4.2 The specialist appointed in terms of the Regulations_

I, J SMALLIE, declare that -- General

declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

WILDSKIES ECOLOGICAL SERVICES

Name of company (if applicable):

29 JANUARY 2018

Date:

Requirements of Appendix 6 – GN R326 of NEMA EIA Regulations as amended (7 April 2017)	Where addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Pages 5-6, Appendix 4
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pages 5-6
c) an indication of the scope of, and the purpose for which, the report was prepared; (ca) an indication of the quality and age of base data used for the specialist report; (cb) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Page 9-10 Page 24-25 Page 39-46
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Page 25-26
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Pages 25-26
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	Page 47
g) an identification of any areas to be avoided, including buffers;	Page 47
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Page 47
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Page 26-27
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Page 39
k) any mitigation measures for inclusion in the EMPr;	Page 39
l) any conditions for inclusion in the environmental authorisation;	Page 39
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Page 48
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (ia) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Page 48
o) a description of any consultation process that was undertaken during the course of	Page 24

preparing the specialist report;	
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Page 24
q) any other information requested by the competent authority.	Page 24
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

1. INTRODUCTION

1.1 Background to the current study

juwi Renewable Energies (juwi) plans to develop a new solar photovoltaic energy facility to the north-east of Kenhardt in the Northern Cape, called Skeerhok PV 3. WildSkies Ecological Services (Pty) Ltd has previously provided juwi with initial advice on the risk to avifauna at this site (see Smallie, 2017), and has conducted pre-construction bird monitoring on site under contract to juwi. Juwi has contracted the CSIR to conduct the necessary environmental impact assessment for the proposed facility and WildSkies to conduct the avifaunal impact assessment. This report is the EIA avifaunal impact assessment.

The specialist conducted site visits in May 2017 and January 2018. The 3 seasons of pre-construction bird monitoring (4 days on site each) were conducted during July and November 2017, and January 2018.

1.2 Terms of reference

The typical terms of reference for a study of this nature are as follows:

- Provide status of bird habitats and identification of all ecologically sensitive areas
- Identification of endangered species and their locations
- Identify conservation worthy areas and how the proposed development can avoid them;
- Identify potential impacts and mitigation measures of the proposed infrastructure on the avifauna
- Classification of each impact according to methods as outlined by the client (see Appendix 1)
- Recommendation of the best management measures to mitigate any risk.
- Identification of any monitoring required during operational phase.

1.3. Description of the proposed development

A summary of the key components of the proposed project is described below (supplied by CSIR). It is important to note at the outset that the exact specifications of the proposed project components will be determined during the detailed engineering phase (subsequent to the issuing of an EA, should such an authorisation be granted for the proposed project).

The project is being developed with a maximum possible installed capacity of 114 MWdc which produces 100 MWac of electricity. Once commercial operation date is achieved, the proposed facility will generate electricity for a minimum period of 20 years. The property on which the SEF is to be constructed will be leased by the project owner from the property owners for the life span of the project. The assessed area includes approximately 400 ha of land in total. Due to the fact that the solar PV facility requires approximately 300 ha of land, there is spatial scope to avoid major environmental constraints through optimisation of the final design of the solar facility. Figure 1 indicates a layout of these project areas in relation to Skeerhok PV 3.

The larger 400 ha buildable area was considered and assessed by the specialists in order to ensure that any development constraints or environmental sensitivities can be avoided in the final siting and location of the proposed facility. Based on the findings of the specialist studies, an environmental sensitivity map has been produced (and included in Chapter 7 of the EIA Report). This map shows the sensitivities on site (terrestrial, aquatic, and sensitive heritage features) within the larger 400 ha site that was assessed. Based on this map, the preferred location for the 300 ha Skeerhok PV 3 facility, also known as the Development Envelope, avoids (where possible) the sensitive features that were identified by the specialists within the original 400 ha assessed area. Based on the boundaries of the Development Envelope and the constraints of the environmental sensitivities, a site layout has also been preliminarily determined for this project (as discussed in Chapter 7 of the EIA Report).

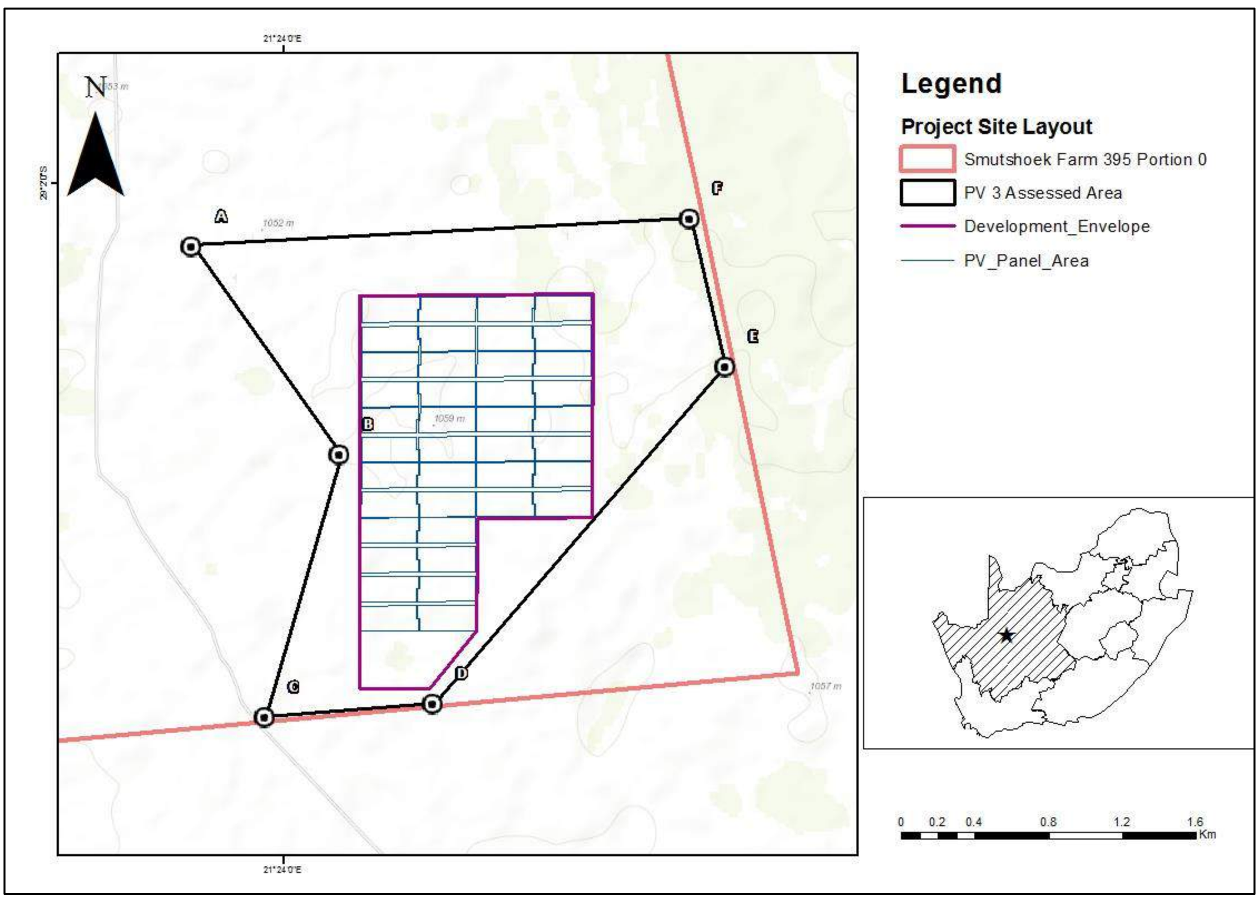

Figure 1. The position and layout of the proposed Skeerhok PV 3 facility.

It should be noted that even though a site layout has been provided (as shown in Figure 1), should the layout change following the issuing of the EA (should it be granted), that any alternative layout occurring within the boundaries of the Development Envelope would not change the scope of work or the findings of the impact assessments undertaken during this EIA. The Development Envelope is considered to be a "box" in which the proposed project components discussed within this chapter can be constructed at whichever location (within the boundaries of the assessed Development Envelope) without requiring an additional assessment or change in impact significance. Any changes to the layout are therefore considered to be non-substantive. This is discussed further in Chapter 7 of the EIA Report. It should be noted that a similar approach has been followed for the electrical infrastructure and transmission lines, which has been assessed as part of a separate Basic Assessment Processes. To this end, an electrical infrastructure corridor has been proposed for proposed transmission lines.

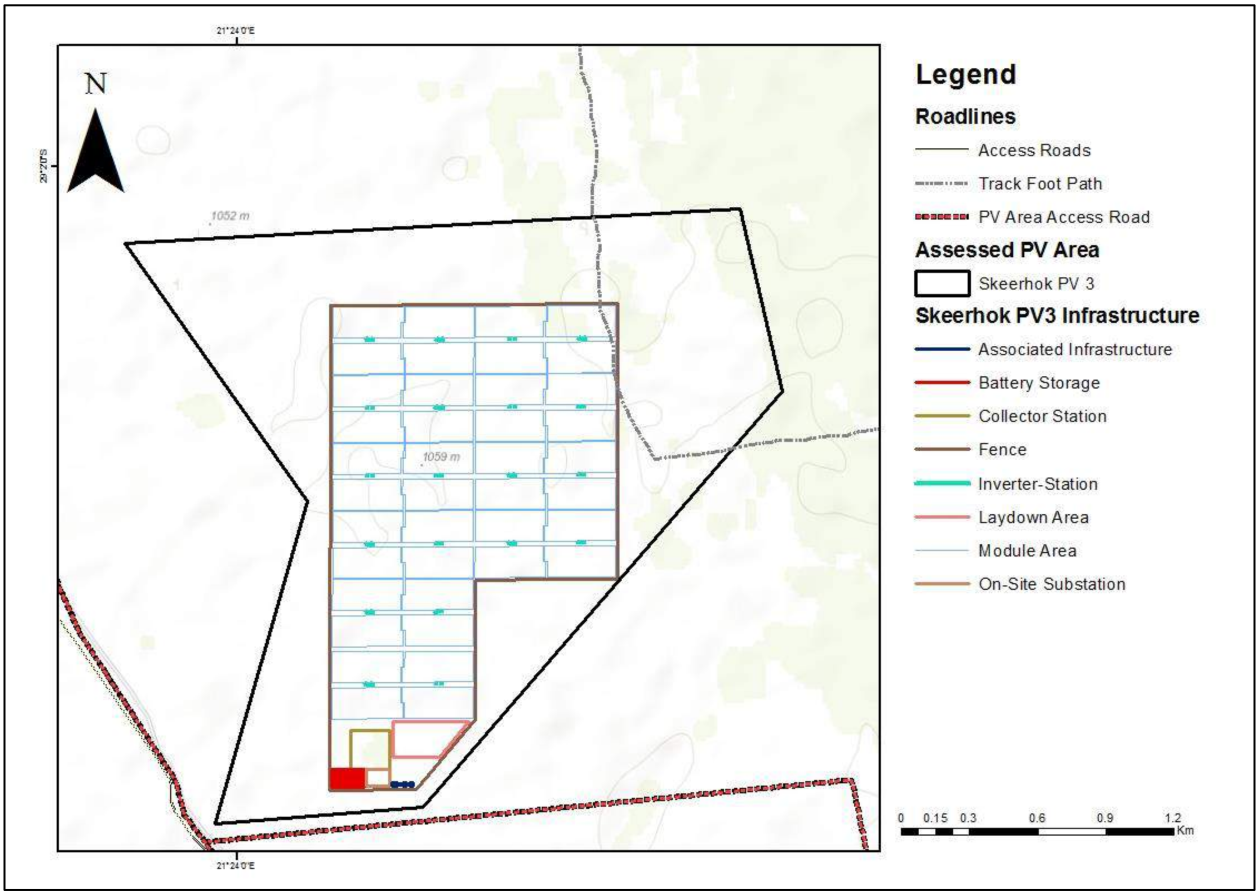

Figure 2. Proposed layout of the Skeerhok PV 3 facility.

The total area of Portion 0 of Smutshoek Farm 395, where the proposed SEF will be constructed, is approximately 4,500 ha, while the development area (area under consideration for this assessment) of the SEF is approximately 300 ha, accounting for 7 % of the total area of the farm.

The two main components of the project will consist of the solar field (solar panels and building infrastructure) and the associated infrastructure. The technical components forming part of the Solar Facility are discussed in detail below.

Table 1. Summary of technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	Approximately 5 m high
Area of PV Array	≤250 hectares
Number of inverters required	To be determined at detailed design phase based on the invertor sizes available at the time of construction.
Area occupied by inverter/ transformer stations/ substations	To be determined at detailed design phase based on the sizes of the invertor and transformer stations available at the time of construction. This area is however incorporated into the PV array area of ≤250 hectares as indicated above.
Capacity of on-site substation	22/33 kV to 132 kV
Area occupied by both permanent and construction laydown areas	≤1 ha
Area occupied by buildings	≤1 ha area for site office, and Operations and Maintenance (O&M) buildings.
Length of internal roads	≤ 15 km
Width of internal roads	≤ 8 m
Proximity to grid connection	Approximately 30 km
Height of fencing	3 m high
Type of fencing	To be determined at construction phase based on the outcomes of the EPC procurement process.

The 100MWac Solar Facility on Portion 0 of Smutshoek Farm 395 will consist of the following components:

Solar Field:

- ≤250 ha of photovoltaic (PV) modules mounted on free field single-axis trackers or fixed tilt PV solar module mounting structures comprised of galvanised steel and aluminium; and below ground electrical cables connecting the PV arrays to the inverter stations, O&M building and collector substation; and
- Ring main units; and
- Inverters and mini-subs.

Collector substation:

- ≤1 ha 22/33 kV to 132 kV collector substation to receive, convert and step up electricity from the PV facility to the 132 kV grid suitable supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32 m telecommunications tower (lattice or monopole type) will be established in the substation area;

O&M area:

- Operations and Maintenance (O&M) buildings;
- ≤1 ha O&M laydown area (near / adjacent substation);
- ≤0.01 ha solar measuring station;
- Parking, reception area, offices, guest accommodations and ablution facilities for operational staff, security and visitors;
- Workshops, storage areas for materials and spare parts;
- Water storage tanks or lined ponds (~160 kl/day during first 3 months; ~90 kl/day for 21 months during rest of construction period; ~20 kl/day during operation);
- Septic tanks and sewer lines to service ablution facilities; and
- Central Waste collection and storage area.

Battery Storage System:

- 100 MWh Battery Storage Facility with a maximum height of 8m and associated operational, safety and control infrastructure;

Access road:

- ≤ 15 km long, ≤ 8 m wide gravel access road running from the Transnet Service Road to the site

Service roads:

- ≤10 km of ≤ 8 m wide gravel internal service roads within the plant boundary;

Other infrastructure:

- Perimeter fencing and internal security fencing and gates as required.
- Access control gate and guard house on access road;
- ≤3.5 km length of water supply pipeline connecting existing boreholes to storage, alternatively water will supplied by the local municipality.
- Stormwater drainage

Construction site office area (used during construction and rehabilitated thereafter):

- ≤1 ha site office area;
- ≤ 10 ha laydown area; and
- ≤1 ha concrete batching plant

The Skeerhok PV 3 project will connect to the Eskom Nieuwehoop Substation located on Portion 3 of Gemsbok Bult Farm 120 via a 132 kV overhead transmission line (the development of the 132 kV line will be considered under a separate Basic Assessment process).

1.4. Background to bird interactions with solar PV facilities

Photovoltaic (PV) technology uses cells to convert sunlight into electric current. Commercial scale facilities typically consist of the following components: PV modules; Inverters and power electronics; structural and wiring hardware; roads; fences; substations; and office buildings.

Note that there are also typically impacts associated with the grid connection power lines. In this case the power line will be the subject of a separate Basic Assessment and is not discussed further in this report.

1.4.1 Habitat destruction

Due primarily to the surface area required for the PV modules or panels (typically approximately 2-5hectares per MW – Ong *et al*, 2013; Hernandez *et al,* 2014 or 1.4 to 6.2 ha/MW according to US Department of Energy 2012) or in the case of Skeerhok PV 3 approximately 300ha in total (project description), and the associated roads, substations, offices etc, solar PV facilities occupy a relatively large amount of land and therefore represent a large human land use in the environment (Walston *et al*, 2015). Lovich and Ennen (2011) and DeVault *et al* (2014) state that in 'many' cases vegetation removal is complete at PV facilities. Our own observations of operational PV facilities in South Africa to date confirm that vegetation removal is complete in all cases. Vegetation removal translates into habitat removal or destruction for bird species. Habitat removal is a consequence of almost any new form of development, and is not particularly unique to solar PV energy. The significance of the habitat removal depends on factors such as: the amount of habitat affected; the uniqueness of the habitat; and the sensitivity and conservation status of the bird species utilizing that habitat.

