CAROLUS SOLAR PV1 FACILITY, NORTHERN CAPE

ENVIRONMENTAL MANAGEMENT PROGRAMME

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EMPR DETAILS

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DEFINITIONS AND TERMINOLOGY

Alien species: A species that is not indigenous to the area or out of its natural distribution range.

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.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Assessment: The process or collecting, organising, analysing, interpreting and communicating information which is relevant.

Biological diversity: The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.

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.

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 as per the EIA Regulations. 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.

Ecosystem: A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

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.

Endemic: An "endemic" is a species that grows/occur 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 assessment practitioner (EAP): An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.

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, is a systematic process of identifying, assessing and reporting environmental impacts associated with an activity.

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: A plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Habitat: The place in which a species or ecological community occurs naturally.

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

Incident: Section 30 of NEMA defines an 'incident' as "an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed."[1]

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.

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

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, which 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.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material

[1]http://ipwis.pgwc.gov.za/ipwisdoc/Public/Publications/ChemicalsMgt/A%20Procedure%20for%20Section%2030%20of%20NEMA.pdf

or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to the Waste Amendment Act (as amended on June 2014); or any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister.

ABBREVIATIONS AND ACRONYMS

DFFE	Department of Forestry, Fisheries and the Environment.
DHSWS	Department of Human Settlements, Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EPC	Engineering Procurement Contractor
ECO	Environmental Control Officer
EO	Environmental Officer
GG	Government Gazette
GN	Government Notice
Ha	Hectare
I&AP	Interested and Affected Party
km^2	Square kilometres
kV	Kilovolt
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
PM	Project Manager
SHE	Safety, Health and Environment
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited

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CHAPTER 1: INTRODUCTION

This Environmental Management Programme has been compiled for the Carolus Solar PV1 Facility, Northern Cape. 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 project is planned as part of a larger cluster of renewable energy projects, and grid connection infrastructure connecting the facilities to the existing Hydra Substation.

This EMPr has been developed on the basis of the findings of the Environmental Impact Assessment (EIA) undertaken for the project (Savannah, 2022), and must be implemented to protect sensitive on-site and off-site features through controlling construction, operation and decommissioning activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts. This EMPr is applicable to all Carolus Solar PV1 (Pty) Ltd employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the Carolus Solar PV1 Facility. The document must be adhered to and updated as relevant throughout the project life cycle. This document fulfils the requirement of the EIA Regulations, 2014 (as amended) and forms part of the EIA report of the project.

In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, halted or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts. While no permitting or licensing requirements arise directly by virtue of the Carolus Solar PV1 Facility, this section will be applicable throughout the life cycle of the project.

CHAPTER 2: PROJECT DETAILS

In responding to the growing electricity demand within South Africa, the need to promote renewable energy and sustainability within the Northern Cape Province, as well as the country's targets for renewable energy. Carolus Solar PV1 (Pty) Ltd is proposing the development of a commercial solar farm and associated infrastructure to add new capacity to the national electricity grid. The Carolus Solar PV1 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 EIA 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. 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 (Wagt Solar PV1, Riet Carolus PV1, and Carolus Solar PV1), and associate individual grid connection infrastructures.

A preferred project site with an extent of ~300ha has been identified by Carolus Solar PV1 (Pty) Ltd as a technically suitable area for the development of the Carolus Solar PV1 Facility. The project site consists of four affected properties:

» Portion 1 of the Farm Riet Carolus No.6.

A development envelope for the placement of the solar facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the EIA process. The development envelope is ~300ha in extent and the development footprint is proposed to accommodate both the PV panels, as well as most of the associated infrastructure, which is required for such a facility, and 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 Wagt en Bietjie (i.e., Wagt 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

Table 2.1: Detailed description of the Carolus Solar PV1 Facility project site

Province	**Northern Cape**
District Municipality	Pixley Ka Seme District Municipality
Local Municipality	
Ward number(s)	
Nearest town(s) (measured from the centre of the project site)	
Affected Properties: Farm name(s), number(s) and portion numbers	»
SG 21 Digit Code (s)	»
Current zoning and Land Use	
Site co-ordinates (centre of project site)	

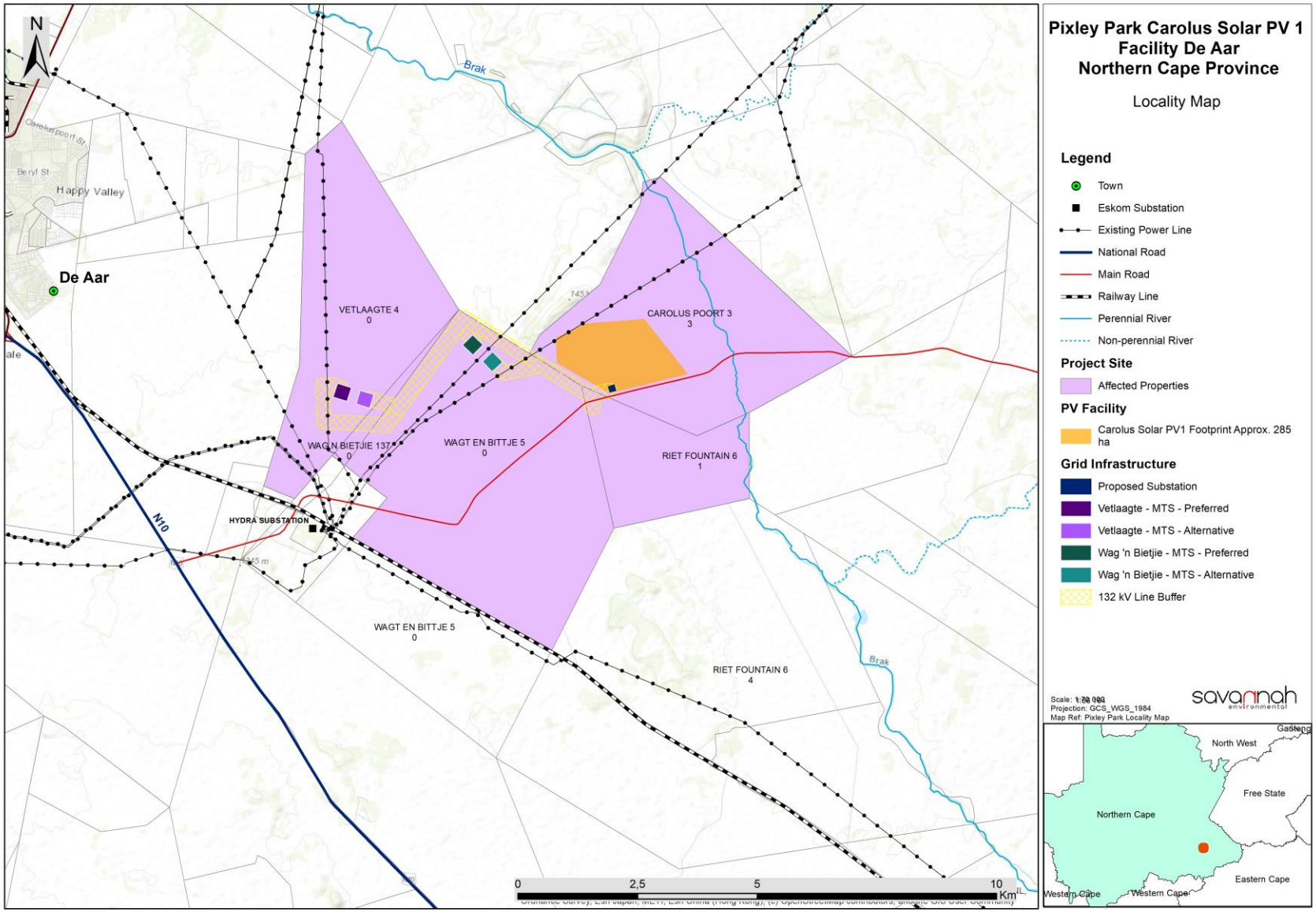

Figure 2.1: Locality map showing the location of the project site and development envelope proposed for the Carolus Solar PV1 Facility

2.1. Findings of the Environmental Impact Assessment

An Environmental Impact Assessment was undertaken for the proposed project in accordance with the requirements of the EIA Regulations, 2014 (as amended) and GNR114 of February 2018.

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.

2.1.1 Impacts on Ecology

There are three plant species listed as Rare (*Anisodontea malavastroides, Aloe broomii* var. *tarkaensis* and *Tridentea virescens*) that could potentially occur on site, but these are all three widespread species that are naturally rare where they are found. None have been previously recorded on this site. There are also two plant species protected according to National legislation (*Crinum bulbispermum* and *Harpagophytum procumbens*) that could potentially occur in the geographical area, but these are also very widespread species. In all five cases the loss of some individuals, if they are found to occur on site, would not affect the conservation status of any of the species. It is, however, unlikely that any of them would be affected.

There are a small number of fauna species of conservation concern that were assessed as having a possibility of occurring on site. The Riverine Rabbit has been previously recorded in the grid in which the site is found and there are some small patches of habitat that are marginally suited to the species, but the known distribution of the species does not include the site and it is not known to occur in this area so it is therefore considered unlikely that it would be found on site. All other species listed here are highly mobile species that are unlikely to be affected by any activities on site.

2.1.2 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.

Therefore, based on the results of the Aquatic Impact Assessment, the pre-mitigation impact significance for all considered aspects is expected to be medium. The expected post-mitigation impact significance is expected to be low should all mitigation measures and recommendations be implemented.

Thus, based on the findings of this study no objection to the authorisation of any of the proposed activities is made at this point based on the current layout as provided by the developer.

2.1.3 Impacts on Avifauna

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities e.g. increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance.

The SABAP2 data indicates that a total of 164 bird species could potentially occur within the broader area. At the PV facility, the priority species which would be most severely affected by disturbance would be ground nesting species, and those that utilise low shrubs for nesting, which are the following: *Ludwig's Bustard, Karoo Korhaan, Black-headed Canary, Sickle-winged Chat, Large-billed Lark, Karoo Prinia, Karoo Eremomela, Fairy Flycatcher, Black-eared Sparrow-Lark, Layard's Warbler and Spotted Eagle-Owl. Large*

eagles breeding on the transmission lines in close proximity of the PV facility could also be at risk of disturbance i.e. Martial Eagle and Tawny Eagle.

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 proposed development 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 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.

2.1.4 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.

Various soil forms were identified within the Pixley project area with the most sensitive soils being classified as the Tubatse, Oakleaf and Bethesda soil forms. These soil forms were determined to be associated with one land capability, namely LCIII. This land capability class was then further refined to land potential level 6 by comparing land capability of climatic capabilities of the project area.

This land potential level was used to determine the sensitivities of soil resources. Only "Low" sensitivities were determined throughout the project area by means of baseline findings. Considering the low sensitivities associated with land potential resources, it is the specialist's opinion that the proposed activities will have an acceptable impact on soil resources and that the proposed activities should proceed as have been planned.

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

The assessment of the possible impacts on the archaeological, historical and palaeontological resources has shown a Low impact from the Carolus Solar PV1 Facility project after mitigation measures. It is further considered that the project can have a potential positive influence on such resources in the region when the proposed conservation initiative from the project considers such resources as part of a larger development strategy.

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 report, 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.

2.1.6 Visual Impacts

The findings of the Visual Impact Assessment undertaken for the proposed 100MW PV facility is that the visual environment surrounding the site, especially within a 1 - 3km radius, 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 Solar PV1 Facility and to the potential cumulative visual impact of the facility in relation to the proposed PV Facilities, 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' close proximity to each other.

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 and landowners in the area. Construction activities may potentially result in a moderate, temporary visual impact both before and after mitigation.
- The PV facility is expected to have a moderate visual impact on observers travelling along the Rondawel-Hutchinson secondary road within a 1km radius of the infrastructure, both before and after mitigation. There are no residences within a 1km radius of the proposed PV facility.
- The operational PV facility could have a moderate visual impact on observers (road users) travelling between a 1 – 3km radius of the PV facility structures. This impact may be mitigated to low. There are no exposed residences within a 1-3km radius of the proposed PV facility.
- The anticipated impact of lighting at the PV facility is likely to be of moderate significance, and 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 proposed PV facility is not located near any operational airports/airfields or major roads. The potential visual impact related to solar glint and glare as an air/road travel hazard is expected to be of low significance.
- There are no residences within a 3km 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 the 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 (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 of the proposed facilities 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.

Considering all factors, it is recommended that the development of the facility as proposed be supported; subject to the implementation of the recommended mitigation measures and management programme recommended within the visual impact assessment (Appendix J).

2.1.7 Socio-economic Impacts

The review of the proposed Carolus Solar PV1 Facility is associated with both positive and negative socio-economic impacts. In order to assess whether the project is beneficial, the additions to the environment brought about by the project need to be evaluated. The additional benefits of the intervention are the difference between the reference case position (i.e., the no-go option) and the position if the intervention is implemented. It involves the evaluation of the net effect and trade-offs associated with the proposed intervention.

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. Stimulation of production, employment, government revenue, skills development, and household income as a result of the investment in the project and its subsequent operations will outweigh possible production, employment and household income losses that could be experienced by local businesses affected by changes in the areas aesthetic and visual resources. It should be noted though that the positive and negative impacts will be distributed mostly amongst different receptors but will not result in inequality. Adherence to the proposed mitigation measures, however, would ensure that the offset of impacts is more balanced and that it also takes into account communities and businesses that will be negatively affected.

The positive effects generated by the project will not offset many of the negative impacts. These include impacts on the sense of place and property and business values that could occur during both construction and operation, the effect on social and economic infrastructure, and crime and social conflicts in the area that could be created during only the construction phase. These impacts though will only affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project in terms of production, employment, government revenue, community benefits and households' earnings. This means that when compared with the no-go option, the proposed project is associated with greater socio-economic benefits.

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.

2.1.8 Impacts on Traffic

The potential traffic and transport related impacts for the construction, operation and decommissioning phases of the proposed Carolus Solar PV1 Facility were identified and assessed. The main impact on the external road network will be during the construction phase. This phase is temporary in comparison to the operational period. The number of abnormal loads vehicles was estimated and to be found to be able to be accommodated by the road network. During operation, it is expected that maintenance and security staff will periodically visit the facility. It is assumed that 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.

The traffic generated during the construction phase, although significant, will be temporary and impacts are considered to be negative and of medium significance before and of low significance after mitigation. The traffic generated during the decommissioning phase will be less than the construction phase traffic and the impact on the surrounding road network will also be considered negative and of medium significance before and of low significance after mitigation.

The access road and access point to the proposed site have been assessed and were found to be acceptable from a traffic engineering perspective.

The development is supported from a transport perspective provided that the recommendations and mitigations contained in this report are adhered to.

The potential impacts associated with proposed Carolus Solar PV1 Facility and associated infrastructure are acceptable from a transport perspective and it is therefore recommended that the proposed facility be authorised.

2.1.9 Assessment of Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

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 (refer to **Table 11.1** and Chapter 10).

Table 11.1: Summary of the cumulative impact significance for the Carolus Solar PV1 Facility

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	High	Medium
Aquatic Ecology	Low	Medium
Avifauna	Low	Medium
Land use, soil and agricultural potential	Low	Low
Heritage (archaeology, palaeontology and cultural landscape)	Low	Low
Visual	Medium	Medium
Socio-Economic	Positive impacts: Low Negative impacts: Low	Positive impacts: Medium Negative impacts: Medium
Traffic	Low	Medium

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. 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.

2.2.10. Environmental Sensitivity Analysis

As part of the specialist investigations undertaken within the project development area, specific environmental features and areas were identified. The environmental features identified within and directly adjacent to the development area and development footprint are illustrated in Figure 2.2. The following points provide a description of the sensitivities identified within the development area:

» **Ecological features:**
The lower slopes of the PV area consist of open plains considered to be low sensitivity while the upper slopes of the PV area are steeper of have a higher woody component and are considered to be medium sensitivity. Along the power line route to the MTS, there are some high sensitivity drainage features, but these can easily be spanned by the power line and are not likely to be significantly impacted by the power line. The drainage feature which occurs along the south-eastern boundary of the PV area would be vulnerable to impact and it is recommended that a freshwater specialist should demarcate the boundary of this feature in the field before construction to ensure that the PV area does not encroach into this area unnecessarily. In terms of fauna, the PV area does not have any habitats present that would be of particularly high value and no specific impact of high magnitude on fauna are expected. However, given the size of the facility and the location within an ESA it is recommended that

specific measures are put in place with regards to the design of the fence around the facility to facilitate the movement of smaller fauna in and out of the PV area. Similarly, no plant species of high concern were observed within the PV and impacts on plant SCC are likely to be low. Perhaps the greatest area of concern regarding the PV facility would be the location of the facility on a fairly steep slope with soils that appear to have high erodibility. The panels would generate a lot of runoff and combined with the high levels of disturbance that would occur after construction, the potential for erosion problems at the site are very high. Consequently, specific mitigation measures to reduce and manage erosion and runoff at the site are recommended.

