approximated to be 781 ha in extent, some of which will be temporary and will be rehabilitated following construction.

It is planned that where existing access roads are able to be utilised within the development footprint, these are widened and upgraded for the solar facility, essentially reducing the extent of disturbance resulting from access road construction.

Based on the above, it can be concluded that considering the 120MW facility, ~30% of the entire extent of the project site will be transformed and disturbed for the development footprint of the Carolus Solar PV1 Facility.

9.3. Potential Impacts on Ecology (Ecology, Flora and Fauna)

The development of the Carolus Solar PV1 Facility and associated infrastructure, is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to PV arrays, roads and associated infrastructure. The following impacts are identified as the major impacts that are likely to be associated with the development and which are assessed for the Carolus Solar PV1 Facility, for the preconstruction, construction and operation phases of the development. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix D** for more details).

9.3.1 Description of Ecological Impacts

Impacts on the ecology of the project site are expected to occur during the construction, operation and decommissioning phases of the Carolus Solar PV1 Facility, as per the development footprint proposed by the developer. The following impacts are identified and assessed for the Carolus Solar PV1 Facility project:

9.3.2 Impact tables summarising the significance of impacts on ecology during construction, operation and decommissioning (with and without mitigation)

Potential impacts were evaluated against the data captured during the desktop assessment to identify relevance to the project area. The relevant impacts associated with the proposed development were then subjected to a prescribed impact assessment methodology which were provided by Savannah Environmental and is available on request.

Anthropogenic activities drive habitat destruction causing displacement of fauna and flora and possibly direct mortality. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. The removal of natural vegetation may reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

Considering the anthropogenic activities and influences within the landscape, several negative impacts to biodiversity were observed within the PAOI and the surrounding landscape.

These include:

» Livestock grazing land-use;
» Persecution and trapping;
» Roads and associated vehicle traffic and road kills;
» Railway line;
» Existing Renewable Energy Facilities in the surrounding landscape; and
» Fencelines and predator-proof fences.

While all of these impacts were not necessarily within the PAOI, they would still affect species occupancy within the landscape.

Construction Phase Impacts

Impact Nature: Loss of habitat within development footprint		
There will be a loss of natural vegetation and habitat due to construction of the solar energy facility. This impact was considered for both the construction and operational phases.		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (10)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	High	Medium
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No

Impact Nature: Loss of habitat within development footprint	
Can impacts be mitigated?	Yes, albeit to a limited extent.
Mitigation:	
• Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both fossorial and epigeic biodiversity (Bennun et al, 2021). If concrete foundations are used that would increase the impact of the project as there would be direct impacts to soil permeability and characteristics, thereby influencing inhabitant fauna. In addition, stormwater runoff and runoff from cleaning the panels would be increased, increasing erosion in the surrounding areas. • Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty et al, 2017; Sinha et al, 2018). The photographs below are sourced from these documents.   • Vegetation clearing to commence only after the necessary permits have been obtained. • Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities.	
Residual Impacts:	
The loss of indigenous vegetation is an unavoidable consequence of the development and cannot be entirely mitigated. The residual impact would be moderate.	

Impact Nature: Degradation and loss of surrounding natural habitat		
Degradation and loss of surrounding natural vegetation arising from construction activities if these are allowed to penetrate into the surrounding area.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Very short term (1)
Magnitude	Moderate (6)	None (0)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium	Low
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• All 'Very High' SEI habitats and buffer zones are to be avoided. • Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, remaining within demarcated construction areas etc. • All construction activity and roads to be within the clearly defined and demarcated areas.		

Impact Nature: Degradation and loss of surrounding natural habitat
• Temporary laydown areas should be clearly demarcated and rehabilitated subsequent to end of use. • Appropriate dust control measures to be implemented. • Suitable sanitary facilities to be provided for construction staff as per the guidelines in Health and Safety Act. • All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner.
Residual Impacts:
It is unlikely that residual impacts are expected if the appropriate mitigation measures are implemented. However, there may still be minimal degradation due to dust precipitation.

Impact Nature: Direct mortality of fauna		
Construction activity will likely lead to direct mortality of fauna due to earthworks, vehicle collisions, accidental hazardous chemical spills and persecution.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium	Low
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, vehicle collisions, poaching, and persecution can be mitigated.	
Mitigation:		
• All personnel should undergo environmental induction with regards to fauna and awareness about not harming or collecting species. • Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate. • Any fauna threatened by the construction activities should be removed safely by an appropriately qualified environmental officer or removal specialist. • All construction vehicles should adhere to a speed limit of maximum 40 km/h to avoid collisions. Appropriate speed control measures and signs must be erected. • All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner. • Any excavations should not be left open for extended periods of time as fauna may fall in and become trapped in them. Excavations should only be dug when they are required and should be used and filled shortly thereafter.		
Residual Impacts:		
It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.		

Impact Nature: Emigration of fauna due to noise pollution		
Construction activity will likely lead to the emigration of fauna due to noise pollution.		
	Without mitigation	**With mitigation**

Extent	Moderate (3)	Moderate (3)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	Medium	Medium
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, but only to a limited extent. The mitigation of noise pollution during construction is difficult to mitigate against	
Mitigation:		
» Considering that many of the mammal fauna recorded within the project area are nocturnal, no construction activity is to occur at night.		
Residual Impacts:		
It is probable that some individuals of susceptible species will emigrate due to the noise generated from the construction activity. However, this is not likely to impact the viability of the local population of any fauna species.		

Operation Phase Impacts

Impact Nature: Loss of habitat within development footprint		
There will be a loss of natural vegetation and habitat due to construction of the solar energy facility. This impact was considered for both the construction and operational phases.		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (10)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	High	Medium
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, albeit to a limited extent.	
Mitigation:		
• All 'Very High' SEI habitats and buffer zones are to be avoided. • Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity (Bennun et al, 2021). If concrete foundations are used that would increase the impact of the project as there would be direct impacts to soil permeability and characteristics, thereby influencing inhabitant fauna. In addition, stormwater runoff and runoff from cleaning the panels would be increased, increasing erosion in the surrounding areas. • Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty et al, 2017; Sinha et al, 2018). The photographs below are sourced from these documents.		

Impact Nature: Loss of habitat within development footprint
 
• Vegetation clearing to commence only after the necessary permits have been obtained. • Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities.
Residual Impacts:
The loss of indigenous vegetation is an unavoidable consequence of the development and cannot be entirely mitigated. The residual impact would be moderate.

Impact Nature: Encroachment of Invasive Alien Plants into disturbed areas		
Invasive Alien Plants (IAPs) tend to encroach into disturbed areas and can outcompete/displace indigenous vegetation.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Moderate (3)
Duration	Permanent (5)	Very short term (1)
Magnitude	High (8)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	High	Low
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• An IAP Management Plan must be written and implemented for the development. The developer must contract a specialist to develop the plan and the developer is responsible for its implementation. • Regular monitoring for IAP encroachment during the operation phase to ensure that no alien invasion problems have developed as result of the disturbance. This should be every 3 months during the first two years of the operation phase and every six months for the life of the project. • All IAP species must be removed/controlled using the appropriate techniques as indicated in the IAP management plan.		
Residual Impacts:		
Based on the lack of IAPs within the development area and the implementation of an IAP Management Plan there are unlikely to be residual impacts		

Impact Nature: Soil erosion and continued habitat degradation		
Disturbance created during the construction phase will leave the development area vulnerable to erosion		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Moderate (3)
Duration	Permanent (5)	Very short term (1)

Impact Nature: Soil erosion and continued habitat degradation		
Magnitude	High (8)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	High	Low
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• A Rehabilitation Plan must be written for the development area and ensured that it be adhered to. • Access roads should have run-off control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • All erosion observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and re-vegetation of any remaining denuded areas with local indigenous perennial shrubs and succulents from the area.		
Residual Impacts:		
There is still the potential for erosion but would have a low impact.		

Impact Nature: Impacts to fauna movement patterns due to reflection effects		
The reflection caused by solar panels may affect the movement patterns of fauna within the landscape		
	Without Mitigation	**With Mitigation**
Extent	High (4)	High (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Mlinor (2)
Probability	Probable (3)	Probable (3)
Significance	Medium	Low
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
» Non-polarising white tape can be used around and/or across panels to minimise reflection (Bennun *et al*, 2021). The reflection caused by the panels attracts numerous insects as the panels are perceived as water bodies. This will negatively impact surrounding ecosystems due to the loss of biota and will result in an influx of fauna attempting to feed on the insects.		
Residual Impacts	There is still the potential for reflection impacts but would have a low impact.	

Impact Nature: Disturbance or persecution of fauna		
The operation and maintenance of the Solar Energy Facility may lead to disturbance or persecution of fauna in the vicinity of the development.		
	Without Mitigation	**With Mitigation**
Extent	Low (2)	Low (2)

Impact Nature: Disturbance or persecution of fauna		
Duration	Long term (4)	Very short term (1)
Magnitude	High (8)	Minor (2)
Probability	Probable (3)	Very improbable (1)
Significance	**Medium**	**Low**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• All staff are to be educated on the importance of local fauna and must be made aware that no poaching or persecution is allowed. • Any fauna threatened by the maintenance and operational activities should be removed to a safe location by an appropriate individual. • All vehicles accessing the site should adhere to a max 40 km/h max to avoid collisions. Appropriate signs must be erected. • If any excavations are to be dug these must not be left open for more than a few hours without ramps for trapped fauna to leave and must be filled at night.		
Residual Impacts:		
Disturbance from maintenance activities will occur albeit at a low and infrequent level.		

Decommissioning Phase Impacts

Impact Nature: Direct mortality of fauna		
Decommissioning activity will likely lead to direct mortality of fauna due to earthworks, vehicle collisions and persecution.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium	Low
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, vehicle collisions, poaching, and persecution can be mitigated.	
Mitigation:		
• All personnel should undergo environmental induction with regards to fauna and awareness about not harming or collecting species. • Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate. • Any fauna threatened by the construction activities should be removed safely by an appropriately qualified environmental officer or removal specialist. • All construction vehicles should adhere to a speed limit of maximum 40 km/h to avoid collisions. Appropriate speed control measures and signs must be erected.		

Impact Nature: Direct mortality of fauna
• All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner. • Any excavations should not be left open for extended periods of time as fauna may fall in and become trapped in them. Excavations should only be dug when they are required and should be used and filled shortly thereafter.
Residual Impacts:
It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.

Impact Nature: Continued habitat degradation		
Disturbance created during decommissioning will leave the development area vulnerable to erosion and alien plant invasion for several years.		
	Without Mitigation	**With Mitigation**
Extent	Moderate (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (3)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Medium	Low
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	
Mitigation:		
• Rehabilitation in accordance with the Rehabilitation Plan for the development must be undertaken in areas disturbed during the decommissioning phase. • Monitoring of the rehabilitated area must be undertaken at quarterly intervals for 3 years after the decommissioning phase. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous flora.		
Residual Impacts:		
No significant residual risks are expected, although IAP encroachment and erosion might still occur but would have a negligible impact if effectively managed.		

9.3.3 Overall Result

9.4. Potential Impacts on Aquatic Ecology

The development of the Carolus Solar PV1 Facility is likely to result in a variety of impacts from an aquatic perspective Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix G** for more details).

9.4.1 Description of Impacts on Aquatic Ecology

Construction could result in the encroachment into watercourses and result in the loss or degradation of these systems, most of which are functional and provide ecological services. Watercourses are also likely to be traversed by roads and other linear infrastructure which might create a barrier to flow and biotic movement across the systems. These disturbances could also result in the infestation and establishment of alien vegetation would affect the functioning of the systems. During construction earthworks will expose and mobilise earth materials which could result in sedimentation of the receiving systems. A number of machines, vehicles and equipment will be required for the phase, aided by chemicals and concrete mixes for the project. Leaks, spillages or breakages from any of these could result in contamination of the receiving water resources. Contaminated water resources are likely to have an effect on the associated biota.

The following potential impacts were considered:

» Construction Phase:
  * Watercourse disturbances/loss: Direct disturbance / degradation / loss to soils or vegetation due to the construction of the facility and associated infrastructure.
  * Water runoff from construction site: Increased erosion and sedimentation; and
  * Contamination of receiving water resources; and

It is anticipated to increase stormwater runoff due to the hardened surfaces and the crossings will result in an increase in run-off volume and velocities, resulted in altered flow regimes. The changes could result in physical changes to the receiving systems caused by erosion, run-off and also sedimentation, and the functional changes could result in changes to the vegetative structure of the systems. The reporting of surface run-off to the systems could also result in the contamination of the systems, transporting (in addition to sediment) diesel, hydrocarbons and soil from the operational areas.

The following potential impacts were considered:

» Operational Phase:
  * Hardened surfaces: Potential for increased stormwater runoff, leading to increased erosion and sedimentation.
  * Contamination: Potential for increased contaminants entering the watercourses.

9.4.2 Impact tables summarising the significance of impacts on aquatic ecology during construction, operation and decommissioning (with and without mitigation)

Nature: Watercourse disturbance / loss Direct disturbance / degradation / loss to soils or vegetation due to the construction of the facility and associated infrastructure, such as crossings		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local(1)
Duration	Moderate-term (3)	Moderate-term (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- Avoid direct impacts to water resources and an associated buffer width (as recommended). This avoidance is not required from watercourse crossings (i.e. roads, pipelines, cables etc), but the number and size of the crossings must be kept to a minimum. Only essential services and equipment are permitted within the crossings and associated buffer during the construction phase.
- Prioritise construction of the crossings during the dry season period.
- Clearly demarcate the construction footprint and restrict all construction activities to within the proposed infrastructure area.
- When clearing vegetation, allow for some vegetation cover as opposed to bare areas.
- Minimize the disturbance footprint and unnecessary clearing of vegetation outside of this area.
- Use the shapefiles to signpost the edge of the watercourses closest to site. Place the sign 25 m from the edge (this is the buffer zone). Label these areas as environmentally sensitive areas, keep out.
- Educate staff and relevant contractors on the location and importance of the identified watercourses through toolbox talks and by including them in site inductions and the overall master plan.
- All activities (including driving) must adhere to the respective buffer areas.
- Promptly remove / control all AIPs that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed.
- All alien vegetation along the transmission servitude should be managed in terms of the Regulation GNR.1048 of 25 May 1984 (as amended) issued in terms of the CARA and IAP regulations.
- Landscape and re-vegetate all denuded areas as soon as possible.
- Implement a suitable stormwater management plan for the facility. Priority must be the return of clean water to the resources, avoiding scouring or erosion at any discharge locations.