1.4.2. Disturbance of birds & displacement effects

Construction of a facility of this nature requires a significant amount of machinery and labour to be present on site for a period of time (approximately 12 -24 months for Skeerhok PV 3 – project description). For the more shy and sensitive bird species this could disturb them and displace them from the area at least for the duration of construction and possibly longer. In addition, species commuting around the area may avoid the site once operational and fly longer distances than usual as a result. For some species this may have critical energy implications. Disturbance of breeding birds is of particular concern since this could result in lower breeding productivity, total breeding failure, and/or temporary or permanent abandonment of the breeding site. All of these can have significant consequences for threatened bird species.

1.4.3. Bird fatality at PV facilities

Until recently very little information on bird fatality at PV facilities around the world was available. As a result there was relatively low concern for this impact amongst ornithologists, certainly when compared to wind energy facilities for example. However, in the last 3-4 years some data has emerged which points towards the direct fatality impacts at PV facilities possibly being far greater than previously understood (Kagan *et al,* 2014; Walston *et al*, 2015). Bird fatalities have been recorded in high numbers at at-least one site in the USA (Kagan *et al,* 2014; Walston *et al*, 2015; Walston *et al*, 2016).

Walston *et al* (2016) reviewed bird fatality information at solar energy facilities across the USA (although finding that most information was available for a smaller area in California). They found that 3 facilities had systematically collected data on avian mortalities, one of which was a PV facility, the California Valley Solar Ranch project of 250MW. At this facility, a total mortality rate of 10.7 birds/MW/year was recorded, consisting of 0.5birds/MW/year from known fatality causes (attributable to the facility) and 10.2birds/MW/year of unknown causes.

It is important to understand that bird abundance and flight activity levels differ according to habitat availability, and other natural features. Therefore the impact on birds through direct fatality is very site specific. The risk can be greatly reduced if the location of the project takes the following features relating to bird habitat into account: migratory flyways; wetlands; riparian vegetation; and availability of habitat amongst the arrays. Avoiding siting the solar project infrastructure in these sensitive areas can greatly reduce the impact on birds (Walston *et al*, 2015).

In addition to the above information, much has been written about the potential to attract certain bird guilds to a solar energy facility (Kagan *et al,* 2014). Such attractants could include evaporative cooling ponds (if present) that provide artificial habitat to birds and their prey. Glare and polarized light could attract insects and in turn foraging bird species (Horváth *et al*, 2009). The so called “lake effect” created by the reflective surfaces of the PV panels have been hypothesized to attract migrating waterfowl that then collide with the panels when they attempt to land (Kagan *et al*, 2014). To date no empirical research has been conducted on this “lake effect” (Walston *et al,* 2015) and it remains unproven.

Birds can also be killed through electrocution on electrical infrastructure such as substations and switching gear on site, and through entanglement in or collision with fences. Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). The larger bird species are most affected since they are most capable of bridging critical clearances on electrical hardware. Species likely to frequent these areas are typically the less sensitive, non-threatened species such as crows.

1.4.5. Nesting & other utilization of facility by birds

Various bird species are quick to seize a new opportunity for perching, roosting or nesting, including on man-made structures (van Rooyen & Ledger 1999, de Goede & Jenkins 2001). In this landscape this is particularly relevant as it is relatively devoid of tall trees. It is likely then that birds will use certain parts of the proposed facility once commissioned. A prime example in this Kenhardt area is the Sociable Weaver *Philetairus socius* which is quick to nest on any vertical infrastructure in this area. Whilst this nesting could be viewed as a positive impact for birds, it typically creates operational problems for the facility, which require management actions such as nest management in order to ensure that the nests don't interfere with operations or increase fire risk. Nest relocation or removal should be done under permit from the provincial authority.

It is also likely that some small species will use the PV panels for shade and this will create a new microhabitat on the site. This should not adversely affect the operation of the equipment however and should also not lead to direct mortalities by these small species.

1.4.6. Altered water runoff patterns

It is likely that altering the nature of the sites surface from natural vegetation to infrastructure, roads, gravel, and possible paving – will alter the way in which water moves on the site after rainfall and cleaning of infrastructure. If this is not carefully managed this could cause soil erosion and thereby alter more bird habitat than necessary by affecting off site areas. Increased runoff could also create moister conditions on or near the site thereby attracting more birds to the area and increasing the likelihood of other interactions with the facility.

1.4.7. Chemical pollution associated with PV panel cleaning

It has been suggested (Jenkins *et al,* 2017) that pollution could occur if hazardous chemicals are used to clean PV panels once operational. This could have secondary effects on vegetation, invertebrate populations and in turn food availability and habitat for birds.

1.4.8. Contextualising solar energy avifaunal impacts

Walston *et al* (2015) stated that it is important to compare solar energy bird fatalities with bird fatalities from other anthropogenic sources. Several authors have done this already including (Erickson *et al*. 2005, 2014; Loss *et al*. 2013; Smallwood 2013; Sovacool 2013). Whilst such contextualization is important, care needs to be taken when using this approach as not all bird species are equally exposed to all of the sources of fatality, and not all comparisons are valid. Drawing comparisons between for example common passerines colliding in high numbers with high rise buildings in cities, and rare Red List bird species colliding with a PV facility in a rural landscape is not reasonable. Small numbers of fatalities of threatened species can far outweigh (in conservation importance) far greater numbers of fatalities of common bird species. Comparisons with other 'rurally' located developments such as wind energy may be far more valid. Importantly, any mortality associated with a new proposed development such as the Skeerhok PV 3 project is added to the existing mortality from all other sources for the species, they do not replace any of the other sources of mortality. For certain bird species, especially Red Listed species it is of critical importance than any new sources of anthropogenic impacts are avoided as far as possible, precisely because the existing other impacts are so difficult to mitigate reactively. Impacts of other forms of development on bird species should be used for context but cannot be used as justification for creating new impacts on those species in our opinion.

1.5. Relevant legislation

Various sets of legislation and policy frameworks are relevant to this specialist study and development, including the following:

- The Convention on Biological Diversity is dedicated to promoting sustainable development. The Convention recognises that biological diversity is about more than plants, animals and micro-organisms and their ecosystems. It is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It is an international convention signed by 150 leaders at the Rio 1992 Earth Summit, and South Africa is a signatory.
- An important principle encompassed by the CBD is the precautionary principle, which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used a reason for delaying management of these risks. The burden of proof that the impact will not occur lies with the proponent of the activity posing the threat.
- The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 117 (as of 1 June 2012) Parties from Africa, Central and South America, Asia, Europe and Oceania. South Africa is a signatory.
- The African-Eurasian Waterbird Agreement: the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is the largest of its kind developed so far under the CMS. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguins. The agreement covers 119 countries from Europe, parts of Asia and Canada, the Middle East and Africa.
- National Environmental Management – Biodiversity Act - Threatened or Protected Species list (TOPS): the following target species for this study are on the list: Kori Bustard, Ludwig’s Bustard, Black Stork, Martial Eagle (all Vulnerable).

- The Northern Cape Nature Conservation Act 9 of 2009 is relevant, and provides protection for most bird species, including Sociable Weaver.

1.6. Study methods

The following information sources were consulted for this study:

- Bird distribution data from the South African Bird Atlas Projects 1 and 2 were obtained to ascertain which bird species occur in the study area (Harrison *et al.* 1997; www.sabap2.adu.org.za; www.mybirdpatch.adu.org.za).
- The conservation status of all bird species occurring in the study area was determined using The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor, Peacock & Wanless, 2015) and the IUCN 2017 Red List.
- A description of the vegetation types occurring in the study area was obtained from The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford 2006).
- The Coordinated Avifaunal Road count project was consulted (Young *et al.* 2003), but no routes exist close to this study area.
- The Important Bird & Biodiversity Areas programme of BirdLife South Africa was consulted (Marnewick, Retief, Theron, Wright, & Anderson, 2015). There are no IBBA's close to the proposed facility.
- Several ecological or avifaunal impact assessment report for other proposed projects in the area were reviewed to obtain an understanding of avifaunal issues in the wider area (Pachnoda Consulting cc, 2015; SDP Ecological, 2016; Scherman Colloty & Associates cc, 2015).
- At the time of writing no comment or input had been received from Interested & Affected Parties or stakeholders.
- Data from the two specialist site visits in May 2017 and January 2018 was used.
- The recent "Best Practice Guidelines: Birds and Solar Energy: Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. (Jenkins, Ralston-Paton & Smit-Robinson, 2017) was consulted for guidance on relevant aspects and for pre-construction bird monitoring requirements for the site.
- Data collected by three pre-construction bird monitoring site visits was used for the purposes of this study.

The pre-construction monitoring on site was conducted as follows:

Preliminary site assessment & design of pre-construction monitoring

- Initial brief site visit by specialist, Identification & assessment of priority bird species list, Identification & assessment of avian habitats available on and near site, Design of pre-construction monitoring methods. This was done in May 2017 (Autumn).
- The specialist site visits consisted of the following:
  - Using a combination of driving and walking the site was covered as thoroughly as possible, in order to see all available habitats and maximise the likelihood of detecting all bird species present.
  - All birds seen and heard were recorded using Birdlasser, 10x32 binoculars, a 20-60x spotting scope, and Garmin GPS.
  - Representative photographs of bird micro habitats were taken.
  - The locations of any sensitive features were annotated on a map.
  - A wider area than the site itself was considered as far as possible in order to address the larger bird species which have large territories, such as Martial Eagle.

Pre-construction monitoring/data collection

- As per BirdLife guidelines (Regime 2) pre-construction bird monitoring to consist of 3 x 4 day site visits spread over approximately 6 months (July, November and late January). These site visits cover the winter, spring/early summer and mid-summer seasons. The mid-summer site visit took place after rainfall on site, and this is reflected in the bird species diversity and abundance increasing on site.
- Each site visit consisted of:
  - 12 Walked transects (each done once per site visit) to sample small passerine species. Small terrestrial birds are an important component of this programme. Given the large spatial scale of PV facilities, these smaller species may be particularly vulnerable to displacement and habitat level effects. Several regionally Red Listed or endemic small passerine species exist in the Bushmanland area. Sampling these smaller species is aimed at establishing indices of abundance for small terrestrial birds in the study area. These counts should be done when conditions are optimal. In this case this means the times when birds are most active and vocal, i.e. early mornings. Twelve walked transects (WT) of approximately 1 kilometre length each were established on the site and counted each season. Counting is done by walking slowly along the transect centre line and recording all birds seen or heard within 200m either side of the centre line. For more details see Jenkins *et al* (2017).

- 3 Driven transects (each done twice per site visit) to sample large terrestrials and raptors. This is a very similar data collection technique to that above, the aim being to establish indices of abundance for large terrestrial species and raptors. These species are relatively easily detected from a vehicle, hence vehicle based (VT) transects are conducted in order to determine the number of birds of relevant species in the study area. Detection of these large species is less dependent on their activity levels and calls, so these counts can be done later in the day. Three VT's were established on suitable roads on and near the site, ranging between 5.1 and 9.5km in length and totalling 20.1km. These transects are each counted twice on each site visit. Counting is done by driving slowly along the road (<40km/hr) and scanning to detect any large birds within 2km either side of the transect. The vehicle is also stopped periodically and observer scans with binoculars from a standing position. For more detail on exact methods of conducting Vehicle transects see Jenkins *et al* (2017).
- The broader area within which the site is located was surveyed for any large sensitive species breeding sites on each site visit. During the first specialist site visit a Martial Eagle 'territory' was suspected, so pre-construction monitoring was used to investigate this further.
- All incidental (i.e. not the product of any formal data collection method) observations of priority bird species were recorded.
- Surveys were conducted of any existing power lines on site for nests, collision & electrocution fatalities. These were done by driving and walking on the servitude and scanning up to 50m either side of the centre line, and on pole/pylon tops.

The layout of the pre-construction bird monitoring activities on site is shown in Figure 3.

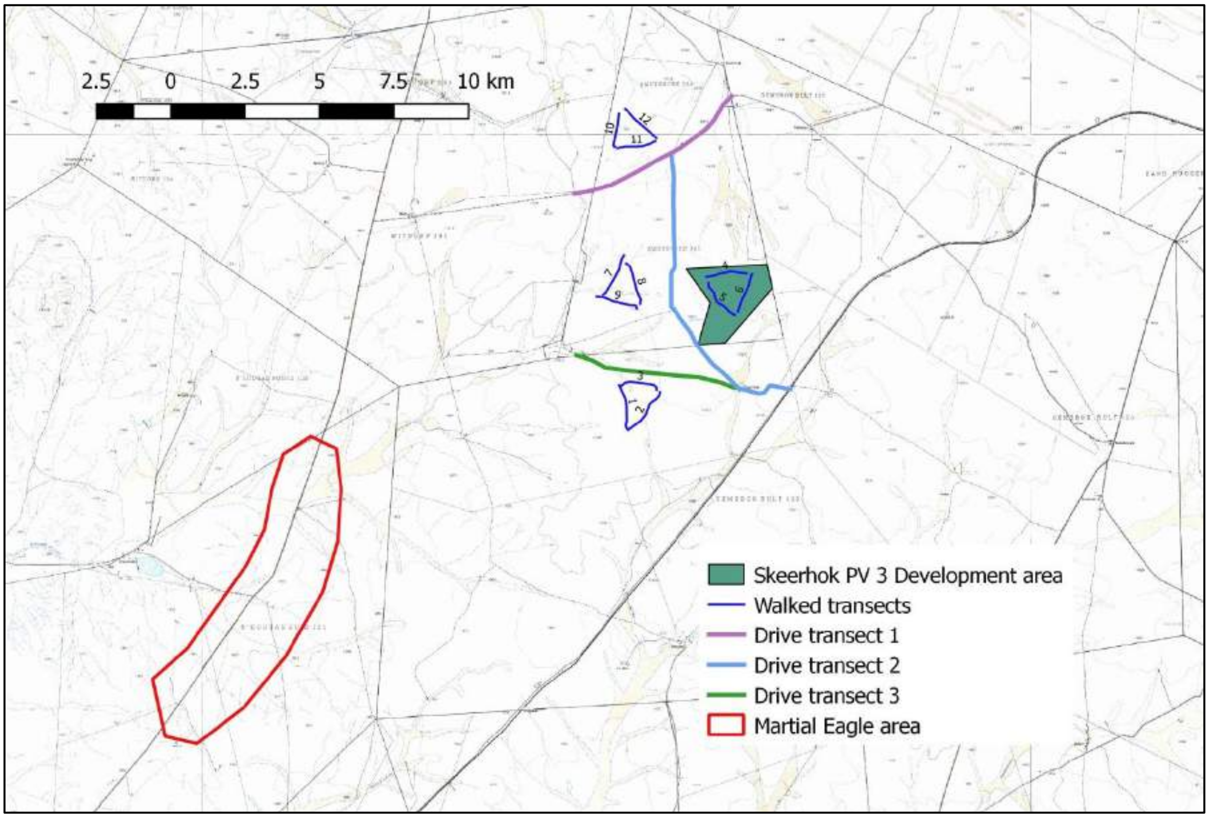

Figure 3. The layout of the bird monitoring activities on site.

1.7. Limitations & assumptions

For the purposes of this study we need to assume that conditions on site during our surveys were representative of general conditions on site, and those conditions likely to exist during the construction and operational phase of the proposed project. Given that our surveys have spanned a period of approximately 9 months (6 months minimum being required by best practice – Jenkins *et al,* 2017) and the operational lifespan of the proposed facility is likely to be at least 20 years, accurate representation is a challenge. We have chosen to examine rainfall data to shed more light on this aspect, since we believe rainfall to be the major driver of ecological and avifaunal conditions on site. We obtained annual rainfall data from the South African Weather Service for the Kenhardt area. This is displayed in Figure 4. The mean annual rainfall recorded from 1960 to 2017 (inclusive) was 147.8mm per annum. In 2017 (the year of our survey efforts) a total of 165.0mm was recorded. Rainfall in our survey year was therefore higher than average. This gives us some confidence in our findings being representative of conditions on site. If the survey year had been particularly dry this could have been cause to question the data collected on site.