» **Aquatic Ecology:**
The results of the habitat assessment indicates natural (class A) and largely natural (class B) instream and riparian conditions for the catchment respectively. The overall ecological importance and sensitivity for the area was determined to be moderate. The overall ecosystem service benefit for the system is intermediate. The recommended buffer was calculated to be 22 m for the drainage lines for the construction and operational phases.

» **Avifauna:**
At the PV facility, the priority species which would be most severely affected by disturbance would be ground nesting species, and those that utilise low shrubs for nesting. the proposed development 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 appropriate mitigation. No fatal flaws were discovered during the investigations and no any buffer zones recommended.

» **Soils:**
The solar panel bases will typically be installed into the soil surface with vegetation expected to be kept intact yet maintained. The "Low" pre- and post-mitigation significance ratings are expected.

» **Heritage Resources:**
The assessment of the possible impacts on the archaeological, historical and palaeontological resources has shown a Low impact from the Carolus Solar PV1 Facility project after mitigation measures. There are limited impacts anticipated to heritage resources from this proposed development. There are no any " no-go" areas that have been identified and no buffers have been recommended for the PV facility.

» **Visual:**
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 and landowners in closer proximity (< 1 km) to the construction activities. No no-go areas have been identified and no buffers have been recommended. The PV facility is expected to have a moderate visual impact on observers travelling along the Rondawel-Hutchinson secondary road, both before and after mitigation. There are no residences within a 1km radius of the proposed PV facility.

» **Socio-economic:**
Sensitive receptors from a socio-economic perspective are similar to those identified from a visual perspective, as detailed above. 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. No no-go areas have been identified and no buffers have been recommended.

» **Traffic:**
The main impact on the external road network will be during the construction phase. This phase is temporary in comparison to the operational period. The number of abnormal loads vehicles was estimated and to be found to be able to be accommodated by the road network. During operation, it is expected that maintenance and security staff will periodically visit the facility. It is assumed that 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.

Based on an analysis of the identified sensitivities for the project development area, no optimisation of the layout is required. The layout as presented within Figure 2.2 is therefore considered to be the most appropriate from an environmental perspective.

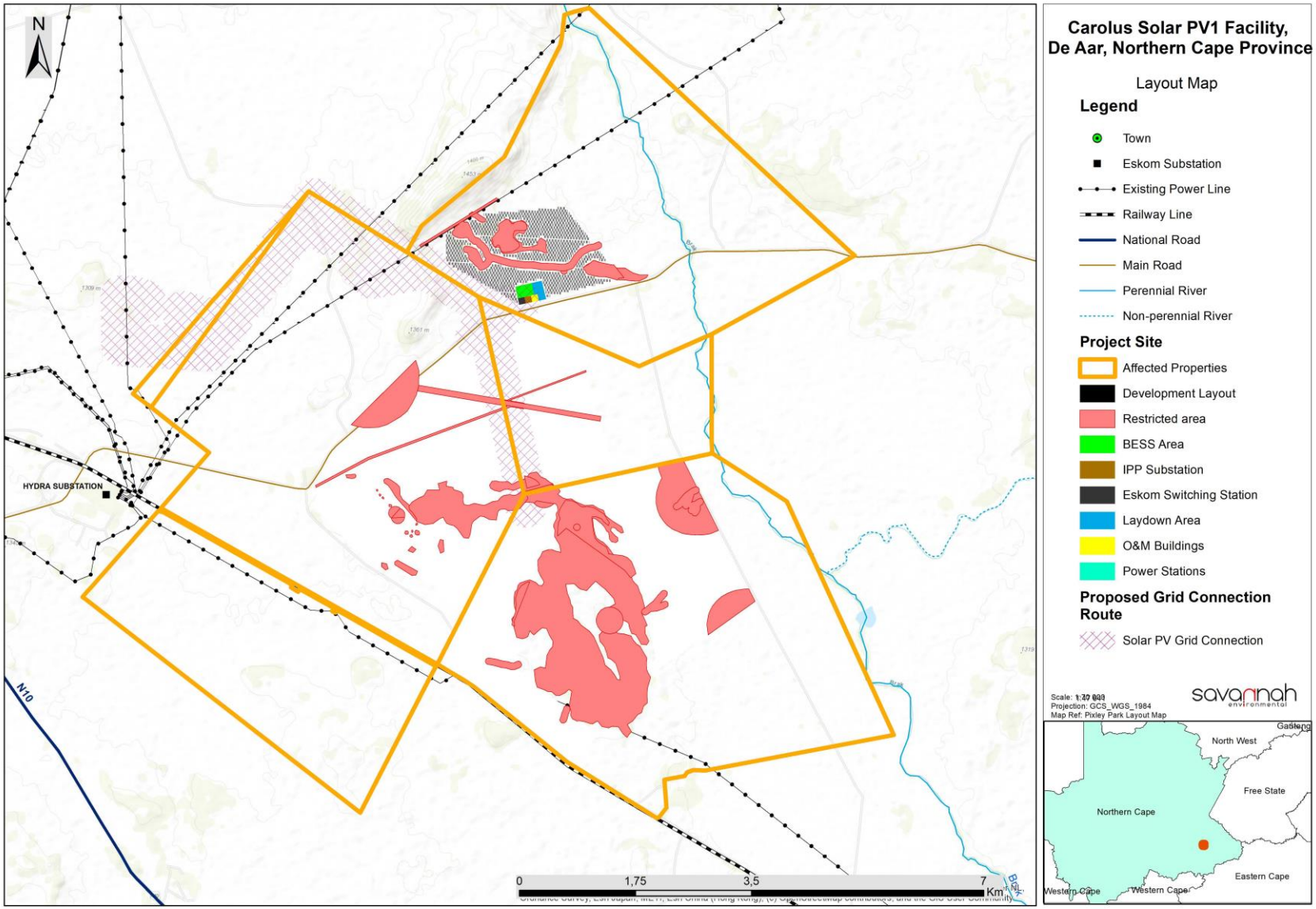

Figure 2.2: The development footprint of the Carolus Solar PV1 Facility , as assessed within this EIA report, overlain on the identified environmental sensitive features

2.2.11. Overall Conclusion (Impact Statement)

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. 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 a bat and 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 high. It must be considered that the addition of the infrastructure of the Carolus Solar PV1 Facilitywill constitute an additional layer to the cultural landscape and must be considered as such within a gazetted REDZ area. 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.

As detailed in the cost-benefit analysis, the benefits of the Carolus Solar PV1 Facilityare 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 Facilitybased 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).

2.2.12. 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 2.2**) 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 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.

2.2. Activities and Components associated with the Carolus Solar PV1 Facility

The main activities/components associated with the Carolus Solar PV1 Facility are detailed in **Table 2.2**.

Table 2.2: Activities associated with Planning, Construction, Operation and Decommissioning of the Carolus Solar PV1 Facility

Pre-construction	
Requirements	» Planning and Design of facility
Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to accommodate the required equipment. » Preparation of the site (e.g. laydown areas). » Mobilisation of construction equipment.
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 collector substation site to determine and confirm the locations of all associated infrastructure.
Construction Phase	
Requirements	» Project receives Environmental Authorisation from the DFFE, preferred bidder allocation granted by DMRE (or other offtaker), 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. » 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, where possible, 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	
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 4,5m wide. Location is to be determined by the final micro-siting or positioning of the PV panels.
Undertake site preparation	i) 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. ii) Stripping of topsoil to be stockpiled, for use during rehabilitation. iii) Vegetation clearance to be undertaken in a systematic manner to reduce the risk of exposed ground being subjected erosion. iv) 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.
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 in sections on flatbed trucks by the PV supplier. Imported components to be transported from the most feasible port of entry, which is deemed to be the Port of Ngqura in the Eastern Cape Province. Alternatively, components can be imported via the Port of Saldanha in the Western Cape. » 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	» 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. For array installation, typically vertical support posts are driven into the ground. Depending on the results of the geotechnical report 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 collector 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- or double-circuit power line will run from the central collector substation and tie into the existing Eskom Gamma Substation.
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.
Undertake site rehabilitation	» Commence with rehabilitation efforts once construction is completed in an area, and all construction equipment is removed. » On commissioning, access points to the site that will not be required for the operation phase will be closed and prepared for rehabilitation.
<u>Operation Phase</u>	
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.
<u>Decommissioning Phase</u>	
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.
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 PV infrastructure (development footprint) will revert back to their original land-use (i.e. primarily grazing) once the Carolus Solar PV1 Facility has reached the end of its economic life and all infrastructure has been decommissioned

CHAPTER 3: PURPOSE AND OBJECTIVES OF THE EMPR

An Environmental Management Programme (EMPr) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced". The objective of this EMPr is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMPr is to help ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMPr is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMPr provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (site clearing and site establishment) through to those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, re-vegetation) and operation. The EMPr also defines monitoring requirements in order to ensure that the specified objectives are met.

This EMPr is applicable to all employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the Carolus Solar PV1 Facility . The document must be adhered to and updated as relevant throughout the project life cycle.

This EMPr has been compiled in accordance with Appendix 4 of the EIA Regulations, 2014 (as amended). This is a dynamic document and will be further developed in terms of specific requirements listed in any authorisations issued for the Carolus Solar PV1 Facility and/or as the project develops. The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management). The specifications have been developed on the basis of the findings of the Environmental Impact Assessment (EIA), and must be implemented to protect sensitive on-site and off-site features through controlling construction, operation and decommissioning activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts.

The EMPr has the following objectives:

- Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the Carolus Solar PV1 Facility .
- Ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- Identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- Propose mechanisms and frequency for monitoring compliance, and prevent long-term or permanent environmental degradation.

» Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that were not considered in the EIA Process.

The mitigation measures identified within the EIA Process are systematically addressed in the EMPr, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Carolus Solar PV1 (Pty) Ltd must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr, and through its integration into the relevant contract documentation provided to parties responsible for construction and/or operation activities on the site. The adequacy and efficacy of implementation is to be monitored by an independent Environmental Control Officer (ECO). Since this EMPr is part of the EIA Process for the Carolus Solar PV1 Facility , it is important that this document be read in conjunction with the EIA report compiled for this project. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMPr and the Environmental Authorisation, the stipulations in the Environmental Authorisation shall prevail over that of the EMPr, unless otherwise agreed by the authorities in writing. Similarly, any provisions in legislation overrule any provisions or interpretations within this EMPr.

This EMPr shall be binding on all the parties involved in the planning, construction and operational phases of the project, and shall be enforceable at all levels of contract and operational management within the project. The document must be adhered to and updated as relevant throughout the project life cycle.

CHAPTER 4: STRUCTURE OF THIS EMPR

The first three chapters provide background to the EMPr and the Carolus Solar PV1 Facility , while the chapters which follow consider the following:

» Planning and design activities;
» Construction activities;
» Operation activities; and
» Decommissioning activities.

These chapters set out the procedures necessary for Carolus Solar PV1 (Pty) Ltd as the project owner, to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The EMPr has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific EMPr table has been established for each environmental objective. The information provided within the EMPr table for each objective is illustrated below:

OBJECTIVE: Description of the objective, which is necessary to meet the overall goals; which take into account the findings of the EIA specialist studies

Project component/s	List of project components affecting the objective, i.e.: » PV panels; » Facility substation; » Access roads; and » Associated infrastructure.
Potential Impact	Brief description of potential environmental impact if objective is not met.
Activity/risk source	Description of activities which could impact on achieving objective.
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion.

Mitigation: Action/control	**Responsibility**	**Timeframe**
List specific action(s) required to meet the mitigation target/objective described above.	Who is responsible for the measures	Time periods for implementation of measures

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the management plan.
Monitoring	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting.

The objectives and EMPr tables are required to be reviewed and possibly modified throughout the life of the PV facility whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components of the solar facility).
» Modification to or addition to environmental objectives and targets.
» Additional or unforeseen environmental impacts are identified and additional measures are required to be included in the EMPr to prevent deterioration or further deterioration of the environment.
» Relevant legal or other requirements are changed or introduced.
» Significant progress has been made in achieving an objective or target such that it should be re-examined to determine if it is still relevant or should be modified, etc.

4.1. Project Team

This EMP was compiled by:

EMP Compilers	
Rendani Rasivhetshele Jo-Anne Thomas	Savannah Environmental
Input from Specialist Consultants	
Terrestrial Ecology (including fauna and flora)	Simon Todd of 3foxes Biodiversity Solutions
Avifauna (including monitoring)	Owen Davies of Arcus Consultancy Services South Africa and Dr Steve Percival of Ecology Consulting
Aquatic	Dr Brian Colloty of EnviroSci
Soil, Land Use, Land Capability and Agricultural Potential	Andrew Husted of The Biodiversity Company
Heritage (including archaeology, palaeontology and cultural landscape)	Cherene de Bruyn and Wouter Fourie of PGS Heritage
Visual	Lourens du Plessis of LOGIS
Socio-economic	Matthew Keeley of Urban-Econ
Traffic	Iris Wink and Adrian Johnson of JG Africa

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes for more than fifteen (15) years. They have managed and drafted Environmental Management Programmes for other power generation projects throughout South Africa, including numerous wind and solar energy facilities.

CHAPTER 5: ROLES AND RESPONSIBILITIES

OBJECTIVE 1: Establish clear reporting, communication, and responsibilities during construction in relation to the overall implementation of the EMPr

For the purposes of the EMPr, the generic roles that need to be defined are those of the:

» Project Developer;
» Project Manager/Site Manager;
» Environmental Control Officer;
» Contractors; and
» Contractor's Safety, Health and Environment Representative/Environmental Officer.

It is acknowledged that the specific titles for these functions may vary once the project is implemented. The purpose of this section of the EMPr is to give a generic outline of what these roles typically entail. It is expected that this will be further defined during project implementation.

i) The Developer

As the Proponent, Carolus Solar PV1 (Pty) Ltd must ensure that the implementation of the project complies with the requirements of all environmental authorisations and all other permits, and obligations emanating from other relevant environmental legislation.

ii) Project Manager/Site Manager

The Project Manager/Site Manager is responsible for overall management of project and EMPr implementation. The following tasks will fall within his/her responsibilities:

» Be fully conversant with the EIA for the project, the EMPr, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.
» Be fully knowledgeable with the contents of all relevant licences and permits.
» Be familiar with the recommendations and mitigation measures of this EMP, and implement these measures.
» Ensure all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
» Monitor site activities on a daily basis for compliance.
» Ensure that the EMPr is correctly implemented throughout the project by means of site inspections and meetings. This must be documented as part of the site meeting minutes.
» Conduct internal audits of the construction site against the EMPr.
» Confine the construction site to the demarcated area.
» Rectify transgressions through the implementation of corrective action.

iii) Environmental Control Officer

A suitably qualified Environmental Control Officer (ECO)[2] must be appointed by the project proponent prior to the commencement of any authorised activities and will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation. Accordingly, the ECO will:

- Be fully knowledgeable of the contents of the EIA.
- Be fully knowledgeable of the contents of the conditions of the EA (once issued).
- Be fully knowledgeable of the contents of the EMPr.
- Be fully knowledgeable of all the licences and permits issued to the site.
- Be fully knowledgeable of the contents of all relevant environmental legislation.
- Ensure that the contents of the EMPr are communicated to the Contractors site staff and that the Site Manager and Contractors are constantly made aware of the contents through ongoing discussion.
- Ensure that the compliance of the EMPr, EA and the legislation is monitored through regular and comprehensive inspection of the site and surrounding areas.
- Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements or site-specific plans.
- Ensure that if the EMPr, EA and/or the legislation conditions, regulations or specifications are not followed then appropriate measures are undertaken to address any non-compliances (for example an ECO may cease construction or an activity to prevent a non-compliance from continuing).
- Ensure that any non-compliance or remedial measures that need to be applied are reported.
- Keep records of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
- Independently report to the DFFE in terms of compliance with the specifications of the EMPr and conditions of the EA (once issued).
- Keep records of all reports submitted to DFFE.