Residual Impacts:

Notable disturbances are expected for the construction phase. However with correctly placed mounted infrastructure the hydrology of the system will recover to some extent during the operational phase. The residual is expected to be low

Nature: *Water runoff from construction site*

Increased erosion and sedimentation & contamination of resources

	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Moderate-term (3)	Moderate-term (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- The contractors used for the construction should have spill kits available prior to construction to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly.
- All construction activities must be restricted to the development footprint area. This includes laydown and storage areas, ablutions, offices etc.
  During construction activities, all rubble generated must be kept in a skip (or similar) and the removed from the site to a licensed facility.
- Construction vehicles and machinery must make use of existing access routes as much as possible.
- All chemicals and toxicants to be used for the construction must be stored in a bunded area;

- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site at designed areas.
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";.
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation).
- All removed soil and material stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.
- No dumping of material on site may take place.
- Implement a suitable stormwater management plan for the facility. Ensure the separation of clean and dirty water.
- All waste generated on site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.
- No activities are permitted within the watercourses and associated buffer areas unless these are for crossings.
- Landscape and re-vegetate all unnecessarily denuded areas as soon as possible

Residual Impacts:
Long term broad scale erosion and sedimentation, and contamination of watercourses. The residual impact is expected to be low.

Operation Phase Impacts

Nature: *Hardened surfaces*
Potential for increased stormwater runoff leading to increased erosion and sedimentation

	Without mitigation	**With mitigation**
Extent	Moderate(3)	Very low (1)
Duration	Moderate-term (3)	Moderate-term (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium ()**	**Low ()**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	

Mitigation:
- Design and implement an effective stormwater management plan.
- Promote water infiltration into the landscape.
- Release only clean water into the environment.
- Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site, each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in).
- Re-vegetate denuded areas as soon as possible.
- Regularly clear drains.
- Minimise the extent of concreted / paved / gravel areas.
- A covering of soil and grass (regularly cut and maintained) around infrastructure is ideal for infiltration. If not feasible, then gravel is preferable over concrete or paving.

Residual Impacts:
Long-term broad scale erosion and sedimentation.

Nature: *Contamination.* Potential for increased contaminants entering the systems		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Very low(1)
Duration	Moderate-term (3)	Moderate-term (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium ()**	**Low ()**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- Design and implement an effective stormwater management plan.
- Release only clean water into the environment.
- The contractors used should have spill kits available to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly.
- All chemicals and toxicants to be used for the construction must be stored in a bunded area.
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site at designed areas.
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation).
- All waste generated on site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

Residual Impacts:
Watercourse deterioration over time.

While no specific impacts have been identified for the decommissioning phase, it is considered that the impacts expected for the construction phase, and the mitigation measures recommended will also be relevant to the decommissioning phase.

9.4.3 Overall Result

The main expected impacts of the proposed Carolus Solar PV1 Facility will be the loss of habitat and emigration of fauna. Based on the outcomes of the SEI determination, there are areas within the PAOI that possess a 'Very High' SEI. This denotes that avoidance mitigation is the only appropriate option for these areas and no destructive development activities should be considered.
There are areas within the PAOI that possess a 'High' SEI. This denotes that avoidance mitigation wherever possible must be implemented. This includes changes to project infrastructure design to limit the amount of habitat impacted. Moreover, the avoidance and minimisation mitigation measures are the most important with respect to the mitigation hierarchy.

In order to evaluate the extent of 'avoidance' achieved for the project, the following is noteworthy:

- The total extent of the entire project area is 8 200 ha;
- The footprint of the Carolus Solar PV1 is 781 ha, thus in isolation approximately 9.5% of the total project area will be developed; and

» The footprint areas for the four proposed solar facilities amounts to 2 103 ha, thus approximately 26% of the total project area will be developed.

Taking into consideration the extent of 'avoidance' achieved for the project, it is the opinion of the specialist that the authorisation of the proposed project may be favourably considered, under condition that all mitigation and impact management actions provided within this report are implemented. It is recommended that should any future developments be proposed for the remaining extent of any 'Very High' or 'High' SEI areas within the associated properties, that offset strategies be required for these authorisations.

9.5. Potential Impacts on Avifauna

The development of the Carolus Solar PV1 Facility is likely to result in a variety of impacts from an avifaunal perspective. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** for more details).

9.5.1 Description of Avifaunal Impacts

The Project Site is located approximately 10km east of De Aar within the Emthanjeni Local Municipality the Pixley ka Seme District Municipality, Northern Cape Province. The four Development Areas within the Project Site will be known as Carolus Solar PV1, Fountain Solar PV1, Riet Fountain Solar PV1 and Carolus Solar PV1 respectively. The four development areas will all connect to the new Vetlaagte Main Transmission Substation (MTS) or the new Wag 'n Bietjie MTS.

The SABAP2 data indicates that a total of 162 species could potentially occur within the broader area where the project is located (see Appendix 1). Of these, 76 are classified as priority species for solar developments. Of the 76 priority species, 45 have a medium to high probability of occurring regularly in the Project Site, and 21 of the priority species were recorded during the field monitoring. Five Red Data species were recorded during the site surveys, namely Cape Vulture (Globally and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered), Secretarybird (Globally Endangered, Regionally Vulnerable), and Tawny Eagle (Globally Vulnerable, Regionally Endangered).

The Project Site falls within the Platberg-Karoo Conservancy Important Bird Area (Marnewick *et al.* 2015). The Platberg–Karoo Conservancy IBA covers the entire districts of De Aar, Philipstown and Hanover, including suburban towns. The landscape consists of extensive flat to gently undulating plains that are broken by dolerite hills and flat-topped inselbergs. The ephemeral Brak River flows in an arc from south-east to north-west, eventually feeding into the Orange River basin. Other ephemeral rivers include the Hondeblaf, Seekoei, Elandsfontein and Ongers rivers with a network of tributaries. Vanderkloof Dam is on the north-eastern boundary (Marnewick *et al.* 2015). This IBA is in the Nama Karoo and Grassland Biomes. The eastern Nama Karoo has the highest rainfall of all the Nama Karoo vegetation types and is thus ecotonal to grassland, with a complex mix of grass- and shrub-dominated vegetation types (Marnewick *et al.* 2015).

The land is used primarily for livestock grazing and agriculture. Commercial livestock farming is mostly extensive wool and mutton production, with some cattle and game farming. Less than 5% of this IBA is cultivated under dry-land or irrigated conditions and includes lucerne and prickly pear *Opuntia ficus-indica* orchards (Marnewick *et al.* 2015).

This IBA contributes significantly to the conservation of large terrestrial birds and raptors. These include Blue Crane *Anthropoides paradiseus*, Ludwig's Bustard *Neotis ludwigii*, Kori Bustard *Ardeotis kori*, Blue Korhaan *Eupodotis caerulescens*, Black Stork *Ciconia nigra*, Secretarybird *Sagittarius serpentarius*, Martial Eagle *Polemaetus bellicosus*, Verreauxs' Eagle *Aquila verreauxii* and Tawny Eagle *Aquila rapax*.

A total of 289 bird species are known to occur in the IBA. IBA trigger species that could potentially occur in the Project Site are the following:

» Blue Crane (Globally Vulnerable, Regionally Near-threatened)
» Blue Korhaan (Globally Near-threatened)
» Martial Eagle (Globally and regionally Endangered)
» Verreaux's Eagle (Regionally Vulnerable)
» Ludwig's Bustard (Globally and Regionally Endangered)
» Secretarybird (Globally Endangered, Regionally Vulnerable)

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants is a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-western United States. In South Africa, only two published scientific studies been conducted on the environmental impacts of PV plants in a South African context (Rudman *et al.*, 2017; Visser *et al.*, 2019). A related scientific study has also been conducted upon the effects of concentrated solar power facilities on wildlife in South Africa (Jeal *et al.*, 2019).

In summary, the main impacts of PV plants on avifauna which have emerged so far include the following:

» Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
» Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
» Collisions with the solar panels
» Entrapment in perimeter fences

9.5.2 Impact tables summarising the significance of impacts on avifauna during construction, operation and decommissioning (with and without mitigation)

Construction Phase Impact

Nature: Displacement of priority species due to disturbance associated with construction of the Pixley Park PV plants and associated infrastructure.		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	1 very short	1 very short
Magnitude	8 high	6 moderate
Probability	5 definite	5 definite
Significance	**55 MEDIUM**	**45 MEDIUM**
Status (positive or negative)	Negative	Negative

Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, but to a limited extent	

Mitigation:

- Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of solar priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.
- A 750m all infrastructure exclusion zone must be implemented around the Jackal Buzzard nest Caroluspoort at 30°39'54.80"S 24° 9'37.22"E and Jackal Buzzard nest Wag ten Bittje at 30°41'50.20"S 24° 7'47.94"E

Residual Risks:

The residual risk of displacement will be reduced but remain at a medium level after mitigation, if the proposed mitigation is implemented.

Nature: During construction: Displacement of priority species due to habitat transformation associated with construction of the Pixley Park PV plants and associated infrastructure.

	Without mitigation	**With mitigation**
Extent	1 site only	1 site only
Duration	4 long term	4 long term
Magnitude	8 high	6 moderate
Probability	5 definite	4 improbable
Significance	**65 HIGH**	**44 MEDIUM**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To a limited extent	

Mitigation:

- A 200m solar panel free buffer zone must be implemented around dams, wetlands, and drainage lines.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the biodiversity and vegetation specialists must be strictly implemented.

Residual Risks:

The residual risk of displacement will be reduced after mitigation but will remain for some species due to the change in habitat.

Operation Phase Impacts

Nature: Mortality of priority species due to collisions with solar panels.

	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	4 low	4 low
Probability	2 probable	2 probable
Significance	**20 LOW**	**20 LOW**

Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No mitigation required	
Mitigation:		
» Due to the expected low significance of this impact, no mitigation measures are recommended.		
Residual Risks:		
Not applicable		

Nature: Entrapment of large-bodied birds in the double perimeter fence lines of the Pixley Park PV plants.		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	6 moderate	4 low
Probability	3 possible	2 improbable
Significance	**36 MEDIUM**	**20 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation:		
» It is recommended that a single perimeter fence is used » Increasing the spacing between at least the top two wires (to a minimum of 30cm) and ensuring they are correctly tensioned will reduce the snaring risk for owls		
Residual Risks:		
The residual risk of electrocution will be low once mitigation is implemented.		

Nature: Mortality of priority species due to electrocution on the medium voltage internal reticulation networks		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	8 high	4 low
Probability	3 possible	1 very improbable
Significance	**42 MEDIUM**	**10 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation:		
» Use underground cables as much as possible. » A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.		
Residual Risks:		
The residual risk of electrocution will be low once mitigation is implemented.		

Nature: Mortality of priority species due to collisions with the medium voltage internal reticulation networks

	Without mitigation	With mitigation
Extent	2 local	2 local
Duration	4 long term	4 long term
Magnitude	6 medium	4 low
Probability	3 possible	2 improbable
Significance	**36 MEDIUM**	**20 LOW**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Use underground cables as much as possible. » All internal medium voltage lines must be marked with Eskom approved Bird Flight Diverters according to the latest official Eskom Engineering Instruction.		
Residual Risks: The residual risk of collision will still be present for Ludwig's Bustard, but significantly reduced for other species.		

Decommissioning phase

The impacts of the decommissioning phase are similar to those of the construction phase, with the exception of a reduced impact of habitat destruction.

Nature: Displacement of priority species due to disturbance associated with decommissioning of the Pixley Park PV plants and associated infrastructure.		
	Without mitigation	**With mitigation**
Extent	2 local	2 local
Duration	1 very short	1 very short
Magnitude	8 high	6 moderate
Probability	5 definite	5 definite
Significance	**55 MEDIUM**	**45 MEDIUM**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, but to a limited extent	
Mitigation: • Activity should be restricted to the footprint of the infrastructure as far as possible. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. • Access to the rest of the property must be restricted. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.		
Residual Risks: The residual risk of displacement will be reduced but remain at a medium level after mitigation, if the proposed mitigation is implemented.		

9.5.4 Overall Result

Climate sensitivity is an important piece of information to incorporate into conservation planning and adaptive management strategies. The persistence of many birds will depend on their ability to colonize climatically suitable areas outside of current ranges and management actions that target climate change adaptation.

South Africa is among the world's top 10 developing countries required to significantly reduce their carbon emissions (Seymore et al. 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi et al. 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

Based on the impact assessment conducted for the Carolus Solar PV1 Facility (including cumulative impacts) it is the avifaunal specialist's informed opinion that the The proposed Pixley Park Renewable Energy Project will have a range of potential pre-mitigation impacts on priority avifauna ranging from low to high, which is expected to be reduced to medium and low with the appropriate mitigation. No fatal flaws were discovered during the investigations. The proposed Carolus Solar PV1 Facility is therefore acceptable and can be approved from an avifaunal perspective.

9.6. Assessment of Impacts on Land Use, Soil and Agricultural Potential

Potential soil and agricultural impacts and the relative significance of the impacts associated with the development of the Carolus Solar PV1 Facility are summarised below (refer to **Appendix H**).

9.6.1. Description of Agricultural Impacts

The impact assessment considered the calculated sensitivities associated with the soil resources expected to be impacted upon by the relevant components. This impact assessment purely focused on the impacts expected towards natural resources (in specific, the soil and associated land capability). Impacts related to the loss of land capability associated with the construction and operational activities have been identified.

9.6.2. Impact tables summarising the significance of impacts on bats during the construction, operation and decommissioning phases (with and without mitigation)

Construction Phase Impacts

Operation Phase Impacts

Decommissioning Phase Impacts
No significant impacts are identified for the decommissioning phase.

9.6.3. Overall Result

9.7. Assessment of Impacts on Heritage Resources

The site possesses a number of landscape elements contributing to a composite cultural landscape including topographical features, open plains, water features, historic scenic routes and farmsteads.

There are limited impacts anticipated to heritage resources from this proposed development and as such, the principle of a renewable energy facility in this location is supported from a heritage perspective provided that the infrastructure is located in areas able to tolerate the impact of the high degree of change from a cultural landscape perspective.

Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix I**).

9.7.1. Description of the Heritage Impacts

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage. As indicated above, the results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and the majority of these are therefore not archaeologically significant. Furthermore, it is noted that pre-colonial occupation tended to be concentrated around the natural shelters created by dolerite outcrops in this area and as such, we highly recommend that careful consideration is made to placing the solar PV infrastructure away from these outcrops.

The main impacts expected to occur on the heritage resources associated with the development of the Carolus Solar PV1 Facility will be during the construction phase.

<u>Heritage resources</u>
Over 79 archaeological observations were made during the survey of the broader area and only 17 observations were made within the area proposed for the Carolus PV development. Hornfels dominated the assemblages with smaller numbers of flakes struck from siltstones. It is very likely that the main dolerite outcrop at Riet Fountain 6 surrounded by this development footprint will contain more sites with a wider range of imported stone such as CCS observed during surveys of the adjacent Vetlaagte PV and the Castle WEF. While the vast majority of the scatters were made during the Middle Stone Age, there was also a relatively clear Later Stone Age presence in the study area.

Many examples of blade forms were found which are typical of the Still Bay period (>70 000 years BP). Relatively dense Later Stone Age sites were found on the far eastern end of Wag 'n Bietjie and these date within the last 2000 years due to the presence of pottery in these sites. Five archaeological sites across the survey area are significant enough to require buffer zones around them to avoid negative impacts from solar PV panels, roads and other related infrastructure. Three of these are rock art sites with engravings on dolerite

boulders that were graded with local medium significance (IIIB) and two LSA sites were identified with relatively dense scatters of stone tools.