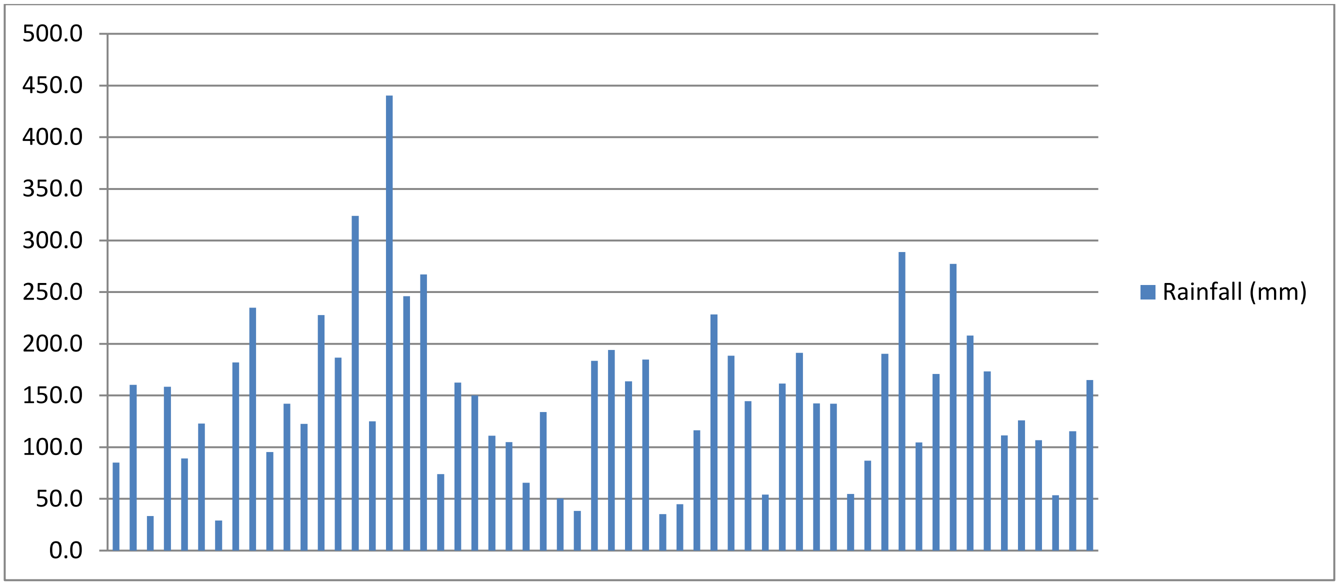

Figure 4. Annual rainfall at Kenhardt from 1960 to 2017 (South African Weather Service).

We conducted pre-construction bird monitoring for a broader area containing two other proposed facilities, Skeerhok PV 1 and Skeerhok PV 2. Our definition of the word ‘site’ is therefore the area encompassed by all 3 sites. Birds are mobile, and particularly in this area, they move in response to environmental conditions. We therefore consider all monitoring data and findings to apply to all 3 sites equally.

2. DESCRIPTION OF BASELINE CONDITIONS

2.1 Vegetation description

According to Mucina and Rutherford (2006), the vegetation on site is mostly "Bushmanland Arid Grassland" (see Figure 5). This is a short, sparse vegetation type, well suited to small passerine and large terrestrial bird species. Within this vegetation type, four micro habitats exist for birds: grassy and shrubby plains, drainage lines, dams and rocky outcrops. In addition the areas immediately surrounding livestock watering points are an important and distinct micro habitat, typically with an increased abundance and diversity of avifauna in response to the availability of water and different vegetation. These micro habitats are pictured in Appendix 4.

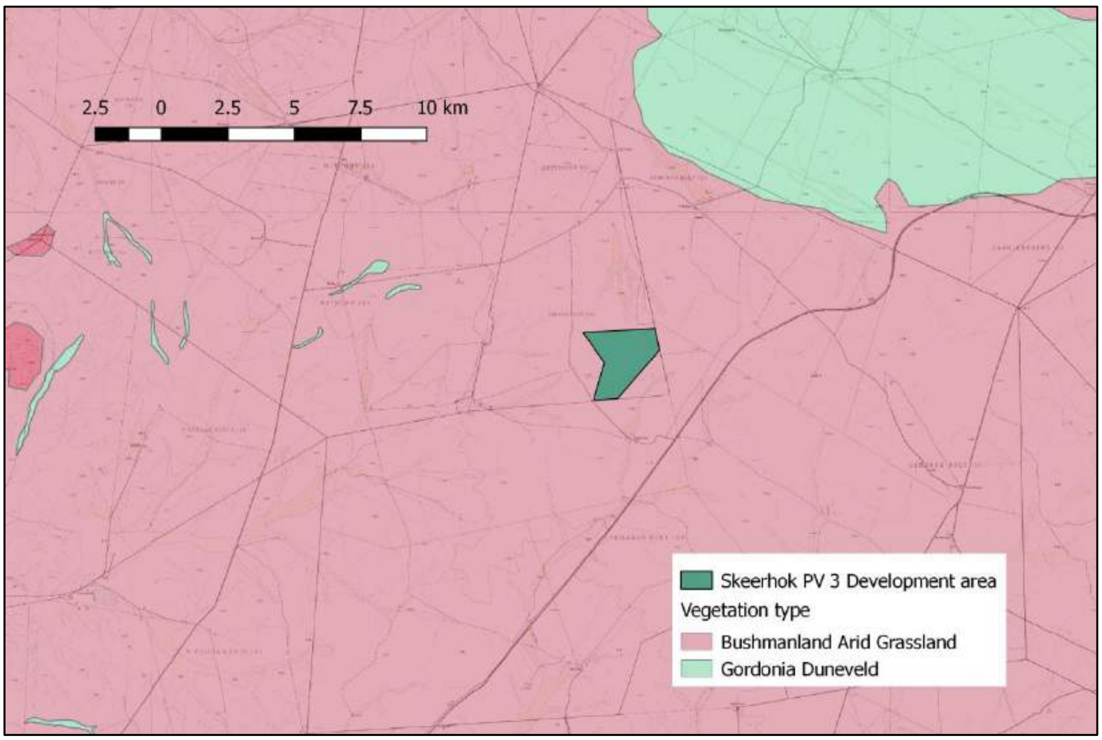

Figure 5. Vegetation classification at the proposed Skeerhok PV3 site.

2.2. Existing anthropogenic features

Although the proposed site is relatively remote, there are several significant existing infrastructures in the area. The site lies between two more or less parallel district gravel roads: the Kenhardt Louisvale road; and the Transnet road. To the immediate east of the Transnet gravel road site lies the Sishen Saldanha railway line, with associated maintenance buildings and communication towers. On the site itself, two new 400kV transmission power lines are currently in the final stages of construction. Several lower voltage distribution power lines exist in the landscape. As a result of these various activities, disturbance levels are relatively high on site for such a remote area, and the landscape is already relatively impacted on.

2.3 Avifaunal community on site

2.3.1. Southern African Bird Atlas Project data

The first and second Southern African Bird Atlas Projects (Harrison *et al*, 1997; & www.sabap2.adu.org.za) recorded a combined total of approximately 199 bird species in the broader area (30-40km radius) within which the Skeerhok PV 3 facility falls (see Appendix 3). These are the species which could occur on the Skeerhok PV 3 site if suitable habitat and conditions occur on site. They have not however all been confirmed on the site itself. Our own specialist site visits and pre-construction bird monitoring data confirms this for each species (see Section 2.3.4 & Appendix 3).

Fourteen of the 199 species which could occur on site are considered regionally Red List species (Taylor *et al*, 2015): **Ludwig's Bustard *Neotis ludwigii*** and **Martial Eagle *Polemaetus bellicosus*** are 'Endangered'; Burchell's Courser *Cursorius rufus*, Verreaux's Eagle *Aquila verreauxii*, Lanner Falcon *Falco biarmicus*, **Red Lark *Calendulauda burra*,** Secretarybird *Sagittarius serpentarius*, and Black Stork *Ciconia nigra* are 'Vulnerable'; and **Kori Bustard *Ardeotis kori*, Karoo Korhaan *Eupodotis vigorsi*i**, Sclater's Lark *Spizocorys sclateri,* Greater Flamingo *Phoenicopterus ruber*, Abdim's Stork *Ciconia abdimii* and African Rock Pipit *Anthus crenatus* are 'Near-threatened. Those species recorded on or near to the Skeerhok PV 3 site by our surveys are shown in bold above and again in Appendix 3.

Most of the above species either have large territories (e.g. Martial Eagle- approximately 113km² breeding territory – van Eeden *et al*, 2017) or are nomadic, ranging widely across the landscape, normally in response to rainfall and food availability (e.g. Ludwig's Bustard, Sclater's Lark). Red Lark is a possible exception to this, having a slightly more sedentary ecology as far as we understand at present (although local movement in relation to conditions cannot be ruled out).

This means that most of these species can be expected to utilise the proposed site occasionally but not necessarily be resident on it. This is discussed more in Section 2.4.

2.3.2. Important Bird & Biodiversity Area data

No IBBA'S exist close to the proposed Skeerhok PV 3 site (Marnewick *et al*, 2015).

2.3.3. Specialist site visit data

We conducted a one day site visit to the area in May 2017 and a two day visit in January 2018. Amongst other species, during these site visits we recorded two regionally Red Listed species on site: Karoo Korhaan (recorded multiple times, mostly in pairs); and Ludwig's Bustard (several birds seen flying in the south of the site). We also recorded two separate adult Martial Eagles *Polemaetus bellicosus* several times approximately 9km to the south-west of the site. These sightings were too far from site to be of any real concern for this assessment, but are documented for the sake of thoroughness. The repeated sightings do indicate that this may be a breeding territory, presumably with a nest somewhere in the area to the west.

2.3.4. Pre-construction bird monitoring data

In accordance with the BirdLife SA Best Practice Guidelines (Jenkins *et al*, 2017), pre-construction bird monitoring was conducted over 3 site visits in a 6 month period (July 2017 to late January 2018). Each site visit consisted of 4 days on site, conducting walked transects (to sample small passerines); driven transects (to sample large terrestrials and raptors); incidental observations of all priority species; power line surveys and breeding site surveys.

Small passerine bird data

Table 2 presents the small passerine bird data collected by walked transects on site across the 3 seasons. A total of 29 bird species were recorded by this method across the 3 seasons, with a peak in species richness in winter (21 species), followed by late summer (18) and early summer (12). None of the 29 species are regionally Red Listed. However there is a very high level of endemism amongst these species, with 6 southern African endemics and 14 Near-endemics. The most abundant species was Lark-like Bunting *Emeriza impetuani* (a near-endemic), followed by Common Swift *Apus apus* and Sociable Weaver *Philetairus socius* (an endemic). Other important species recorded on site include: Stark's Lark *Spizocorys starki* (a near-endemic which was abundant on site in all 3 seasons); Black-eared Sparrowlark *Eremopterix australis* (an endemic recorded in winter and late summer); and Grey-backed Sparrowlark *Eremopterix verticalis* (a near-endemic recorded in winter and late summer).

Red Lark *Certhilauda burra,* Sclater's Lark *Spizocorys sclateri*, and Burchell's Courser *Cursorius rufus* (all regionally Red Listed and in the case of the larks endemics) were not recorded on site by this method. Red Lark was recorded once on site (1 individual) by drive transects. Sclater's Lark and Burchell's Courser were not recorded on site by any methods.

Table 2. Summary small passerine bird species data collected by walked transects across 3 seasons.

			Total			Winter			Early summer			Mid-summer		
	Transect length		48.12			16.04			16.04			16.04		
	# species		29			21			12			18		
Common name	Scientific name	Regional Red List or Endemic	birds	rec	birds/km	birds	rec	birds /km	birds	rec	birds/km	birds	rec	birds/km
Lark-like Bunting	*Emberiza impetuani*	NE	544	38	11.31	502	22	31.30	1	1	0.06	41	15	2.56
Common Swift	*Apus apus*		244	4	5.07							244	4	15.21
Sociable Weaver	*Philetairus socius*	E	242	5	5.03	153	3	9.54				89	2	5.55
Stark's Lark	*Spizocorys starki*	NE	220	55	4.57	34	10	2.12	113	34	7.04	73	11	4.55
Spike-Heeled Lark	*Chersomanes albofasciata*	NE	135	46	2.81	80	25	4.99	23	8	1.43	32	13	2.00
Black-eared Sparrow-Lark	*Eremopterix australis*	E	133	5	2.76	67	2	4.18				66	3	4.11
Rufous-eared Warbler	*Malcorus pectoralis*		48	37	1.00	21	15	1.31	13	9	0.81	14	13	0.87
Namaqua Sandgrouse	*Pterocles namaqua*	NE	33	5	0.69	24	3	1.50				9	2	0.56
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	NE	30	4	0.62	19	1	1.18				11	3	0.69
Cape Sparrow	*Passer melanurus*	NE	26	9	0.54	12	4	0.75				14	5	0.87
Scaly-Feathered Finch	*Sporopipes squamifrons*	NE	20	2	0.42	20	2	1.25						
Chat Flycatcher	*Bradornis infuscatus*	NE	18	16	0.37				11	9	0.69	7	7	0.44
Sabota Lark	*Calendulauda sabota*	NE	18	17	0.37	3	2	0.19	1	1	0.06	14	14	0.87
Yellow Canary	*Crithagra flaviventris*	NE	15	6	0.31	11	5	0.69				4	1	0.25
Ant-Eating Chat	*Myrmecocichla formicivora*	E	11	8	0.23	6	4	0.37	3	2	0.19	2	2	0.12
Large-billed Lark	*Galerida magnirostris*	E	10	9	0.21	4	3	0.25	3	3	0.19	3	3	0.19
Red-Capped Lark	*Calandrella cinerea*		7	5	0.15	7	5	0.44						
Namaqua Dove	*Oena capensis*		6	1	0.12				6	1	0.37			
Speckled Pigeon	*Columba guinea*		5	1	0.10	5	1	0.31						
Tractrac Chat	*Cercomela tractrac*	NE	5	4	0.10	5	4	0.31						
Cape Penduline Tit	*Anthoscopus minutus*	NE	4	2	0.08	2	1	0.12	2	1	0.12			
Eastern Clapper-Lark	*Mirafra fasciolata*	NE	3	3	0.06							3	3	0.17
Bokmakierie	*Telophorus zeylonus*	NE	2	2	0.04	2	2	0.12						
Double-banded Courser	*Rhinoptilus africanus*		2	1	0.04				2	1	0.12			
Karoo Long-billed Lark	*Certhilauda subcoronata*	E	2	2	0.04				2	2	0.12			

Capped Wheatear	*Oenanthe pileata*		1	1	0.02							1	1	0.06
Karoo Scrub-Robin	*Erythropygia coryphaeus*	E	1	1	0.02							1	1	0.06
Southern Grey-Headed Sparrow	*Passer diffusus*		1	1	0.02	1	1	0.06						
White-Browed Sparrow-Weaver	*Plocepasser mahali*		1	1	0.02	1	1	0.06						

NE = Near-endemic; E = Endemic. Rec = # records.

Table 3. Summary large terrestrial and raptor species data collected by driven transects across 3 seasons.

			Total			Winter			Early summer			Mid- summer		
		Transect length	120.6			40.2			40.2			40.2		
		# species	6			2			2			5		
Common name	Scientific name	Regional Red List or endemic	birds	rec	birds/ km	birds	rec	birds/ km	birds	rec	birds/ km	birds	rec	birds/ km
Northern Black Korhaan	*Afrotis afraoides*	E	17	13	0.14	2	2	0.05	9	5	0.22	6	6	0.15
Red Lark	*Calendulauda burra*	VU, E	1	1	0.01	1	1	0.02						
Double-banded Courser	*Rhinoptilus africanus*		4	2	0.03				3	1	0.07	1	1	0.02
Kori Bustard	*Ardeotis kori*	NT	1	1	0.01							1	1	0.02
Ludwig's Bustard	*Neotis ludwigii*	EN, NE	2	2	0.02							2	2	0.05
Southern Pale Chanting Goshawk	*Melierax canorus*		1	1	0.01							1	1	0.02

E = Endemic; VU = Vulnerable; NT = Near-threatened; EN = Endangered; NE = Near-endemic. Rec = # records

Table 4. Summary data for incidental observations of priority species.

			Winter		Early summer		Mid-summer	
Common name	Scientific name	Regional Red List or endemic	Birds	Rec	Birds	Rec	Birds	Rec
Ludwig's Bustard	*Neotis ludwigii*	EN, NE	2	2			4	1
Martial Eagle	*Polemaetus bellicosus*	EN	3	2				
Northern Black Korhaan	*Afrotis afraoides*	E	1	1	1	1	3	3
Pale Chanting Goshawk	*Melierax canorus*	NE	1	1	2	1	2	2

Large terrestrial and raptor data

Table 3 presents a summary of the data collected by this method. A total of 6 species were recorded by this method, 2 in winter, 2 in early summer and 5 in mid-summer. One of the 6 species, Red Lark is not typically recorded by this method (drive transects not being well suited to small species), but is included here as it is a priority species for this site and was not recorded by any other method. Three of the 6 species are regionally Red Listed: Red Lark is Vulnerable; Kori Bustard *Ardeotis kori* is Near-threatened; and Ludwig's Bustard *Neotis ludwigii* is Endangered. These 3 species are also endemic or near-endemic, and one additional species, the Northern Black Korhaan *Afrotis afraoides* is endemic but not Red Listed.

Incidental observations of priority species

Table 4 presents summary incidental observation data. Four priority species were recorded by this method: Ludwig's Bustard (Endangered, Near-endemic); Martial Eagle (Endangered); Northern Black Korhaan (Endemic); and Pale Chanting Goshawk (Near-endemic).

Existing power line surveys

The existing distribution power lines were surveyed as far as possible whilst on site. Several Sociable Weaver nests were found in the greater surveyed area. On top of one such nest we suspected a Pale Chanting Goshawk could be nesting, but this was later determined not to be the case. We recorded no bird collision or electrocution fatalities under the existing lines during this period. It is noted that two new transmission power lines were under construction during this monitoring period but were not surveyed as access was prohibited due the nature of the construction activities.