The ECO must be present full-time on site for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, to facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing (i.e. during site establishment, and excavation of foundations). Thereafter, monthly compliance audits can be undertaken, provided that adequate compliance with the EA, environmental permits and EMPr is achieved. The developer should appoint a designated Environmental Officer (EO) to be present on-site to deal with any environmental issues as the arise. The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

iv) Contractors

The Lead Contractor is responsible for the following:

- Ensure compliance with the EA, environmental permits and the EMPr at all times during construction.
- Have the overall responsibility of the EMPr and its implementation.

[2] The ECO should have a relevant degree or technical diploma in environmental management and at least 2 years' experience in the field

- Ensure that all appointed contractors and sub-contractors are aware of the EMPr and their respective responsibilities.
- Provide all necessary supervision during the execution of the project.
- Comply with any special conditions as stipulated by landowners.
- Inform and educate all employees about the environmental risks associated with the various activities to be undertaken, and highlight those activities which should be avoided during the construction process in order to minimise significant impacts to the environment.
- Maintain an environmental register which keeps a record of all incidents which occur on the site during construction. These incidents include:
  - Public involvement / complaints
  - Health and safety incidents
  - Hazardous materials stored on site
  - Non-compliance incidents
  - Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
- Where construction activities are undertaken is close to any inhabited area, the necessary precautions shall be taken by the Contractor to safeguard the lives and property of the inhabitants.
- Conduct audits to ensure compliance to the EMPr.
- Ensure there is communication with the Project Manager, the ECO, and relevant discipline engineers on matters concerning the environment.
- Should the Contractor require clarity on any aspect of the EMPr the Contractor must contact the Environmental Consultant/Officer for advice.

Contractors and Service Providers must be aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The contractor's obligations in this regard include the following:

- Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- A copy of the EMPr must be easily accessible to all on-site staff members.
- Employees must be familiar with the requirements of this EMPr and the environmental specifications as they apply to the construction of the solar facility.
- Prior to commencing any site works, all employees and sub-contractors must have attended an environmental awareness training course which must provide staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Staff will be informed of environmental issues as deemed necessary by the ECO.

All contractors (including sub-contractors and staff) and service providers are ultimately responsible for:

- Ensuring adherence to the environmental management specifications
- Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken
- Any lack of adherence to the above will be considered as non-compliance to the specifications of the EMPr
- Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to

- Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting
- Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO
- Ensuring that a register of all public complaints is maintained
- Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations)

v) Contractor's Safety, Health and Environment Representative/Environmental Officer

The Contractor's Safety, Health and Environment (SHE) Representative/Environmental Officer (EO), employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the SHE/EO must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's SHE/EO should:

- Be well versed in environmental matters.
- Understand the relevant environmental legislation and processes.
- Understand the hierarchy of Environmental Compliance Reporting, and the implications of Non-Compliance.
- Know the background of the project and understand the implementation programme.
- Be able to resolve conflicts and make recommendations on site in terms of the requirements of this Specification.
- Keep accurate and detailed records of all EMPr-related activities on site.

OBJECTIVE 2: Establish clear reporting, communication, and responsibilities during operation in relation to overall implementation of the EMPr during operation

Formal responsibilities are necessary to ensure that key procedures are executed during operation. Several professionals will form part of the operation team. For the purposes of the EMPr, the generic roles that need to be defined are those of the:

- Operations Manager; and
- Environmental Manager

It is acknowledged that the specific titles for these functions may vary once the project is implemented. The purpose of this section of the EMPr is to give a generic outline of what these roles typically entail. It is expected that this will be further defined during project implementation.

i) Operations Manager

The Plant Manager will:

- Ensure that adequate resources (human, financial, technology) are made available and appropriately managed for the successful implementation of the operational EMPr.
- Conduct annual basis reviews of the EMPr to evaluate its effectiveness.
- Take appropriate action as a result of findings and recommendations in management reviews and audits.
- Provide forums to communicate matters regarding environmental management.

ii) Environmental Manager

The Environmental Manager will:

- Develop and Implement an Environmental Management System (EMS) for the solar facility and associated infrastructure.
- Manage and report on the solar facility's environmental performance.
- Maintain a register of all known environmental impacts and manage the monitoring thereof.
- Conduct internal environmental audits and co-ordinate external environmental audits.
- Liaise with statutory bodies (such as the National and Provincial Department of Environmental Affairs and conservation authorities) on environmental performance and other issues.
- Conduct environmental training and awareness for the employees who operate and maintain the solar facility.
- Compile environmental policies and procedures.
- Liaise with interested and affected parties on environmental issues of common concern.
- Track and control the lodging of any complaints regarding environmental matters.

The Environmental Manager must provide fourteen (14) days written notification to the DFFE that the Carolus Solar PV1 Facility operation phase will commence.

CHAPTER 6: MANAGEMENT PROGRAMME: PLANNING AND DESIGN

Overall Goal: undertake the pre-construction (planning and design) phase in a way that:

- Ensures that the design of the solar facility responds to the identified environmental constraints and opportunities.
- Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements.
- Ensures that adequate regard has been taken of identified environmental sensitivities, as well as any landowner and community concerns and that these are appropriately addressed through design and planning (where applicable).
- Enables the construction activities to be undertaken without significant disruption to other land uses and activities in the area.
- Ensures that the best environmental options are selected for the solar facility.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

6.1. Objectives

OBJECTIVE 1: To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Subject to final facility micro-siting and subsequent acceptance from DFFE, the development footprint detailed in **Figure 2.2** must be implemented. Cognisance of sensitive areas defined in **Figure 2.2** and within the EIA report should be considered when undertaking the final design of the facility.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Design fails to respond optimally to the identified environmental considerations. » Employment creation for the construction, operation and decommissioning activities. » Design fails to respond optimally to the environmental considerations.
Activities/risk sources	» Positioning of PV panels and alignment of access roads and underground cabling. » Positioning of substation and power line. » Positioning of balance of plant. » Pre-construction activities, e.g. geotechnical investigations.
Mitigation: Target/Objective	» To ensure that the design of the PV facility responds to the identified environmental constraints and opportunities, including the constraints identified through the EIA Process.

	» To ensure that pre-construction activities are undertaken in an environmentally friendly manner by e.g. avoiding identified sensitive areas. » Optimal planning of visual infrastructure to minimise visual impact.

Mitigation: Action/control	Responsibility	Timeframe
Plan and conduct pre-construction activities in an environmentally responsible manner and in a manner that does not lead to unnecessary impacts and disturbance.	Developer EPC Contractor	Pre-construction
Consider design level mitigation measures recommended by the specialists, as detailed within the EIA report and relevant appendices.	Developer EPC Contractor	Design phase
All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk	Developer EPC Contractor	Design phase
In terms of the boundary fence, no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants. The boundary fence should have access points for smaller fauna to enter and exit the PV area.	Developer EPC Contractor	Design phase
Access to the grid connection should not cross any systems, resulting in additional new tracks to reach the pylons/towers.	Developer EPC Contractor	Design phase
Where practical, powerlines/cables on the project site should be underground.	Developer EPC Contractor	Design phase
Where practical, grid connection infrastructure should follow existing servitudes such as existing powerlines, roads and fences.	Developer EPC Contractor	Design phase
Pylon positions should be placed in a staggered manner in relation to adjacent parallel transmission lines to increase the overall visibility of transmission infrastructure to avifauna such as bustards.	Developer EPC Contractor	Design phase
Any new overhead power lines must be of a design that minimises electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components and possible bird perches (e.g. cross arms) of 1.8 m or greater.	Developer EPC Contractor	Design phase
Plan to install appropriate marking devices (BFDs – bird friendly devices) on all new overhead power lines to increase visibility. The advice of a specialist should be sought regarding the type, placement and spacing of the BFDs to be used and the type of pylon structure to be used.	Developer EPC Contractor	Design phase
The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths.	Developer EPC Contractor	Design phase
Temporary laydown areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.	Developer EPC Contractor	Design phase

Mitigation: Action/control	Responsibility	Timeframe
High traffic areas and buildings such as offices, batching plants, storage areas etc. should, where possible, be situated in areas that are already disturbed.	Developer EPC Contractor	Design phase
Make use of existing roads where possible when planning the access road layout for the PV facility. Take cognisance of the topography and limit cut and fill requirements.	Developer EPC Contractor	Design phase
the number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible.	Developer EPC Contractor	Design phase
Plan as little lighting as possible, and only where essential for operation of the facility.	Developer EPC Contractor	Design phase
Design the facility such that no runoff is directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond.	Developer EPC Contractor	Design phase
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 2.2.	Developer	Design phase

Performance Indicator	» Design meets the objectives and does not degrade the environment. » Design and layouts respond to the mitigation measures and recommendations in the EIA report.
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the facility design by the Project Manager and ECO prior to the commencement of construction.

OBJECTIVE 2: Ensure that relevant permits and site-specific plans are in place to manage impacts on the environment

Project Component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Impact on identified sensitive areas. » Design fails to respond optimally to the environmental considerations.
Activities/Risk Sources	» Positioning of all project components » Pre-construction activities, e.g. geotechnical investigations, site surveys of substation footprint, power line servitude and internal access roads and environmental walk-through surveys.

	» Positioning of temporary sites.
Mitigation: Target/Objective	» To ensure that the design of the power plant responds to the identified environmental constraints and opportunities. » To ensure that pre-construction activities are undertaken in an environmentally friendly manner. » To ensure that the design of the power plant responds to the identified constraints identified through pre-construction surveys.

Mitigation: Action/Control	Responsibility	Timeframe
Obtain any additional environmental permits required prior to the commencement of construction.	Developer	Pre-construction
Obtain abnormal load permits for transportation of project components to site (if required).	Contractor(s)	Prior to construction
Pre-construction walk-through of the facility's final layout in order to locate species of conservation concern that can be translocated as well as comply with the provincial permit conditions.	Developer Specialist	Pre-construction
Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes as well as temporary laydown areas and facilities, to identify any nests/breeding/roosting activity of sensitive species. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around breeding activity, and lowering levels of associated noise.	Developer Specialist	Pre-construction
The necessary biodiversity permits must be obtained prior to removal of any species of concern.	Project developer	Pre-construction
Search and rescue of species of conservation concern should be conducted prior to clearing activities.	Developer Contractor	Pre-construction
A detailed geotechnical investigation is required for the design phase for all infrastructure components.	Developer	Design phase
Obtain any additional environmental permits required (e.g. water use license, protected plant permits, faunal relocation permit, etc.). Copies of permits/licenses must be submitted to the Director: Environmental Impact Evaluation at the DFFE , and kept on site during the construction and operation phases of the project.	Developer	Design phase
A stormwater management plan must be developed in the pre-construction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks.	Contractor(s)	Design phase
Develop a detailed method statement for the implementation of the alien invasive management plan and open space management plan for the site (refer to **Appendix C**).	Developer	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
Develop a detailed method statement for the implementation of the plant rescue and protection plan for the site (refer to **Appendix E**).	Developer	Pre-construction
Develop a detailed method statement for the implementation of the re-vegetation and habitat rehabilitation plan for the site (refer to **Appendix D**).	Developer	Pre-construction
Develop a detailed method statement for the implementation of the traffic and transportation management plan for the site (refer to **Appendix F**).	Developer	Pre-construction
Develop an effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Developer	Pre-construction
Prepare a detailed Fire Management Plan in collaboration with surrounding landowners.	Developer	Pre-construction
Develop and implement an alien, invasive and weeds eradication/control plan.	Developer Specialist	Pre-construction
A comprehensive rehabilitation / monitoring plan must be developed in consultation with a specialist, and must be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed.	Developer Contractor Specialist	Pre-construction

Performance Indicator	» Layout does not destroy/degrade no-go areas. » No disturbance of no-go areas. » Permits are obtained and relevant conditions complied with. » Relevant management plans and Method Statements prepared and implemented.
Monitoring	» Review of the design by the Project Manager and the ECO prior to the commencement of construction. » Monitor ongoing compliance with the EMPr.

OBJECTIVE 3: Ensure compliance of required mitigation measures and recommendations by contractors

Project Component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Impact on identified sensitive areas. » Planning fails to respond optimally to the environmental considerations.

Activities/Risk Sources	» Positioning of all project components » Pre-construction activities. » Positioning of temporary sites. » Employment and procurement procedures.
Mitigation: Target/Objective	» To ensure that appropriate planning is undertaken by the contractor to ensure compliance with the conditions of the EA and EMPr. » To ensure that pre-construction and construction activities are undertaken in an environmentally friendly manner.

Mitigation: Action/Control	Responsibility	Timeframe
The terms of this EMPr and the Environmental Authorisation must be included in all tender documentation and Contractors contracts.	Developer Contractor	Pre-construction
Create awareness of skills through posters and media announcements and set-up a skills desk at a central and accessible location. The skills desk should serve to record local job seeker skills.	Developer Contractor	Pre-construction
Develop a local community safety forum to establish monitoring methods for the surrounding community.	Developer Contractor	Pre-construction
The developer should encourage the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies.	Developer Contractor	Pre-construction
The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers were feasible.	Developer Contractor	Pre-construction

Performance Indicator	» Conditions of the EA and EMPr form part of all contracts. » Local employment and procurement is encouraged.
Monitoring	» Monitor ongoing compliance with the EMPr and method statements.

OBJECTIVE 4: To ensure effective communication mechanisms

It is important to maintain on-going communication with the public (including affected and surrounding landowners) during the construction and operation phases of the Carolus Solar PV1 Facility . Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.

Potential Impact	» Impacts on affected and surrounding landowners and land uses.
Activity/risk source	» Activities associated with pre-construction phase. » Activities associated with construction of the PV facility. » Activities associated with operation.
Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners. » Addressing any issues and concerns raised as far as possible in as short a timeframe as possible.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Compile and implement a grievance mechanism procedure for the public (including the affected and surrounding landowners) (using **Appendix B**) to be implemented during both the construction and operation phases of the PV facility and if applicable during decommissioning. This procedure should include the details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues. The mechanism must also include procedures to lodge complaints in order for the local community to express any complaints or grievances with the construction process. A Public Complaints register must be maintained by the Contractor to record all complaints and queries relating to the project and the actions taken to resolve the issue. A Project Specific Grievance Mechanism will be developed and implemented prior to construction.	Developer Contractor O&M Operator	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop and implement a grievance mechanism for the construction, operation and closure phases of the PV facility for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.	Developer Contractor O&M Operator	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop a public relations (PR) campaign prior to commencement of construction to communicate to community members the construction programme, inclusive of regular updates to generate excitement in the community.	Developer	Pre-construction
Meet with the affected owners and discuss their concerns over property and land values, as well as educate and inform them on the potential environmental impacts that could ensue.	Developer	Pre-construction
Create partnerships with local tourism and game farm industry to promote the development of green energy in the community and for these establishments to communicate to their guests the benefits of green energy	Developer	Pre-construction
Develop an incident reporting system to record non-conformances to the EMPr.	Contractor	Pre-construction Duration of construction

Performance Indicator	» Effective communication procedures in place for all phases as required.
Monitoring	» An incident reporting system used to record non-conformances to the EMPr. » Grievance mechanism procedures implemented.

	» Public complaints register developed and maintained.

CHAPTER 7: MANAGEMENT PROGRAMME: CONSTRUCTION

Overall Goal: Undertake the construction phase in a way that:

- Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
- Enables construction activities to be undertaken without significant disruption to other land uses and activities in the area, in particular concerning noise impacts, farming practices, traffic and road use, and effects on local residents.
- Minimises the impact on the indigenous natural vegetation, protected tree species, and habitats of ecological value.
- Minimises impacts on fauna using the site.
- Minimises the impact on heritage sites should they be uncovered.
- Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed.

An environmental baseline must be established during the undertaking of construction activities, where possible.

7.1. Objectives

In order to meet the overall goal for construction, the following objectives, actions, and monitoring requirements have been identified.

OBJECTIVE 1: Securing the site and site establishment

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Hazards to landowners and public. » Security of materials. » Substantially increased damage to natural vegetation. » Potential impact on fauna and avifauna habitat.
Activities/risk sources	» Open excavations (foundations and cable trenches). » Movement of construction employees, vehicles and plant equipment in the area and on-site.
Mitigation: Target/Objective	» To secure the site against unauthorised entry. » To protect members of the public/landowners/residents.