None of these archaeologically significant observations are located within the Carolus PV development area. These observations do not warrant further study as they are typical of the area and are ubiquitously distributed in low densities of less than 5 artefacts per observation. Much of the archaeological material will be well conserved within a series of areas that can't be developed for the solar PV arrays while the flat, grassy vlaktes that are ideal for the solar PV farms are also the areas with the lowest archaeological sensitivity.

Palaeontology

Cultural Landscape

According to the Cultural Landscape Assessment (Sarah Winter, 2021). The site forms part of an intact cultural landscape representatives of the Central Plateau of the Great Karoo possessing heritage value for historical, aesthetic, architectural, social and scientific reasons. The site possesses a number of landscape elements contributing to a composite cultural landscape including topographical features, open plains, water features, historic scenic routes and farmsteads. The PV facility can be accommodated within an acceptable level of impact provided that high visibility sloped inclines are avoided.

9.7.2. Impact tables summarising the significance of impacts on heritage during construction, operation and decommissioning (with and without mitigation)

9.7.3. Overall Result

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage. As indicated above, the results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and the majority of these are therefore not archaeologically significant. Furthermore, it is noted that pre-colonial occupation tended to be concentrated around the natural shelters created by dolerite outcrops in this area and as such, we highly recommend that careful consideration is made to placing the solar PV infrastructure away from these outcrops.

Based on experience, other reports and the lack of any significant previously recorded fossils from the area, it is unlikely that any fossils would be preserved in the Tierberg Formation or Adelaide Subgroup. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr.

9.8. Assessment of Visual Impacts

Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of the Carolus Solar PV1 Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix j**).

9.8.1. Description of Visual Impacts

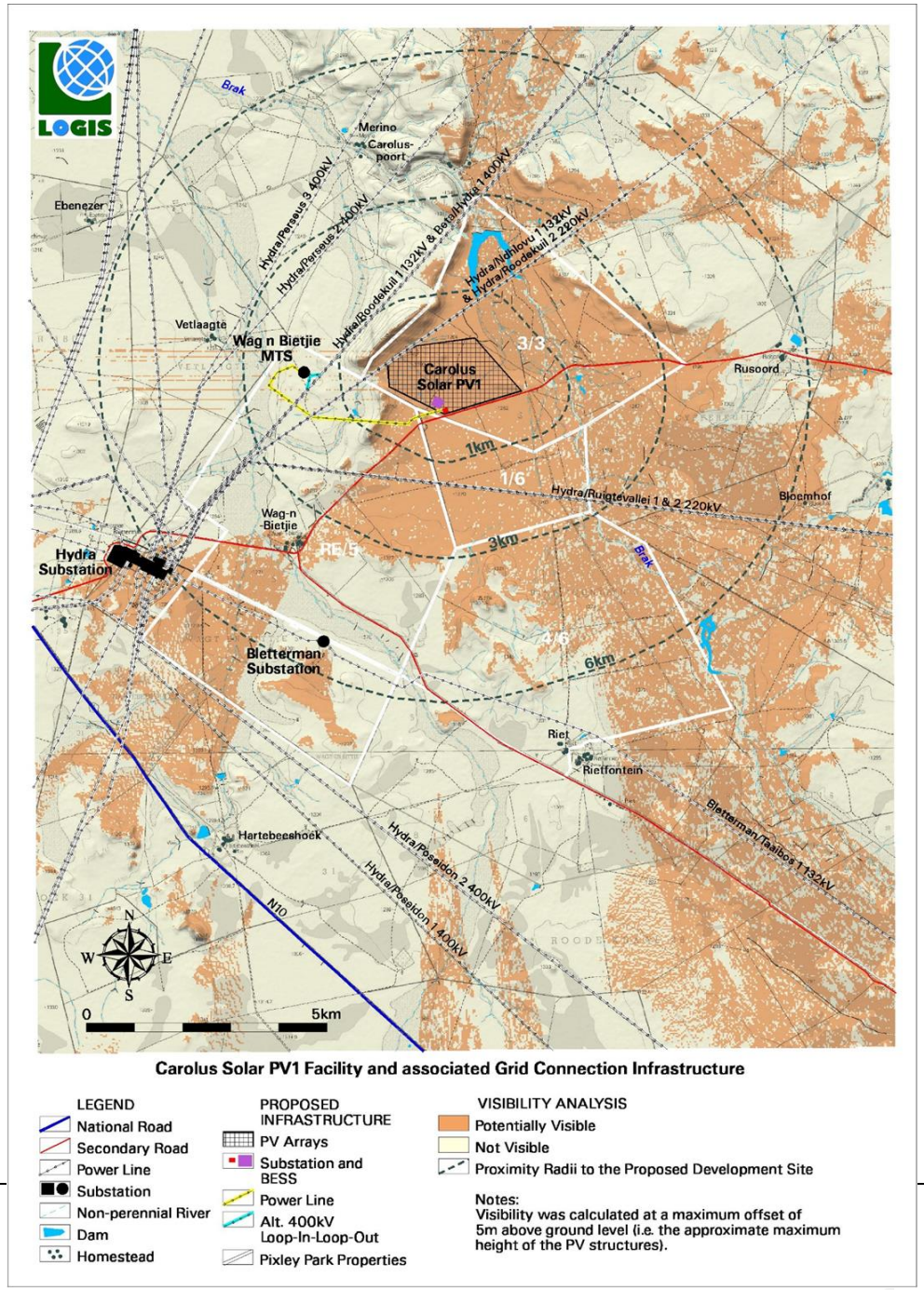
The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed PV facility are displayed on Figure 8.2. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged to calculate the visual impact index.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures (if applicable)
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential magnitude of the visual impact.

The index indicates that potentially sensitive visual receptors within a 1km radius of the PV facility may experience a very high visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; high within a 1–3km radius (where/if sensitive receptors are present) and moderate within a 3–6km radius (where/if sensitive receptors are present). Receptors beyond 6km are expected to have a low potential visual impact



Carolus Solar PV1 Facility and associated Grid Connection Infrastructure

LEGEND
- National Road
- Secondary Road
- Power Line
- Substation
- Non-perennial River
- Dam
- Homestead

PROPOSED INFRASTRUCTURE
- PV Arrays
- Substation and BESS
- Power Line
- Alt. 400kV Loop-In-Loop-Out
- Pixley Park Properties

VISIBILITY ANALYSIS
- Potentially Visible
- Not Visible
- Proximity Radii to the Proposed Development Site

Notes:
Visibility was calculated at a maximum offset of 5m above ground level (i.e. the approximate maximum height of the PV structures).

Figure 8.1: Visual impact index and potentially affected sensitive visual receptors

Magnitude of the potential visual impact

0 – 1km

The majority of the exposed areas in this zone fall within vacant open space, generally devoid of observers or potential sensitive visual receptors. A section of the secondary road (receptor site 1 on **Map 6**) may experience visual impacts of **very high** magnitude.

1 – 3km

The majority of the exposed areas in this zone fall within vacant farmland or natural open space, generally devoid of observers or potential sensitive visual receptors. This zone contains no homesteads, just sections of the abovementioned secondary road where observers may experience visual impacts of **high** magnitude.

3 – 6km

There are two (2) potential sensitive receptor site within this zone, namely the Wag-n-Bietjie homestead (site 2) and Bloemhof (site 3). The magnitude of the visual impact is expected to be **moderate**, however it should be noted that the Wag-n-Bietjie homestead falls within the proposed Carolus Solar PV1 site which forms park of Pixley Park.

9.8.2. Impact table summarising the significance of visual impacts during construction and operation (with and without mitigation)

Construction Phase Impacts

Nature of Impact: Visual impact of construction activities on users of the secondary road in close proximity to the proposed PV facility.		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Very High **(10)**	Moderate **(6)**
Probability	Definite **(5)**	Highly Probable **(4)**
Significance	High **(80)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint.

Construction:

- Ensure that vegetation cover adjacent to the development footprint (if present) is not unnecessarily removed during the construction phase, where possible.
- Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).

» Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. » Rehabilitate all disturbed areas (if present/if required) immediately after the completion of construction works.
Residual impacts: None, provided rehabilitation works are carried out as specified.

Operation Phase Impacts

Nature of Impact: Visual impact on observers travelling along the secondary road within a 1km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(72)**	Moderate **(42)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation / Management: <u>Planning:</u> » Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint, where possible. » Consult adjacent landowners (if present) in order to inform them of the development and to identify any (valid) visual impact concerns. » Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover. <u>Operations:</u> » Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

Nature of Impact: Visual impact on observers travelling along the secondary road within a 1 – 3km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(45)**	Low **(26)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, however best practice measures are recommended.	

Mitigation / Management:

Planning:

- Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint.

Operations:

- Maintain the general appearance of the facility as a whole.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact:

Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed PV facility.

	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very High **(10)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(54)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning & operation:

- Shield the sources of light by physical barriers (walls, vegetation, or the structure itself).
- Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights.
- Make use of minimum lumen or wattage in fixtures.
- Make use of down-lighters, or shielded 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.

Residual impacts:

The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact:

The visual impact of solar glint and glare as a visual distraction and possible road travel hazard

	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	N.A.
Duration	Long term **(4)**	N.A.
Magnitude	Low **(4)**	N.A.
Probability	Improbable **(2)**	N.A.
Significance	Low **(24)**	N.A.
Status (positive or negative)	Negative	N.A.
Reversibility	Reversible **(1)**	N.A.
Irreplaceable loss of resources?	No	N.A.
Can impacts be mitigated?	N.A.	

Mitigation:

N.A.

Residual impacts:
N.A.

Nature of Impact: The visual impact of solar glint and glare on residents of homesteads in closer proximity to the PV facility		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(24)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning & operation: » Use anti-reflective panels and dull polishing on structures, where possible and industry standard. » Adjust tilt angles of the panels if glint and glare issues become evident, where possible. » If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

Nature of Impact: Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(24)**	Low **(24)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: » Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint/power line servitude where possible. Operations: » Maintain the general appearance of the infrastructure. Decommissioning: » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Medium to longer distance **(2)**	Medium to longer distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: » Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint/servitude, where possible. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

9.8.3. Overall Result

The findings of the Visual Impact Assessment undertaken for the proposed 120MW PV facility is that the visual environment surrounding the site, especially within a 1km radius (and potentially up to a radius of 3km) of the proposed facility, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years).

This impact is applicable to the individual Carolus PV1 facility and to the potential cumulative visual impact of the facility in relation to the proposed Pixley Park where the combined frequency of visual impact is expected be greater. The potential area of cumulative visual exposure is however still deemed to be within acceptable limits, considering the PV facilities' relatively close proximity to each other, the generally remote location of the infrastructure, and the limited number of observers within the region.

The following is a summary of impacts remaining, assuming mitigation as recommended, is exercised:

- During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users in the area. Construction activities may potentially result in a **high**, temporary visual impact, that may be mitigated to **moderate**.
- The PV facility is expected to have a **high** visual impact pre-mitigation and a **moderate** visual impact post mitigation on observers travelling along the secondary road. There are no affected residences within a 1km radius of the proposed PV facility.

- The operational PV facility could have a **moderate** visual impact on observers travelling along the secondary road within a 1 – 3km radius of the PV facility structures. This impact may be mitigated to **low**.
- The anticipated impact of lighting at the PV facility is likely to be of **moderate** significance, and may be mitigated to **low**.
- The potential visual impact related to solar glint and glare as a road travel hazard is expected to be of **low** significance.
- There are no affected residences within a 1km radius of the proposed PV facility. The potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads) is therefore expected to be of **low** significance, both before and after mitigation.
- The anticipated visual impact resulting from the construction of on-site ancillary infrastructure is likely to be of **low** significance both before and after mitigation.
- The anticipated visual impact of the proposed PV facility on the regional visual quality (i.e. beyond 6km of the proposed infrastructure), and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance.
- The cumulative visual impact is expected to be of **moderate** significance due to their remote locations and the general absence of potential sensitive visual receptors.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **moderate** to **low** significance. Anticipated visual impacts on sensitive visual receptors (if and where present) in close proximity to the proposed facility are not considered to be fatal flaws for the proposed PV facility.
(**Appendix J**).

9.9. Assessment of Socio-economic Impacts

Potential social and socio-economic impacts and the relative significance of the impacts associated with the development of the Carolus Solar PV Facility are summarised below (refer to **Appendix K**).

9.9.1 Description of Socio-economic Impacts

Impacts are expected to occur with the development of the Carolus Solar PV1 Facility during the construction, operation and decommissioning phases. Both positive and negative impacts are identified and assessed.

Positive impacts during construction includes:
- Creation of employment and business opportunities, and opportunity for skills development and on-site training.

Negative impacts during construction includes:
- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of jobseekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.
- Nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles.
- Impact on productive farmland.

Positive impacts during operation includes:
» The establishment of infrastructure to improve energy security and support renewable sector.
» Creation of employment opportunities.
» Benefits to the affected landowners.
» Benefits associated with the socio-economic contributions to community development.

Negative impacts during operation includes:
» Visual impacts and associated impacts on sense of place.
» Impact on property values.
» Impact on tourism.

9.9.2 Impact tables summarising the significance of socio-economic impacts during construction, operation and decommissioning (with and without mitigation measures)

Construction Phase Impacts

Nature: Creation of employment and business opportunities during the construction phase		
	Without Mitigation	**With Enhancement**
Extent	Local – Regional (3)	Local – Regional (4)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	High (8)
Probability	Highly probable (4)	Highly probable (4)
Significance	Medium (44)	Medium (56)
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	
Enhancement: See below		
Residual impacts: Improved pool of skills and experience in the local area.		

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short term for community as a whole (2)	Short term for community as a whole (2)
Magnitude	Moderate for the community as a whole (6)	Low for community as a whole (4)
Probability	Probable (3)	Probable (3)

Significance	Medium for the community as a whole (30)	Low for the community as a whole (21)
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: See below		
Residual impacts: Impacts on family and community relations that may, in some cases, persist for a long period of time. Also, in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.		

Nature: Potential impacts on family structures, social networks and community services associated with the influx of job seekers		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Low (24)
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: See below		
Residual impacts: See cumulative impacts.		

Nature: Potential risk to safety of scholars, farmers and farm workers, livestock and damage to farm infrastructure associated with the presence of construction workers on site		
	Without Mitigation	**With Mitigation**
Extent	Local (3)	Local (2)

Duration	Short term (2)	Short term (2)
Magnitude	Medium (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (33)	Low (24)
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses and damage to farm infrastructure etc.	Yes, compensation paid for stock losses and damage to farm infrastructure etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: See below		
Residual impacts: No, provided losses are compensated for.		

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
	Without Mitigation	**With Mitigation**
Extent	Local (4)	Local (2)
Duration	Short term (2)	short term (2)
Magnitude	Moderate due to reliance on agriculture for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Low (24)
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and crop losses etc.	Yes, compensation paid for stock and crop losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: See below		
Residual impacts: No, provided losses are compensated for.		