Breeding site surveys

During the winter survey the suspected Martial Eagle breeding territory (See Figure 6) was visited 4 times. On one occasion a single adult was recorded perched and on a second visit the two adults were recorded, one carrying prey (meerkat). The area was visited 6 times during early summer with no records of Martial Eagles. The mid-summer survey recorded on adult once flying in the area out of 4 visits to the area. A farm worker informed our team that the eagles are seen more frequently further to the west. Although this would require further confirmation, this may indicate that this pair of eagles resides more to the west, which would mean their nest is a considerable distance from the proposed Skeerhok site (at least 10km) and not at risk if the development goes ahead.

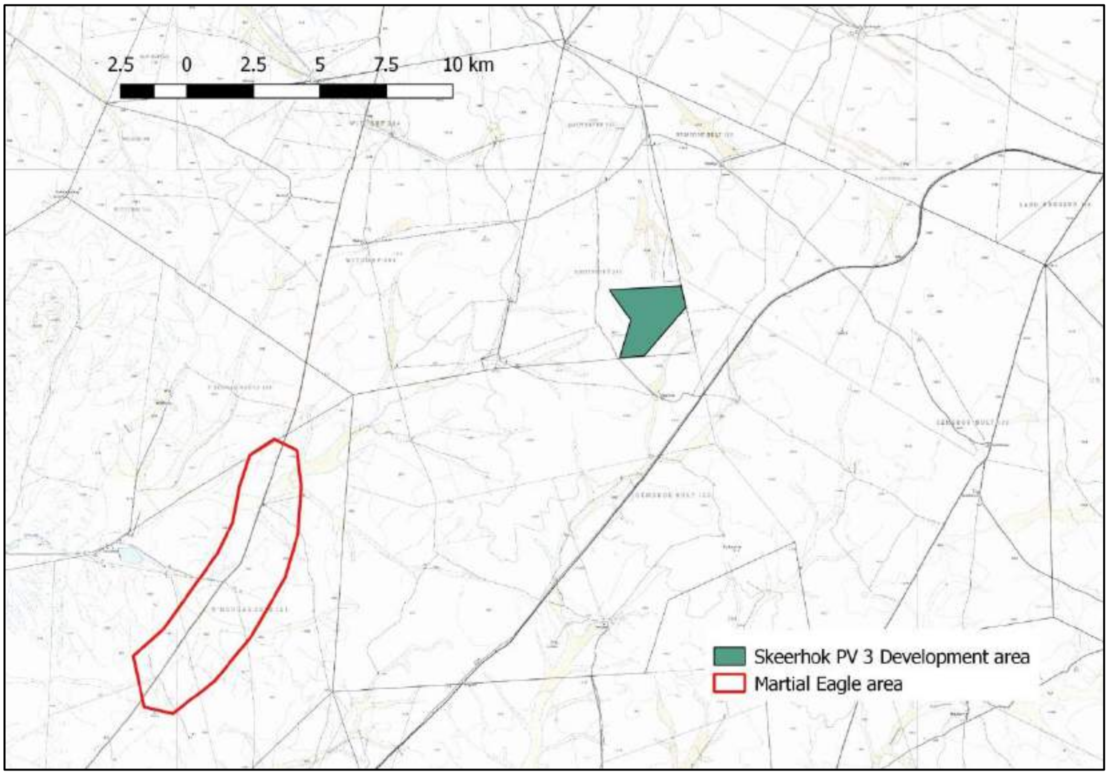

Figure 6. The suspected Martial Eagle territory relative to Skeerhok PV 3.

Overall species list

Our work on site compiled a comprehensive list of bird species recorded by all methods and incidentally. A total of 57 species were recorded on site: 43 in winter; 29 in early summer; and 41 in mid-summer (Appendix 2). Thirty of these species are endemic or near-endemic to southern Africa. Two regionally Endangered (Martial Eagle and Ludwig's Bustard) and two Vulnerable (Kori Bustard and Red Lark) were recorded.

Location of priority species records

Figure 7 presents the location of all priority species records (collected by incidental observations, driven transects, and focal site surveys). Several records of Northern Black Korhaan, Ludwig's Bustard and Stark's Lark were made on the actual footprint of the proposed Skeerhok PV 3. All records are however considered relevant since these birds move around, and a bird recorded several kilometres off the site itself could easily be found on site the following day (for example). It is important to stress that Martial Eagle was only recorded in an area approximately 9-10 km west of the proposed site. This is not far for a bird like this to travel, but the clumping of records in the area shown in Figure 7 and total absence of records on or closer to site does indicate a preference for that area by the birds.

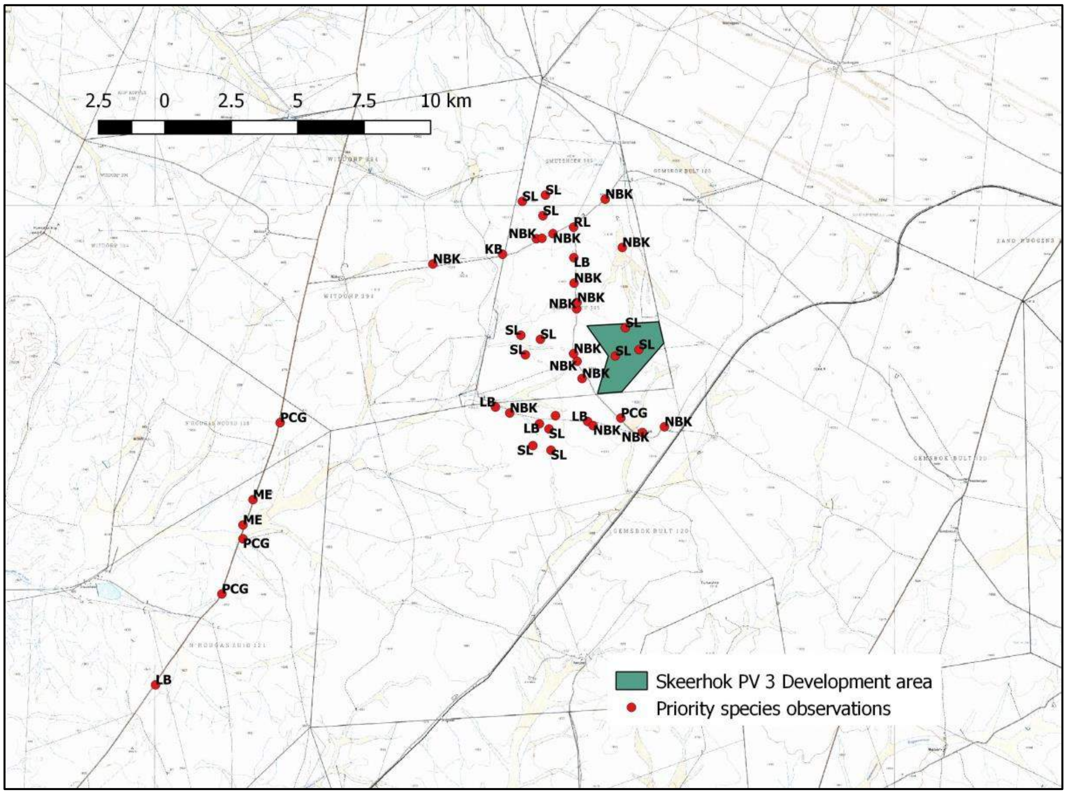

Figure 7. Location of all priority species records across all monitoring methods. LB – Ludwig's Bustard; PCG - Pale Chanting Goshawk; ME – Martial Eagle; NBK – Northern Black Korhaan; KB – Kori Bustard; SL – Stark's Lark.

2.4 Priority bird species for this site

The following is a summary of the relevance of the proposed site for the priority bird species:

2.4.1. Large terrestrial species

These physically large species are likely to be affected to some extent by disturbance and habitat destruction. They are also vulnerable to collision with overhead power lines.

Ludwig's Bustard

Ludwig's Bustard is a wide-ranging bird endemic to the south-western region of Africa (Hockey *et al.* 2005). This species was listed as globally Endangered in 2010 because of potentially unsustainable power line collision mortality, exacerbated by the rapidly expanding power grid (Jenkins *et al.* 2011, BirdLife International 2013). Ludwig's Bustards are both partially nomadic and migratory (Allan 1994, Shaw 2013), with a large proportion of the population moving west in the winter months to the Succulent Karoo. In the arid and semi-arid Karoo environment, bustards are also thought to move in response to rainfall, so the presence and abundance of bustards in any one area are not predictable. Therefore, collisions are also largely unpredictable, and vary greatly between seasons and years (Shaw 2013). While there is no evidence yet of population-level declines resulting from collision mortality, detailed range-wide power line surveys estimate that tens of thousands of bustards (from a total South African population of approximately 114,000 birds) die annually on the existing power grid in this country, which is of grave concern given that they are likely to be long-lived and slow to reproduce. It seems likely that there will be a threshold power line load at which population declines will become apparent, but it is not possible to accurately predict what this will be, and such effects will probably only be noticed when it is too late to do anything about it (Shaw 2013).

Therefore, extreme caution is necessary in the planning of any new infrastructure and in particular power lines in the range of this species.

In our view, Ludwig's Bustard could be an occasional visitor to the site, sometimes in groups if conditions are favourable. The impacts of habitat destruction and disturbance caused by the facility on this species will be of moderate significance (since the species ranges so widely). The risk of collision of this species with overhead power lines is high but this will be discussed in the Basic Assessment for the grid connection power line.

Kori Bustard

Kori Bustards are classified as regionally Near-threatened (Taylor *et al* 2015), with an estimated population of 2,000 – 5,000 birds in South Africa (Hockey *et al.* 2005). There are also worries for the population consequences of power line mortality for this species, given that some 14% of the population is estimated to die annually on Karoo transmission lines alone (Shaw 2013). Kori Bustards in the arid areas are thought to be locally nomadic (Hockey *et al.* 2005) and thus likely suffer greater collision rates than more sedentary populations in other areas (e.g. the Kalahari; Senyatso 2011).

Kori Bustard could visit the site occasionally, singly or in pairs. The impacts of habitat destruction and disturbance caused by the facility on this species will be of moderate significance. The risk of collision of this species with overhead power lines is high but this will be discussed in the Basic Assessment for the grid connection power line.

Secretarybird

This species is classified as regionally Vulnerable (Taylor *et al* 2015), and has recently been up-listed to globally Vulnerable on the basis of population declines (BirdLife International 2013). While there is no current population estimate in South Africa, there has been a reduction of sightings in the areas it previously occupied (SABAP 2 c.f. SABAP 1 data). This is probably mainly due to habitat loss, but power line collisions may also be a significant factor. The physical attributes of Secretarybirds mean that they are highly vulnerable to collision, and data from Karoo transmission lines (Shaw 2013) and the Central Incident Register (Eskom-EWT 2012) indicate that these birds do indeed collide across their range. However, as the population is sparsely distributed it is probably underrepresented in available collision data, and further research would be necessary to better understand potential population impacts of this source of unnatural mortality.

Secretarybird could utilise the site and may breed in the wider area, although we did not find any nests. We were informed by the landowner that Secretarybirds are no longer present in this area. At this stage we believe the main risk to this species will be collision with overhead power lines but this will be discussed in the Basic Assessment for the grid connection power line.

Black Stork

Black Stork is classified as Vulnerable and has experienced a population decline (Taylor *et al,* 2015). This species will be mostly confined to larger river valleys and gorges, and we do not expect it to be a regular visitor to the current study area.

We do not anticipate this species to utilise the site, and risk to the species will consequently be low.

Karoo Korhaan

Karoo Korhaan has recently been upgraded to Near-threatened (Taylor *et al* 2015). As a sedentary species, they seem to be less susceptible to collision than the larger, more mobile bustards, but they are still frequently recorded as collision victims in the Karoo, which is their stronghold (Shaw 2013). There is some evidence that Karoo Korhaans are not as abundant as previously thought (Shaw 2013), so additional mortality caused by the proposed grid connection power line is of concern.

In our opinion this species is likely to utilise the site frequently (several pairs of birds). Destruction of habitat will therefore have some effect on these pairs, of moderate significance. This species will also be susceptible to collision with overhead power lines but that will be assessed in the power line Basic Assessment.

2.4.2. Raptors

Martial Eagle

The Martial Eagle is classified as globally Near-threatened, and regionally Endangered (Taylor *et al* 2015, BirdLife International 2013). This species is well known to have adapted to using Eskom transmission line towers for perching, roosting and nesting. We recorded the species in the broader area 5 times, but not on the site itself. We were unable to locate any breeding site for the species, although it seems likely to be further west of where we recorded it.

In our view, the impact of habitat destruction on this species will be of low significance, on account of its large range relative to the size of the proposed development, the fact that it was not recorded on site, and that habitat of this type is not limited in this area. Collision and electrocution on the overhead power lines are risks to the adult birds, and more so the juveniles produced by breeding but this will be discussed in the Basic Assessment for the grid connection power line.

Verreaux's Eagle

Verreaux's Eagle is classified as regionally Vulnerable. It occurs in the broader area. This is a species that typically uses mountainous areas or at least rocky areas on account of its need for cliffs to breed on, and the habitat of its' primary prey species Rock Hyrax. This species has also learnt to nest on Eskom pylons (which opens up new areas of the country for use by the species, away from mountains), so this cannot be ruled out in this area in the future, although we did not find any such nest. We anticipate that this species could occasionally forage over the site.

Based on current information we do not believe this species is at risk on the proposed site.

Lanner Falcon

The Lanner Falcon is classed as Vulnerable and the species does seem to be in decline (Taylor *et al,* 2015). This species is susceptible to collision with overhead cables such as power lines, and also has a tendency to nest on power line structures, which could bring it into close proximity of the proposed power line.

We did not record this species on site but believe that it probably does occur in the area, and could breed on the new transmission power lines once construction is complete. This species will be at low risk from the proposed development.

2.4.3. Small terrestrial species

Burchell's Courser

Burchell's Courser is classified as Vulnerable by Taylor *et al* (2015). It is a nomadic species with an estimated regional population of <10 000 birds. It has undergone a significant reduction in population size in recent decades. This species will most likely be found on the open plains in the study area, often in the most sparse vegetation. Habitat loss is a key threat for this species, although its nomadic nature means that it would most likely move to better habitat elsewhere if disturbed or displaced from a particular site.

We did not record this species on site, but conclude that it could use the site at times. This species will be susceptible to habitat loss as a result of construction of the facility. If the species breeds on site then it would be at risk of disturbance.

Red Lark

Bushmanland is renowned for its high diversity and abundance of larks, many of which are endemic to southern Africa (Hockey *et al.* 2005). Up to 14 lark species can be seen in this area. Red Lark is listed as Vulnerable (Taylor *et al*, 2015), and has been recorded in the broader area by the SABAP project. It is a habitat specialist, utilising the red sand dunes and adjacent plains.

We recorded a single Red Lark on site during the pre-construction bird monitoring. We are also aware that the species has been recorded elsewhere in the wider area (Pachnoda Consulting cc, 2015). It is possible that a small population of this species are resident in the area. The risk to this species will in our view be of medium significance, primarily through habitat destruction.

Sclater's Lark

Sclater's Lark is an endemic species classified as Near-threatened by Taylor *et al* (2015). It is mostly found on stony arid plains, often associated with quartz gravel. This is a nomadic species, which moves around in response to rainfall and food availability. It has been recorded in this area by the SABAP project previously. We did not record it on site, but expect that it could utilise the site at times when conditions are right.

We conclude that this species could occur on site at times. Destruction of habitat and disturbance will be of moderate significance for this species.

Stark's Lark

Stark's Lark is a near-endemic species, not Red Listed. It is nomadic, moving in response to rainfall. Its preferred habitat is arid and semi-arid open plans particularly on calcrete. We recorded large numbers of the species on site through all 3 seasons. Due to this species' endemic status and the fact that it is not well represented in protected areas, this is a priority species for this site.

We conclude that this species will be affected by habitat destruction at a moderate to high significance level if the facility is built.

3. EVALUATION OF IMPACTS

The various potential impacts that could occur as a result of the proposed facility have been identified and discussed below and rated formally in Table 5 according to criteria supplied by the CSIR (Appendix 1).

3.1. Habitat destruction associated with the construction of the facility

During the construction and maintenance phases of this project, a certain amount of habitat destruction and alteration will take place. The nature of the proposed facility means that the majority of the development footprint (PV module) will be transformed from the current vegetation to an industrial site. The vegetation under the PV panels will be brush cut. This is better for habitat destruction than total clearing of vegetation. In this case this surface area affected is estimated to be approximately 300 hectares. This is a substantial impact in terms of bird habitat loss on the site. We have judged the significance of this impact to be HIGH, given that a number of important arid adapted bird species will be affected. Mitigation will reduce the significance of this impact to MODERATE.

Mitigation

Since this habitat destruction is inevitable, the only meaningful mitigation for this impact is to ensure that the layout of the facility is placed on low sensitivity areas on site. More detail follows:

- Water courses, drainage lines, streams and wetlands should be avoided and a no go buffer of 100m be applied around them.
- Dams and livestock water points should likewise be avoided with a 100m no go buffer.
- Rocky outcrops should be avoided with a 100m no go buffer.
- All staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted.
- Care should be taken not to introduce or propagate alien plant species/weeds during construction.