Mitigation: Action/control	Responsibility	Timeframe
Secure the site, working areas and excavations in an appropriate manner. Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.	Contractor EO	During site establishment Maintenance: for duration of Contract
The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English and any other relevant indigenous languages, all to the approval of the Site Manager. All unattended open excavations shall be adequately demarcated and/or fenced.	Contractor	During site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure the area and implement access control procedures.	Contractor	During site establishment Maintenance: for duration of Contract
Establish SABS 089: 1999 Part 1 approved bunded areas for the storage of hazardous materials and hazardous waste.	Contractor	During site establishment and during construction
Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown.	Contractor	During site establishment and during construction
Water consumption requirements for the site for the construction if not obtained from an authorised water user within the area, must be authorised by the Department of Water and Sanitation.	Developer	Prior to water use
Supply adequate weather and vermin proof waste collection bins and skips (covered at minimum with secured netting or shade cloth) at sites where construction is being undertaken. Separate bins should be provided for general and hazardous waste. As far as possible, provision should be made for separation of waste for recycling.	Contractor	Site establishment, and duration of construction

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured as a result of construction activities. » Fauna and flora is protected as far as practically possible. » Appropriate and adequate waste management and sanitation facilities provided at construction site.
Monitoring	» Regular visual inspection of the fence for signs of deterioration/forced access. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site. » ECO/ EO to monitor all construction areas on a continuous basis until all construction is completed; immediate reporting back to the site manager. » ECO/ EO to address any infringements with responsible contractors as soon as these are recorded.

OBJECTIVE 2: Appropriate management of the construction site and construction workers

Project Component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Damage to indigenous natural vegetation and sensitive areas. » Damage to and/or loss of topsoil (i.e. pollution, compaction etc.). » Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities. » Pollution/contamination of the environment.
Activities/Risk Sources	» Vegetation clearing and levelling of equipment storage area/s. » Access to and from the equipment storage area/s. » Ablution facilities. » Contractors not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment.
Mitigation: Target/Objective	» Limit equipment storage within demarcated designated areas. » Ensure adequate sanitation facilities and waste management practices. » Ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment.

Mitigation: Action/Control	Responsibility	Timeframe
To minimise impacts on the surrounding environment, contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation, the EIA report, and this EMPr, as well as the requirements of all relevant environmental legislation.	Contractors	Construction
Contractors must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Contractor and sub-contractor/s	Pre-construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Contractor	Construction
All construction vehicles must adhere to clearly defined and demarcated roads. No driving outside of the development boundary must be permitted.	Contractor	Construction
Ensure all construction equipment and vehicles are properly maintained at all times.	Contractor	Construction
Minimise the development footprint within high sensitivity areas	Contractor	Construction
Develop an integrated management plan for the development area, which is beneficial to fauna and flora.	Specialist	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
Ensure that construction workers are clearly identifiable. All workers must carry identification cards and wear identifiable clothing.	Contractor	Construction
Pre-construction environmental induction must be undertaken 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.	Contractor	Construction
Regular toolbox talks should be undertaken to ensure appropriate levels of environmental awareness.	Contractor	Construction
Contact details of emergency services must be prominently displayed on site.	Contractor	Construction
Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff.	Contractor	Construction
Personnel trained in first aid must be on site to deal with smaller incidents that require medical attention.	Contractor	Construction
Road borders must be regularly maintained to ensure that vegetation remains short to serve as an effective firebreak. An emergency fire plan must be developed with emergency procedures in the event of a fire.	Contractor	Duration of construction
Strict control of the behaviour of construction workers must be implemented in terms of works near watercourses.	Contractor	Construction
Ensure waste storage facilities are maintained and emptied on a regular basis.	Contractor	Duration of construction
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Duration of Contract
No liquid waste, including grey water, may be discharged into any water body or drainage line. All sewage disposal to take place at a registered and operational wastewater treatment works. Proof of disposal to be retained as proof of responsible disposal.	Contractor	Duration of construction
All contaminated water must be contained by means of careful run-off management on site.	Contractor	Construction
Ensure compliance with all national, regional and local legislation with regard to the storage, handling and disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials.	Contractor	During construction.
Ensure ablution facilities are appropriately maintained. Ablutions must be cleaned regularly and associated waste disposed of at a registered/permitted waste disposal site. Ablutions must be removed from site when construction is completed.	Contractor and sub-contractor/s	Duration of contract
Cooking and eating of meals must take place in a designated area. No fires are allowed on site. No firewood or kindling may be gathered from the site or surrounds.	Contractor and sub-contractor/s	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to food waste.	Contractor and sub-contractor/s	Duration of contract
Keep a record of all hazardous substances stored on site. Clearly label all the containers storing hazardous waste.	Contractor	Duration of contract
A Method Statement must be compiled for the management of pests and vermin within the site, specifically relating to the canteen area if applicable.	Contractor	Construction
Ensure proper health and safety plans in place during the construction period to ensure safety on and around site during construction, including fencing of the property and site access restriction.	Contractor and sub-contractor/s	Pre-construction
All disturbed areas that are not used such as excess road widths, should be rehabilitated with locally occurring shrubs and grasses after construction to reduce the overall footprint of the development.	Contractor and sub-contractor/s	Construction
On completion of the construction phase, all construction workers must leave the site within one week of their contract ending.	Contractor and sub-contractor/s	Construction

Performance Indicator	» Code of Conduct drafted before commencement of the construction phase. » Appropriate training of all staff is undertaken prior to them commencing work on the construction site. » Ablution and waste removal facilities are in a good working order and do not pollute the environment due to mismanagement. » All areas are rehabilitated promptly after construction in an area is complete. » Excess vegetation clearing and levelling is not undertaken. » No complaints regarding contractor behaviour or habits.
Monitoring	» Regular audits of the construction camps and areas of construction on site by the EO. » Proof of disposal of sewage at an appropriate licensed wastewater treatment works. » Proof of disposal of waste at an appropriate licensed waste disposal facility. » An incident reporting system must be used to record non-conformances to the EMPr. » Observation and supervision of Contractor practices throughout the construction phase by the EO. » Complaints will be investigated and, if appropriate, acted upon.

OBJECTIVE 3: Maximise local employment and business opportunities associated with the construction phase

The construction phase of 100 MW SEF will extend over a period of approximately 18-24 months and create in the region of 350 employment opportunities. Based on information provided by the proponent, approximately 75% of the jobs will benefit low-skilled workers, 25% semi-skilled and 5% high skilled.

Beyond the direct employment opportunities that will be created by the project during the construction phase, the development will also have a positive spin-off effect on the employment situation in other sectors of the national and local economies. Through the procurement of local goods (i.e., consumption induced effects) the project will support employment in the sectors such as construction, business services and trade.

Project component/s	» Construction activities associated with the establishment of the PV facility, including associated infrastructure.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/risk sources	» The employment of outside contractors to undertake the work and who make use of their own labour will reduce the employment and business opportunities for locals. Employment of local labour will maximise local employment opportunities.
Mitigation: Target/Objective	» The Developer, in discussions with the local municipality, should aim to employ as many workers (skilled, semi-skilled / low-skilled) from the local areas/ towns, as possible. » The Developer should also develop a database of local BBBEE service providers.

Mitigation: Action/control	Responsibility	Timeframe
Recruit local labour as far as feasible to increase the benefits to the local households.	Contractor	Construction
Create a local skills database.	Contractor	Construction
Employ labour intensive methods in construction where feasible.	Contractor	Construction
Co-ordinate with the local municipality and relevant labour unions to inform the local labour force about the project that is planned to be established and the jobs that can potentially be applied for.	Contractor	Construction
Establish a local skills desk in the local area to determine the potential skills that could be sourced in the area.	Contractor	Construction
Establish a local skills desk (in Somerset East, Riebeek East and Cookhouse) to determine the potential skills that could be sourced in the area	Contractor	Construction
Employ labour-intensive methods in construction where feasible.	Contractor	Construction
Sub-contract to local construction companies particularly SMMEs and BBBEE compliant enterprises where possible.	Contractor	Construction
Use local suppliers where feasible and arrange with the local SMMEs to provide transport, catering and other services to the construction crews.	Contractor	Construction
Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases.	Contractor	Construction
Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers, especially those from local communities.	Contractor	Construction
Facilitate broader skills development programme as part of socio-economic development commitments.	Contractor	Construction
Sub-contract to local construction companies where possible.	Contractor	Construction
Use local suppliers where feasible and arrange with local SMMEs and BBBEE compliant enterprises to provide transport, catering, and other services to the construction crews.	Contractor	Construction

Performance Indicator	» Maximum amount of semi and unskilled labour locally sourced where possible. » Local suppliers and SMMEs contracted where possible. » Skills transfer facilitated where required.

	» Apprenticeship programmes established
Monitoring and Reporting	» Contractors and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE 4: Minimise the negative social impacts on family structures and social networks due to the presence of construction workers from outside the area

The migration of people to the area could result in social conflicts between the local population and the migrant work force as the local population could perceive these migrant workers as "stealing" their employment opportunities. Likewise, the influx of people into the area, could potentially lead to a temporary increase in the level of crime, illicit activity and possibly a deterioration of the health of the local community through the spread of infectious diseases. Without any form of income these individuals run the risk of exacerbating the level of poverty within the area. Aside from the broader community issues the increase in the number of people in the area is likely to have an adverse effect on crime levels, incidents of trespassing, development of informal trading and littering. There is also potentially a likelihood of increased stock theft.

The low and semi-skilled workers are likely to be local residents and will therefore from part of the local family and social network.

Project component/s	» Construction and establishment activities associated with the establishment of the PV facility, including associated infrastructure. » Construction work force.
Potential Impact	» The presence of construction workers who live outside the area and who are housed in local towns can impact on family structures and social networks. » Presence of construction workers on site may result in loss of livestock due to stock theft and damage to farm infrastructure, such as gates and fences. Poaching of wild animals may also occur. » Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities. » Impact on the safety of farmers and communities (increased crime etc.) by construction workers and also damage to farm infrastructure such as gates and fences. » Increase in production and GDP-R.
Activities/risk sources	» The presence of construction workers can impact negatively on family structures and social networks, especially in small, rural communities. » The presence of construction workers on the site can result in stock thefts or illegal hunting/ trapping of fauna and or game and damage to farm infrastructure.
Mitigation: Target/Objective	» Avoid and/or minimise the potential impact of construction workers on the local community and their livelihoods. » To minimise impacts on the social and biophysical environment. » Maximise the economic benefit to the local municipality. » Prohibit theft of stock and valuables on impacted and adjacent farm portions. » Procure goods and services, as far as practically possible, from the local municipality. » Initiate site access control and monitor movement to and from the site.

Mitigation: Action/control	Responsibility	Timeframe
Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area	Contractor	Construction
Ensure that any damages or losses to nearby affected farms that can be linked to the conduct of construction workers are adequately reimbursed	Contractor	Construction
Assign a dedicated person to deal with complaints and concerns of affected parties	Contractor	Construction
The construction of on-site accommodation will likely mitigate some social conflicts from taking place. The developer should, however, organise appropriate transport for the workers from the site to the nearest towns in order to access services or to buy goods. This will reduce the amount of time the staff spend walking to or from the site.	Contractor	Construction
Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers	Contractor	Construction
Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations	Contractor	Construction
Implement a policy that no employment will be available at the gate.	Contractor	Pre-construction/ construction
Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers. Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations.	Developer Contractor	Pre-construction/ construction

Performance Indicator	» No criminal activities attributable to the construction workers are reported. » No complaints received from landowners or the general public.
Monitoring and Reporting	» An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE 5: Control of noise pollution stemming from construction activities

Various construction activities would be taking place during the development of the facility and may pose a noise risk to the closest receptors. These activities could include temporary or short-term activities where small equipment is used (such as the digging of trenches to lay underground power lines). The impact of such activities is generally very low. Impacts may however occur where activities are undertaken at night.

Project component/s	» PV panels. » PV panels.

	» Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Increased noise levels at potentially sensitive receptors.
Activity/risk source	» Any construction activities taking place within 500m from potentially noise sensitive developments (NSD). » Site preparation and earthworks. » Construction-related transport. » Foundations or plant equipment installation. » Building activities.
Mitigation: Target/Objective	» Ensure that maximum noise levels at potentially sensitive receptors are less than 65dBA. » Prevent the generation of disturbing or nuisance noises. » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensure compliance with the National Noise Control Regulations. » Ensure night-time noise levels less than 45 dBA.

Mitigation: Action/control	Responsibility	Timeframe
Establish a line of communication and notify all stakeholders and NSDs of the means of registering any issues, complaints or comments.	Developer	Construction
Night-time construction activities (closer than 800 m from Noise Sensitive Developments (NSDs)) are not recommended and must be minimised where possible, and only if these activities can be minimised to one location using minimum equipment.	Developer	Construction
Roads must not be constructed within 150m from occupied dwellings used for residential purposes (to reduce noise levels below 42 dBA if construction traffic may use the road at night).	Developer	Construction
Ensure that all equipment is maintained and fitted with the required noise abatement equipment.	EPC Contractor	Weekly inspection
The construction crew must abide by the local by-laws regarding noise.	EPC Contractor	Construction phase

Performance Indicator	» Construction activities do not change the existing ambient sound levels with more than 7dB. » Ensure that maximum noise levels at potentially sensitive receptors are less than 65 dBA. » No noise complaints are registered
Monitoring and Reporting	» Ambient sound measurements are recommended to take place prior to the construction of the PV facility.

OBJECTIVE 6: Management of dust and emissions and damage to roads

During the construction phase, limited gaseous or particulate emissions (and dust) is anticipated from exhaust emissions from construction vehicles and equipment on-site, as well as vehicle entrained dust from the movement of vehicles on the internal access roads.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Dust impacts can occur from cleared areas and from vehicle movement along gravel roads. » Release of minor amounts of air pollutants (for example NO_2, CO and SO_2) from vehicles and construction equipment.
Activities/risk sources	» The movement of construction vehicles and their activities on the site. » Clearing of vegetation and topsoil. » Excavation, grading and scraping. » Transport of materials, equipment and components. » Re-entrainment of deposited dust by vehicle movements. » Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces. » Fuel burning from construction vehicles with combustion engines.
Mitigation: Target/Objective	» To avoid and or minimise the potential dust impacts associated with heavy vehicles, and also minimise damage to roads. » To ensure emissions from all vehicles are minimised, where possible, for the duration of the construction phase. » To minimise nuisance to the community and adjacent landowners from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase.

Mitigation: Action/control	Responsibility	Timeframe
Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Contractor	Construction phase
Vehicles and equipment must be maintained in a road-worthy condition at all times. Road worthy certificates must be in place for all heavy vehicles at the outset of the construction phase and updated on a monthly basis.	Contractor	Construction phase
Vehicles used to transport sand and building materials must be fitted with tarpaulins or covers when travelling on roads.	Contractor	Construction phase
Ensure vehicles adhere to speed limits on public roads and speed limits set within the site by the Site Manager.	Contractor Transportation contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Ensure that damage to gravel public roads and access roads attributable to construction vehicles is repaired before completion of the construction phase.	EPC Contractor	Before completion of construction phase
Disturbed areas must be re-vegetated as soon as practicable after construction is complete in an area.	EPC Contractor	At completion of the construction phase

Performance Indicator	» Appropriate dust suppression measures implemented on site during the construction phase. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed or before entering the site. » Road worthy certificates in place for all heavy vehicles at the outset of the construction phase and updated on a monthly basis.
Monitoring and Reporting	» The Developer and appointed EO must monitor indicators listed above to ensure that they have been met for the construction phase. » Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE 7: Conservation of the existing soil resource within the site and in the adjacent areas

The natural soil on the site needs to be preserved as far as possible to minimise impacts on the environment. Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern. Uncontrolled run-off relating to construction activities (excessive wetting, etc.) will also lead to accelerated erosion. Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems.

A set of strictly adhered to mitigation measures are required to be implemented in order to effectively limit the impact on the environment. The disturbed areas where human impact is likely are the focus of the mitigation measures laid out below.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Erosion and soil loss. » Increased runoff. » Downstream sedimentation.
Activities/risk sources	» Rainfall and wind erosion of disturbed areas. » Excavation, stockpiling and compaction of soil. » Concentrated discharge of water from construction activity.