Nature: Potential noise, dust and safety impacts associated with construction activities and movement of traffic to and from the site		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short Term (2)	Short Term (2)

Magnitude	Medium (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Medium (30)	Low (15)
Status	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: See below		
Residual impacts: If damage to local farm roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were not responsible for the damage.		

Nature: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the SEF will damage farmlands and result in a loss of farmlands for grazing.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated (5)	Short term if damaged areas are rehabilitated (2)
Magnitude	Medium (6)	Minor (2)
Probability	Probable (3)	Highly Probable (4)
Significance	Medium (36)	Low (20)
Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated
Can impact be mitigated?	Yes, however, loss of farmland cannot be avoided	
Mitigation: See below		
Residual impacts: Overall loss of farmland could affect the livelihoods of the affected farmers, their families, and the workers on the farms and their families. However, disturbed areas can be rehabilitated.		

Operation Phase Impacts

Nature: Development of infrastructure to generate clean, renewable energy		
	Without Mitigation	**With Mitigation**

Extent	Local, Regional and National (4)	Local, Regional and National (5)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Highly Probable (4)	Definite (5)
Significance	High (64)	High (85)
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	Reduced CO_2 emissions and impact on climate change
Can impact be mitigated?	Yes	
Enhancement: See below		
Residual impacts: Overall reduction in CO_2 emission, reduction in water consumption for energy generation, contribution to establishing an economically viable commercial renewables generation sector in the Northern Cape and South Africa.		

Nature: Creation of employment and business opportunities associated with the operational phase		
	Without Mitigation	**With Enhancement**
Extent	Local and Regional (1)	Local and Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Definite (5)
Significance	Low (27)	Medium (50)
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impact be enhanced?	Yes	
Enhancement: See below		
Residual impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area		

Nature: The generation of additional income represents a significant benefit for the local affected farmer(s) and reduces the risks to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as feed etc.		
	Without Mitigation	**With Enhancement**
Extent	Local (1)	Local (3)

Duration	Long term (4)	Long term (4)
Intensity	Low (4)	Moderate (6)
Likelihood	Probable (3)	Definite (5)
Significance	Low (27)	Medium (53)
Status	Positive	Positive
Reversibility	Yes	Yes
Can impact be enhanced?	Yes	
Enhancement: See below		
Residual impacts: Support for local agricultural sector and farming		

Nature: Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development		
	Without Mitigation	**With Enhancement[18]**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Intensity	Low (4)	Moderate (6)
Likelihood	Probable (3)	Definite (5)
Significance	Medium (30)	High (65)
Status	Positive	Positive
Reversibility	Yes	Yes
Can impact be enhanced?	Yes	
Enhancement: See below		
Residual impacts: Promotion of social and economic development and improvement in the overall well-being of the community		

Nature: Visual impact associated with the proposed solar facility and the potential impact on the area's rural sense of place and adjacent land uses.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	Medium (33)	Medium (33)
Status	Negative	Negative

[18] Enhancement assumes effective management of the community trust

Reversibility	Yes, solar facility can be removed.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: See below		
Residual impacts: Support for local agricultural sector and farming		

Nature: Potential impact of the SEF on property values		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (21)
Status	Negative	Negative
Reversibility	Yes, solar facility can be removed.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Enhancement: See below		
Residual impacts: Potential impact on current rural sense of place and associated property values.		

Nature: Potential impact of the SEF on local tourism operations and visitors. The impact will be linked to the potential visual impacts and the perception of people visiting the area.		
	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Medium (30)	Low (24)
Status	Negative	Negative
Reversibility	Yes, solar facility can be removed.	
Irreplaceable loss of resources?	No	No

Can impact be mitigated?	Yes
Enhancement: See below	
Residual impacts: Potential impact on current rural sense of place.	

Decommissioning Phase Impacts

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20 - 25 years post commissioning. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning.

Given the relatively small number of people employed during the operational phase (~ 20), the social impacts at a community level associated with decommissioning will be limited. In addition, potential impacts associated with the decommissioning phase can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative).

Nature: Social impacts associated with retrenchment including loss of jobs, and source of income		
	Without Mitigation	**With Mitigation**
Extent	Local and regional (2)	Local and regional (1)
Duration	Medium Term (2)	Very Short Term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (40)	Low (24)
Status	Negative	Negative
Reversibility	Yes, assumes retrenchment packages are paid to all affected employees	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: See below		
Residual impacts: Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses. However, decommissioning can also create short term, temporary employment opportunities associated with dismantling etc.		

9.9.3 Overall Result

The findings of the SIA indicate that the development of the proposed 120 MW Carolus PV SEF and associated infrastructure will create employment and business opportunities for locals in the ELM during both the construction and operational phase of the project. All of the potential negative impacts, with the exception of the impact on sense of place, can also be effectively mitigated.

The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the report should be implemented in order to maximise the potential benefits. The significance of this impact is rated as **High Positive**. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives. The establishment of the proposed 120 MW Carolus PV SEF and associated infrastructure including a BESS is therefore supported by the findings of the SIA.

Recommendations
The enhancement and mitigation measures outlined in the SIA and other key specialist reports should be implemented.

9.10. Assessment of Impacts on Traffic

Potential impacts on the traffic components of the affected area and the relative significance of the impacts associated with the development of the Carolus Solar PV1 Facility are summarised below (refer to **Appendix L**).

9.10.1 Description of Traffic Impacts

The potential transport related impacts are described below.

- Construction Phase
  - Construction related traffic
  - The construction traffic would also lead to noise and dust pollution.
- Operational Phase
  - During operation, it is expected that staff and security will visit the facility. Approximately twenty (20) full-time employees will be stationed on site. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- Decommissioning Phase
  - This phase will result in the same impact as the Construction Phase as similar trips are expected.

9.10.2 Impact tables summarising the significance of impacts on traffic during the construction and operation phases (with and without mitigation)

Construction Phase Impacts

Nature: Traffic congestion due to an increase in traffic caused by the transportation of equipment, material and staff to site.

The number of heavy vehicles per 7MW installation is estimated to range between 200 and 300 trips depending on the site conditions and requirements. For the 120MW, the total trips can therefore be estimated to be between 2 857 and 4 286 heavy vehicle trips, which will generally be made over a 12-month construction period.

Choosing the worst-case scenario of 4 286 heavy vehicles over a 12-month period travelling on an average of 22 working days per month, the resulting daily number of vehicle trips is 17.

Considering that the number of vehicle trips during peak hour traffic in a rural environment can roughly be estimated at around 20-40% of the average daily traffic, the resulting vehicle trips for the construction phase are approximately 4 - 7 trips.

If the panels are imported instead of manufactured within South Africa, the respective shipping company will be able to indicate how the panels can be packed (for example using 2MW packages and 40ft containers). These can then be stored at the port and repacked onto flatbed trucks.

It is assumed that during the peak of the construction period, 200 employees will be active on site.

It is difficult to accurately estimate the construction traffic for the transportation of materials as it depends on the type of vehicles, tempo of the construction, source/location of construction material etc. However, it is assumed that at the peak of construction, approximately 150 construction vehicle trips will access the site per day.

The impact on the surrounding road network and the general traffic is therefore deemed nominal as the 203 trips will be distributed across a 9-hour working day. The majority of the trips will occur outside the peak hours.

The significance of the transport impact without mitigation measures during the construction phase can be rated as medium. However, considering that this is temporary and short term in nature, the impact can be mitigated to an acceptable level.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (1)
Magnitude	Moderate (6)	Low (2)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Completely reversible	Completely reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» 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.
Residual Impacts:
Traffic will return to normal levels after construction is completed

Nature: Air quality will be affected by dust pollution

The impact will occur due to the increase in construction traffic associated with the transport of equipment, material and staff to site during the construction phase

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (1)
Magnitude	Moderate (5)	Low (2)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Completely reversible	Completely reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Dust suppression of gravel roads during the construction phase, as required.
» Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.

Residual Impacts:

Traffic will return to normal levels after construction is completed.
Dust pollution during the construction phase cannot be completely mitigated but mitigation measures will significantly reduce the impact. Dust pollution is limited to the construction period.

Nature: Noise pollution due to traffic in the construction phase

The impact will occur due to the increase in construction traffic associated with the transport of equipment, material and staff to site during the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (1)
Magnitude	Moderate (5)	Low (2)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Completely reversible	Completely reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Stagger component delivery to the site.
» Reduce the construction period.
» The use of mobile batching plants and quarries in close proximity to the project site.
» Staff and general trips should occur outside of peak traffic periods.

Residual Impacts:

Traffic will return to normal levels after construction is completed.
Noise pollution during the construction phase cannot be completely mitigated but mitigation measures will significantly reduce the impact. Noise pollution is limited to the construction period.

9.10.3 Overall Result

This report for the EIA stage addressed key issues and alternatives to be considered for the proposed Pixley Park Solar Cluster:

- The preferred Port of Entry for imported components is the Port of Ngqura.
- The proposed access road located off the N10 is deemed a suitable access road as it is an existing gravel road i.e. less expensive to upgrade and/or maintain. However, the Client should note that application for wayleaves and permits should be made to the railway authority (Transnet) well in advance of construction commencing, with specific reference to the railway crossing at the Hydra Substation. The rail authority (Transnet) might also withhold approval.
- The current condition and suitability of the main access road from the R389 should be determined as an alternative route should wayleave approval not be granted by the rail authority.
- It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage.
- The construction phase traffic, although significant, will be temporary and can be mitigated to an acceptable level.
- During operation, it is expected that staff and security will periodically visit each of the facilities. It is assumed that approximately 30 full-time employees will be stationed on each of the four sites. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- The construction and decommissioning phases of the development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e. the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network and impacts are considered to have low significance.

The potential mitigation measures mentioned in the construction phase are:

- Dust suppression
- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.
- A “dry run” of the preferred route.
- Design and maintenance of internal roads.
- If required, any low hanging overhead lines (lower than 5.1m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.
- The potential mitigation measures mentioned in the operational phase are:
- Staff and general (maintenance) trips should occur outside of peak traffic periods as far as possible.
- The provision of water storage tanks and/or boreholes.
- Water bowsers trips should occur outside of peak traffic periods as far as possible.
- Spread the cleaning of the panels over a week.
- Using a larger water bowser.

The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is

short term i.e., the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

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 Pixley Solar PV Cluster are acceptable with the implementation of the recommended mitigation measures and can therefore be authorised.

9.11. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the Carolus Solar PV1 Facility. Should this alternative be selected, there would be no environmental impacts on the site or to the surrounding local area due to the construction and operation activities of a PV facility. All baseline information provided in this report relates to the current situation on site and in the surrounding area, and can be considered the no-go alternative. Impacts are limited to the status quo. All negative impacts, specifically related to the development of the PV facility, discussed in this report will not materialise. In addition, positive impacts identified to be associated with the project will be foregone. These are described below.

a) Land use and agriculture

The land capability of the project site indicates that the entire site is considered to be of low sensitivity. Based on the land capability and the land use suitability in terms of agriculture this includes grazing, veld and plantation. The proposed development footprint of the Carolus Solar PV1 Facility would allow the on-going current grazing and farming activities to continue on areas of the affected properties that will not house solar PV infrastructure.

Therefore the current land-use will be retained, while also generating renewable energy from the solar irradiation. It is detailed in the SEIA (**Appendix K**), that the generation of additional income represents a significant benefit for the local affected farmer(s) and reduces the risks to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as feed.

The implementation of the 'do-nothing' alternative would leave the land-use restricted to the current livestock grazing and limitations experienced in terms of land capability, losing out on the above-mentioned opportunities. Therefore, from a land-use perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of a viable and compatible land use. Use of the identified site for the development of the proposed solar energy facility is considered to be a preferred land use as the benefits will outweigh the impacts.

b) Socio-economic impact

Social: The impacts of pursuing the no-go alternative are both positive and negative as follows:

» The benefits would be that there is no disruption from an influx of jobseekers into the area, nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.

» There would also be an opportunity lost in terms of job creation, skills development and associated economic business opportunities for the local economy, as well as a loss of the opportunity to generate energy from a renewable resource without creating detrimental effects on the environment.

Foregoing the proposed development would not necessarily compromise the development of renewable energy facilities in South Africa. However, the socio-economic benefits for local communities at this location and within the surrounding area would be forfeited. The area has experienced social challenges which has resulted in the need for socio-economic upliftment.

Therefore, from a socio-economic perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of socio-economic benefits, when considering the current socio-economic conditions of the area.

New Business: Some of the positive spin off effects that are to ensue from the project expenditure will be localised in the communities located near the site, such as the towns of Richmond and Victoria West. The local services sector and specifically the trade, transportation, catering and accommodation, renting services, personal services and business services are expected to benefit the most from the project activities during the construction phase. New business sales that will be stimulated as a result of the establishment of the solar facility, albeit for a temporary period, will be lost with the implementation of the 'do nothing' alternative. Therefore from a business perspective, the 'do-nothing' alternative is not preferred as there is a loss of new business opportunities.

Employment: The development of the Carolus Solar PV1 Facility within the Ubuntu Local Municipality will aid in a reduction of the unemployment rate, however if the solar facility is not developed then the unemployment rate will not be positively influenced by the proposed development. The upliftment and socio-economic benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative. Therefore, from an employment perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of employment opportunities.

Skills development: The establishment of the Carolus Solar PV1 Facility will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Various renewable energy facilities are proposed to be developed in the area and in the Northern Cape Province, which means that the transfer of skills from foreign experts to the local engineers and construction workers will take place, similar to what has taken place where other renewable energy facilities have been constructed and operated within the Province. The skills training and transfer benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative.

Municipal goals: The opportunity to contribute to the innovative energy sourcing methods as identified by the Ubuntu Local Municipality as per a draft policy which sets out the criteria which will enable the evaluation of renewable energy generation infrastructure to be developed in a manner that will limit the potential negative impacts thereof will not be met should the Carolus Solar PV1 Facility not be constructed with the implementation of the 'do nothing' alternative.

The no-go alternative will therefore result in the above economic benefits not being realised and a subsequent loss of income and opportunities to local people. From this perspective the no-go alternative is not preferred.

c) Regional scale impact

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the Carolus Solar PV1 Facility is only proposed to contribute a contracted capacity of up to 120MW to the grid capacity, this would assist in meeting the electricity demand for the relevant private off-takers and would also assist in meeting the government's goal for renewable energy and the energy mix. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

- Increased energy security;
- Resource saving (i.e. fossil fuels and water);
- Exploitation of South Africa's significant renewable energy resource;
- Pollution reduction;
- Climate friendly development;
- Support for international agreements;
- Employment creation;
- Acceptability to society; and
- Support to a new industry sector.

At present, South Africa is some way off from fully exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation, with the country's significant renewable energy potential largely untapped to date.

The Integrated Resource Plan (IRP) (2019) provides for the development of 6 000MW of capacity from large scale solar energy facilities by 2030. The IRP essentially drives the assortment of energy to be implemented for South Africa which is known as the energy mix of the country, considering various generation technologies.