3.2. Disturbance of birds & displacement effects

Disturbance of avifauna during the construction (and thereafter during maintenance and operational and decommissioning) of the facility and associated infrastructure is likely to occur. Disturbance of breeding birds is typically of greatest concern. In this regard any breeding sites of sensitive bird species would be the most important. For this aspect a much larger area than the site itself is considered since disturbance effects could be relevant for several kilometres.

We have not identified any such breeding sites at this stage. We conclude the significance of this impact to be LOW both with and without mitigation and for all 3 phases: construction, operation, and decommissioning. This could change between now and construction of the facility as priority birds may move into the area and nest. In such a treeless landscape, the recent construction of the two new 400kv transmission lines in particular presents a sudden increase in nesting substrate for tree nesting bird species.

Mitigation

- A site specific avifaunal walk through should be conducted by a qualified ornithologist as part of the site specific EMP just prior to construction, so as to ensure that no sensitive bird species have started breeding on or near site. If any such sites are found case specific mitigation measures will need to be designed.
- Facility lighting during construction & operation should be kept to a minimum and should make use of latest technology to ensure that light disturbance is minimised. This will also reduce the attraction of insects (and in turn insectivorous birds) to the facility.

3.3. Bird fatality at facility

Bird fatalities are likely to occur for a number of reasons, as discussed elsewhere in this report. Based on our data collected on bird species on site, we conclude that this impact will be of MODERATE significance reduced to LOW significance with mitigation. Overall the abundance of birds on site is low and there seems little in the way of landscape or habitat features to concentrate birds into particular areas where impacts could occur. The impact of electrocution of birds on electrical substations is possible, but is likely to be of LOW significance, as threatened bird species are not likely to frequent these switching stations and substations.

Mitigation

- The more sensitive habitat areas of the site should be avoided. A buffer area has been identified around all farm dams (of 100m) within which no PV panels or other above ground infrastructure should be built. The same should ideally apply to all livestock watering points as far as possible, and drainage lines/water courses/wetlands. This is to provide separation between the facility and water associated birds. Secondly no additional surface water sources (dams, ponds, reservoirs, treatment works etc) should be developed on or close to the PV panels in order to limit the attractiveness of the area to birds.
- The PV panels should spend as little time as possible time in a vertical position since this presents a greater collision hazard. It is not clear at this stage whether the panels will be a fixed tilt or utilise single axis tracking.

- Very little is known about this impact in South Africa. For this reason a post construction monitoring programme is recommended for this site, as prescribed by the latest relevant guidelines, in order to document any impacts and provide the basis for an adaptive management approach to any impacts.
- Mitigation is complex at electrical structures since there are many ways in which birds could get electrocuted as the hardware is complex and provides many different potential perches for birds. It is therefore recommended that mitigation be applied reactively once the facility is operational, only if a significant problem is detected. Monitoring of this infrastructure for bird fatalities should be built into the operational environmental management plan for the facility.

3.4. Nesting & other use of infrastructure by birds

Certain species, in particular Sociable Weaver and crows, are likely to use some of the facility infrastructure for nesting, perching and roosting. At face value this is a positive impact for birds and has been rated as LOW significance. However, nesting typically brings birds into conflict with facility management as they may make maintenance difficult for staff, and also poses a fire risk since nests present abundant fuel for fires. This will require management on site, preferably through the operational Environmental Management Plan (EMP). As with electrocutions in substation yards, the exact location of this impact is very difficult to predict at this stage and should be managed as and when it occurs, in consultation with a bird specialist and in compliance with all relevant legislation.

Mitigation

- None required for the impact of the facility on birds. For the impact of the birds nesting on the facility, we recommend nest management on a case by case basis under the supervision of an avifaunal specialist, and in conformance with all relevant national and provincial legislation.
- We recommend that the operational phase EMP include provision for application to the provincial authority for permits for any necessary nest management.

3.5. Altered run off patterns

It is likely that water used to wash the panels and rainfall will fall to the bare ground and then need to runoff somewhere. If not managed correctly this could either result in water standing for long periods, which would attract birds and their prey thereby placing them at risk of collision with infrastructure, or it could result in soil erosion. This could also extend the impact of habitat destruction beyond the immediate footprint and increase the 300 hectares to a larger area if not managed correctly. This has been rated as LOW significance pre-mitigation.

Mitigation

- This will need to be managed through the development of a carefully considered surface water/drainage management plan for the site.

3.7. Chemical pollution from cleaning panels

There is a risk that if hazardous chemicals are used to clean panels and fall to the ground and enter the environment this could have secondary effects. This has been rated as LOW significance pre-mitigation.

Mitigation

- The surface water management plan should stipulate the use of environmentally friendly and acceptable cleaning products.

Table 5. Impact assessment tables.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE													
Clearing of vegetation	**Habitat loss/alteration**	Negative	Site	Permanent	Substantial	Definite	Low	Moderate	See Section 3.1	High (2)	Moderate(3)	1	High
General construction activities	**Disturbance**	Negative	Local	Short term	Moderate	Probable	High	Moderate	See Section 3.2	Low (4)	Low (4)	2	Medium
OPERATIONAL PHASE													
Operation of facility	**Bird fatalities**	Negative	Site	Long term	Moderate	Probable	High	Moderate	See Section 3.3	Moderate (3)	Low (4)	1	Low
	Nesting of birds	Positive	Site	Long term	Slight	Probable	High	Low	See Section 3.4	Low (4)	Low (4)	3	High
	Altered water runoff	Negative	Local	Long term	Slight	Probable	High	Low	See Section 3.5	Low (4)	Low (4)	2	Low
	Chemical pollution	Negative	Local	Long term	Slight	Probable	High	Low	See Section 3.6	Low (4)	Low (4)	4	Low
DECOMMISSIONING PHASE													

Decommissioning activities	**Disturbance**	Negative	Local	Short term	Moderate	Probable	High	Moderate	See Section 3.2	Low (4)	Low (4)	1	Medium

3.7 Cumulative effects of development on avifauna in this area

Figure 8, Table 6 and Appendix 3 present the known relevant projects within a 20km radius of the proposed Skeerhok PV 3 (information supplied by CSIR). There are 14 solar PV projects in this radius including the 3 Skeerhok PV projects. DEA has stated that no more than 6 of these projects can be awarded preferred bidder status due to the constraints of the SKA project, but for the purposed of this cumulative impact assessment we have assumed the worst case scenario of all projects being built.

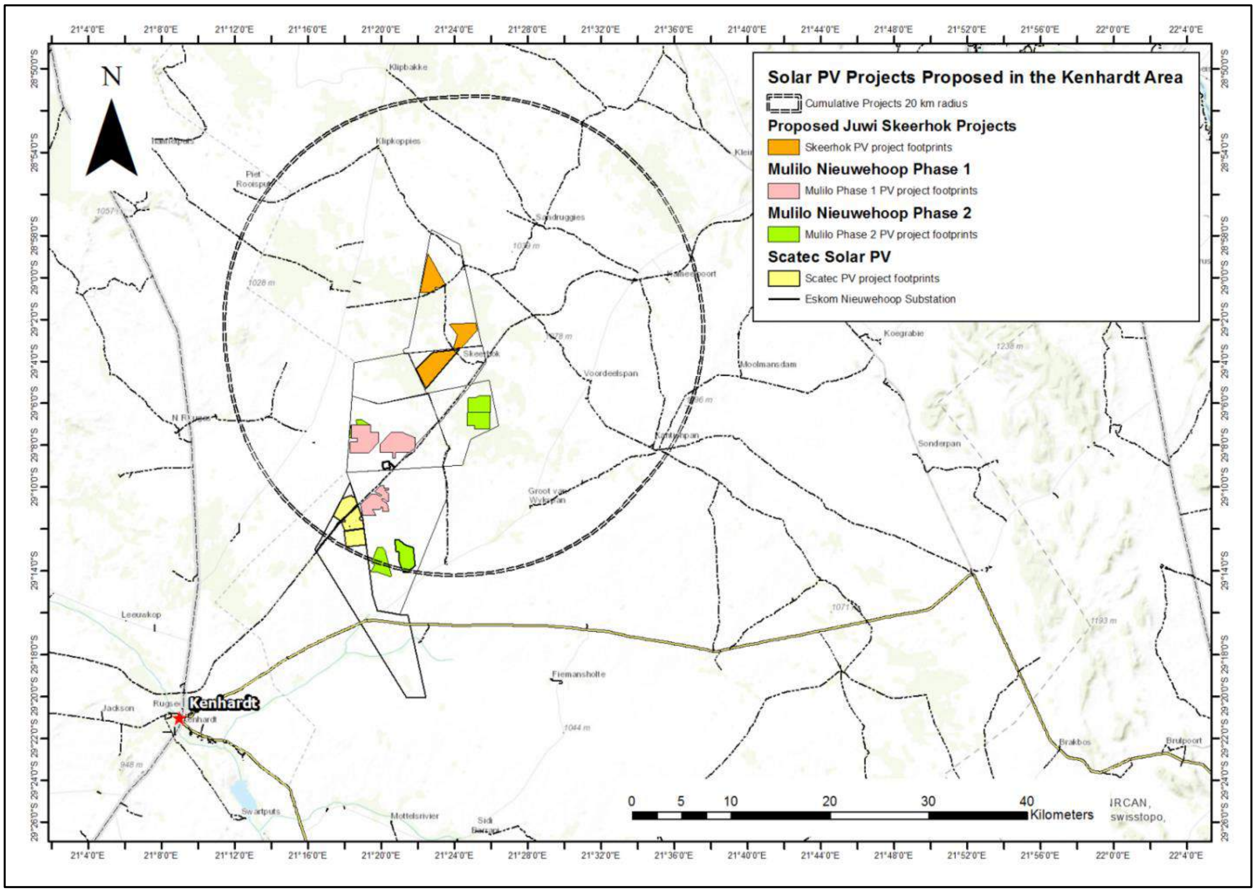

Figure 8. Projects identified by the CSIR within a 20km radius of the Skeerhok PV 3 project.

The cumulative impacts have been assessed below, according to the guidance offered by the DEA (DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria) and IFC guidelines (Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets"(International Finance Corporation)) on this matter.

Specifically, the steps undertaken in the cumulative impact assessment section of the study were as follows:

- Define and assess the impacts of the Skeerhok PV 3 project. *See Section 3.1 to 3.7*

- Identify and obtain details for all operational and authorised overhead power lines and solar energy facilities (within 20km radius of Skeerhok PV 3 activities). *See Figure 8, Table 6 & Appendix 3.*
- Identify impacts of the proposed Skeerhok PV 3 project which are also likely or already exist at the other projects. *All of the impacts described in Section 3.1 to 3.7 will occur on the other solar PV facilities. However the most important one of these impacts and the one which we know will definitely occur (i.e. some of the others are slightly speculative) is that of habitat destruction. The area of habitat which is altered or destroyed is also a good indicator of some of the other impacts. We have therefore used habitat destruction as the focus impact for the cumulative impact assessment. Habitat destruction is likely to be most significant for a suite of arid adapted endemic small species including: Red Lark, Sclater's Lark; Stark's Lark, Burchell's Courser; Black-eared and Grey-backed Sparrowlarks and others.*
- Where possible obtain reports and data for other projects. *This has been done as far as possible. In most cases specialist avifaunal studies were not done. Ecological reports considered avifauna but not comprehensively.*
- As far as possible quantify the effect of all projects on key bird species local populations (defined and estimated). *Where the amount of habitat to be altered or destroyed has been specified in other project reports this has been used. However many of the reports do not quantify this. In these cases we have assumed that a 75MW facility will destroy 250 hectares of habitat. See Table 6 for these figures.*
- Express the likely impacts associated with the Skeerhok PV 3 project as a proportion of the overall impacts on key species. *This analysis is presented in Table 6. Skeerhok PV2 will represent 8.4% of the total habitat destruction across all solar projects. We have to assume that the importance of the habitat for the relevant bird species is uniform across all this habitat. In which case Skeerhok PV 3 will contribute approximately 8.4% of the total impact of habitat destruction on birds. It is however important to note that our estimate is that all 14 projects will only take up 2.8% of the total area within the 20km radius of the Skeerhok site. Of this 2.8% Skeerhok PV 3 contributes 0.2%. in our view this is a small proportion of the broader landscape.*
- A reasoned overall opinion will be expressed on the suitability of the proposed development against the above background. This will include a cumulative impact assessment statement. *This has been presented below Table 6.*
- The decision making process with respect to the above will be clearly documented in the report. *This section.*
- Identified cumulative impacts must be clearly defined and where possible the size of the identified impact quantified and indicated. *See above and Table 6.*
- Detailed process flow and proof must be provided to indicate how the specialists' recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project. *This section.*

- The cumulative impacts significance rating must also inform the need and desirability of the proposed development. *This has been addressed with the Cumulative Impacts Statement.*
- A cumulative impact environmental statement on whether the proposed development must proceed. *See below Table 6.*

Table 6. Summary information for the proposed solar facilities within 20km of Skeerhok PV 3.

Project	Capacity (MW)	Footprint (ha)	Proportion of total footprint of all projects	Proportion of 20km radius circle (125 664 hectares)
Gemsbok PV1	75	250	7.0%	0.2%
Gemsbok PV2	75	250	7.0%	0.2%
Boven PV1	75	250	7.0%	0.2%
Kenhardt PV1	75	250	7.0%	0.2%
Kenhardt PV2	75	250	7.0%	0.2%
Kenhardt PV3	75	250	7.0%	0.2%
Boven Solar PV3	75	329	9.2%	0.3%
Gemsbok PV5	75	275	7.7%	0.2%
Gemsbok PV6	75	275	7.7%	0.2%
Gemsbok PV3	75	289	8.1%	0.2%
Skeerhok PV1	100	300	8.4%	0.2%
Skeerhok PV2	100	300	8.4%	0.2%
Skeerhok PV3	100	300	8.4%	0.2%
Total	1050MW	3568ha		2.8%

Cumulative Impact Statement

The proposed facility will result in the removal of natural vegetation and the transformation from a natural landscape to a totally transformed industrial type land use. This will render that area almost totally unavailable as habitat for birds. It stands to reason that the more land is transformed in this way the greater the impact on birds. The cumulative impact of multiple solar energy facilities on birds is therefore negative. Given that we have judged the impact of this proposed Skeerhok facility to be of HIGH significance for avifauna (mitigated to MODERATE), the construction of multiple additional facilities will result in the overall cumulative impact being HIGH negative.

As mentioned above, this cumulative impact assessment assumes the worst case scenario of up to 14 solar facilities being constructed in this 20km radius. However, if as per the DEA statement, only 6 are built, this would reduce the significance of the impacts by approximately half. This would probably result in the significance being rated as MODERATE rather than the current HIGH.

4. AVIFAUNAL CONSTRAINTS OR SENSITIVITY MAPPING

The sensitive features for avifauna on and near the proposed site are as follows:

1. Major drainage lines, water courses, streams, wetlands. These will be used as flight paths by various bird species and also typically contain more woody vegetation thereby providing a different micro habitat and attracting more diverse bird species. We recommend a no go buffer of 100m around these areas.

2. Farm dams. These areas provide almost the only source of surface water in this arid environment and so will attract birds. They also typically result in more woody vegetation. We recommend a no go buffer of 100m around these areas.

3. Livestock watering points. These areas attract a greater abundance and diversity of species and should be avoided by the new infrastructure. We recommend a no go buffer of 100m around these areas. If this is not possible then the water point should be closed and developed elsewhere on the farm.

4. Major rocky outcrops. These areas attract a different assemblage of small bird species and should be avoided as far as possible. We recommend a no go buffer of 100m around these.

The proposed facility layout is presented in Figure 9. The above sensitive features have already been designed out of this layout, i.e. this recommended mitigation has already been applied.