	» Stormwater run-off from sealed surfaces. » Mobile construction equipment movement on site. » Roadside drainage ditches. » Project related infrastructure, such as buildings, PV panels and fences.
Mitigation: Target/Objective	» To minimise erosion of soil from site during construction. » To minimise damage to vegetation by erosion or deposition. » To retain all topsoil with a stable soil surface

Mitigation: Action/control	Responsibility	Timeframe
Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan	Contractor	Construction
All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	Contractor	Construction
Only the proposed access roads as per the development footprint are to be used to reduce any unnecessary compaction.	Contractor	Construction
Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks.	Contractor	Construction
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion.	Contractor	Construction
Salvaging topsoil: » Topsoil must always be salvaged and stored separately from subsoil and lower-lying parent rock or other spoil material. ∗ Topsoil stripping removes up to 30 cm or less of the upper soils. ∗ In cultivated areas, depth of topsoil may increase and needs to be confirmed with the land owner. » Prior to salvaging topsoil the depth, quality and characteristics of topsoil should be known for every management area. o This will give an indication of total volumes of topsoil that need to be stored to enable the proper planning and placement of topsoil storage. o Different types of topsoil – rocky soils and sands or loams must be stored separately. » Topsoil should be removed (and stored) under dry conditions to avoid excessive compaction whenever topsoil will have to be stored for longer than one year.	Contractor	Construction
Storing topsoil: » Viability of stored topsoil depends on moisture, temperature, oxygen, nutrients and time stored. » Rapid decomposition of organic material in warm, moist topsoil rapidly decreases microbial activity necessary for nutrient cycling, and reduces the amount of beneficial micro-organisms in the soil. » Stockpile location should ideally be in a disturbed but weed-free area.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
» Storage of all topsoil that is disturbed should be of a maximum height of 2m and the maximum length of time before re-use is 18 months. » Topsoil handling should be reduced to stripping, piling (once), and re-application. Between the stockpiling and reapplication, stored topsoil should not undergo any further handling except control of erosion and (alien) invasive vegetation. » Where topsoil can be reapplied within six months to one year after excavation, it will be useful to store the topsoil as close as possible to the area of excavation and re-application, e.g. next to cabling trenches. » Do not mix overburden with topsoil stockpiles, as this will dilute the proportion of fertile soil (with less fertile subsoil or rock material). » Employ wind nets made from Hessian or similarly fibrous and biodegradable material, where required, to stabilise newly placed topsoil stockpiles and to reduce wind erosion. » In cases where topsoil has to be stored longer than 6 months or during the rainy season, soils should be kept as dry as possible and protected from erosion and degradation by: ∗ Preventing ponding on or between heaps of topsoil ∗ Covering topsoil berms ∗ Preventing all forms of contamination or pollution ∗ Preventing any form of compaction ∗ Monitoring the establishment of all invasive vegetation and removing such if it appears ∗ Keeping slopes of topsoil at a maximal 2:1 ratio ∗ Monitoring and mitigating erosion where it appears » Where topsoil needs to be stored in excess of one year, it is recommended to either cover the topsoil or allow an indigenous grass cover to grow on it – if this does not happen spontaneously, seeding should be considered.		
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas.	Contractor	Construction
Spillages of cement to be cleaned up immediately and disposed or re-used in the construction process.	Contractor	Construction
Spill kits to be kept on active parts of the construction site and at site offices.	Contractor	Construction
Cement batching to take place in designated areas only, as approved on site layout (if applicable).	Contractor	Construction
When preparing the hard setting area, cuts should be used for fill with little or no wastages.	Contractor	Construction
Implement erosion control measures denuded areas as required and monitor erosion and manage all occurrences according to the erosion management plan (refer to **Appendix G**). Erosion control measures should be implemented in areas where slopes have been disturbed.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Control depth of all excavations and stability of cut faces/sidewalls.	Contractor	Construction
Reapplying topsoil: » Spoil materials and subsoil must be back-filled first, then covered with topsoil. » Immediate replacement of topsoil after the undertaking of construction activities within an area. » Generally, topsoil should be re-applied to a depth slightly greater than the topsoil horizon of a pre-selected undisturbed reference site. » The minimum depth of topsoil needed for re-vegetation to be successful is approximately 20 cm. » If the amount of topsoil available is limited, a strategy must be devised to optimise re-vegetation efforts with the topsoil available. » Reapplied topsoil should be landscaped in a way that creates a variable microtopography of small ridges and valleys that run parallel to existing contours of the landscape. The valleys become catch-basins for seeds and act as run-on zones for rainfall, increasing moisture levels where the seeds are likely to be more concentrated. This greatly improves the success rate of re-vegetation efforts. » To stabilise reapplied topsoil and minimise raindrop impact and erosion: * Use organic material from cleared and shredded woody vegetation where possible * Alternatively, suitable geotextiles or organic erosion mats can be used as necessary » Continued monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation.	Contractor	Construction
Re-applied topsoil needs to be re-vegetated as soon as possible.	Contractor	Construction
Implement general erosion control measures/practises: » Runoff control and attenuation can be achieved by using any or a combination of sand bags, logs, silt fences, storm water channels and catch-pits, shade nets, geofabrics, seeding or mulching as needed on and around cleared and disturbed areas. * Ensure that all soil surfaces are protected by vegetation or a covering to avoid the surface being eroded by wind or water. » Ensure that heavy machinery does not compact areas that are not meant to be compacted as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. » Prevent the concentration or flow of surface water or storm water down cut or fill slopes or along pipeline routes or roads and ensure measures to prevent erosion are in place prior to construction.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
» Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation. » Vegetation clearing should occur in parallel with the construction progress to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then result in sedimentation. » When implementing dust control measures, prevent over-wetting, saturation, and run-off that may cause erosion and sedimentation.		
Conservation measures should be applied to ensure that soil does not get unusable or unproductive and to ensue soil stabilisation.	Contractor	Construction
Regular monitoring for erosion should be undertaken after construction to ensure that no erosion problems have developed as result of the disturbance must be undertaken, as per the Erosion Management and Rehabilitation Plans for the project.	Contractor	Construction

Performance Indicator	» Minimal level of soil erosion around site. » Minimal level of soil degradation. » No activity outside demarcated areas. » Acceptable state of excavations. » No activity in restricted areas. » Acceptable state of excavations, as determined by EO and ECO. » Progressive return of disturbed and rehabilitated areas to the desired end state (refer also to the Plant Rescue and Protection Plan in **Appendix E**). » No indications of visible topsoil loss.
Monitoring and Reporting	» Continual inspections of the site by the EO. » Reporting of ineffective sediment control systems and rectification as soon as possible. » If soil loss is suspected, acceleration of soil conservation and rehabilitation measures must be implemented.

OBJECTIVE 8: Minimise the impacts on and loss of indigenous vegetation and control of alien invasive plants

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.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation.

	» Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Loss of plant cover leading to loss of faunal habitat and loss of specimens of protected plants. » Soil erosion. » Increased fire hazards. » Increased water use.
Activity/risk source	» Site preparation and clearing. » Soil disturbance » Introduction of plant propagules with people and vehicles. » Activities outside of designated construction areas. » Driving off designated routes.
Mitigation: Target/Objective	» To limit construction activities to designated areas. » Implement invasive plant clearing prior to construction, but after site demarcation.

Mitigation: Action/control	Responsibility	Timeframe
Communicate clearly to all contractors that no disturbance outside the demarcated areas will be tolerated.	Contractor	Construction
Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However, caution should be exercised to avoid using material that might entangle fauna.	Contractor	Construction
Vegetation clearing to commence only after walk-through has been conducted and necessary permits obtained and search and rescue completed	Contractor CEO	Construction
Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.	Contractor CEO	Construction
Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas.	CEO	Construction
All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.	Contractor CEO	Construction
No fires should be allowed within the site as there is a risk of runaway veld fires.	Contractor	Construction
No fuelwood collection should be allowed on-site.	Contractor	Construction
Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.	Contractor	Construction
Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem plant species are already present in the area and are likely to increase rapidly if not controlled.	Contractor	Construction
Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility must be undertaken as these are also likely to be prone to invasion problems.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	Contractor	Construction
Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off.	Contractor	Construction
Unnecessary impacts on surrounding natural vegetation must be avoided, The construction impacts must be contained to the footprint of the PV facility.	Contractor	Construction
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible once construction is complete in an area » Do not import soil from areas with alien plants.	Contractor	Construction
Establish an on-going monitoring programme to detect, quantify and remove any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act and Act 43 of 1983 and NEM: Biodiversity Act).	Contractor	Construction
Immediately control any alien plants that become established using registered control methods appropriate for the particular species in question. Where necessary, obtain an opinion from a registered Pest Control Officer.	Contractor	Construction
All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor.	Contractor	Construction
The use of herbicides and pesticides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides (a registered Pest Control Officer). It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site along with any other nationally or internationally similarly restricted/banned products.	Contractor	Construction
A registered Pest Control Officer must be appointed to implement the invasive alien plants and weeds management plan. The Pest Control Officer must supervise the clearing team to ensure compliance with the invasive alien plants and weeds management plan.	Contractor	Construction
All cleared areas should be revegetated with indigenous perennial species from the local area.	Contractor	Construction

Performance Indicator	» No disturbance outside of designated work areas. » Limited alien infestation within project control area. » Construction activities restricted to the development footprint.
Monitoring and Reporting	» Observation of vegetation clearing activities by ,the EO throughout the construction phase. » Monitoring of alien plant establishment within the site on an on-going basis.

OBJECTIVE 9: Protection of terrestrial fauna

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Vegetation clearance and associated impacts on faunal habitats. » Traffic to and from site.
Activity/risk source	» Site preparation and earthworks. » Foundations or plant equipment installation. » Mobile construction equipment movement on site. » Access road construction activities. » Substation construction facilities.
Mitigation: Target/Objective	» To minimise footprints of habitat destruction. » To minimise disturbance to resident and visitor faunal species.

Mitigation: Action/control	Responsibility	Timeframe
The extent of clearing and disturbance to the vegetation must be kept to a minimum so that impact on fauna and their habitats is restricted.	Contractor	Construction
During construction any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer.	Contractor CEO	Construction
The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off of the construction site.	Contractor	Construction
All personnel should undergo environmental induction with regards to fauna and, in particular, awareness about not harming or collecting species such as snakes, tortoises and owls, which are often persecuted out of superstition.	Contractor CEO	Construction
If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.	Contractor CEO	Construction
The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off of the construction site.	Contractor CEO	Construction
If any parts of the site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs or HPS bulbs) as far as practically possible, which do not attract insects and which should be directed downwards.	Contractor	Construction
All construction vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
In terms of the boundary fence, no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants. The boundary fence should have access points for smaller fauna to enter and exit the PV area.	Contractor	Duration of contract

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation and habitats for fauna. » Limited impacts on faunal species (i.e. noted/recorded fatalities), especially those of conservation concern.
Monitoring and Reporting	» Observation of vegetation clearing activities by the EO throughout construction phase. » Supervision of all clearing and earthworks by the EO.

OBJECTIVE 10: Protection of avifauna

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Disturbance of birds (e.g. destruction of habitat). » Displacement of birds. » Collision with project components. » Traffic to and from site.
Activity/risk source	» Site preparation and earthworks. » Displacement of priority species due to habitat and destruction associated with construction of the PV plant and associated infrastructure. » Mortality of priority species due to collisions with solar panels. » Entrapment of large-bodied birds in the double perimeter fence. » Mortality of priority species due to collision and electrocution on the medium voltage internal reticulation network
Mitigation: Target/Objective	» To minimise footprints of habitat destruction. » To minimise disturbance to resident and visitor avifaunal species.

Mitigation: Action/control	Responsibility	Timeframe
The extent of clearing and disturbance to the vegetation must be kept to a minimum so that impact on avifauna and their habitats is restricted.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Speed limits (30 km/h) should be strictly enforced on site to reduce probability of vehicle collisions.	Contractor	Construction
No dogs or cats other than those of the landowners should be allowed on site.	Contractor	Construction
Construction camps should be lit with as little light as practically possible, with the lights directed downwards where appropriate.	Contractor	Construction
Each pylon for new overhead power lines must be fitted with a safe bird perch.	Contractor	Construction
The appointed Environmental Officer must be trained to identify the potential Red Data species as well as the signs that indicate possible breeding by these species. The Environmental Officer must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species.	Contractor	Construction
If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.	Contractor	Construction
Any holes dug e.g. for foundations of pylons should not be left open for extended periods of time to prevent entrapment by ground dwelling avifauna or their young and only be dug when required and filled in soon thereafter.	Contractor	Construction
Temporary fencing must be suitably constructed, e.g. if double layers of fencing are required for security purposes they should be positioned at least 2 m apart to reduce the probability of entrapment by larger bodied species that may find themselves between the two fences.	Contractor	Construction
Roadkill is to be reported to the ECO and removed as soon as possible to reduce the attraction of the site to crows and other scavengers.	Contractor	Construction
Organic waste is to be disposed of in an appropriate manner to reduce the attraction of the site to crows and other scavengers.	Contractor	Construction
Appropriate bird flight diverters (BFDs) to be installed on all lengths of new overhead power lines;	Contractor	Construction

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation and habitats for avifauna. » Limited impacts on avifaunal species (i.e. noted/recorded fatalities), especially those of conservation concern.
Monitoring and Reporting	» Observation of vegetation clearing activities by the EO throughout construction phase. » Supervision of all clearing and earthworks by the EO.

OBJECTIVE 11: Minimise impacts on heritage sites during the construction of the PV facility

Project component/s	» Excavations of foundations. » Excavations of trenches for the installation of cabling and infrastructure.
Potential Impact	» Loss of archaeological artefacts. » Impact to palaeontological resources. » Impacts on cultural landscapes.
Activity/risk source	» All bulk earthworks.
Mitigation: Target/Objective	» A 1km no-go development buffer be maintained around Site GK038 and a 500m no-go development buffer be maintained around Site GK037 to ensure that no impact occurs. » A 50m no development buffer area must be implemented around site GK048 » This no-go development buffer refers to new infrastructure and not the existing roads to be used by the PV facilities. » Should any significant archaeological resources be uncovered during the course of the construction phase, work must cease in the area of the find and SAHRA must be contacted regarding an appropriate way forward.

Mitigation: Action/control	Responsibility	Timeframe
Contractors must be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow if they find sites. All staff must also be familiarised with procedures for dealing with heritage objects/sites.	Contractor	Construction
<u>Chance Find Procedure:</u> » If a chance find is made the person responsible for the find must immediately stop working and all work must cease in the immediate vicinity of the find. » The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the Environmental Officer (EO) (if appointed) or site manager . The EO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates. » A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates. » Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Upon receipt of the preliminary report, the Heritage Agency will inform the EO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary. » The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilised and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find. » In the event that the fossil cannot be stabilised the fossil may be collected with extreme care by the EO (or site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site. » Once Heritage Agency has issued the written authorisation, the developer may continue with the development.		
Measures to minimise impacts on Cultural Landscape: Ecological: » Species and ecosystem loss should be prevented by limiting fragmentation in the landscape, and should therefore adhere to the following general recommendations: » Remaining areas of endemic and endangered natural vegetation should be conserved. » High and Very High Sensitivity Ecological areas (crest lines and drainage lines), should be protected from development. » Areas of habitat are found among the rocky outcrops and contribute to the character, as well as biodiversity of the area. Care should be taken that habitats are not needlessly destroyed. » Careful planning should incorporate areas for stormwater runoff where the base of the structure disturbed the natural soil. Local rocks found on the site could be used to slow stormwater (instead of concrete, or standard edge treatments), and prevent erosion that would be an unfortunate consequence that would alter the character of the site. By using rocks from site, it helps to sensitively keep to the character. » The principle of 'tread lightly' must be applied for any activity (and associated development requirements e.g. toilets for the construction process) should be emphasised. Aesthetic: » Encourage mitigation measures (for instance use of vegetation) to 'embed' or disguise the proposed structures within the surrounding tourism and agricultural landscape at ground level, road edges etc; » The continuation of the traditional use of material could be enhanced with the use of the rocks on the site as building	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
material. This would also help to embed structures into the landscape that does not have to be standard containers that clutter the landscape. » Using material found on the site adds to the sense of place and reduces transportation costs of bringing materials to site. » Where additional infrastructure (i.e. roads) is needed, the upgrade of existing roads to accommodate the development should be the first consideration. The local material such as the rocks found within the area could be applied to address stormwater runoff from the road to prevent erosion. » Infrastructure improvement, including new roads and upgrades to the road network, should be appropriate to the rural context (scale, material etc.). » The layout of the facility should have an emphasis on place-making, i.e. landscape-related heritage considerations, as opposed to standard infrastructure driven requirements; » Prevent the construction of new buildings/structures on visually sensitive, steep, elevated or exposed slopes, ridgelines and hillcrests. Retain the integrity of the distinctive landscape character; » Scale and massing should be sensitive to the surrounding landscape, although this is challenging with regard to the development of WEFs. » Avoid visual clutter in the landscape by intrusive signage, and the intrusion of commercial corporate development along roads » Avoid development of infrastructure (such as buildings and power lines), on crests or ridgelines due to the impact on the visual sensitivity of skylines. » Retain view-lines and vistas focused on prominent natural features such as mountain peaks or hills, as these are important place-making and orientating elements for experiencing the cultural landscape. <u>Historic</u>: » The integrity of the historic farm werfs should be maintained and protected. » Names of routes and watercourses that refer to traditional use during the time of the hunter-gatherers and herders, as well as the colonial era, should be celebrated. » Traditional planting patterns should be protected by ensuring that existing trees are not needlessly destroyed, as these signify traces of cultural intervention in a harsh environment. These planting patterns include the trees planted around the werfs. » In some cases, remnant planting patterns (even single trees) uphold the historic character of an area. Interpretation of these landscape features as historic remnants should occur.		