9.11.1 Conclusion

The no-go is the continuation of the existing land use, i.e. maintain the status quo. As detailed in the sections above, there would be no environmental impacts on the site or to the surrounding local area due to the construction and operation activities of a solar facility with the implementation of this alternative. All negative impacts, specifically related to the development of the solar facility, discussed in this report will not materialise.

The 'do-nothing' alternative will do little to influence the renewable energy targets set by government. However, as the project site experiences ample solar resource and optimal grid connection opportunities are available, not developing the Carolus Solar PV1 Facility would see such an opportunity being lost. In addition, the Northern Cape Province will not benefit from additional generated power being evacuated directly into the Province's grid. Therefore, from a regional perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of benefits for the regional area.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with the Carolus Solar PV1 Facility. All impacts associated with the project can be mitigated to acceptable levels. If the solar facility is not developed the following positive impacts will not be realised:

- Job creation from the construction and operation phases.
- Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
- Meeting of energy generation mix in a most economic and rapid manner.
- Provision of clean, renewable energy in an area where it is optimally available.

As detailed above, the 'do-nothing' alternative will result in a number of lost opportunities. The 'do nothing' alternative is therefore not preferred and not proposed to be implemented for the development of the Carolus Solar PV1 Facility.

CHAPTER 10 ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 9, a solar PV development may have effects (positive and negative) on natural resources, the social environment and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the Carolus Solar PV1 Facility largely in isolation (from other similar developments).

This chapter assesses the potential for the impacts associated with the project to become more significant when considered in combination with the other operating or proposed renewable energy projects within the area.

10.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a EIA Assessment Report

This chapter of the BA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of EIA assessment reports:

Requirement	Relevant Section
3(j)(i) an assessment of each identified potentially significant impact and risk, including cumulative impacts.	The cumulative impacts associated with the development of the Carolus Solar PV1 Facility are included and assessed within this chapter.

10.2 Approach taken to Assess Cumulative Impacts

The cumulative impacts that have the potential to be compounded through the development of the solar PV facility and its associated infrastructure in proximity to other similar developments include impacts such as those listed below. The role of the cumulative assessment is to confirm if such impacts are relevant to the Carolus Solar PV1 Facility within the project site being considered for the development. This assessment considers whether the cumulative impact will result in:

- Unacceptable loss of threatened or protected vegetation types or species through clearing, resulting in an impact on the conservation status of such flora or ecological functioning;
- Unacceptable loss to sensitive aquatic features;
- Unacceptable risk to avifauna through habitat loss, avoidance and displacement;
- Unacceptable risk to bats through loss of habitat or infringement on roosting or breeding areas;
- Unacceptable loss of high agricultural potential areas presenting a risk to food security and increased soil erosion;
- Complete or whole-scale change in sense of place and character of an area and unacceptable visual intrusion;
- Unacceptable loss of heritage resources;
- Unacceptable negative socio-economic impact; and
- Unacceptable impact to the traffic network.

Further to the above, positive cumulative impacts are also expected and will be associated with socio-economic aspects and benefits.

Figure 10.1 indicates the location of the Carolus Solar PV1 Facility in relation to all other operating and proposed renewable energy facilities located within the surrounding area of the project site. These projects were identified using the DFFE Renewable Energy Database and current knowledge of projects operating and being proposed in the area. For the assessment of cumulative impacts, developments within 30km radius from the Carolus Solar PV1 Facility were considered. (**Figure 10.2**). This is in line with the DFFE's requirements.

In the case of the Sun Garden PV Facility, there are several solar farms located within a 30km radius of the project site and one other solar facility. These are listed in Table 10.1 and illustrated in **Figure 10.1**. At the time of writing this EIA report some facilities were still in process of obtaining Environmental Authorisation and other facilities already operational. The potential for cumulative impacts is summarised in the sections which follow and have been considered within the specialist studies (refer to **Appendices D – L**).

Table 10.1: Renewable energy developments located within the broader area (within a 30km radius) of the Carolus Solar PV1 Facility project site

Project Name	Project Status
Longyuan Mulilo Wind Energy Facility Maanhaarberg	(Operational)
Inca Solar PV Energy Project	(Approved)
Renosterberg Solar PV Facility	(Approved)
Castle Wind Energy Facility	(In Process)
Proposed PV facility on farm Blaauwkratz	(In Process)
Proposed PV facility on farm Caroluspoort	(In Process)
Proposed PV facility on farm Jakhalsfontein	(In Process)
Proposed PV facility on farm Loskop	(Approved)
Renosterberg Solar PV Facility	(Approved)
Ilanga Lethemba Solar PV Energy Facility	(Approved)
Mulilo Renewable Energy Wind Energy Facility	(Approved)
Photovoltaic Solar Energy Facility on Paarde Valley Farm	(Approved)
Solar PV Plant on farm Paarde	(Approved)
Scatec Solar PV Energy Facility	(Operational)

It should be noted that not all the renewable energy developments presently under consideration by various renewable energy developers will be built for operation. Not all proposed developments will be granted the relevant permits by the relevant authorities (DFFE, DMRE, NERSA and Eskom) and this is because of the following reasons:

- There may be limitations to the capacity of the existing or future Eskom grid;
- Not all applications will receive a positive environmental authorisation;
- There are stringent requirements to be met by applicants in terms of the REIPPP Programme and a highly competitive process that only selects the best projects;
- Not all proposed projects will be viable because of lower renewable resources on some sites;
- Not all proposed projects will be able to reduce the associated negative impacts to acceptable levels or be able to mitigate the impacts to acceptable levels (fatally flawed);
- Not all proposed facilities will eventually be granted a generation license by NERSA and sign a Power Purchase Agreement with Eskom; and

» Not all developers will be successful in securing financial support to advance their projects further.

As there is uncertainty whether all the above-mentioned projects will be implemented, it is also difficult to quantitatively assess the potential cumulative impacts. The cumulative impacts of other known facilities in the broader area and the Carolus Solar PV1 Facility are therefore qualitatively assessed in this Chapter.

It is important to explore the potential for cumulative impacts on a quantitative basis as this will lead to a better understanding of these impacts and the potential for mitigation that may be required. The scale at which the cumulative impacts are assessed is important. For example, the significance of the cumulative impact on the regional or national economy will be influenced by renewable energy developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by renewable energy developments that are in closer proximity to each other, e.g., up to 30km to 50km apart. For practical purposes a sub-regional scale of 30km has been selected for this cumulative impact evaluation.

In the sections below a summary of the potential for a cumulative impact resulting from several renewable energy developments within a 30km radius of the Carolus Solar PV1 Facility are explored (refer also to the specialist reports contained in **Appendix D** to **L**). Impacts are assessed accordingly in terms of the proposed project in isolation and the impact considering other projects within the area or the cumulative impact with and without mitigation, as was deemed relevant by the specialist. The approach taken by the various specialists in assessing cumulative impacts is informed by the scale at which the impact is likely to occur.

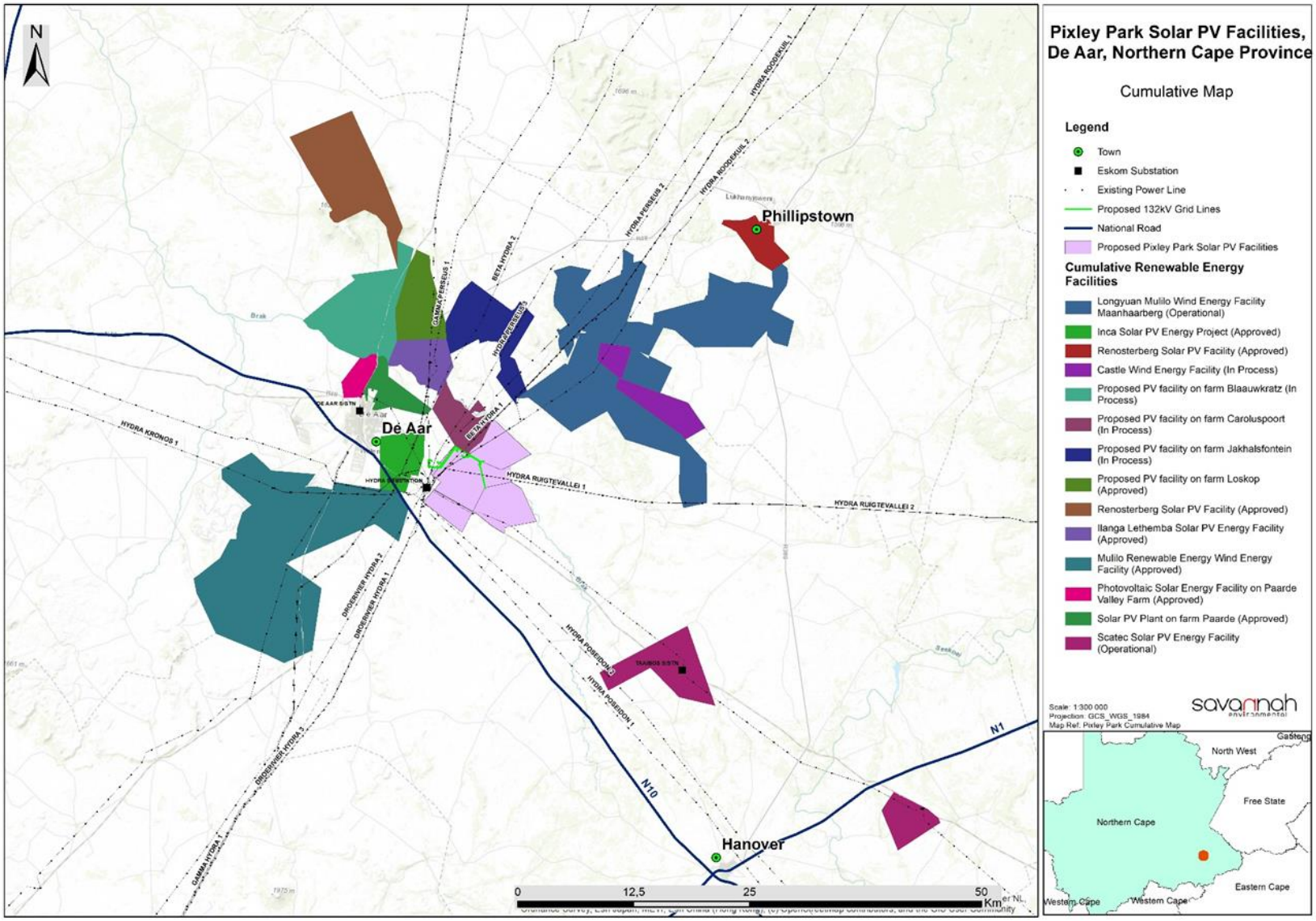


Figure 10.1: Renewable energy projects located within the surrounding area of the Carolus Solar PV1 Facility project site that are considered as part of the cumulative impact assessment

10.3 Cumulative Impacts on Ecological Processes

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system.

This section describes the cumulative potential impacts of the project on biodiversity. Cumulative impacts are assessed in context of the extent of the proposed development area, other developments in the area, as well as general habitat loss and transformation resulting from other activities in the area.

Presently, the surrounding immediate and broader landscape consists of natural vegetation used for supporting livestock and to a lesser extent game. The Phase 1 and Phase 2 REDZs spatial files and the South African Renewable Energy EIA Application Database (DFFEb, 2021) was overlaid onto the Northern Upper Karoo remnants layer. The remnants layer was released as part of the NBA (Skowno *et al*, 2019) and provides the present spatial extent of vegetation. The South African Renewable Energy EIA Application Database contains spatial data for renewable energy applications for environmental authorisation. It includes spatial and attribute information for both active (in process and with valid authorisations) and non-active (lapsed or replaced by amendments) applications. Data is captured and managed on a parcels level as well as aggregated to the project level at the boundary level.

Considering the limited extent of approved and in process developments within the Northern Upper Karoo and its 'Not Protected' EPL (**Error! Reference source not found.**), the expected cumulative impact is expected to be of a 'Medium' significance.

Impact Nature: Cumulative habitat loss within the region		
The development of the proposed Carolus Solar PV1 Facility will contribute to cumulative habitat loss within the Northern Upper Karoo and Ecological Support Areas		
	Overall impact of the proposed development considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Very low (1)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium	Medium
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	Yes, in certain cases
Can impacts be mitigated	Yes, to some degree. However, should the entirety of the REDZ areas be developed, the cumulative impacts on the receiving environment will be regarded as 'High'.	
Mitigation: Ensure that a rehabilitation plan and IAP management plan be compiled for each development and are effectively implemented. Set-aside areas (Avoidance areas) should be established in order to conserve natural habitats where possible.		

10.4 Cumulative Impacts on Aquatic Ecology

Desktop information associated with the proposed Carolus Solar PV1 development indicates that the indirectly affected downstream Brak River system and directly associated ephemeral tributaries within the project area have sensitivity to modification. These systems serve as ESA's, CBAs and important NFEPA upstream management areas. The desktop PES of the Brak River SQR is moderately modified (class C), and that of the Western tributary SQR is largely natural (class B) with an associated ecological importance and sensitivity of moderate and low, respectively. The Recommended Ecological Category (REC) to be maintained is a class B which can be achieved through the responsible management of the tributary network and associated catchment.

The of June 2022 dry season survey found limited surface water within the ephemeral drainage features. Surface water was present in the Brak River and in a tributary to the east of project area with limited water quality impacts recorded. The EC was however elevated above the RWQOs within the Brak River downstream of the project area at site Brak Down, indicating likely catchment influence and/or high background levels. No water was present in the Western Tributary system.

The watercourses presented present flat floodplain habitat features with no clear banks or riparian features which is typical for watercourses in an arid region. These ecosystems and adjacent terrestrial habitat was dominated by open natural land and largely unmodified, with some influence from land use activities within their catchment. Despite their current level of modification and ephemeral nature, the watercourses are sensitive to further modification as these systems do provide drinking opportunities (in times of rainfall) and habitat for foraging, nesting and refugia for terrestrial biota and avifauna. Therefore, the watercourses in the project area are regarded as sensitive environments in relation to changes in habitat integrity, flow and water quality requiring avoidance from the project related disturbance activities and maintenance of baseline conditions.

The aquatic features presented in this report require a buffer of 50 m and are to be treated as a no-go zone and avoided as far as is feasible. Ensuring aquatic features and buffers are intact increases the resilience of a watercourse to future disturbances. These buffers would ensure adequate ecological integrity maintenance adjacent to the proposed solar facilities.

Impact statement

An impact statement is required as per the NEMA regulations with regards to the proposed development.
As a result of the ephemeral nature of the watercourses and susceptibility to erosion, the construction and operation phase activities would influence the hydrology, water quality and soil movement within the affected watercourses, notably where the proposed powerline infrastructure and all alternatives traverse these aquatic features and their associated 50 m buffer. Provided the powerline route be designed so that the pylons are located outside of no-go zones (where feasible), the project will present limited residual impacts to the watercourses.