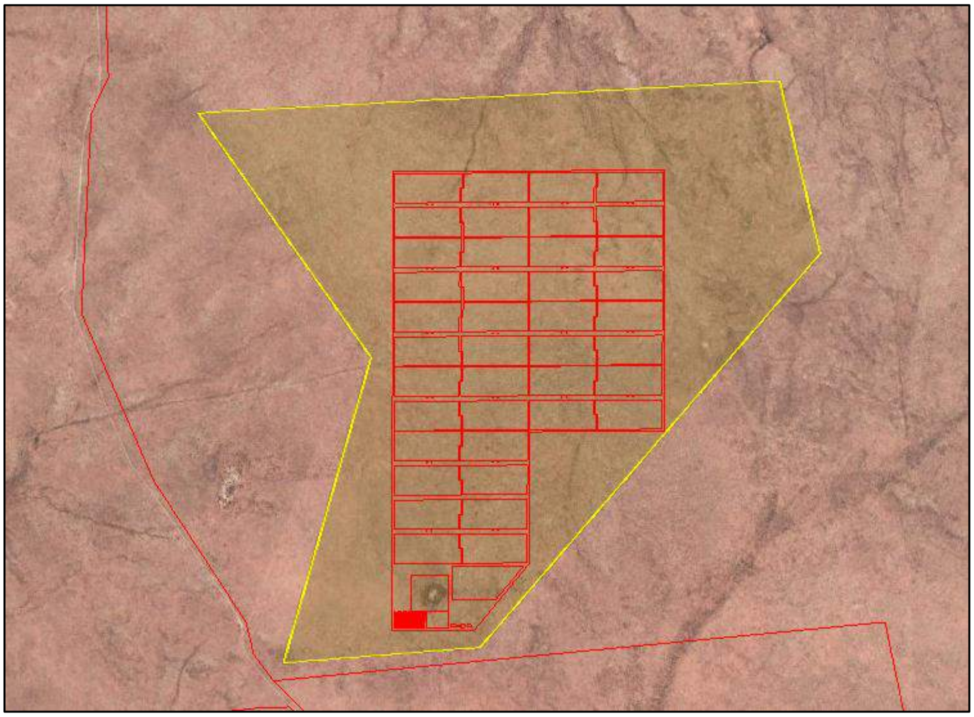

Figure 9. The detailed Skeerhok PV 3 layout superimposed on Google Earth image. The developable area is shown in yellow and the actual layout footprint in red.

5. OPERATIONAL PHASE (POST CONSTRUCTION) BIRD MONITORING FRAMEWORK

Post-construction monitoring should be started as soon as possible after the facility becomes operational. This should ensure that the immediate effects of the facility on resident and passing birds are recorded, while avoiding the confusing, short-term effects of the construction process. The below framework is that recommended by Jenkins *et al* (2017).

Post-construction bird data collection or monitoring is critical to:

- Determine the actual impacts of the facility.
- Determine if additional mitigation is required (adaptive management).
- Provide an indication of likely impacts from scaling-up (similar developments in same general area);
- Improve future assessments.

Post-construction monitoring can be divided into three categories: habitat classification; quantifying bird abundance (replicating baseline data collection); and quantifying bird mortalities.

Habitat classification

The exact 'as built' effects of the facility on the natural habitat should be delineated, classified and quantified once construction is complete. This should take into account any secondary effects such as erosion, alien plant invasion, and incomplete rehabilitation of areas used temporarily.

Bird abundance

As a rule of thumb survey protocols used in baseline data collection should be repeated during the first two years of operation (e.g. 6 months/3 seasons in year 1, and 6 months/3 seasons in year 2 for Regime 2 sites), and should be combined with monitoring of fatalities over the full two-year period. This should be subject to review at the end of this time and in the event that significant impacts are measured it may be necessary to extend data collection for longer. It may also be necessary to repeat post-construction monitoring protocols periodically (perhaps every 3-5 years) over the lifetime of the project.

Quantifying bird mortalities/fatality estimates

This should be done by a dedicated full time team of staff searching the facility regularly (recommended weekly) with a formal and measureable searching method. Any bird carcasses found should be kept on site in a freezer until all necessary information has been recorded. It will also be necessary to conduct searcher efficiency and carcass persistence trials on site to obtain estimates of these factors for use in the statistical analysis, to account for those birds not found or removed by scavengers.

Reporting

Quarterly reports, summarising interim findings should be complied and submitted to BirdLife South Africa and the Department of Environmental Affairs. At the end of each year of monitoring, a more detailed post-construction monitoring report analysing the results should be completed and submitted to relevant stakeholders (as identified by the DEA).

6. CONCLUSION

Our work on site to date has made the following findings with respect to avifauna:

- Our surveys on site took place in a slightly above average rainfall year (165.0mm in 2017 c.f. 147.8mm p.a. mean since 1960). This means that our data should be representative of typical conditions on site.
- The proposed Skeerhok site is already relatively impacted by linear infrastructure including roads, railway line, and transmission and distribution power lines.
- There are no Important Bird & Biodiversity Areas close to the proposed site.
- Walked transects on site recorded 29 small passerine bird species in total. Twenty of these species are either endemic or near endemic to southern Africa, which is a very high level of endemism. Whilst the most abundant species on site were all common species, and important endemic, Stark's Lark *Spizocorys starki* was also recorded in relatively high abundance on site. No regionally Red Listed species were recorded on site by this method.
- Driven transects on site recorded 6 priority species. Two were small passerines, Red Lark *Certhilauda burra* (Vulnerable -1 individual), and Double-banded Courser *Rhinoptilus africanus*. The 4 remaining species were: Kori Bustard *Ardeotis kori* (Near-threatened), Ludwig's Bustard *Neotis ludwigii* (Endangered), and Northern Black Korhaan *Afrotis afraoides*. Three of these species are regionally Red Listed (Taylor *et al,* 2015) as indicated above.
- Martial Eagle *Polemaetus bellicosus* (Endangered) was recorded several times off site, approximately 9km to the west. Although these birds are suspected to breed somewhere in that area (We did not locate a nest) this is too far from the proposed site to be of concern.
- A total of 57 bird species were recorded on site during our monitoring programme by all methods and incidentally. Thirty of these are endemic or near-endemic. This included 5 regionally Red Listed species, the 4 mentioned above already and Karoo Korhaan *Eupodotis vigorsii* (Near-threatened). Sclater's Lark *Spizocorys sclateri* and Burchell's Courser *Cursorius rufus* were not recorded on site during this programme, but are considered likely to visit the site occasionally when conditions are right.
- Considering the bird and habitat data collected on site we conclude that the following species will be most at risk if the proposed development goes ahead: Ludwig's Bustard; Kori Bustard; Karoo Korhaan; Red Lark; Sclater's Lark; and Stark's Lark. There are many more endemic but not Red Listed species which will also be of concern, but we feel the above suite of species serves as a good surrogate for those more common species in terms of impact assessment and management.

Our preliminary assessment of the significance of the impacts on avifauna on site is as follows:

- Habitat destruction during the construction phase will be of HIGH significance, mitigated to MODERATE significance.

- Disturbance of birds during the construction phase will be of LOW significance.
- Bird fatalities at the facility during the operational phase (mostly through collision with infrastructure) will be of MODERATE significance, mitigated to LOW.
- Nesting of birds on the facility infrastructure during the operational phase will be of LOW significance.
- Altered surface water runoff on site during the operational phase will be of LOW significance.
- Chemical pollution due to panel cleaning during the operational phase will be of LOW significance.
- Disturbance of birds during the construction phase will be of LOW significance.

Mitigation for inclusion in the EMPr

The following mitigation measures are recommended:

- Water courses, drainage lines, streams and wetlands should be avoided and a no go buffer of 100m be applied around them.
- Dams and livestock water points should likewise be avoided with a 100m no go buffer.
- Rocky outcrops should be avoided with a 100m no go buffer.
- All staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted.
- Care should be taken not to introduce or propagate alien plant species/weeds during construction.
- A site specific avifaunal walk through should be conducted by a qualified ornithologist as part of the site specific EMP just prior to construction, so as to ensure that no sensitive bird species have started breeding on or near site. If any such sites are found case specific mitigation measures will need to be designed.
- Facility lighting during construction & operation should be kept to a minimum and should make use of latest technology to ensure that light disturbance is minimised. This will also reduce the attraction of insects (and in turn insectivorous birds) to the facility.
- The PV panels should spend as little time as possible time in a vertical position since this presents a greater collision hazard. It is not clear at this stage whether the panels will be able to tilt or be fixed.
- Very little is known about the impacts of solar facilities on birds in South Africa. For this reason a post construction monitoring programme is recommended for this site in order to document any impacts and provide the basis for an adaptive management approach to any impacts.
- Mitigation is complex at electrical structures since there are many ways in which birds could get electrocuted as the hardware is complex and provides many different potential perches for birds. It is therefore recommended that mitigation be applied reactively once the facility is operational, only if a significant problem is detected. Monitoring of this infrastructure for bird fatalities should be built into the operational environmental management plan for the facility.

- We recommend that the operational phase EMP include provision for application to the provincial authority for permits for any necessary nest management.
- A carefully considered surface water/drainage management plan must be developed for the site including attention to the use of environmentally friendly cleaning chemicals.

Environmental impact statement

The Skeerhok site is important habitat for an assemblage of arid zone bird species, many of which are endemic. The transformation of natural habitat for the proposed facility will therefore be of high significance. Fortunately the facility will transform a small area relative to the remaining habitat, which is fairly uniform in the broader area. The impact of habitat destruction can be mitigated to **moderate significance** by ensuring that the more sensitive micro habitats are designated as no go areas. All other impacts are **of moderate or low** significance. We recommend that the facility be authorised, provided that the recommendations of this report are implemented.

Cumulative impact statement

The proposed facility will result in the removal of natural vegetation and the transformation from a natural landscape to a totally transformed industrial type land use. This will render that area almost totally unavailable as habitat for birds. It stands to reason that the more land is transformed in this way the greater the impact on birds. The cumulative impact of multiple solar energy facilities on birds is therefore negative. Given that we have judged the impact of this proposed Skeerhok facility to be of HIGH significance for avifauna (mitigated to MODERATE), the construction of multiple additional facilities will result in the overall cumulative impact being HIGH negative.

This cumulative impact assessment assumes the worst case scenario of up to 14 solar facilities being constructed in this 20km radius. However, if as per the DEA statement, only 6 are built, this would reduce the significance of the impacts by approximately half. This would probably result in the significance being rated as MODERATE rather than the current HIGH.

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APPENDIX 1. CRITERIA AGAINST WHICH IMPACTS ARE ASSESSED (SUPPLIED BY CSIR)

The identification of potential impacts and risks should include impacts that may occur during the construction, operational and decommissioning phases of the activity. The assessment of impacts is to include direct, indirect, as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed activity is well understood so that the impacts associated with the activity can be understood. The process of identification and assessment of impacts will include:

- Determine the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determine future changes to the environment that will occur if the activity does not proceed;
- An understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

As per DEA *Guideline 5: Assessment of Alternatives and Impacts* the following methodology is to be applied to the prediction and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of 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 as a result of the activity.

- **Cumulative impacts** are 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. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

- **Nature of impact** - this reviews the type of effect that a proposed activity will have on the environment and should include "what will be affected and how?"

- **Spatial extent** – The size of the area that will be affected by the risk/impact:
  - Site;
  - Local (<10 km from site);
  - Regional (<100 km of site);
  - National; or
  - International (e.g. Greenhouse Gas emissions or migrant birds).

- **Duration** – The timeframe during which the risk/impact will be experienced:
  - Very short term (instantaneous);

- Short term (less than 1 year);
- Medium term (1 to 10 years);
- Long term (the impact will occur for the project duration); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).

▪ **Reversibility of impacts -**
  - High reversibility of impacts (impact is highly reversible at end of project life, i.e. this is the most favourable assessment for the environment. For example, the nuisance factor caused by noise impacts associated with the operational phase of an exporting terminal can be considered to be highly reversible at the end of the project life);
  - Moderate reversibility of impacts;
  - Low reversibility of impacts; or
  - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on the site caused by building foundations could be non-reversible).

▪ **Irreplaceability of resource loss caused by impacts –**
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment. For example, if the project will destroy unique wetland systems, these may be irreplaceable);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts will further be assessed in terms of the following:

▪ **Probability** – The probability of the impact occurring:
  - Improbable (little or no chance of occurring);
  - Probable (<50% chance of occurring);
  - Highly probable (50 – 90% chance of occurring); or
  - Definite (>90% chance of occurring regardless of prevention measures).

▪ **Consequence**–The anticipated severity of the impact:
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or

- Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

- **Significance** – To determine the significance of an identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 1 below). The approach incorporates internationally recognised methods from the Intergovernmental Panel on Climate Change (IPCC) (2014) assessment of the effects of climate change and is based on an interpretation of existing information in relation to the proposed activity, to generate an integrated picture of the risks related to a specified activity in a given location, with and without mitigation. Risk is assessed for each significant stressor (e.g. physical disturbance), on each different type of receiving entity (e.g. the municipal capacity, a sensitive wetland), qualitatively (very low, low, moderate, high, very high) against a predefined set of criteria (as shown in Figure 1 below).

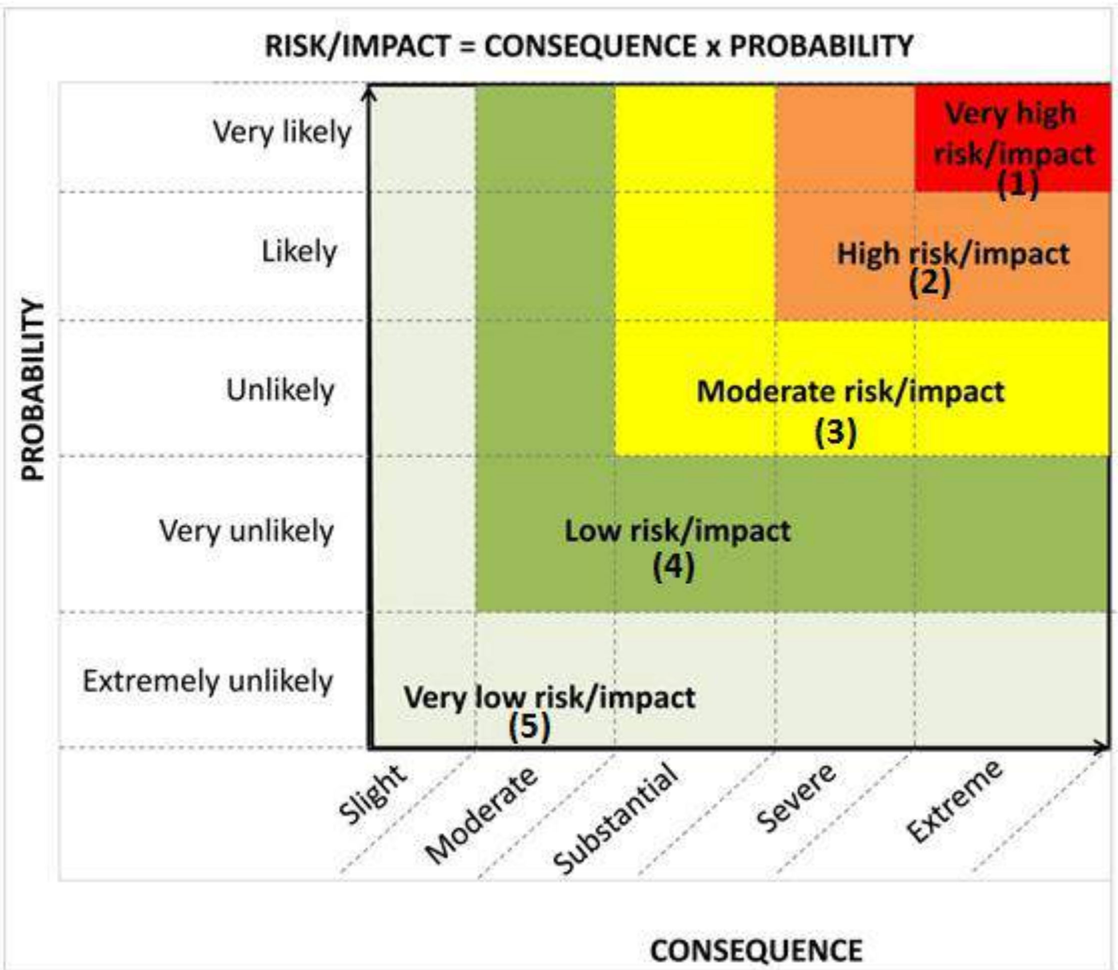

Figure 1: Guide to assessing risk/impact significance as a result of consequence and probability.

- **Significance** – Will the impact cause a notable alteration of the environment?

- Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
- Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
- Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated); or
- High (the risk/impacts will result in a considerable alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making).
- Very high (the risk/impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

The above assessment must be described in the text (with clear explanation provided on the rationale for the allocation of significance ratings) and summarised in an impact assessment Table in a similar manner as shown in the example below (Table 1).

With the implementation of mitigation measures, the residual impacts/risks must be ranked as follows in terms of significance:

- Very low = 5;
- Low = 4;
- Moderate = 3;
- High = 2; and
- Very high = 1.

- **Status** - Whether the impact on the overall environment (social, biophysical and economic) will be:
  - Positive - environment overall will benefit from the impact;
  - Negative - environment overall will be adversely affected by the impact; or
  - Neutral - environment overall will not be affected.

- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
  - Low;
  - Medium; or
  - High.

Impacts will then be collated into an EMPr and these will include the following:

- Management actions and monitoring of the impacts;

- Identifying negative impacts and prescribing mitigation measures to avoid or reduce negative impacts; and
- Positive impacts will be identified and enhanced where possible.

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts will be evaluated for the construction, operational and decommissioning phases of the development. The assessment of impacts for the decommissioning phase will be brief, as there is limited understanding at this stage of what this might entail. The relevant rehabilitation guidelines and legal requirements applicable at the time will need to be applied;
- The impact evaluation will, where possible, take into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area; and
- The impact assessment will attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.
- Impacts should be assessed for all layouts and project components.
- **IMPORTANT NOTE FROM THE CSIR**: Impacts should be described both before and after the proposed mitigation and management measures have been implemented. The assessment of the potential impact "before mitigation" should take into consideration all management actions that are already part of the project design (which are a given). The assessment of the potential impact "after mitigation" should take into consideration any additional management actions proposed by the specialist, to minimise negative or enhance positive impacts.