Mitigation: Action/control	Responsibility	Timeframe
» Mountain slopes have been used for traditional practices for many years, and care should be taken that any significant cultural sites, such as burials and veldkos/medicinal plant resources, are not disturbed. » Where the historic function of a building/site is still intact, the function has heritage value and should be protected. Please take note of the items listed below: » Surviving examples (wagon routes, outspans, and commonage), where they are owned in some public or communal way (or by a body responsible for acting in the public interest) and where they are found to be actively operating in a communal way, will have cultural and heritage value and should be enhanced and retained. » The new roads should display minimum scale designs where possible. » Maintain traditional movement patterns across rural landscapes or to places of socio-historical value. (a) Avoid privatization or the creation of barriers to traditional access routes. (b) Retain old roadways, which have been replaced by newer roads, for use as recreation trails. » Respect existing patterns, typologies and traditions of settlement-making by promoting the continuity of heritage features. These include: (a) indigenous; (b) colonial; and (c) current living heritage in the form of tangible and intangible associations to place. » Respect traditional werf settlement patterns by considering the entire werf as the component of significance. This includes the backdrop of the natural landscape against which it is sited, as well as its spatial structure. Any development that impacts the inherent character of the werf component should be discouraged. <u>Social</u>: » Care should be taken that existing functions such as outspan areas (see criteria for these under historic) are not lost in the development stages, as it fulfils an important function within the cultural landscape. » The local community around the development should benefit from job opportunities created by the proposed development. <u>Economic</u>: » Sheep or game farming should be allowed to continue in the area and between the panels where feasible. » Care should be taken to reduce visual impact from surrounding tourism areas, by following the recommendations included in the VIA.		

Performance Indicator	» Reporting of and liaison about possible finds of heritage resources. » Heritage resources noticed and rescued.

	» All heritage items located are dealt with as per the legislative guidelines. » Measures to reduce impacts on cultural landscape are implemented.
Monitoring and Reporting	» Ensure staff are aware of heritage resources and the procedure to follow when found. » EO to conduct inspections of open excavations.

OBJECTIVE 12: Minimisation of visual impacts associated with construction

During construction heavy vehicles, components, cranes, equipment and construction crews will frequent the area and may cause, at the very least, a visual nuisance to landowners and residents in the area as well as road users.

Project component/s	» Construction site. » Transportation of staff and equipment.
Potential Impact	» Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and the resulting erosion. » Construction traffic.
Activity/risk source	» The viewing of visual scarring by observers in the vicinity of the PV facility or from the roads in the surrounding area.
Mitigation: Target/Objective	» Minimal disturbance to vegetation cover in close vicinity of the PV facility and its related infrastructure. » Minimised construction traffic, where possible. » Minimal visual intrusion by construction activities and intact vegetation cover outside of the immediate construction work areas.

Mitigation: Action/control	Responsibility	Timeframe
Retain and maintain natural vegetation in all areas outside of the development footprint.	Contractor	Construction
Ensure that vegetation is not unnecessarily removed during the construction period.	Contractor	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Contractor	Construction
Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.	Contractor	Construction
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Construction
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works.	Contractor	Construction

Performance Indicator	» Construction site maintained in a neat and tidy condition. » Site appropriately rehabilitated after construction is complete.
Monitoring	» Monitoring of vegetation clearing during construction by EO. » Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).

OBJECTIVE 13: Appropriate handling and management of waste

The construction of the PV facility and associated infrastructure will involve the generation of various wastes. In order to manage the wastes effectively, guidelines for the assessment, classification, and management of wastes, along with industry principles for minimising construction wastes must be implemented. The main wastes expected to be generated by the construction activities include:

» general solid waste
» hazardous waste
» inert waste (rock and soil)
» liquid waste (including grey water and sewage)

Project Component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices.
Activity/Risk Source	» Packaging. » Other construction wastes. » Hydrocarbon use and storage. » Spoil material from excavation, earthworks and site preparation.
Mitigation: Target/Objective	» To comply with waste management legislation. » To minimise production of waste. » To ensure appropriate waste storage and disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/Control	Responsibility	Timeframe
Implement an integrated waste management approach that is based on waste minimisation and incorporates reduction, recycling, re-use and disposal where appropriate. Where solid waste is disposed of, such disposal shall only occur at an appropriately licensed landfill.	Contractor	Construction
Construction method and materials must be carefully considered in view of waste reduction, re-use, and recycling opportunities.	Contractor	Construction
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Construction
Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises is placed, dumped or deposited on adjacent/surrounding properties.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste as required. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.	Contractor	Construction
Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.).	Contractor	Construction
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Construction
Uncontaminated waste must be removed at least weekly for disposal, if feasible; other wastes must be removed for recycling/ disposal at an appropriate frequency.	Contractor	Construction
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area and clearly labelled. This must be regularly removed and recycled (where possible) or disposed of at an appropriately licensed landfill site.	Contractor	Construction
Waste must be stored in accordance with the relevant legislative requirements.	Contractor	Construction
Waste must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Construction
No liquid waste, including grey water, may be discharged into any water body or drainage line. All sewage disposal to take place at a registered and operational wastewater treatment works.	Contractor	Construction
All liquid wastes must be contained in appropriately sealed vessels/ponds within the footprint of the development, and be disposed of at a designated waste management facility.	Contractor	Construction
Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Construction
Regularly serviced chemical toilet facilities and/or septic tank must be used to ensure appropriate control of sewage.	Contractor	Construction
Daily inspection of all chemical toilets and septic tanks must be performed by environmental representatives on site.	Contractor	Construction
In the event where sewage is discharged into the environment, all contaminated vegetation/ rock and soil must be removed immediately and treated as hazardous waste.	Contractor	Construction
Under no circumstances may waste be burnt or buried on site.	Contractor	Construction
Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly, or at an appropriate frequency, at registered waste disposal sites.	Contractor	Construction
Upon the completion of construction, the area must be cleared of potentially polluting materials (including chemical toilets). Spoil stockpiles must also be removed and appropriately disposed of or the materials re-used for an appropriate purpose.	Contractor	Construction

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests for all waste streams.
Monitoring	» Observation and supervision of waste management practices throughout construction phase. » Waste collection will be monitored on a regular basis. » Waste documentation completed. » Proof of disposal of sewage at an appropriate wastewater treatment works. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 14: Appropriate handling and storage of chemicals, hazardous substances

The construction phase may involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents.

Project Component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers. » Soil pollution.
Activity/Risk Source	» Vehicles associated with site preparation and earthworks. » Construction activities of area and linear infrastructure. » Hydrocarbon spills by vehicles and machinery during levelling, vegetation clearance and transport of workers, materials and equipment and fuel storage tanks. » Accidental spills of hazardous chemicals. » Polluted water from wash bays and workshops. » Pollution from concrete mixing.
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons. » To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons. » Prevent and contain hydrocarbon leaks. » Undertake proper waste management. » Store hazardous chemicals safely in a bunded area.

Mitigation: Action/Control	Responsibility	Timeframe
Implement an emergency preparedness plan during the construction phase.	Contractor	Construction
Any liquids stored on site, including fuels and lubricants, must be stored in accordance with applicable legislation.	Contractor	Construction
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants. These must be maintained regularly.	Contractor	Construction
Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment must be contained using a drip tray with plastic sheeting filled with absorbent material when not parked on hard standing.	Contractor	Construction
All hazardous materials 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 as related to the nature of the spill.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
Establish an appropriate Hazardous Stores and fuel storage area which is in accordance with the Hazardous Substance Amendment Act, No. 53 of 1992. This must include but not be limited to: » Designated area; » All applicable safety signage; » Firefighting equipment; » Enclosed by an impermeable bund as per the requirements of the relevant standards and any relevant by-laws; » Protected from the elements, » Lockable; » Ventilated; and » Has adequate capacity to contain 110% of the largest container contents.	Contractor	Construction
The storage of flammable and combustible liquids such as oils must be stored in compliance with Material Safety Data Sheets (MSDS) files.	Contractor	Construction
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures. Where required, a NEMA Section 30 report must be submitted to DFFE within 14 days of the incident.	Contractor	Construction
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Construction
Spilled concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Construction
Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately in line with procedures by trained staff with the appropriate equipment.	Contractor	Construction
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Construction
All machinery and equipment must be inspected regularly for faults and possible leaks,	Contractor	Construction
Routine servicing and maintenance of vehicles must not to take place on-site (except for emergencies). If repairs of vehicles must take place, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Construction
Construction machinery must be stored in an appropriately sealed area.	Contractor	Construction
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Construction
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Construction
An effective monitoring system must be put in place to detect any leakage or spillage of all hazardous substances during their transportation, handling, installation and storage.	Contractor	Construction
Precautions must be in place to limit the possibility of oil and other toxic liquids from entering the soil or clean stormwater system.	Contractor	Construction
As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site.	Contractor	Construction
Have appropriate action plans on site, and training for contactors and employees in the event of spills, leaks and other potential impacts to the aquatic systems. All waste generated on-site during construction must be adequately managed.	Contractor	Construction
Minimise fuels and chemicals stored on site.	Contractor	Construction
Implement a contingency plan to handle spills, so that environmental damage is avoided.	Contractor	Construction
Drip trays must be used during all fuel/chemical dispensing and beneath standing machinery/plant.	Contractor	Construction
In the case of petrochemical spillages, the spill must be collected immediately and stored in a designated area until it can be disposed of in accordance with the Hazardous Chemical Substances Regulations, 1995 (Regulation 15).	Contractor	Construction

Performance Indicator	» No chemical spills outside of designated storage areas. » No water or soil contamination by spills. » Safe storage of hazardous chemicals. » Proper waste management.
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase. » A complaints register must be maintained, in which any complaints from the community will be logged. » An incident reporting system must be used to record non-conformances to the EMPr. » On-going visual assessment to detect polluted areas and the application of clean-up and preventative procedures. » Monitor hydrocarbon spills from vehicles and machinery during construction continuously and record volume and nature of spill, location and clean-up actions. » Monitor maintenance of drains and intercept drains weekly. » Analyse soil samples for pollution in areas of known spills or where a breach of containment is evident when it occurs. » Records of accidental spills and clean-up procedures and the results thereof must be audited on an annual basis by the ECO. » Records of all incidents that caused chemical pollution must be kept and a summary of the results must be reported to management annually.

OBJECTIVE 15: Effective management of concrete batching plant

Concrete is required during the construction of the PV facility. In this regard there could be a need to establish a temporary batching plant within the site. Batching plants are facilities/installations that combine various ingredients to form concrete. Some of these inputs include sand, water, aggregate (rocks, gravel, etc.), fly ash, potash, and cement.

Turbid and highly alkaline wastewater, dust emissions and noise are the key potential impacts associated with concrete batching plants. Concrete batching plants, cement, sand and aggregates can produce dust. Potential pollutants in batching plant wastewater and stormwater include cement, sand, aggregates, chemical additive mixtures, fuels and lubricants.

Project component/s	» Concrete batching plant.
Potential Impact	» Dust emissions. » Release of contaminated water. » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation.
Activity/risk source	» Operation of the batching plant. » Packaging and other construction wastes. » Hydrocarbon use and storage. » Spoil material from excavation, earthworks and site preparation.
Mitigation: Target/Objective	» To ensure that the operation of the batching plant does not cause pollution to the environment or harm to persons.

Mitigation: Action/control	Responsibility	Timeframe
Where possible concrete batching plants should be sited such that impacts on the environment or the amenity of the local community from noise, odour or polluting emissions are minimised.	Contractor	Construction phase
The provision of natural or artificial wind barriers such as trees, fences and landforms may help control the emission of dust from the plant.	Contractor	Construction phase
Where there is a regular movement of vehicles. Access and exit routes for heavy transport vehicles should be planned to minimise noise and dust impacts on the environment.	Contractor	Construction phase
The concrete batching plant site should demonstrate good maintenance practices, including regular sweeping to prevent dust build-up.	Contractor	Construction phase
The prevailing wind direction should be considered to ensure that bunkers and conveyors are sited in a sheltered position to minimise the effects of the wind.	Contractor	Construction phase
Aggregate material should be delivered in a damp condition, and water sprays or a dust suppression agent should be correctly applied to reduce dust emissions and reduce water usage.	Contractor	Construction phase

Mitigation: Action/control	Responsibility	Timeframe
Conveyors must be designed and constructed to prevent fugitive dust emissions. This may include covering the conveyor with a roof, installing side protection barriers and equipping the conveyor with spill trays, which directs material to a collection point. Belt cleaning devices at the conveyor head may also assist to reduce spillage.	Contractor	Construction phase
The site should be designed and constructed such that clean stormwater, including roof runoff, is diverted away from contaminated areas and directed to the stormwater discharge system.	Contractor	Construction phase
Contaminated stormwater and process wastewater should be captured and recycled where possible. A wastewater collection and recycling system should be designed to collect contaminated water.	Contractor	Construction phase
Areas where spills of oils and chemicals may occur should be equipped with easily accessible spill control kits to assist in prompt and effective spill control.	Contractor	Construction phase
Ensure that all practicable steps are taken to minimise the adverse effect of noise emissions. This responsibility includes not only the noise emitted from the plant and equipment but also associated noise sources, such as radios, loudspeakers and alarms.	Contractor	Construction phase
Where possible, waste concrete should be used for construction purposes at the batching plant or project site.	Contractor	Construction phase

Performance Indicator	» No complaints regarding dust. » No water or soil contamination by chemical spills. » No complaints received regarding waste on site or indiscriminate dumping.
Monitoring and Reporting	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout the construction phase. » A complaints register must be maintained, in which any complaints from the community must be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system must be used to record non-conformances to the EMPr. » The Developer or appointed ECO/EO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE 16: Traffic management and transportation of equipment and materials to site

The construction and decommissioning phases of the project will be the most significant in terms of traffic impacts resulting from the transport of equipment (including PV facility components) and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate mostly to works within the site boundary (i.e. the PV facility and ancillary infrastructure) and the external road network. This section should be read in conjunction with the Traffic and Transportation Plan attached as **Appendix F**.

Project component/s	» PV panels.

	» Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted. » Risk of accidents. » Deterioration of road pavement conditions (i.e. both surfaced and gravel road) due to abnormal loads.
Activity/risk source	» Construction vehicle movement. » Speeding on local roads. » Degradation of local road conditions. » Site preparation and earthworks. » Foundations or plant equipment installation. » Mobile construction equipment movement on-site. » Substation construction activities.
Mitigation: Target/Objective	» Minimise impact of traffic associated with the construction of the PV facility on the local traffic volume, existing infrastructure, property owners, animals, and road users. » To minimise the potential for negative interaction between pedestrians or sensitive users and traffic associated with the PV facility construction. » To ensure all vehicles are roadworthy and all materials/equipment are transported appropriately and within any imposed permit/licence conditions. » 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.