It is the specialist's opinion and supported by survey findings, the specialist agrees with the "Very High" aquatic theme sensitivity as per the National Web based Environmental Screening Tool. However, considering the minimum reporting requirements for aquatic biodiversity, the project infrastructure involves linear activities (powerlines and associated service roads) with impacts considered temporary, and it is the specialist's opinion that following the implementation of avoidance mitigation, recommendations and remedial measures, the Western Tributary can be returned to the current state within two years of the

completion of the construction phase. Therefore, authorisation of the proposed development can be carefully considered.

10.5 Cumulative Impacts on Avifauna

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change in an area, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy projects within a 30 km radius that have received an EA at the time of starting the environmental impact process, as well as the proposed Pixley Park Renewable Energy Project. There are currently 14 renewable energy projects authorised, operational or in process within a 30 km radius around the cluster of four proposed Solar PV Development Areas of the proposed Pixley Park Renewable Energy Project.

The total affected land parcel area taken up by authorised and planned renewable energy projects within the 30 km radius is approximately 1 316 km². The total affected land parcel area affected by the Pixley Solar Renewable Energy Cluster equates to approximately 83.2km². The combined land parcel area affected by authorised renewable energy developments within the 30 km radius around the proposed Pixley Park Renewable Energy Project, including the latter, thus equals approximately 1 399 km². Of this, the proposed Pixley Park Renewable Energy Project land parcel areas constitute ~5.8%. The cumulative impact of the proposed Pixley Park Renewable Energy Project is thus anticipated to be **low** after mitigation.

The total area within the 30km radius around the proposed projects equates to about 4 053 km² of similar habitat (excluding developed areas). The total combined size of the land parcels potentially affected by renewable energy projects will equate to ~34.5% of the available untransformed habitat in the 30km radius. Assuming that all the projects are actually constructed, the cumulative impact of all the proposed renewable energy projects is estimated to be **medium**. However, the actual physical footprint of the renewable energy facilities will be much smaller than the land parcel areas themselves. Furthermore, several of these projects must still be subject to a competitive bidding process where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction.

Nature: *Cumulative impacts associated with renewable energy facilities* • *Displacement due to disturbance associated with the construction of the renewable energy facility and associated infrastructure* • *Displacement due to habitat transformation associated with the construction and operation of the renewable energy facility and associated infrastructure* • *Collisions with the solar panels* • *Collison with wind turbines* • *Entrapment in perimeter fences* • *Displacement due to disturbance associated with the decommissioning of the renewable energy facilities and associated infrastructure* • *Mortality of priority species due to electrocution on the medium voltage internal reticulation networks* • *Mortality of priority species due to collisions with the medium voltage internal reticulation networks*		
	Cumulative impact of the proposed Pixley Park Renewable Energy Project within a 30km radius (post mitigation).	**Cumulative impact of other renewable energy projects within a 30km radius (post mitigation)**
Extent	3 regional	3 regional
Duration	4 long term	4 long term
Magnitude	2 minor	6 moderate
Probability	3 probable	4 highly probable

Significance	**27 LOW**	**52 MEDIUM**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Loss of resources?	No	Yes
Can impacts be mitigated?	Yes	
Confidence in findings: Medium.		
Mitigation: • All mitigation measures listed in this report for the Pixley Park Renewable Energy Project and all mitigation measures relevant to avifauna listed in the various specialist reports for the other planned projects within a 30km radius of the Pixley Park Renewable Energy Project should be followed.		

10.6 Cumulative Impacts on Land Use, Soil and Agricultural Potential

Fifteen land capabilities have been digitised by (DAFF, 2017) across South Africa, of which eight potential land capability classes are located within the proposed footprint area's assessment corridors, including;

- » Land Capability 1 to 5 (Very Low to Low Sensitivity); and
- » Land Capability 6 to 8 (Low to Moderate Sensitivity).

The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project focus area, which is covered by "Very Low" to "Low" sensitivities. Some patches are characterised by "Moderate Low to Moderate" sensitivities (see **Error! Reference source not found.**). In the assessment area, there is no segregation of agricultural lands or crop fields with high potentials from all the infrastructure, (i.e., powerlines, proposed alternative routes, solar substation and BESS facilities). The available crop fields boundary areas with high sensitivity following the DEA Screening Tool (2022) are found outside the project area. It is also worth noting that, there are limitations on the actual soil properties distribution and field occurrence as the baseline soil assessment results were not presented. Such soil properties are important in the determination of the soil field land capability classes required for the land potential classes (i.e., combination of climate capability level and land capability class). The "Very Low to Moderate" sensitivities fall within the DAFF, (2017) requirements for a compliance statement report only. It is the specialist`s recommendation that, the proposed Carolus solar renewable energy facility and associated infrastructure will have limited effects based on the desktop sensitivities and potentials from the DAFF, (2017). Therefore, the project may be favourably considered.

10.7 Cumulative Impacts on Heritage (including archaeology, palaeontology and cultural landscape)

The proposed renewable energy facilities are located within a cluster of approved renewable energy facilities located outside of De Aar. In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise culturally significant landscape. The proposed development is therefore unlikely to result in unacceptable risk or loss, nor will the proposed development result in a complete change to the sense of place of the area or result in an unacceptable increase in impact due to its location as one of many renewable energy facilities in this area.

According to the VIA completed for this project, The construction of the Carolus PV1 Facility may increase the cumulative visual impact of industrial type infrastructure within the region, especially in relation to the other three (3) solar energy facilities that form part of Pixley Park. The cumulative visual impact is expected to be of moderate significance due to their remote locations and the general absence of potential sensitive visual receptors.

10.8 Cumulative Visual Impacts

Nature of Impact: The potential cumulative visual impact of the PV facility on the visual quality of the landscape.		
	Overall impact of the proposed project considered in isolation (with mitigation)	***Cumulative impact of the project and other projects within the area (with mitigation)***
Extent	Very short distance **(4)**	Medium to longer distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(36)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	

Generic best practise mitigation/management measures:

Planning:

- Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint where possible.

Operations:

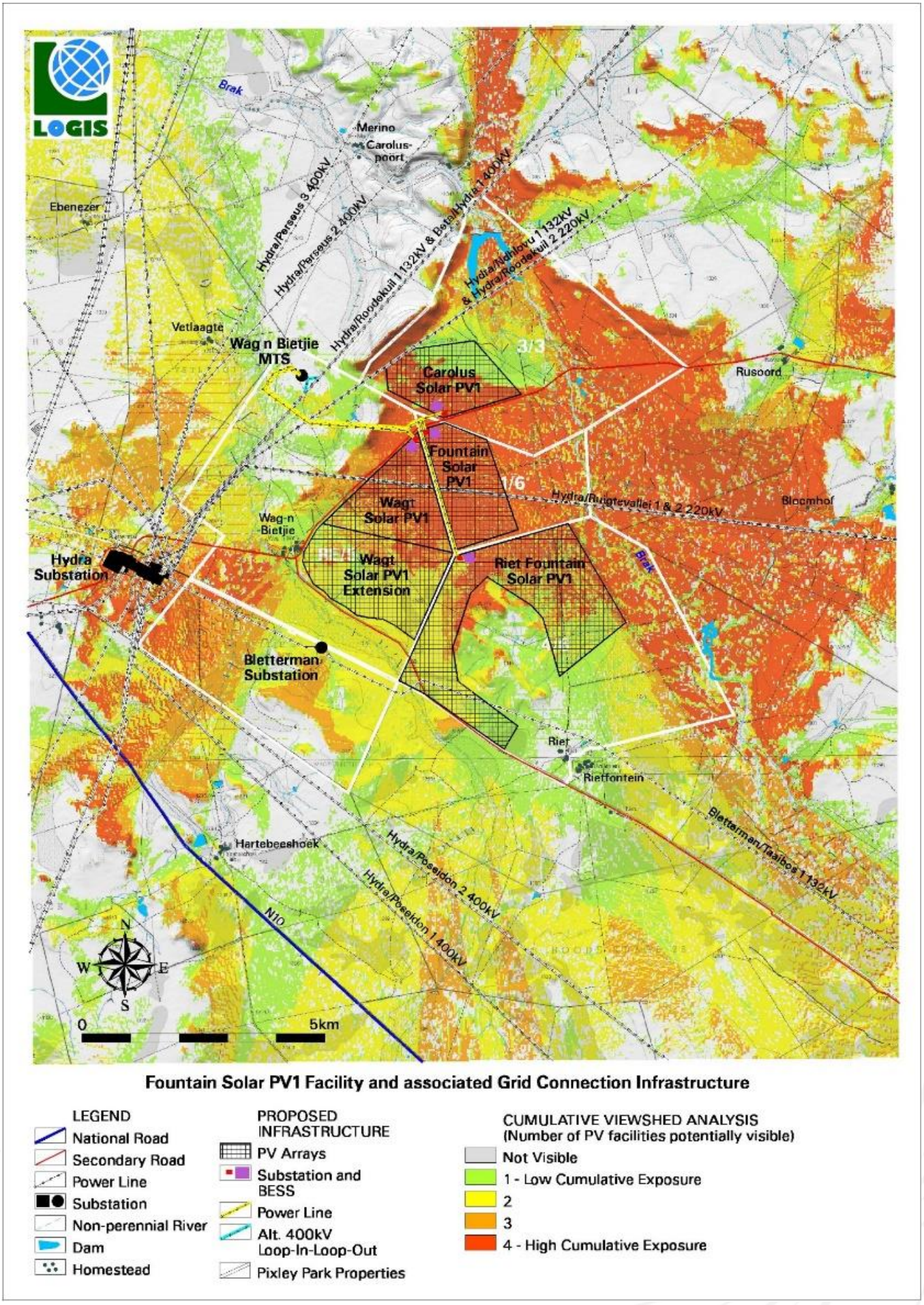
- Maintain the general appearance of the facility as a whole.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.


LOGIS
Brak
Merino
Carolus-poort
Ebenezer
Hydra/Perseus 3 400kV
Hydra/Perseus 2 400kV
Hydra/Roodekuil 1 132kV & Beta/Hydra 1 400kV
Hydra/Aldrloru 1 132kV & Hydra/Roodekuil 2 220kV
Vetlaagte
Wag n Bietjie MTS
3/3
Carolus Solar PV1
Rusoord
Fountain Solar PV1
1/6
Wagt Solar PV1
Hydra/Ruigtevallei 1 & 2 220kV
Bloemhof
Wag-n-Bietjie
Hydra Substation
Wagt Solar PV1 Extension
Riet Fountain Solar PV1
Brak
Bletterman Substation
Riet
Rietfontein
Bletterman/Taaibos 1 132kV
Hartebeeshoek
Hydra/Poseidon 2 400kV
Hydra/Poseidon 1 400kV
N10
N
W
E
S
0
5km
Fountain Solar PV1 Facility and associated Grid Connection Infrastructure
LEGEND
National Road
Secondary Road
Power Line
Substation
Non-perennial River
Dam
Homestead
PROPOSED INFRASTRUCTURE
PV Arrays
Substation and BESS
Power Line
Alt. 400kV Loop-In-Loop-Out
Pixley Park Properties
CUMULATIVE VIEWSHED ANALYSIS
(Number of PV facilities potentially visible)
Not Visible
1 - Low Cumulative Exposure
2
3
4 - High Cumulative Exposure

10.9 Cumulative Socio-Economic Impacts

Nature: Visual impacts associated with the establishment of more than one SEF and the potential impact on the area's rural sense of place and character of the landscape.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local and regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Medium (30)
Status (positive/negative)	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Loss of resources?	No	No
Can impacts be mitigated?	Yes	
Confidence in findings: High.		
Mitigation: See below		

Nature: The establishment of a number of renewable energy facilities in the ELM has the potential to place pressure on local services, specifically medical, education and accommodation		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local and regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Medium (30)
Status (positive/negative)	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Loss of resources?	No	No
Can impacts be mitigated?	Yes	
Confidence in findings: High.		
Mitigation: See below		

Nature: The establishment of a number of solar energy facilities in the ELM will create employment, skills development and training opportunities, creation of downstream business opportunities.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local and regional (2)
Duration	Long term (4)	Long term (4)

Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	Low (27)	High (60)
Status (positive/negative)	Positive	Positive
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Loss of resources?	No	No
Can impacts be mitigated?	Yes	
Confidence in findings: High.		
Enhancement: See below		

10.10 Cumulative Traffic Impacts

10.11 Conclusion regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Carolus Solar PV1 Facility throughout all phases of the project life cycle and within all areas of study considered as part of this EIA report. The main aim for the assessment of cumulative impacts considering the Carolus Solar PV1 Facility is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.
The following conclusions can be drawn regarding the cumulative impacts associated with the project:

- There will be no unacceptable loss or impact on ecological aspects (vegetation types, species and ecological processes) due to the development of the Carolus Solar PV1 Facility and other renewable energy facilities within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no significant loss of sensitive and significant aquatic features, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable risk to avifauna with the development of the Carolus Solar PV1 Facility and other renewable energy projects within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable loss of land capability due to the development of the Carolus Solar PV1 Facility and other renewable energy projects within the surrounding areas, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- Change to the sense of place and character of the area is expected with the development of renewable energy facilities. However, the change is not considered to be a fatal flaw.
- There will be no unacceptable loss of heritage resources associated with the development of the Carolus Solar PV1 Facility and other developments within the surrounding areas. The cumulative impact is therefore acceptable.
- No unacceptable socio-economic impacts are expected to occur. The cumulative impact is therefore acceptable.
- No unacceptable impacts to the traffic network are expected to occur with the development of the Carolus Solar PV1 Facility and other renewable energy projects within the surrounding areas. The cumulative impact is therefore acceptable.

Positive cumulative impacts are expected to occur from a socio-economic perspective. These impacts will range from a medium to high significance depending on the impact being considered.

All cumulative impacts associated with the Carolus Solar PV1 Facility will be of low to medium significance, with impacts of a high significance associated with bats cumulative impacts. A summary of the cumulative impacts is included in **Table 10.3**.

Table 10.3: Summary of the cumulative impact significance for the Carolus Solar PV1 Facility within the project site

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Ecology	Very Low	Low
Aquatic Ecology	Very Low	Moderate
Avifauna	Low	Low
Land use, soil and agricultural potential	Very Low	Low
Heritage (archaeology, palaeontology and cultural landscape)	Low	Moderate
Visual	Moderate	Moderate
Socio-Economic	Low	Moderate
Traffic		

The location of the Carolus Solar PV1 Facility project site and the surrounding renewable energy projects being considered as part of this cumulative impact assessment is considered to assist with the concentration of the negative impacts within an area, as well as the focussing of positive impacts and benefits.

Based on the specialist cumulative assessment and findings, the development of the Carolus Solar PV1 Facility and its contribution to the overall impact of all renewable energy facilities to be developed within a 30km radius, it can be concluded that the Carolus Solar PV1 Facility cumulative impacts will be of low to medium significance, with impacts of a high significance mainly relating to bats impacts. It was concluded that the development of the Carolus Solar PV1 Facility will not result in unacceptable, cumulative impacts and will not result in a whole-scale change of the environment.