APPENDIX 2. BIRD SPECIES RECORDED IN THE BROADER STUDY AREA BY THE SABAP 1 & SABAP 2 PROJECTS; & CONFIRMED BY ON SITE PRE-CONSTRUCTION BIRD MONITORING.

'1' denotes presence, not abundance

E – Endemic, NE – near-endemic

EN – Endangered; VU – Vulnerable; NT – Near-threatened

Regional Red List – Taylor *et al*, 2015

SABAP1 – recorded by this project

SABAP2 – recorded by this project

Winter, Early Summer, Mid-summer – recorded in these seasons

Common name	Scientific name	Regional Red List	Endemic/near	SABAP1	SABAP2	Winter	Early summer	Mid-summer
Avocet, Pied	*Recurvirostra avosetta*			1				
Barbet, Acacia Pied	*Tricholaema leucomelas*			1	1	1	1	1
Barbet, Crested	*Trachyphonus vaillantii*				1			
Batis, Pririt	*Batis pririt*			1	1			
Bee-eater, European	*Merops apiaster*			1	1			
Bee-eater, Swallow-tailed	*Merops hirundineus*			1	1			
Bishop, Southern Red	*Euplectes orix*			1	1			
Bokmakierie	*Telophorus zeylonus*		NE	1	1	1		
Brubru	*Nilaus afer*			1				
Bulbul, African Red-eyed	*Pycnonotus nigricans*		NE	1	1	1		1
Bunting, Cape	*Emberiza capensis*			1		1		1
Bunting, Cinnamon-breasted	*Emberiza tahapisi*				1			
Bunting, Lark-like	*Emberiza impetuani*		NE	1	1	1	1	1
Bustard, Kori	*Ardeotis kori*	VU		1	1			1
Bustard, Ludwig's	*Neotis ludwigii*	EN	NE	1	1	1		1
Buzzard, Jackal	*Buteo rufofuscus*			1				
Canary, Black-headed	*Serinus alario*			1	1			

Canary, Black-throated	*Crithagra atrogularis*			1	1	1		
Canary, White-throated	*Crithagra albogularis*			1	1			
Canary, Yellow	*Crithagra flaviventris*		NE	1	1	1	1	
Chat, Ant-eating	*Myrmecocichla formicivora*		E	1	1	1	1	1
Chat, Familiar	*Cercomela familiaris*			1	1	1		
Chat, Karoo	*Cercomela schlegelii*			1	1			
Chat, Sickle-winged	*Cercomela sinuata*			1	1			
Chat, Tractrac	*Cercomela tractrac*		NE	1	1	1	1	
Cisticola, Desert	*Cisticola aridulus*			1	1			
Cisticola, Grey-backed	*Cisticola subruficapilla*			1				
Coot, Red-knobbed	*Fulica cristata*			1				
Cormorant, Reed	*Phalacrocorax africanus*			1	1			
Cormorant, White-breasted	*Phalacrocorax carbo*			1	1			
Courser, Burchell's	*Cursorius rufus*			1	1			
Courser, Double-banded	*Rhinoptilus africanus*			1	1		1	1
Crombec, Long-billed	*Sylvietta rufescens*			1	1			
Crow, Pied	*Corvus albus*			1	1	1	1	1
Cuckoo, Diderick	*Chrysococcyx caprius*			1				
Cuckoo, Jacobin	*Clamator jacobinus*			1				
Darter, African	*Anhinga rufa*			1				
Dove, Laughing	*Streptopelia senegalensis*			1	1			1
Dove, Namaqua	*Oena capensis*			1	1	1	1	1
Dove, Red-eyed	*Streptopelia semitorquata*			1				
Dove, Rock	*Columba livia*			1				
Drongo, Fork-tailed	*Dicrurus adsimilis*			1	1			
Duck, Maccoa	*Oxyura maccoa*			1				
Duck, Yellow-billed	*Anas undulata*			1				
Eagle, Booted	*Aquila pennatus*			1				
Eagle, Martial	*Polemaetus bellicosus*	EN		1	1	1		1
Eagle, Verreaux's	*Aquila verreauxii*	VU		1	1			
Eagle-owl, Spotted	*Bubo africanus*			1	1			
Egret, Cattle	*Bubulcus ibis*			1				

Egret, Little	*Egretta garzetta*			1				
Eremomela, Yellow-bellied	*Eremomela icteropygialis*			1	1	1		
Falcon, Lanner	*Falco biarmicus*	VU		1	1			
Falcon, Pygmy	*Polihierax semitorquatus*			1	1	1		1
Finch, Red-headed	*Amadina erythrocephala*			1	1			
Finch, Scaly-feathered	*Sporopipes squamifrons*		NE	1	1	1		1
Fiscal, Common (Southern)	*Lanius collaris*			1	1	1	1	1
Fish-eagle, African	*Haliaeetus vocifer*			1	1			
Flamingo, Greater	*Phoenicopterus ruber*	NT		1				
Flycatcher, Chat	*Bradornis infuscatus*			1	1	1	1	1
Flycatcher, Fairy	*Stenostira scita*			1				
Flycatcher, Fiscal	*Sigelus silens*			1	1			
Flycatcher, Marico	*Bradornis mariquensis*				1			
Flycatcher, Spotted	*Muscicapa striata*			1				
Goose, Egyptian	*Alopochen aegyptiacus*			1	1			
Goose, Spur-winged	*Plectropterus gambensis*			1	1			
Goshawk, Pale Chanting	*Melierax canorus*		NE	1	1	1	1	1
Grebe, Black-necked	*Podiceps nigricollis*				1			
Grebe, Little	*Tachybaptus ruficollis*			1				
Greenshank, Common	*Tringa nebularia*			1	1			
Guineafowl, Helmeted	*Numida meleagris*			1	1			
Gull, Grey-headed	*Larus cirrocephalus*			1				
Hamerkop	*Scopus umbretta*			1				
Harrier, Montagu's	*Circus pygargus*			1				
Harrier-Hawk, African	*Polyboroides typus*			1				
Heron, Black-headed	*Ardea melanocephala*			1				
Heron, Goliath	*Ardea goliath*			1				
Heron, Grey	*Ardea cinerea*			1	1			
Hoopoe, African	*Upupa africana*			1				
Ibis, African Sacred	*Threskiornis aethiopicus*			1				
Ibis, Glossy	*Plegadis falcinellus*			1				
Ibis, Hadeda	*Bostrychia hagedash*				1			

Kestrel, Greater	*Falco rupicoloides*			1	1			
Kestrel, Lesser	*Falco naumanni*				1			
Kestrel, Rock	*Falco rupicolus*			1	1		1	1
Kite, Black	*Milvus migrans*			1				
Kite, Black-shouldered	*Elanus caeruleus*			1				
Kite, Yellow-billed	*Milvus aegyptius*			1				
Korhaan, Karoo	*Eupodotis vigorsii*			1	1			
Korhaan, Northern Black	*Afrotis afraoides*		NE		1	1	1	1
Lapwing, Blacksmith	*Vanellus armatus*			1	1			
Lapwing, Crowned	*Vanellus coronatus*			1	1	1	1	1
Lark, Eastern Clapper	*Mirafra fasciolata*		NE		1			1
Lark, Fawn-coloured	*Calendulauda africanoides*			1	1			
Lark, Karoo Long-billed	*Certhilauda subcoronata*		E	1	1	1	1	1
Lark, Large-billed	*Galerida magnirostris*		E	1		1	1	1
Lark, Long-billed	*Mirafra curvirostris*			1				
Lark, Red	*Calendulauda burra*	VU	NE		1	1		
Lark, Red-capped	*Calandrella cinerea*			1		1		
Lark, Sabota	*Calendulauda sabota*		NE	1	1	1	1	1
Lark, Sclater's	*Spizocorys sclateri*	NT		1	1			
Lark, Spike-heeled	*Chersomanes albofasciata*		NE	1	1	1	1	1
Lark, Stark's	*Spizocorys starki*		NE	1	1	1	1	1
Lovebird, Rosy-faced	*Agapornis roseicollis*			1				
Martin, Brown-throated	*Riparia paludicola*			1				
Martin, Rock	*Hirundo fuligula*			1	1			
Masked-weaver, Southern	*Ploceus velatus*			1	1			
Moorhen, Common	*Gallinula chloropus*			1				
Mousebird, Red-faced	*Urocolius indicus*			1	1			
Mousebird, White-backed	*Colius colius*		E	1	1		1	1
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*			1	1			
Ostrich, Common	*Struthio camelus*			1	1			
Owl, Barn	*Tyto alba*			1	1			
Palm-swift, African	*Cypsiurus parvus*			1				

Penduline-tit, Cape	*Anthoscopus minutus*		NE	1	1	1	1	
Pigeon, Speckled	*Columba guinea*			1	1	1	1	
Pipit, African	*Anthus cinnamomeus*			1	1			1
Pipit, African Rock	*Anthus crenatus*			1				
Plover, Kittlitz's	*Charadrius pecuarius*			1	1			
Plover, Three-banded	*Charadrius tricollaris*			1	1			1
Pochard, Southern	*Netta erythrophthalma*			1				
Prinia, Black-chested	*Prinia flavicans*			1	1			
Prinia, Karoo	*Prinia maculosa*				1			
Quail, Common	*Coturnix coturnix*			1				
Quelea, Red-billed	*Quelea quelea*			1	1			
Reed-warbler, African	*Acrocephalus baeticatus*			1	1			
Robin-chat, Cape	*Cossypha caffra*			1				
Rock-thrush, Short-toed	*Monticola brevipes*			1				
Roller, Lilac-breasted	*Coracias caudatus*				1			
Ruff	*Philomachus pugnax*			1				
Sanderling	*Calidris alba*			1				
Sandgrouse, Namaqua	*Pterocles namaqua*		NE	1	1	1		1
Sandpiper, Common	*Actitis hypoleucos*			1	1			
Sandpiper, Curlew	*Calidris ferruginea*			1				
Sandpiper, Marsh	*Tringa stagnatilis*			1				
Sandpiper, Wood	*Tringa glareola*			1				
Scimitarbill, Common	*Rhinopomastus cyanomelas*			1	1			
Scops-owl, Southern White-faced	*Ptilopsus granti*			1				
Scrub-robin, Kalahari	*Cercotrichas paena*		NE	1	1	1	1	1
Scrub-robin, Karoo	*Cercotrichas coryphoeus*		E	1	1			1
Secretarybird	*Sagittarius serpentarius*	VU		1				
Shelduck, South African	*Tadorna cana*			1	1			
Shoveler, Cape	*Anas smithii*			1				
Shrike, Crimson-breasted	*Laniarius atrococcineus*		NE		1	1		
Shrike, Lesser Grey	*Lanius minor*			1	1			

Shrike, Red-backed	*Lanius collurio*			1				
Snake-eagle, Black-chested	*Circaetus pectoralis*			1				
Sparrow, Cape	*Passer melanurus*		E	1	1	1	1	1
Sparrow, House	*Passer domesticus*			1	1		1	
Sparrow, Southern Grey-headed	*Passer diffusus*				1	1		
Sparrow-weaver, White-browed	*Plocepasser mahali*			1	1	1		
Sparrowlark, Black-eared	*Eremopterix australis*		E	1	1	1		1
Sparrowlark, Grey-backed	*Eremopterix verticalis*		NE	1	1	1		1
Spoonbill, African	*Platalea alba*			1				
Starling, Cape Glossy	*Lamprotornis nitens*			1	1			
Starling, Pale-winged	*Onychognathus nabouroup*			1	1			
Starling, Wattled	*Creatophora cinerea*			1				
Stilt, Black-winged	*Himantopus himantopus*			1				
Stint, Little	*Calidris minuta*			1				
Stonechat, African	*Saxicola torquatus*			1				
Stork, Abdim's	*Ciconia abdimii*	NT		1				
Stork, Black	*Ciconia nigra*	VU		1				
Stork, White	*Ciconia ciconia*			1				
Sunbird, Dusky	*Cinnyris fuscus*		NE	1	1		1	
Sunbird, Southern Double-collared	*Cinnyris chalybeus*				1			
Swallow, Barn	*Hirundo rustica*			1	1			
Swallow, Greater Striped	*Hirundo cucullata*			1	1			
Swallow, Pearl-breasted	*Hirundo dimidiata*				1			
Swallow, White-throated	*Hirundo albigularis*			1				
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*			1				
Swift, Alpine	*Tachymarptis melba*			1				
Swift, Bradfield's	*Apus bradfieldi*			1				
Swift, Common	*Apus apus*			1				1
Swift, Little	*Apus affinis*			1	1			
Swift, White-rumped	*Apus caffer*			1	1			1
Teal, Cape	*Anas capensis*			1	1			

Teal, Red-billed	*Anas erythrorhyncha*		1	1			
Tern, White-winged	*Chlidonias leucopterus*		1				
Thick-knee, Spotted	*Burhinus capensis*		1	1			
Thrush, Karoo	*Turdus smithi*		1	1			
Thrush, Olive	*Turdus olivaceus*		1				
Tit, Ashy	*Parus cinerascens*		1	1			
Tit, Grey	*Parus afer*			1			
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*		1	1			
Tit-babbler, Layard's	*Parisoma layardi*		1				
Turtle-dove, Cape	*Streptopelia capicola*		1	1			1
Wagtail, Cape	*Motacilla capensis*		1	1			
Warbler, Cinnamon-breasted	*Euryptila subcinnamomea*		1				
Warbler, Namaqua	*Phragmacia substriata*		1				
Warbler, Rufous-eared	*Malcorus pectoralis*	E	1	1	1	1	1
Warbler, Willow	*Phylloscopus trochilus*		1	1			
Waxbill, Black-faced	*Estrilda erythronotos*			1			
Waxbill, Common	*Estrilda astrild*		1				
Weaver, Sociable	*Philetairus socius*	E	1	1	1	1	1
Wheatear, Capped	*Oenanthe pileata*		1	1	1	1	1
Wheatear, Mountain	*Oenanthe monticola*	NE	1	1	1		
White-eye, Cape	*Zosterops virens*		1	1			
White-eye, Orange River	*Zosterops pallidus*		1				
Whydah, Pin-tailed	*Vidua macroura*		1				
Woodpecker, Cardinal	*Dendropicos fuscescens*		1				

APPENDIX 3. PROJECTS PROPOSED IN THE VICINITY OF THE SKEERHOK PV 3 PROJECT (SUPPLIED BY CSIR) .