Mitigation: Action/control	Responsibility	Timeframe
Develop and implement a detailed method statement for the implementation of the traffic and transportation management plan (refer to **Appendix F**).	Contractor(s), (Transportation sub-contractor)	Construction
Heavy vehicles travelling on secondary roads should adhere to low-speed limits to minimise noise and dust pollution.	Contractor(s), (Transportation sub-contractor)	Construction
If feasible, no construction activities should be carried out during weekends and outside day time working hours	Contractor	Construction
Provide adequate signage along the R335 and R400 to warn motorists of the construction activities taking place on the site. Signage must be maintained on an on-going basis.	Contractor	Construction
Stagger component delivery to the site.	Contractor	Construction
Stagger the construction period.	Contractor	Construction
The use of mobile batching plants and quarries in close proximity to the project site would decrease the impact on the surrounding road network.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Staff and general trips should occur outside of peak traffic periods.	Contractor	Construction
Regular maintenance of gravel roads by the contractor during the construction phase.	Contractor	Construction
A designated access (or accesses) to the proposed site must be created to ensure safe entry and exit.	Contractor	Construction
Provide adequate signage along the N10, R355 & R400 to warn motorists of the construction activities taking place on the site.	Contractor	Construction
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor(s), (Transportation sub-contractor)	Duration of contract
Construction vehicles carrying material to the site should avoid using roads through densely populated built-up areas.	Contractor(s), (Transportation sub-contractor)	Duration of contract
The movement of all vehicles (barring clearing machinery) within the site must be on designated roadways.	Contractor(s)	Duration of contract
All hazardous substances must be transported in accordance with the relevant legislation and regulations.	Contractor(s)	Duration of contract
Roads must be designed so that changes to surface water runoff are avoided and erosion is not initiated.	Contractor(s)	Duration of contract

Performance Indicator	» No traffic incidents involving project personnel or appointed contractors. » Appropriate signage in place. » No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the PV facility.
Monitoring	» Visual monitoring of traffic control measures to ensure they are effective. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 17: Ensure appropriate rehabilitation of disturbed areas such that residual environmental impacts are remediated or curtailed

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas

	» All other associated infrastructure.
Potential Impact	» Environmental integrity of the site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activity/risk source	» Site preparation and earthworks. » Excavation of foundations and trenches. » Temporary laydown areas. » Temporary access roads/tracks. » Other disturbed areas/footprints.
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas. » To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed.

Mitigation: Action/control	Responsibility	Timeframe
A site rehabilitation programme should be compiled and implemented (refer to **Appendix D**).	EPC Contractor in consultation with Specialist	Construction
Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken.	Contractor	Following execution of the works
All cleared areas must be revegetated with indigenous perennial shrubs and succulents from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	Contractor	Following execution of the works
All disturbed areas that are not used such as excess road widths, should be rehabilitated with locally occurring shrubs and grasses after construction to reduce the overall footprint of the development.	Contractor	Following execution of the works
Rehabilitation of the working areas must be concurrent with the construction of the project.	Contractor	Construction
All temporary facilities, equipment and waste materials must be removed from site and appropriately disposed of.	Contractor	Following execution of the works
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following execution of the works
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Contractor	Following execution of the works
On-going alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis.	Contractor	Construction

Performance Indicator	» All portions of site, including construction camp and working areas, cleared of equipment and temporary facilities. » Topsoil replaced on all areas and stabilised. » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites. » Closed site free of erosion and alien invasive plants.

Monitoring and Reporting	» On-going inspection of rehabilitated areas in order to determine the effectiveness of the rehabilitation measures implemented during the operational lifespan of the PV facility. » On-going alien plant monitoring and removal should be undertaken on an annual basis. » An incident reporting system must be used to record non-conformances to the EMPr.

7.2. Detailing Method Statements

OBJECTIVE 19: Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMPr will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager and ECO.

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details with regard to:

» Details of the responsible person/s
» Construction procedures
» Materials and equipment to be used
» Getting the equipment to and from site
» How the equipment/material will be moved while on-site
» How and where material will be stored
» The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
» Timing and location of activities
» Compliance/non-compliance with the Specifications
» Any other information deemed necessary by the Site Manager

Method Statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities. Specific areas to be addressed in the method statement: pre, during and post construction include:

» Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities and to be established etc., including a site camp plan indicating all of these).
» Preparation of the site (i.e. clearing vegetation, compacting soils and removing existing infrastructure and waste).
» Soil management/stockpiling and erosion control.
» Excavations and backfilling procedure.

- Stipulate norms and standards for water supply and usage (i.e. comply strictly to licence and legislation requirements and restrictions).
- Stipulate the stormwater management procedures recommended in the stormwater management method statement.
- Ablution facilities (placement, maintenance, management and servicing).
- Solid Waste Management:
  - Description of the waste storage facilities (on site and accumulative).
  - Placement of waste stored (on site and accumulative).
  - Management and collection of the waste process.
  - Recycle, re-use and removal process and procedure.
- Liquid waste management:
  - Design, establish, maintain and operate suitable pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into rivers, streams or existing drainage systems.
  - Should grey water (i.e. water from basins, showers, baths, kitchen sinks etc.) need to be disposed of, link into existing facilities or sewerage systems where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no unacceptable seepage occurs.
- Dust and noise pollution:
  - Describe the necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
  - Procedure to control dust at all times on the site, access roads, borrow pits and spoil sites (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.
- Hazardous substance storage (ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply):
  - Lists of all potentially hazardous substances to be used.
  - Appropriate handling, storage and disposal procedures.
  - Prevention protocol of accidental contamination of soil at the storage and handling areas.
  - All storage areas, (i.e. for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).
- Fire prevention and management measures on site.
- Fauna and flora protection process on and off site (i.e. removal to reintroduction or replanting, if necessary):
  - Rehabilitation, re-vegetation process and bush clearing.
- Incident and accident reporting protocol.
- General administration.
- Designate access road and the protocol for when roads are in use.
- Requirements on gate control protocols.

The Contractor may not commence with the activity covered by the Method Statement until it has been reviewed by the Site Manager, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

7.3. Awareness and Competence: Construction Phase of the Carolus Solar PV1 Facility

OBJECTIVE 20: To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractors obligations in this regard include the following:

- All employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment. This includes the discussion/explanation of site environmental matters during toolbox talks.
- The content and requirements of Method Statements are to be clearly explained to all plant operators and general workers. All staff acting in a supervisory capacity is to have copies of the relevant Method Statements and be aware of the content thereof.
- Ensuring that a copy of the EMPr is readily available on-site, and that all senior site staff is aware of the location and have access to the document. Senior site staff will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the PV facility.
- Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training session. The training session must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
  - Records must be kept of those that have completed the relevant training.
  - Training should be done either in a written or verbal format but must be appropriate for the receiving audience.
  - Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.
- All sub-contractors must have a copy of the EMPr and sign a declaration/ acknowledgement that they are aware and familiar with the contents and requirements of the EMPr and that they will conduct work in such a manner as to ensure compliance with the requirements of the EMPr.
- Contractors and main sub-contractors should have basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.
- Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
- Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) are erected at prominent locations throughout the site.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately

presented to all staff present on-site, clearly describing their obligations towards environmental controls and methodologies in terms of this EMPr. This training and awareness will be achieved in the following ways:

7.3.1 Environmental Awareness Training

Environmental Awareness Training must be undertaken by the EPC Contractor and must take the form of an on-site talk and demonstration by the EO before the commencement of site establishment and construction on site. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. A record of attendance of this training must be maintained by the SHE Officer on site.

7.3.2 Induction Training

Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations; Contractor's or Engineer's staff; administrative or site staff; sub-contractors or visitors to site.

This induction training should be undertaken by the Contractor's EO and should include discussing the developer's environmental policy and values, the function of the EMPr and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight the overall "do's" and "don'ts" on site and clarify the repercussions of not complying with these. The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the SHE Officer on site.

7.3.3 Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least once a week) where foremen, environmental and safety representatives of different components of the works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and the prevention of the reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

7.4. Monitoring Programme: Construction Phase of the Carolus Solar PV1 Facility

OBJECTIVE 21: To monitor the performance of the control strategies employed against environmental objectives and standards

A monitoring programme must be in place not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. Monitoring during construction must be on-going for the duration of this phase. The Project Manager must ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process will be to monitor the implementation of the specified environmental specifications, in order to:

- Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications
- Ensure adequate and appropriate interventions to address non-compliance
- Ensure adequate and appropriate interventions to address environmental degradation
- Provide a mechanism for the lodging and resolution of public complaints
- Ensure appropriate and adequate record keeping related to environmental compliance
- Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site
- Aid in communication and feedback to authorities and stakeholders

All documentation e.g. audit/monitoring/compliance reports and notifications, required to be submitted to the DFFE in terms of the Environmental Authorisation, must be submitted to the Director: Compliance Monitoring of the Department.

Records relating to monitoring and auditing must be kept on site and made available for inspection to any relevant and competent authority in respect of this development.

7.4.1. Non-Conformance Reports

All supervisory staff including Foremen, Resident Engineers, and the ECO must be provided with the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any environmental non-conformance by the Contractor. Records of penalties imposed may be required by the relevant authority within 48 (forty eight) hours.

The non-conformance report will be updated on completion of the corrective measures indicated on the finding sheet. The report must indicate that the remediation measures have been implemented timeously and that the non-conformance can be closed-out to the satisfaction of the Site Manager and ECO.

7.4.2. Incident Reports

According to Section 30 of National Environmental Management Act (NEMA), an "Incident" is defined as an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed.

In terms of the requirements of NEMA, the responsible person must, within 14 days of the incident, report to the Director General, provincial head of department and municipality such information as is available to enable an initial evaluation of the incident, including:

(a) the nature of the incident;
(b) the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;
(c) initial measures taken to minimise impacts;
(d) causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and

(e) measures taken and to be taken to avoid a recurrence of such incident.

7.4.3. Monitoring Reports

A monitoring report will be compiled by the ECO on a monthly basis (or as dictated by the conditions of the EA) and must be submitted to the Director: Compliance Monitoring at DFFE for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded, corrective action required, and details of those non-conformances or incidents which have been closed out, or any other aspect as per the Appendix 7 of the EIA Regulations (2014, as amended 2017). The EPC contractor must ensure that all waste manifests are provided to the ECO on a monthly basis in order to inform and update the DFFE regarding waste related activities.

7.4.4. Audit Report

The Developer must ensure that project compliance with the conditions of the Environmental Authorisation is audited by an independent auditor, and that the audit reports are submitted to the Director: Compliance Monitoring at the DFFE at intervals as dictated by the conditions of the EA. Such audits must be undertaken during both the construction and operation phases of the PV facility. The effectiveness of the mitigation measures and recommendations for amongst others the following: grievance incidents; waste management, alien and open space management, re-vegetation and rehabilitation, plant rescue and protection and traffic and transportation should be audited. The results must form part of the project monitoring and audit reports.

7.4.5. Final Audit Report

A final environmental audit report must be compiled by an independent external auditor and be submitted to DFFE upon completion of the construction and rehabilitation activities (within 30 days of completion of the construction phase. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions and the requirements of the EMPr.

CHAPTER 8: MANAGEMENT PROGRAMME: OPERATION

Overall Goal: To ensure that the operation of the PV facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the Carolus Solar PV1 Facilityin a way that:

» Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
» Enables the PV facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to farming practices, traffic and road use, and effects on local residents.
» Minimises impacts on fauna using the site.

An environmental manager must be appointed during operation whose duty will be to ensure the implementation of the operational EMPr.

8.1. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE 1: Securing the site and general maintenance during operation

Safety issues may arise with public access to the PV facility (e.g. unauthorised entry to the site) or to the substation. Prevention and control measures to manage public access are therefore important.

General maintenance at the Carolus Solar PV1 Facilitywill be required during the operation phase. The maintenance required may also include the replacement of PV panels, if required during the operation lifetime of the facility.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Hazards to landowners and public.
Activities/risk sources	» Uncontrolled access to the PV facility and associated infrastructure.
Mitigation: Target/Objective	» To secure the site against unauthorised entry. » To protect members of the public/landowners/residents.

Mitigation: Action/control	Responsibility	Timeframe
General onsite maintenance of the PV panels during the operation phase must in no way impact or negatively affect the environment, and contractors or other service providers providing onsite maintenance must be made aware of this EMPr and the content thereof.	O&M Operator	Operation phase
Secure access to the site and entrances.	O&M Operator	Operation phase
Post information boards about public safety hazards and emergency contact information.	O&M Operator	Operation phase
A grievance and consultation plan must be developed and kept on the site at all times during operation of the PV facility. All grievances between landowners and Carolus Solar PV1 (Pty) Ltd and between Carolus Solar PV1 (Pty) Ltd or any service provider or other entity should be recorded and dealt with in the appropriate grievance channels are outlined in the grievance plan which must be established. Community consultation with surrounding landowners and community members must continue through the life cycle of the project, and must be reported on as such in the grievance and consultation plan. This will allow the receipt of - and facilitate resolution of concerns and grievances about the project's social and environmental issues raised by individuals or groups during the project operational period.	O&M Operator	Operation phase
Should PV panels be required to be replaced, the following will apply: » Site access must be confirmed for the transportation of the required components and equipment to the site and location of the infrastructure to be replaced. » Materials and components are to be stored within the previously disturbed construction laydown area. No disturbance of areas outside of these areas should occur. » Full clean-up of all materials must be undertaken after the removal and replacement of the PV panels and associated infrastructure is complete, and disturbed areas appropriately rehabilitated. » Most of the materials used for PV panels can be recycled. The majority of the panel can be recovered and re-used or recycled. Recyclable materials must be transported off-site by truck and managed at appropriate facilities in accordance with relevant waste management regulations. No waste materials may be left on-site following the replacement. » Waste material which cannot be recycled shall be disposed of at an appropriately licensed waste disposal site or as required by the relevant legislation.	O&M Operator	Operation phase

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured.

	» No complaints from landowners/ public.
Monitoring and Reporting	» Regular visual inspection of fence for signs of deterioration/forced access. » An incident reporting system must be used to record non-conformances to the EMPr. » A public complaints register must be developed and maintained on site. » Landowners should be consulted regularly.

OBJECTIVE 2: Protection of indigenous natural vegetation, fauna and maintenance of rehabilitation

Indirect impacts on vegetation and terrestrial fauna during operation could result from maintenance activities and the movement of people and vehicles on site. In order to ensure the long-term environmental integrity of the site following the construction, maintenance of the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established.

Project component/s	» Areas requiring regular maintenance. » Route of the security team. » PV facility including access roads and laydown areas. » Areas disturbed during the construction phase and subsequently rehabilitated at its completion.
Potential Impact	» Disturbance to or loss of vegetation and/or habitat. » Alien plant invasion. » Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activity/Risk Source	» Movement of employee vehicles within and around site.
Mitigation: Target/Objective	» Maintain minimised footprints of disturbance of vegetation/ habitats on-site. » Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation.

Mitigation: Action/Control	Responsibility	Timeframe
An integrated management plan for the development area during operation, which is beneficial to fauna and flora, should be developed and implemented.	O&M Operator	Operation phase
Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.	O&M Operator	Operation phase
The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except landowners or other individuals with the appropriate permits and permissions where required.	O&M Operator	Operation phase
If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects.	O&M Operator	Operation phase
All vehicles accessing the site should adhere to a low speed limit (30km/h max for heavy vehicles and 40km/h for light vehicles) to	O&M Operator	Operation phase

Mitigation: Action/Control	Responsibility	Timeframe
avoid collisions with susceptible species such as snakes and tortoises.		
Noise and disturbance on the site should be kept to a minimum during operation and maintenance activities.	O&M Operator	Operation phase
If In terms of the boundary fence, no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants. The boundary fence should have access points for smaller fauna to enter and exit the PV area.	O&M Operator	Operation phase
Site Access should be strictly controlled, to avoid unnecessary disturbance.	O&M Operator	Operation phase
Minimise lighting at night as far as possible.	O&M Operator	Operation phase
Maintain maintenance activities only around relevant PV infrastructures and avoid disturbance around undisturbed natural vegetation and existing buildings.	O&M Operator	Operation phase
All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.	O&M Operator	Operation phase
Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance must be undertaken, as per the Erosion Management and Rehabilitation Plans for the project.	O&M Operator	Operation phase
All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	O&M Operator	Operation phase
Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem plant species are already present in the area and are likely to increase rapidly if not controlled.	O&M Operator	Operation phase
Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility must be undertaken as these are also likely to be prone to invasion problems.	O&M Operator	Operation phase
Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	O&M Operator	Operation phase
All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor.	O&M Operator	Operation phase
Vehicle movements must be restricted to designated roadways.	O&M Operator	Operation phase

Mitigation: Action/Control	Responsibility	Timeframe
In order to increase general faunal protection, the use of any pesticide in the PV facility area should be prohibited.	O&M Operator	Operation phase
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	O&M Operator	Operation phase
Vegetation control within the PV facility should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner if necessary.	O&M Operator Specialist	Operation phase
All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor.	O&M Operator	Operation phase
The use of herbicides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides. It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site along with any other nationally or internationally similarly restricted/banned products.	O&M Operator	Operation phase
Implement an animal removal plan to ensure safety of workers and fauna.	O&M Operator	Operation phase
Fire breaks should be established, where appropriate and as discussed with the landowners. Access roads could also act as fire breaks.	O&M Operator Specialist	Duration of contract
There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs and succulents from the local area.	O&M Operator	Operation phase
Annual site inspection for erosion with follow up remedial action where problems are identified.	Specialist	Annual monitoring until successful re-establishment of vegetation in an area
Noise and disturbance on the site should be kept to a minimum during operation and maintenance activities.	O&M Operator	Operation phase

Performance Indicator	» No further disturbance to vegetation or terrestrial faunal habitats. » No erosion problems resulting from operational activities within the PV facility. » Low abundance of alien plants within affected areas. » Maintenance of a ground cover that resist erosion. » Continued improvement of rehabilitation efforts.
Monitoring	» Observation of vegetation on-site by environmental manager. » Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas. » Annual monitoring with records of alien species presence and clearing actions. » Annual monitoring with records of erosion problems and mitigation actions taken with photographs.