CHAPTER 11 CONCLUSIONS AND RECOMMENDATIONS

Carolus Solar PV1 (Pty) Ltd.is proposing the development of a Photovoltaic (PV) Solar Energy Facility and associated infrastructure located on a site approximately 10km east of De Aar within the Emthanjeni Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. A study area consisting of the Remaining Portion 4 of the Farm Carolus No. 6 (4/6) is being considered for the solar PV facility. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 120MW and will be known as the Carolus Solar PV1 Facility.

A preferred project site with an extent of ~2200 ha has been identified by the developer as a technically suitable area for the development of the Riet Fountain Solar PV1 Facility.

The infrastructure associated with the solar PV facility, including all associated infrastructure will include:

» Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology
» Inverters and transformers
» Cabling between the panels
» Battery Energy Storage System (BESS)
» Laydown areas, construction camps, site offices
» 12m wide Access Road and entrance gate to the project site and switching station
» 6m wide internal distribution roads
» Operations and Maintenance Building, Site Offices, Ablutions with conservancy tanks, Storage Warehouse, workshop, Guard House
» Onsite IPP substation, including all necessary electrical and auxiliary equipment required at the collector substation that serves that solar facility. This would include transformer, switchyard/bay, control building, fences etc

The facility will be connected to the national electricity grid via the following infrastructure (to be assessed in a separate Basic Assessment Report):
» Onsite Switching Station (SwS), adjacent to the IPP substation (SS).
» A 132kV Overhead Power Line (OHPL) from the SwS connecting back to a Main Transmission Substation (MTS). There is an MTS proposed on either the farm Vetlaagte (i.e., Vetlaagte MTS) or the farm Carolus en Bietjie (i.e., Carolus en Bietjie MTS). Two separate EA processes are currently underway to authorise the two MTS's and it is uncertain at this stage as to which MTS will be authorised and used to connect these projects.
» The development of the Riet Fountain Solar PV1 Facility may require the following at the above-mentioned MTSs:
    * an extension of the 132kV Busbar.
    * an extension of the 400kV Busbar
    * an additional 400/132kV Transformer to be added
    * a new 132kV Feeder Bay

Riet Fountain Solar PV1 (Pty) Ltd has confirmed that the project site is particularly suitable for solar energy development from a technical perspective due to the strength of the prevailing solar resources, access to the electricity grid, compatibility with the current land use and land availability.

A summary of the recommendations and conclusions for the proposed project is provided in this Chapter.

11.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a EIA Report

This chapter of the EIA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of basic assessment reports:

Requirement	Relevant Section
3(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report	A summary of the findings of the specialist studies undertaken for the Riet Fountain Solar PV1 Facility has been included in **section 11.2**.
3(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.	An environmental impact statement containing the key findings of the environmental impacts of the Riet Fountain Solar PV1 Facility has been included as **section 11.5**. An Environmental Sensitivity and Layout map of the Riet Fountain Solar PV1 Facility has been included as **Figure 11.1** which overlays the development footprint (as assessed within the EIA) of the PV facility with the environmental sensitive features located within the project site. A summary of the positive and negative impacts associated with the Riet Fountain Solar PV1 Facility has been included in **section 11.2**.
3(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.	All conditions required to be included in the Environmental Authorisation of the Riet Fountain Solar PV1 Facility has been included in **section 11.6**.
3(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.	A reasoned opinion as to whether the Riet Fountain Solar PV1 Facility should be authorised has been included in **section 11.5**.

11.2. Evaluation of the Riet Fountain Solar PV1 Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-L** provide a detailed assessment of the potential impacts that may result from the development of the Riet Fountain Solar PV1 Facility. This chapter concludes the environmental assessment of the solar PV facility by providing a summary of the results and conclusions of the assessment of both the project site and development footprint for the Riet Fountain Solar PV1 Facility. In so doing, it draws on the information gathered as part of the EIA process, the knowledge gained by the environmental specialists and the EAP and presents a combined and informed opinion of the environmental impacts associated with the project.

No environmental fatal flaws or unacceptable impacts were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of sensitive features within the development footprint as specified by the specialists.

The potential environmental impacts associated with the Riet Fountain Solar PV1 Facility identified and assessed through the EIA process include:

- Impacts on ecology, flora, and fauna.
- Impacts on aquatic ecology.
- Impacts on avifauna.
- Impacts on land use, soils, and agricultural potential.
- Impacts on heritage resources, including archaeology, palaeontology, and the cultural landscape.
- Visual impacts on the area imposed by the components of the facility.
- Positive and negative socio- economic impacts.
- Traffic impacts, including increased pressure on the existing road network.

11.2.1. *Impacts on Ecology*

The aim of the Biodiversity Impact Assessment was to provide information to guide the risk of the proposed Riet Fountain Solar PV1 Facility to the ecosystems affected by its development and their inherent fauna and flora.

Based on the latest available ecologically relevant spatial data the following information is pertinent to the project area:

- It is recognised as an Ecological Support Area as per the Northern Cape Critical Biodiversity Areas spatial database.
- The Combined Terrestrial Biodiversity Theme Sensitivity was rated as 'Very High' according to the Environmental Screening Tool;
- The Ecosystem Protection Level for the vegetation type associated with the development footprint is regarded as Not Protected; and
- It is regarded as an Upstream Management Area according to the NFEPA database.

The habitat physiognomy within the development area is diverse and, based on the fauna components recorded within the development area and proximal landscape, the area provides important ecosystem services, particularly with regards to the maintenance of dynamic soil properties and pollination services. The SEI of the development area was determined to vary from 'Very Low' to 'Very High' based on the high likelihood of occurrence for NT species, the extent of the area considered and its connectivity to natural areas within the landscape, and the low resilience of the vegetation type. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

11.2.2. *Impacts on Aquatic Ecology*

The topography of the proposed Riet Fountain PV1 development area has a gentle gradient that drains to the centre of the PV1 area with no obvious drainage system, however the area does drain eastwards into the Brak River. Additionally, portions of the 132 kV powerline traverses an ephemeral drainage line as well as an instream dam at the same location. Impacts would therefore be expected directly within the tributary network through the physical loss of drainage features as well as damage to the remaining habitat.

Impacts include changes to the hydrological regime such as alteration of surface run-off patterns, runoff velocities and or volumes associated with vegetation clearing, earthworks, levelling, soil stockpiling and the establishment of infrastructure (powerline pylons, BESS and substation) and road network. This would include watercourse crossing infrastructure for the powerline maintenance road and potential watercourse crossing infrastructure within the Riet Fountain PV1 development area. The presence of solar panels and associated

compacted road network increases hard surfaces within the catchment, resulting in an increase in runoff during high precipitation events and may be significant if poorly designed stormwater management infrastructure is implemented. The aforementioned alterations will have a direct result on the sediment movement and drainage characteristics both locally within the influenced tributaries and associated downslope areas such the Brak River. Altered surface run-off patterns, runoff velocities and or volumes above the natural flow regime of the ephemeral drainage lines is expected to cause potentially extensive damage to the bed and banks through erosion and scouring with associated sedimentation of instream habitat. Powerline pylons constructed within the tributaries and associated marginal zones will result in direct loss or the disturbance of watercourse habitat with associated alteration of hydrology. In turn, habitat disturbance may degrade habitat quality and produce watercourse and surrounding corridor (Ecological Support Area) fragmentation. A negative shift in the biotic integrity of the tributaries would be expected based on the severity of alterations or losses. It should be taken into account that the Karoo may take decades to rehabilitate, therefore rehabilitation may be challenging, highlighting the need to avoid disturbance of these areas.

It is important to highlight that these arid climate systems receive majority of their rainfall during short rainfall events and only present surface flow for limited time periods. Some rainfall events can be considered as massive with resultant flooding. Therefore, careful consideration should be given to the hydrology of these systems with special attention given to stormwater and watercourse crossing designs (likely unnecessary – no road shapefiles available) and resultant discharge velocities.

These disturbances will be the greatest during the construction phase as the related disturbances could result in direct loss and/or damage, while to a lesser degree in the operation phase (i.e. as and when maintenance occurs).

Desktop information associated with the proposed Riet Fountain Solar PV1 development indicates that the indirectly affected downstream Brak River system and directly associated ephemeral tributaries within the project area have sensitivity to modification. These systems serve as ESAs, CBAs and important NFEPA upstream management areas. The desktop PES of the Brak River SQR is moderately modified (class C), and that of the Western tributary SQR is largely natural (class B) with an associated ecological importance and sensitivity of moderate and low, respectively.

The Recommended Ecological Category (REC) to be maintained is a class B which can be achieved through the responsible management of the tributary network and associated catchment.

The June 2022 dry season survey undertaken for this assessment found limited surface water within the ephemeral drainage features. Surface water was present in the Brak River and in a tributary to the east of project area with limited water quality impacts recorded. The EC was however elevated above the RWQOs within the Brak River downstream of the project area at site Brak Down, indicating likely catchment influence and/or high background levels. No water was present in the Western Tributary system.

The watercourses presented present flat floodplain habitat features with no clear banks or riparian features which is typical for watercourses in an arid region. These ecosystems and adjacent terrestrial habitat was dominated by open natural land and largely unmodified, with some influence from land use activities within their catchment. Despite their current level of modification and ephemeral nature, the watercourses are sensitive to further modification as these systems do provide drinking opportunities (in times of rainfall) and habitat for foraging, nesting and refugia for terrestrial biota and avifauna. Therefore, the watercourses in the

project area are regarded as sensitive environments in relation to changes in habitat integrity, flow and water quality requiring avoidance from the project related disturbance activities and maintenance of baseline conditions.

The aquatic features presented in this report require a buffer of 50 m and are to be treated as a no-go zone and avoided as far as is feasible. Ensuring aquatic features and buffers are intact increases the resilience of a watercourse to future disturbances. These buffers would ensure adequate ecological integrity maintenance adjacent to the proposed solar facilities.

11.2.3. *Impacts on Avifauna*

The impacts of solar PV facilities on avifauna are not well understood, particularly in the South African context. Nevertheless, the low and very low classification of the site ecological importance for avifaunal SCCs as assessed through this EIA reduces the overall risk of significant impacts to the local avifaunal community by the proposed development, despite any gaps that may exist in our current understanding of potential impacts.

The Species Assessment Guideline states areas identified to be of low SEI development activities of medium to high impact are acceptable following the implementation of appropriate minimisation and restoration mitigation measures. The proposed Pixley Park Renewable Energy Project will have a range of potential pre-mitigation impacts on priority avifauna ranging from low to high, which is expected to be reduced to medium and low with the appropriate mitigation. No fatal flaws were discovered during the investigations. Based on the impact assessment conducted for the Riet Fountain Solar PV Facility (including cumulative impacts) it is the avifaunal specialist's informed opinion that the proposed development will not have a significant negative impact on the viability or persistence of SCC populations in the area following the implementation of mitigation measures. The proposed Riet Fountain Solar PV Facility is therefore acceptable and can be approved from an avifaunal perspective.

In addition to the mitigation measures outlined for each potential impact, the requirement for post-construction/operational phase monitoring is to be included in the Environmental Management Programme (EMPr). This is necessary to determine the actual impacts of the proposed development, determine if additional mitigation is required and learn about impacts and improve future assessments. The activity monitoring methods and data collection should replicate those employed during pre-construction monitoring as closely as possible in terms of effort and timing and should follow any additional recommendations of the latest best-practice guidelines available at the time.

11.2.4. *Impacts on Land Use, Soil and Agricultural Potential*

It is the specialist's opinion that the baseline findings do not concur with the land capabilities identified by means of the DAFF (2017) desktop findings in regard to land capability sensitivities. No "High" land capability sensitivities were identified within proximity to any of the proposed activities. Considering the lack of sensitivity and the measures put in place in regard to stormwater management and erosion control, it is the specialist's opinion that all activities will have an acceptable impact on agricultural productivity. Furthermore, no measures in regard to moving components in their micro-setting were required to avoid or minimise fragmentation and disturbances of agricultural activities.

The most sensitive soil forms that can be expected within the assessment corridor is the Hutton and Oakleaf soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with "Very Low to Moderate" sensitivities, which correlates with the requirements for a compliance statement only.

The available climate can limit crop production significantly. The harsh climatic conditions are associated with low annual rainfall and high evapotranspiration potential demands of the area. The area is not favourable for most cropping practices.

It is worth noting that, additional baseline soil field assessments can give a better and informed understanding of the proposed project area soil, land potential classes with minimal limitations. It is the specialist's opinion that the proposed solar renewable energy project based on the DAFF (2017) land capability sensitivity of the areas will have limited impact on the agricultural production ability of the land. Additionally, the proposed activities for the Riet Fountain solar facility and associated infrastructure will not result in the segregation of any high production agricultural land. The available areas with high crop field boundary sensitivity (DEA Screening Tool, 2022) are located outside the proposed project area as well. Therefore, the proposed Riet Fountain solar renewable energy project development and associated infrastructure may be favourably considered.

11.2.5. *Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)*

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage on the flat, grassy plains with higher sensitivities in the immediate areas on and surrounding the dolerite outcrops. The results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and are therefore not archaeologically significant.

The public consultation process will be undertaken by the EAP during the EIA. No heritage-related comments have been received to-date. SAHRA is required to comment on this HIA and make recommendations prior to the granting of the Environmental Authorisation.

The assessment of the cultural landscape indicated that the project will have a low impact on the cultural landscape. The general mitigation measures for renewable energy development in areas of cultural landscape significance as proposed by Sarah Winter, (2021) as well as Lavin (2021) will still result in a marginal reduction of impact. Analysis of the findings of the SEIA for this project further reveals that the social and economic benefit for the region outweighs the need for conservation of cultural resources.

The overall impact of the Riet Fountain Solar PV1 Facility on the heritage resources identified during this assessment is considered as acceptable after the recommendations have been implemented and therefore, impacts can be mitigated to acceptable levels allowing for the development to be authorised.

11.2.6. *Visual Impacts*

The construction and operation of the proposed Riet Fountain PV1 facility and its associated infrastructure may have a visual impact on the study area, especially within a 1km radius (and potentially up to a radius

of 3km) of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The combined visual impact or cumulative visual impact of up to four solar energy facilities (i.e. the proposed Riet Fountain PV1, and the other 3 proposed PV facilities that form part of Pixley Park) is expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of PV arrays visible) to exposed receptors, especially those located within a 3km radius, is expected to be greater than it would be for a single solar energy facility. The cumulative visual impact is however still expected to be within acceptable limits, due to the limited potential sensitive visual receptors.

Overall, the significance of the visual impacts is expected to range from **moderate** to **low** as a result of the generally undeveloped character of the landscape and the remote location of the project infrastructure. There are a very limited number of potential sensitive visual receptors within a 3km radius of the proposed structures, although the possibility does exist for visitors to the region to venture into closer proximity to the PV facility structures. These observers may consider visual exposure to this type of infrastructure to be intrusive.

A number of mitigation measures have been proposed. Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the PV facility and associated infrastructure would be considered to be acceptable from a visual impact perspective and can therefore be authorised.