OBJECTIVE 3: Erosion management

The large amount of disturbance created during construction would leave the site highly vulnerable to erosion. The site is steep in some areas and along with friable soils, the disturbance created at construction will render the impacted areas highly vulnerable to erosion and measures to limit erosion will need to be implemented. This impact is likely to manifest during construction and would persist into the operation phase and should therefore be assessed for both phases.

Project component/s	» PV facility, including access roads. » Areas disturbed during the construction phase and subsequently rehabilitated at its completion.
Potential Impact	» Disturbance to or loss of vegetation and/or habitat. » Loss of soil resources. » Sedimentation of water resources
Activity/Risk Source	» Stormwater runoff from panels and roads. » Runoff of wash water during cleaning of panels
Mitigation: Target/Objective	» Implement appropriate erosion control measures to minimise risk of erosion.

Mitigation: Action/Control	Responsibility	Timeframe
Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan.	O&M Operator	Operation phase
All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.	O&M Operator	Operation phase
It may be necessary to construct ponds in some areas to capture and process runoff from the site. If this is necessary, this should take place in consultation with a freshwater specialist. Any ponds constructed should not be lined with smooth plastic as fauna tend to fall into such ponds and are unable to escape due to the slippery sides of the pond.	O&M Operator	Operation phase
Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance must be undertaken, as per the Erosion Management and Rehabilitation Plans for the project.	O&M Operator	Operation phase
All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	O&M Operator	Operation phase
All cleared areas must be revegetated with indigenous perennial shrubs and succulents from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	O&M Operator	Operation phase

Performance Indicator	» No erosion problems resulting from operational activities within the PV facility.
Monitoring	» Regular inspections to monitor erosion within the site and along access roads.

OBJECTIVE 4: Protection of avifauna

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Disturbance to or loss of birds as a result of collision with the PV panels and project components. » Destruction of habitat. » Displacement of birds. » Electrocution on power line. » Traffic to and from site.
Activity/risk source	» PV panels. » Substation. » Power line.
Mitigation: Target/Objective	» More accurately determine the impact of the operating PV facility on collision-prone Red Data species. » Minimise impacts associated with the power line and the substation.

Mitigation: Action/control	Responsibility	Timeframe
Aerial assessment or maintenance of the powerline (e.g. by helicopter) should not be conducted within 1 000 m of any located SCC nest (e.g. a newly constructed Martial Eagle nest on the transmission infrastructure) during the relevant breeding season where possible.	Operator	Operation phase
All vehicles should adhere to clearly defined and demarcated roads, no off-road driving should be allowed.	Operator	Operation phase
Speed limits (30 km/h) should be strictly enforced to reduce unnecessary noise.	Operator	Operation phase
The movement of personnel should be restricted to the servitudes and access roads on the project site.	Operator	Operation phase
No dogs or cats other than those of the landowners should be allowed on site.	Operator	Operation phase
Any No-go areas identified should be adhered to.	Operator	Operation phase
Lighting should be kept to a minimum to avoid attracting insects and birds, light sensors/switches should be utilised to keep lights off when not required; and	Operator	Operation phase
Lighting fixtures should be hooded and directed downward where possible, to minimize the skyward and horizontal illumination, lighting should be motion activated where possible.	Operator	Operation phase
The operational monitoring programme for the overhead powerline route must be implemented to locate potential	Operator	Operation phase

Mitigation: Action/control	Responsibility	Timeframe
collision (and electrocution) fatalities. Any fatalities located should be reported to Birdlife South Africa (BLSA) and the Endangered Wildlife Trust (EWT).		

Performance Indicator	» Minimal additional disturbance to bird populations on the PV facility site. » Continued improvement of bird protection devices, as informed by the operational monitoring.
Monitoring and Reporting	» Observation of avifaunal populations and incidence of injuries/death from collisions with PV panels and power line. » Monitoring of facility and reporting where fatalities do occur.

OBJECTIVE 5: Minimisation of visual impact

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Visual intrusion. » Visual impact of the solar facility degradation and vegetation rehabilitation failure.
Activity/risk source	» PV panels and other infrastructure. » Access roads. » Viewing of the degradation and vegetation rehabilitation failure by observers on or near the site.
Mitigation: Target/Objective	» To minimise the potential for visual impact. » Minimise the contrast with the surrounding environment and visibility of the PV facility to humans. » The containment of light emitted from the substation in order to eliminate the risk of additional night-time visual impacts. » Well maintained and neat facility.

Mitigation: Action/control	Responsibility	Timeframe
Maintain the general appearance of the facility as a whole, including the PV panels, servitudes and the ancillary buildings.	O&M Operator	Operation and maintenance
Lighting of the facility (for example security lights) should be kept to a minimum. Lights should be directed downwards.	O&M Operator	Operation phase
Management of lighting impacts: » 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.	O&M Operator	Operation phase

Mitigation: Action/control	Responsibility	Timeframe
» 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.		

Performance Indicator	» Appropriate visibility of infrastructure to aircraft. » Well maintained and neat facility with intact vegetation on and in the vicinity of the PV facility.
Monitoring and Reporting	» Ensure that aviation warning lights or other measures are installed before construction is completed and are fully functional at all times. » Monitoring of the entire site on an ongoing basis by the operator.

OBJECTIVE 6: Appropriate handling and management of hazardous substances and waste

The operation of the PV facility will involve the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste and hazardous waste.

Project component/s	» PV panels. » Access roads. » Cabling between project components. » Onsite facility substation. » Power line. » Battery Energy Storage System (BESS) » Laydown areas » All other associated infrastructure.
Potential Impact	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices.
Activity/risk source	» Transformers and switchgear – substation. » Fuel and oil storage.
Mitigation: Target/Objective	» To comply with waste management legislation. » To minimise production of waste. » To ensure appropriate waste disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/control	Responsibility	Timeframe
All hazardous materials 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 as related to the nature of the spill.	O&M Operator	Operation phase

Mitigation: Action/control	Responsibility	Timeframe
Storage areas for hazardous substances must be conducted within a secured and clearly demarcated area.	O&M Operator	Operation phase
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	O&M Operator	Operation phase
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation.	O&M Operator	Operation and maintenance
Waste handling, collection and disposal operations must be managed and controlled by a waste management contractor.	O&M Operator / waste management contractor	Operation phase
Used oils and chemicals: » Where these cannot be recycled, appropriate disposal must be arranged with a licensed facility in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations.	O&M Operator	Operation phase
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	O&M Operator	Operation phase
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	O&M Operator	Operation and maintenance
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	O&M Operator	Operation phase
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	O&M Operator/ waste management contractor	Operation phase
No waste may be burned or buried on site.	O&M Operator	Operation phase

Performance Indicator	» No complaints received regarding waste on site or dumping. » Internal site audits identifying that waste segregation, recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests. » No contamination of soil.
Monitoring and Reporting	» Waste collection must be monitored internally on a regular basis. » Waste documentation must be completed and made available for inspection on request. » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon. » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the environmental manager. All appropriate waste disposal certificates must accompany the monthly reports.

OBJECTIVE 7: Maximise benefits and opportunities for local communities associated with local employment, skills opportunities, socio-economic development plans and a community trust

The construction phase of 100 MW SEF will extend over a period of approximately 18-24 months and create in the region of 350 employment opportunities. Based on information provided by the proponent, approximately 75% of the jobs will benefit low-skilled workers, 25% semi-skilled and 5% high skilled. which is a small but positive contribution towards addressing the high unemployment rates observed in Ward 3 of the Ubuntu Local Municipality and Northern Cape Province.

Aside from the direct employment opportunities, the facility will support an estimated 13 FTE employment positions created through the production and consumption indirect and induced effects. Due to the spatial allocation of procurement spending and direct employment created, most of the indirect and induced positions will also be created within the local area. The trade, agriculture and community and personal services sectors will benefit the most from these new employment opportunities.

In addition to the planned employment creation during operation and maintenance of the PV facility, the developer intends to make a positive contribution to employment opportunities in other non-solar related industries.

Project component/s	» PV facility. » Day to day operational activities associated with the PV facility including maintenance.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised as far as possible.
Activity/risk source	» The operation phase of the PV facility will create permanent employment opportunities. » The establishment of a PV facility has the potential to create an attraction for visitors to the area. The development also has the potential to promote the benefits of renewable energy projects.
Mitigation: Target/Objective	» Create medium- to long-term full time employment opportunities for locals.

Mitigation: Action/control	Responsibility	Timeframe
The operator of the solar energy facility should be encouraged to, as far as possible, procure materials, goods and products required for the operation and maintenance of the facility from local suppliers to increase the positive impact in the local economy.	O&M Operator	Operation phase
Where possible, local labour should be considered for employment so as to increase the positive impact on the local economy.	O&M Operator	Operation phase
As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility.	O&M Operator	Operation phase
The developer should consider establishing vocational training programmes for the local labour force to promote the development of skills required by the solar energy facility and	Developer O&M Operator	Operation phase

Mitigation: Action/control	Responsibility	Timeframe
thus provide for the opportunities for these people to be employed in other similar facilities elsewhere in the future.		
A social development and economic development programme should be devised by the developer and implemented throughout the project's lifespan. The plan should be developed in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits. These plans should be reviewed on an annual basis and, where necessary, updated.	Developer O&M Operator	Operation phase
When identifying enterprise development initiatives, the focus should be on creating sustainable and self-sufficient enterprises.	Developer O&M Operator	Operation phase
In devising the programmes to be implemented, the developer should take into account the local Integrated Development Plans and Local Economic Development Strategy (Blue Crane Route, 2020).	Developer O&M Operator	Operation phase

Performance Indicator	» Maximum amount of semi and unskilled labour locally sourced where possible. » Local suppliers and SMMEs contracted where possible. » Skills transfer facilitated where required. » A social development and economic development programme developed and implemented.
Monitoring and Reporting	» Indicators listed above must be met for the operation phase.

OBJECTIVE 8: Implement an appropriate fire management plan during the operation phase

The vegetation on the site may be at risk of fire, especially during drought conditions experienced in the area. The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

Project Component/s	» Operation and maintenance of the PV facility and associated infrastructure.
Potential Impact	» Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. In addition, fire can pose a risk to the PV facility infrastructure.
Activities/Risk Sources	» The presence of operation and maintenance personnel and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	» To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/Control	Responsibility	Timeframe
Provide adequate firefighting equipment on site. Apply for membership to the local Fire Protection Association, should there be one.	O&M Operator	Operation phase

Mitigation: Action/Control	Responsibility	Timeframe
Provide fire-fighting training to selected operation and maintenance staff.	O&M Operator	Operation phase
Ensure that appropriate communication channels are established to be implemented in the event of a fire.	O&M Operator	Operation phase
Fire breaks should be established where and when required. Cognisance must be taken of the relevant legislation when planning and burning firebreaks (in terms of timing, etc.). Access roads may also act as fire breaks.	O&M Operator	Operation phase
Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency.	O&M Operator	Operation phase
Contact details of emergency services should be prominently displayed on site.	O&M Operator	Operation phase

Performance Indicator	» Firefighting equipment and training provided before the construction phase commences. » Appropriate fire breaks in place.
Monitoring and Reporting	» The Developer must monitor indicators listed above to ensure that they have been met.

8.2. Monitoring Programme: Operation Phase of the Carolus Solar PV1 Facility

OBJECTIVE 9: To monitor the performance of the control strategies employed against environmental objectives and standards

A monitoring programme must be in place not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. An internal environmental audit must be conducted every 6 months and an external audit must be conducted once a year in order to confirm compliance with the requirements of all environmental permits (including the Environmental Authorisation, once issued) for the project, this EMPr, and all relevant legislation. The results of the audit reports must be made available to the DFFE and the relevant authorities on request, and must be part of monitoring and audit reports. An annual audit report must be compiled and submitted to DFFE. The aim of the auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications.
» Ensure adequate and appropriate interventions to address non-compliance.
» Ensure adequate and appropriate interventions to address environmental degradation.
» Provide a mechanism for the lodging and resolution of public complaints.
» Ensure appropriate and adequate record keeping related to environmental compliance.
» Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site.

» Aid in the communication and feedback to authorities and stakeholders.

CHAPTER 9: MANAGEMENT PROGRAMME: DECOMMISSIONING

The PV infrastructure which will be utilised for the Carolus Solar PV1 Facility is expected to have a lifespan of 25 to 30 years (with maintenance). Equipment associated with this PV facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the PV facility would comprise the dismantling and replacement of the PV panels and supporting structures with more appropriate technology/infrastructure available at that time. It must be noted that decommissioning activities will need to be undertaken in accordance with the legislation applicable at that time, which may require this section of the EMPr to be revisited and amended.

The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore are not repeated in this section.

» ***Site Preparation***
Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment, preparation of the site (e.g. laydown areas, construction platform) and the mobilisation of construction equipment.

» ***Dismantle and Remove Infrastructure***
The PV facility infrastructure (panels and supporting structure, inverters, etc) will be dismantled once it reaches the end of its economic lifespan. Once dismantled, the components will be reused, recycled, or disposed of in accordance with regulatory requirements (NEMA / NEM:WA). All parts of the facility would be considered reusable or recyclable except for the blades.

9.1. Objectives

In decommissioning the Carolus Solar PV1 Facility , Carolus Solar PV1 (Pty) Ltd must ensure that:

» All structures not required for the post-decommissioning use of the site (may include the PV panels, substation, ancillary buildings, monitoring masts) are dismantled and/or demolished, removed and waste material disposed of at an appropriately licensed waste disposal site or as required by the relevant legislation.
» Rehabilitate access/service roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.
» All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimise the risk of erosion.
» Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.
» Any fauna encountered during decommissioning activities should be removed to safety by a suitably qualified person.
» All vehicles to adhere to low speed limits (i.e. 30km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust.
» Retrenchments should comply with South African Labour legislation of the day.

The general specifications of Chapter 6 (Construction) are also relevant to the decommissioning of the Carolus Solar PV1 Facility and must be adhered to.

APPENDIX A:
FACILITY OPTIMISED LAYOUT AND SENSITIVITY MAPS

APPENDIX B:
GRIEVANCE MECHANISM FOR COMPLAINTS AND ISSUES

APPENDIX C:
OPEN SPACE MANAGEMENT PLAN

APPENDIX D:
RE-VEGETATION AND HABITAT REHABILITATION PLAN

APPENDIX E:
PLANT RESCUE AND PROTECTION PLAN

APPENDIX F:
TRAFFIC AND TRANSPORTATION MANAGEMENT PLAN

APPENDIX G:
STORMWATER AND EROSION MANAGEMENT PLAN

APPENDIX H:
WASTE MANAGEMENT PLAN

APPENDIX I:
EMERGENCY PREPARDENESS, RESPONSE AND FIRE MANAGEMENT PLAN

APPENDIX J:
CURRICULCUM VITAE OF THE PROJECT TEAM