11.2.7. *Socio-economic Impacts*

The findings of the SIA indicate that the development of the proposed 250 MW Riet Fountain PV SEF and associated infrastructure will create employment and business opportunities for locals in the ELM during both the construction and operational phase of the project. All of the potential negative impacts, with the exception of the impact on sense of place, can also be effectively mitigated.

The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the report should be implemented in order to maximise the potential benefits. The significance of this impact is rated as **High Positive**. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives. The establishment of the proposed 250 MW Riet Fountain PV SEF and associated infrastructure including a BESS is therefore supported by the findings of the SIA.

Recommendations

Based on the information presented in the SEIA report, it is concluded that the net positive impacts associated with the development and operation of the proposed solar energy facility are expected to outweigh the net negative effects. The project is also envisaged to have a positive stimulus on the local economy and employment creation, leading to the economy's diversification and a small reduction in the unemployment rate. The project should therefore be considered for development. It should, however, be acknowledged that any negative impacts would be largely borne by the farms in the immediate vicinity and households residing on them, whilst the positive impacts will be largely concentrated in the local and national economies. Due to this imbalance, it is recommended that the mitigation measures suggested being strictly adhered to. Application of these mitigation measures will ensure that the negative impacts on the nearby farms and businesses are minimised and that the distribution of the potential benefits of the project are more balanced.

11.2.8. *Impacts on Traffic*

The Traffic Impact Assessment report for the EIA stage addressed key issues and alternatives to be considered for the proposed Pixley Park Solar Cluster:

- The preferred Port of Entry for imported components is the Port of Ngqura.
- The proposed access road located off the N10 is deemed a suitable access road as it is an existing gravel road i.e. less expensive to upgrade and/or maintain. However, the Client should note that application for wayleaves and permits should be made to the railway authority (Transnet) well in advance of construction commencing, with specific reference to the railway crossing at the Hydra Substation. The rail authority (Transnet) might also withhold approval.
- The current condition and suitability of the main access road from the R389 should be determined as an alternative route should wayleave approval not be granted by the rail authority.
- It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage.
- The construction phase traffic, although significant, will be temporary and can be mitigated to an acceptable level.
- During operation, it is expected that staff and security will periodically visit each of the facilities. It is assumed that approximately 30 full-time employees will be stationed on each of the four sites. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- The construction and decommissioning phases of the development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e. the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network and impacts are considered to have low significance.

The potential mitigation measures mentioned in the construction phase are:

- Dust suppression
- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.

- The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.
- A "dry run" of the preferred route.
- Design and maintenance of internal roads.
- If required, any low hanging overhead lines (lower than 5.1m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.

The potential mitigation measures mentioned in the operational phase are:

- Staff and general (maintenance) trips should occur outside of peak traffic periods as far as possible.
- The provision of water storage tanks and/or boreholes.
- Water bowsers trips should occur outside of peak traffic periods as far as possible.
- Spread the cleaning of the panels over a week.
- Using a larger water bowser.

The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e., the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

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 Pixley Solar PV Cluster are acceptable with the implementation of the recommended mitigation measures and can therefore be authorised.

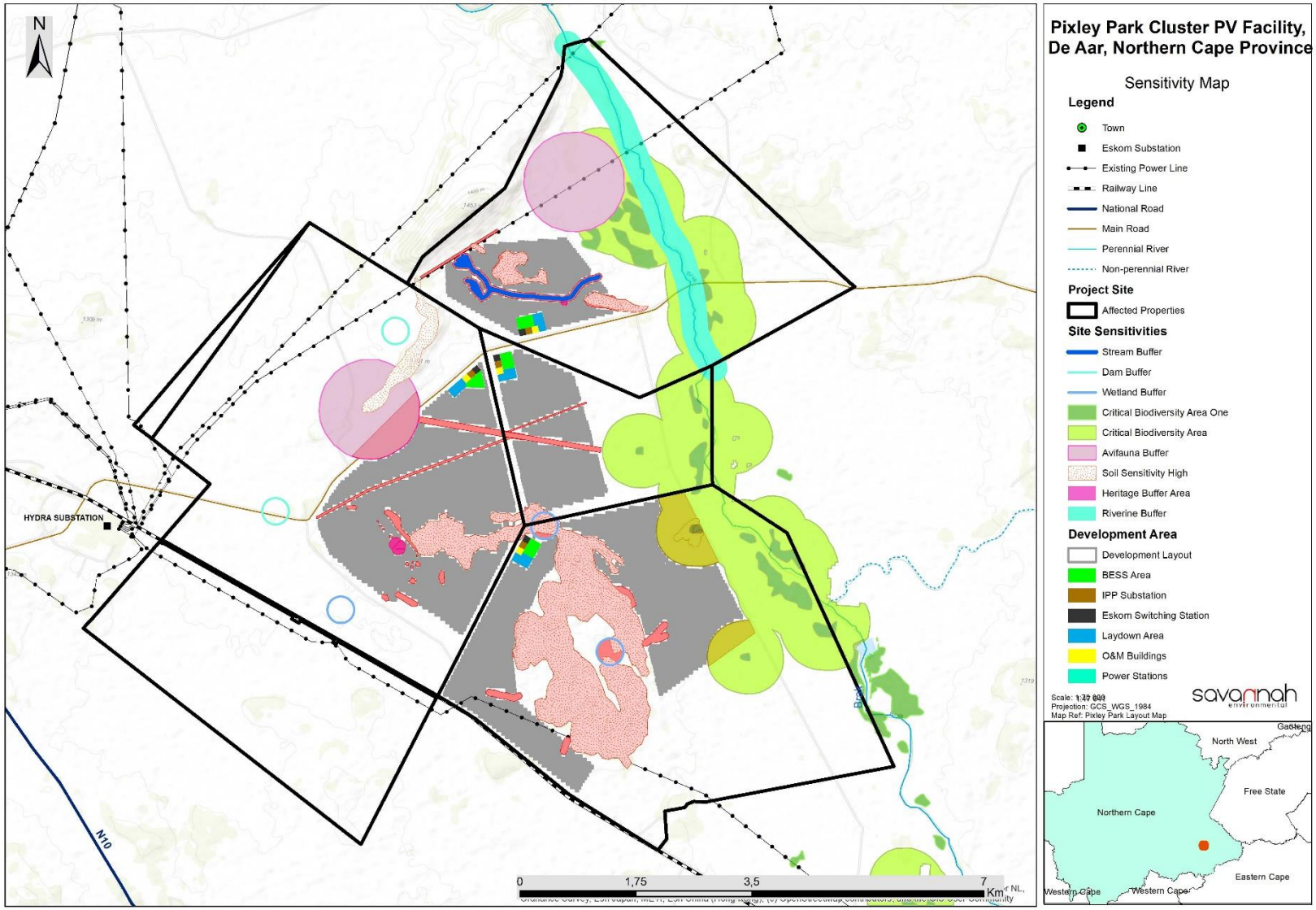


Figure 11.1: The development Cluster of the Pixley Park Solar PV Facility, as assessed within this EIA process overlain on the identified environmental sensitive features (**Appendix O**)

Figure 11.2: The development of the Riet Fountain Solar PV Facility, as assessed within this EIA process overlain on the identified environmental sensitive features

11.3. Overall Conclusion

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using solar irradiation as the preferred technology, due to the availability of a suitable solar resource. Independent specialists appointed to undertake the assessment of potential impacts associated with the project assessed a larger area in order to inform the best location for the solar facility infrastructure. The Specialists considered desktop data, results from field work, existing literature and the National Web-based Environmental Screening Tool to inform the identification of sensitivities. A proposed layout was designed after provision of sensitivity data by the specialists with the aim of avoiding sensitive areas identified.

Based on the specialist investigations of the larger area, a technically viable development footprint was proposed by the developer and assessed as part of the EIA process. The findings of the assessment of the development footprint undertaken by independent specialists have informed the results of this EIA report. The specialist findings have indicated that there are no identified fatal flaws associated with the implementation of the project within the project site.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level. The project development area is located outside of any protected area and outside of any Critical Biodiversity Areas (CBAs) as defined in the Provincial Conservation Plan. When considering biodiversity and socio-economic benefits and impacts on the affected and surrounding areas, the following is concluded from the specialist studies undertaken within this EIA process.

From a biodiversity perspective, the site is not located within a protected area. The site is located within an extensive ESA 2 area. However, overall, there are no specific long-term impacts likely to be associated with the development of the Riet Fountain Solar PV1 Facility that cannot be reduced to a low significance. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. No sensitivities were identified from an avifauna perspective, and the layout proposed ensures that all aquatic sensitivities identified through the EIA process are avoided and recommended buffer areas are honoured. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e. tier 1 of the mitigation hierarchy). Where impacts could not be avoided, appropriate mitigation has been proposed to minimise impacts. It follows therefore that the project does not adversely impact on the ecological integrity of the area.

In addition, consideration must also be given to the positive and negative socio-economic impact. Impacts on cultural landscape are expected to be low. It must be considered that the addition of the infrastructure of the Riet Fountain Solar PV1 Facility will constitute an additional layer to the cultural landscape. Through the implementation of the economically feasible recommendations as set out in the Heritage impact Assessment and contained in this report it will be possible to preserve older layers of the cultural landscape and in some cases even enhance them through consideration such as the use of older name places in the naming of infrastructure and enhancing local heritage through the incorporation of such structures in project conservation initiatives to name a few.

The Socio-economic Impact Assessment has identified short-term (construction related) impact indicators and operational related socio-economic impact indicators. The assessment of the proposed facility, and its

net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with the Riet Fountain Solar PV1 Facility. All impacts associated with the project can be mitigated to acceptable levels. If the solar facility is not developed (i.e. the 'do nothing alternative implemented), the following positive impacts will not be realised:

» Job creation from the construction and operation phases.
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Meeting of energy generation mix in a most economic and rapid manner.
» Provision of clean, renewable energy in an area where it is optimally available.

The benefits of the Riet Fountain Solar PV1 Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility. From an economic perspective, both positive and negative impacts are expected.

Based on the conclusions of the specialist studies undertaken, it can be concluded that the development of the Riet Fountain Solar PV1 Facility based on the current layout as provided by the developer will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

11.4. Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer within the development envelope, the avoidance of the sensitive environmental features within the project site, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the Riet Fountain Solar PV1 Facility is acceptable within the landscape and can reasonably be authorised. The proposed layout as provided by the developer (**Figure 11.1**) is considered to be the most appropriate from an environmental perspective as it avoids identified sensitivities and recommended buffer areas.

The following infrastructure would be included within an authorisation issued for the project:

» Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology
» Inverters and transformers
» Cabling between the panels
» Battery Energy Storage System (BESS)
» Laydown areas, construction camps, site offices
» 12m wide Access Road and entrance gate to the project site and switching station
» 6m wide internal distribution roads

- Operations and Maintenance Building, Site Offices, Ablutions with conservancy tanks, Storage Warehouse, workshop, Guard House
- Onsite IPP substation, including all necessary electrical and auxiliary equipment required at the IPP substation that serves that solar facility. This would include transformer, switchyard/bay, control building, fences etc
- The facility will be connected to the national electricity grid via the following infrastructure (to be assessed in a separate Basic Assessment Report):
- Onsite Switching Station (SwS), adjacent to the IPP substation (SS).
- A 132kV Overhead Power Line (OHPL) from the SwS connecting back to a Main Transmission Substation (MTS). There is an MTS proposed on either the farm Vetlaagte (i.e., Vetlaagte MTS) or the farm Carolus en Bietjie (i.e., Carolus en Bietjie MTS). Two separate EA processes are currently underway to authorise the two MTS's and it is uncertain at this stage as to which MTS will be authorised and used to connect these projects.
- The development of the Riet Fountain Solar PV1 Facility may require the following at the above-mentioned MTSs:
  - an extension of the 132kV Busbar.
  - an extension of the 400kV Busbar
  - an additional 400/132kV Transformer to be added
  - a new 132kV Feeder Bay

The following key conditions would be required to be included within an authorisation issued for the Riet Fountain Solar PV Facility:

- All mitigation measures detailed within this EIA report, as well as the specialist reports contained within **Appendices D to L** are to be implemented.
- The EMPr as contained within **Appendix M** of this EIA report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Riet Fountain Solar PV1 Facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Following the final design of the Riet Fountain Solar PV1 Facility, a revised layout must be submitted to DFFE for review and approval prior to commencing with construction. No development is permitted within the identified no-go areas as detailed in **Figure 11.1.**
- A pre-construction walk-through of the final layout, including roads and underground cables, should be undertaken before construction commences and adjusted where required to reduce impacts on species of conservation concern and habitats of concern.
- The permitter fence of the facility must have access points for smaller fauna at least every 50m of fence. These should be a minimum of 40cm x 20cm in size and should be orientated both vertically and horizontally.
- The facility must have a detailed runoff and erosion management plan that takes account of the vulnerability of the area to erosion damage. This should be developed with input from a specialist with specific experience in this regard.
- Implement a chance finds procedure for the rescuing of any fossils or heritage resources discovered during construction.
- If any archaeological material or human burials are uncovered during construction activities, work in the immediate area should be halted, the find reported to the heritage authorities and inspected by an

archaeologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.

» Maintain vegetation cover (i.e. either natural or cultivated) immediately adjacent to the actual development footprint, both during construction and operation of the proposed facility.
» Monitor all rehabilitated areas for one year following decommissioning and implement remedial actions as and when required.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DFFE.

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120317	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120820	HIA Phase 1	Celeste Booth	01/12/2012	An Archaeological Ground-Truthing Walk-Through For The Nobelsfontein Wind Energy Facility Situated On A Site South Of Victoria West On The Farms Nobelsfontein 227, Annex Nobelsfontein 234, Ezelsfontein 235, And Rietkloofplaaten 239, Northern Cape Province
251290	PIA Deskto p	Lloyd Rossouw	01/01/2014	Combined Environmental Environmental Impact Assessment for the proposed Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Eskom Distribution Grid Connection Infrastructure near Murraysburg, Western Cape. Chapter 13: Palaeontology Impact Assessment.
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357137	Heritag e Impact Assess	Timothy Hart	13/10/2015	Heritage Impact Assessment for the proposed Umsinde Emoyeni Wind Energy Facility

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360840	Non Impact Assessment Related Reports	Wouter Fourie	05/03/2016	Environmental Impact Assessment of the proposed amendments to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape â€“ Specialist Heritage Opinion
360850	HIA Phase 1	Wouter Fourie	04/03/2016	Basic assessment process for Proposed development of supporting infrastructure to the Victoria West Wind Energy Facility, Victoria West
6805	AIA Phase 1	Len van Schalkwyk, Elizabeth Wahl	01/09/2007	Heritage Impact Assessment of Gamma Grassridge Power Line Corridors and Substation, Eastern, Western and Northern Cape Provinces, South Africa
7035	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	05/03/2011	A Phase 1 Archaeological Impact Assessment (AIA) for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape Province on the farms Phaisantkraal 1, Modderfontein 228, Nobelsfontein 227, Annex Nobelsfontein
7036	AIA Desktop	Celeste Booth, Natasha Higgitt	19/11/2010	An Archaeological Desktop Study for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape
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