Project Name	Applicant	DEA Reference Number	Brief project description	Phase
Nieuwehoop 400/50 kV Substation loop in and loop out lines, Northern Cape Province.	Eskom Holdings SOC Limited	DEA Reference Number: 12/12/20/1166	Construction of the 400/50kv Nieuwehoop substation between the Garona and Aries substations, and 3km Loop In and Loop Out Lines.	The project received a positive EA on 21 February 2011. The substation has been constructed.
EIA, WULA and EMPr for the proposed Solar CSP Integration Project: Project 1 – Solar substation, 2 X 400 kV power lines from Aries to the solar substation and 400 kV power line from Nieuwehoop to the Solar substation.	Eskom Holdings SOC Limited	DEA Reference Number: 12/12/20/2606 NEAS Reference Number: DEA/EIA/0000785/2011	The proposed Solar Park Integration Project entails the construction of a substation at the Upington Solar Park, 400 kV transmission lines to the east and south of Upington to feed the electricity into Eskom's National Grid as well as the construction of a number of 132 kV power lines inter-linking the IPP solar plants with the Eskom Grid and distributing the power generated to Upington.	The project received a positive EA on 14 February 2014.
Proposed construction of Gemsbok PV1 75 MW Solar PV facility on the remaining extent of Portion 3 of the Farm Gemsbok Bult 120, Kenhardt, Northern Cape.	Mulilo Renewable Project Developments (Pty) Ltd	DEA Reference Number: 14/12/16/3/3/2/710	Mulilo Renewable Project Developments (Pty) Ltd intends to develop a 75 MW Solar PV power generation project on the farm Gemsbok Bult (Remaining Extent of Portion 3 of Farm 120).	These projects have received Environmental Authorization on 09/11/2015
Proposed construction of Gemsbok PV2 75 MW Solar PV facility on the remaining extent of Portion 3 of the Farm Gemsbok Bult 120, Kenhardt, Northern Cape.	Mulilo Renewable Project Developments (Pty) Ltd	DEA Reference Number: 14/12/16/3/3/2/711	Mulilo Renewable Project Developments (Pty) Ltd intends to develop a 75 MW Solar PV power generation project on the farm Gemsbok Bult (Remaining Extent of Portion 3 of Farm 120).	
Proposed construction of Boven PV1 75 MW Solar PV facility on the remaining extent of the Farm Boven Rugzeer 169, Kenhardt, Northern Cape.	Mulilo Renewable Project Developments (Pty) Ltd	DEA Reference Number: 14/12/16/3/3/2/712	Mulilo Renewable Project Developments (Pty) Ltd intends to develop a 75 MW Solar PV power generation project on the farm Boven Rugzeer (Remaining Extent of Farm 169).	
Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 1) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape.	Scatec Solar	14/12/16/3/3/2/837	Scatec Solar intends to develop a 75 MW Solar PV power generation project on the remaining extent of Onder Rugzeer Farm 168.	These projects have received Environmental Authorization on 07/08/2017

Project Name	Applicant	DEA Reference Number	Brief project description	Phase
Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 2) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape.	Scatec Solar	14/12/16/3/3/2/838	Scatec Solar intends to develop a 75 MW Solar PV power generation project on the remaining extent of Onder Rugzeer Farm 168.	
Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 3) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape.	Scatec Solar	14/12/16/3/3/2/836	Scatec Solar intends to develop a 75 MW Solar PV power generation project on the remaining extent of Onder Rugzeer Farm 168.	
Proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 1) on the remaining extent of Onder Rugzeer Farm 168 and the remaining extent of Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.	Scatec Solar	14/12/16/3/3/1/1547	Scatec Solar intends to develop a 132 KV transmission line extending from the proposed 75 MW Solar PV facility (Kenhardt PV 1) to the Eskom Nieuwehoop substation on the remaining extent of Portion 3 of Gemsbok Bult Farm 120.	These projects have received Environmental Authorization on 22/09/2017
Proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 2) on the remaining extent of Onder Rugzeer Farm 168, and the remaining extent of Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.	Scatec Solar	14/12/16/3/3/1/1546	Scatec Solar intends to develop a 132 KV transmission line extending from the proposed 75 MW Solar PV facility (Kenhardt PV 2) to the Eskom Nieuwehoop substation on the remaining extent of Portion 3 of Gemsbok Bult Farm 120.	
Proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 3) on the remaining extent of Onder Rugzeer Farm 168, and the remaining extent of Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.	Scatec Solar	14/12/16/3/3/1/1545	Scatec Solar intends to develop a 132 KV transmission line extending from the proposed 75 MW Solar PV facility (Kenhardt PV 3) to the Eskom Nieuwehoop substation on the remaining extent of Portion 3 of Gemsbok Bult Farm 120.	
Proposed development of a 75 MW Solar PV Facility (Boven Solar PV 3) on	Mulilo Renewable	14/12/16/3/3/2/846	Mulilo Renewable Project Developments (Pty) Ltd proposes to develop a 75 MW Solar PV power	Appeal process for these projects is

Project Name	Applicant	DEA Reference Number	Brief project description	Phase
the remaining extent of Boven Rugzeer Farm 169, north-east of Kenhardt, Northern Cape.	Project Developments (Pty) Ltd		generation project on the Remaining extent of Boven Rugzeer Farm 169.	underway.
Proposed development of a 75 MW Solar PV Facility (Gemsbok Solar PV 5) on Portion 8 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.	Mulilo Renewable Project Developments (Pty) Ltd	14/12/16/3/3/2/843	Mulilo Renewable Project Developments (Pty) Ltd proposes to develop a 75 MW Solar PV power generation project on Portion 8 of Gemsbok Bult Farm 120.	
Proposed development of a 75 MW Solar PV Facility (Gemsbok Solar PV 6) on Portion 8 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.	Mulilo Renewable Project Developments (Pty) Ltd	14/12/16/3/3/2/846	Mulilo Renewable Project Developments (Pty) Ltd proposes to develop a 75 MW Solar PV power generation project on Portion 8 of Gemsbok Bult Farm 120.	
Proposed development of a 75 MW Solar PV Facility (Gemsbok Solar PV 3) on Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.	Mulilo Renewable Project Developments (Pty) Ltd	14/12/16/3/3/2/841	Mulilo Renewable Project Developments (Pty) Ltd proposes to develop a 75 MW Solar PV power generation project on Portion 3 of Gemsbok Bult Farm 120.	

APPENDIX 4. PHOTOGRAPHS OF MICRO HABITATS AVAILABLE TO BIRDS ON THE SKEERHOK PV 3 SITE.

APPENDIX 5. SPECIALIST CURRICULUM VITAE.

JONATHAN JAMES SMALLIE

WildSkies Ecological Services (2011/131435/07)

Curriculum Vitae

BACKGROUND

Date of birth:	20 October 1975
Qualifications:	BSC – Agriculture (Hons) (completed 1998)
	University of Natal – Pietermaritzburg
	MSC – Environmental Science (completed 2011)
	University of Witwaterstrand
Occupation:	Specialist avifaunal consultant
Profession registration:	South African Council for Natural Scientific Professions

CONTACT DETAILS

Cell number: 082 444 8919

Fax: 086 615 5654

Email: jon@wildskies.co.za

Postal: 36 Utrecht Avenue, Bonnie Doon, East London, 5210

PROFESSIONAL EXPERIENCE

Consulting Projects:

Post construction bird monitoring for wind energy facilities:

Dassieklip (Caledon) –initiated in April 2014; Dorper Wind Farm (Molteno) – initiated in July 2014; Jeffreys Bay Wind Farm – initiated in August 2014; Kouga Wind Farm – started Feb 2015; Cookhouse West Wind Farm – started March 2015; Grassridge Wind Farm – initiated in April 2015; Chaba Wind Farm – initiated December 2015; Amakhala Emoyeni 01 Wind Farm initiated August 2016; Gibson Bay Wind Farm – initiated March 2017; Nojoli Wind Farm initiated March 2017.

Pre-construction bird monitoring & EIA for wind energy facilities:

Golden Valley; Middleton; Dorper; Qumbu; Ncora; Nqamakhwe; Ndakana; Thomas River; Peddie; Mossel Bay; Hluhluwe; Richards Bay; Garob; Outeniqua; Castle; Wolf; Inyanda-Roodeplaat; Dassiesridge; Great Kei; Bayview; Grahamstown; Bakenskop; Umsobomvu; Stormberg; Zingesele; Oasis; Gunstfontein; Naumanii; Golden Valley Phase 2; Ngxwabangu; Hlobo; Woodstock; and Impofu wind energy facilities.

Other Electricity Generation projects:

Port of Nqura Power Barge EIA; Bonnievale Solar Energy Facility; Dealesville Solar Energy Facility; Rooipunt Solar Energy Facility; De Aar Solar Energy Facility; Noupoort Solar Energy Facility, Aggeneys Solar Energy Facility; Tugela Hydro-Electric Scheme*;* Eskom Concentrated Solar Power Plant; Bronkhorstspruit Solar Photovoltaic Plant; De Aar Solar Energy Facility; Paulputs Solar Energy Facility; Kenhardt Solar Energy Facility.

Overhead transmission power lines (>132 000 kilovolts):

Oranjemund Gromis 220kv; Perseus Gamma 765kv; Aries Kronos 765kv; Aries Helios 765kv; Perseus Kronos 765kv; Helios Juno 765kv; Borutho Nzelele 400kv; Foskor Merensky 275kv; Kimberley Strengthening; Mercury Perseus 400kV; Eros Neptune Grassridge 400kV; Kudu Juno 400kV; Garona Aries 400kV; Perseus Hydra 765Kv; Tabor Witkop 275kV; Tabor Spencer 400kV; Moropule Orapa 220kV (Botswana); Coega Electrification; Majuba Venus 765kV; Gamma Grassridge 765kV; Gourikwa Proteus 400KV; Koeberg Strengthening 400kV; Ariadne Eros 400kV; Hydra Gamma 765kV; Zizabona transmission - Botswana

Overhead distribution power lines (<132 000 kilovolts):

Kanoneiland 22KV; Hydra Gamma 765kV; Komani Manzana 132kV; Rockdale Middelburg 132kV; Irenedale 132 kV; Zandfontein 132kV; Venulu Makonde 132 kV; Spencer Makonde 132 kV; Dalkeith Jackal Creek 132Kv; Glen Austin 88kV; Bulgerivier 132kV; Ottawa Tongaat 132kV; Disselfontein 132kV; Voorspoed Mine 132kV; Wonderfontein 132kV; Kabokweni Hlau Hlau 132kV; Hazyview Kiepersol 132kV; Mayfern Delta 132kV; VAAL Vresap 88kV; Arthursview Modderkuil 88kV; Orapa, AK6, Lethakane substations and 66kV lines (Botswana); Dagbreek Hermon 66kV; Uitkoms Majuba 88kV; Pilanesberg Spitskop 132kV; Qumbu PG Bison 132kV; Louis Trichardt Venetia 132kV; Rockdale Middelburg Ferrochrome 132kV; New Continental Cement 132KV; Hillside 88kV; Marathon Delta 132kV; Malelane Boulder 132kV; Nondela Strengthening 132kV; Spitskop Northern Plats 132kV; West Acres Mataffin 132kV; Westgate Tarlton Kromdraai 132kV; Sappi Elliot Ugie 132kV; Melkhout Thyspunt 132kV; St Francis Bay 66kv

Risk Assessments on existing power lines:

Hydra-Droerivier 1,2 & 3 400kV; Hydra-Poseidon 1,2 400kV; Butterworth Ncora 66kV; Nieu-Bethesda 22kV; Maclear 22kV (Joelshoek Valley Project); Wodehouse 22kV (Dordrecht district); Burgersdorp Aliwal North Jamestown 22kV; Cradock 22kV; Colesberg area 22kV; Loxton self build 11kV; Kanoneiland 22kV; Stutterheim Municipality 22kV; Majuba-Venus 400kV; Chivelston-Mersey 400kV; Marathon-Prairie 275kV; Delphi-Neptune 400kV; Ingagane – Bloukrans 275kV; Ingagane – Danskraal 275kV; Danskraal – Bloukrans 275kV

Avifaunal "walk through" (EMP's):

Kappa Omega 765kv; Rockdale Marble Hall 400kv*;* Beta Delphi 400kV; Mercury Perseus 765kV; Perseus 765kV Substation; Beta Turn 765kV in lines; Spencer Tabor 400kV line; Kabokweni Hlau Hlau 132kV; Mayfern Delta 132Kv; Eros Mtata 400kV; Cennergi Grid connect 132kV; Melkhout Thyspunt 132kv.

Strategic Environmental Assessments for Master Electrification Plans:

Northern Johannesburg area; Southern KZN and Northern Eastern Cape; Northern Pretoria; Western Cape Peninsula

Other specialist studies:

Bird Impact Assessment for Lizzard Point Golf Estate – Vaaldam; Bird Impact Assessment for Lever Creek Estates housing development; Investigation into rotating Bird Flapper saga – Aberdeen 22Kv; Investigation of in excess of 80 separate incidents of bird mortalities on power line networks from August 1999 to present; Investigation of bird mortalities at 3 substations; Special investigation into faulting on Ariadne-Eros 132kV; Special investigation into Bald Ibis faulting on Tutuka Pegasus 275kV; Special investigation into bird related faulting on 22kV Geluk Hendrina line; Special investigation into bird related faulting on Camden Chivelston 400kV line

Specialist risk assessments for wildlife airport hazards:

Kigali International Airport – Rwanda; Port Elizabeth Airport – specialist study as part of the EIA for the proposed Madiba Bay Leisure Park; Manzini International Airport (Swaziland); Polokwane International Airport; Mafekeng International Airport; Lanseria Airport

Positions held to date:

- ✓ August 1999 to May 2004: Eastern Cape field officer for the South African Crane Working Group of the Endangered Wildlife Trust
- ✓ May 2004 to November 2007: National Field officer for Eskom-EWT Strategic Partnership and Airports Company SA – EWT Strategic Partnership (both programmes of Endangered Wildlife Trust)
- ✓ November 2007 to August 2011: Programme Manager – Wildlife & Energy Programme – Endangered Wildlife Trust
- ✓ August 2011 to present: Independent avifaunal specialist – Director at WildSkies Ecological Sevices (Pty) Ltd

Relevant achievements:

- ✓ Recipient of BirdLife South Africa's Giant Eagle Owl in 2011 for outstanding contribution to bird conservation in SA
- ✓ Founded and chaired for first two years – the Birds and Wind Energy Specialist Group (BAWESG) of the Endangered Wildlife Trust & BirdLife South Africa.

Conferences attended and presented at:

- ✓ May 2011. Conference of Wind Energy and Wildlife, Trondheim, Norway.

- ✓ March 2011. Chair and facilitator at Endangered Wildlife Trust – Wildlife & Energy Programme – "2011 Wildlife & Energy Symposium", Howick, SA
- ✓ September 2010 – Raptor Research Foundation conference, Fort Collins, Colorado. Presented on the use of camera traps to investigate Cape Vulture roosting behaviour on transmission lines
- ✓ May 2010 - Wind Power Africa 2010. Presented on wind energy and birds
- ✓ October 2008. Session chair at Pan-African Ornithological Conference, Cape Town, South Africa
- ✓ March 27 – 30 2006: International Conference on Overhead Lines, Design, Construction, Inspection & Maintenance, Fort Collins Colorado USA. Presented a paper entitled "Assessing the power line network in the Kwa-Zulu Natal Province of South Africa from a vulture interaction perspective".
- ✓ June 2005: IASTED Conference at Benalmadena, Spain – presented a paper entitled "Impact of bird streamers on quality of supply on transmission lines: a case study"
- ✓ May 2005: International Bird Strike Committee 27th meeting – Athens, Greece. Presented a paper entitled Bird Strike Data analysis at SA airports 1999 to 2004.
- ✓ 2003: Presented a talk on "Birds & Power lines" at the 2003 AGM of the Amalgamated Municipal Electrical Unions – in Stutterheim - Eastern Cape
- ✓ September 2000: 5th World Conference on Birds of Prey in Seville, Spain.

Papers & publications:

- ✓ Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Guidelines on how to avoid or mitigate impacts of electricity power grids on migratory birds in the African-Eurasian Region. CMS Technical Series Number XX. Bonn, Germany.
- ✓ Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Review of the conflict between migratory birds and electricity power grids in the African-Eurasian region. CMS Technical Series Number XX, Bonn, Germany.
- ✓ Jenkins, A.R., van Rooyen, C.S, Smallie, J.J, Harrison, J.A., Diamond, M.D., Smit-Robinson, H.A & Ralston, S. 2014. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa
- ✓ Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International.
- ✓ Jordan, M., & Smallie, J. 2010. A briefing document on best practice for pre-construction assessment of the impacts of onshore wind farms on birds. Endangered Wildlife Trust , Unpublished report
- ✓ Smallie, J., & Virani, M.Z. 2010. A preliminary assessment of the potential risks from electrical infrastructure to large birds in Kenya. Scopus 30: p32-39
- ✓ Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. Ostrich 2010. 81 (2) p109-113
- ✓ Jenkins, A.R., Smallie, J.J., & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 2010. 20: 263-278.
- ✓ Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. Modelling power line collision risk for the Blue Crane *Anthropoides paradiseus* in South Africa. Ibis 2010 (152) p590-599.
- ✓ Jenkins, A.R., Allan, D.G., & Smallie, J.J. 2009. Does electrification of the Lesotho Highlands pose a threat to that countries unique montane raptor fauna? Dubious evidence from surveys of three existing power lines. Gabar 20 (2).
- ✓ Smallie, J.J., Diamond, M., & Jenkins, A.R. 2008. Lighting up the African continent – what does this mean for our birds? Pp 38-43. In Harebottle, D.M., Craig, A.J.F.K., Anderson, M.D., Rakotomanana, H., & Muchai. (eds). Proceedings of the 12th Pan-african Ornithological Congress. 2008. Cape Town. Animal Demography Unit. ISBN (978-0-7992-2361-3)
- ✓ Van Rooyen, C., & Smallie, J.J. 2006. The Eskom –EWT Strategic Partnership in South Africa: a brief summary. Nature & Faunae Vol 21: Issue 2, p25

- ✓ Smallie, J. & Froneman, A. 2005. Bird Strike data analysis at South African Airports 1999 to 2004. Proceedings of the 27th Conference of the International Bird Strike Committee, Athens Greece.
- ✓ Smallie, J. & Van Rooyen, C. 2005. Impact of bird streamers on quality of supply on transmission lines: a case study. Proceedings of the Fifth IASTED International Conference on Power and Energy Systems, Benalmadena, Spain.
- ✓ Smallie, J. & Van Rooyen, C. 2003. Risk assessment of bird interaction on the Hydra-Droërivier 1 and 2 400kV. Unpublished report to Eskom Transmission Group. Endangered Wildlife Trust. Johannesburg. South Africa
- ✓ Van Rooyen, C. Jenkins, A. De Goede, J. & Smallie J. 2003. Environmentally acceptable ways to minimise the incidence of power outages associated with large raptor nests on Eskom pylons in the Karoo: Lessons learnt to date. Project number 9RE-00005 / R1127 Technology Services International. Johannesburg. South Africa
- ✓ Smallie, J. J. & O'connor, T. G. (2000) Elephant utilization of *Colophospermum mopane*: possible benefits of hedging. African Journal of Ecology 38 (4), 352-359.

Courses & training:

- ✓ Successfully completed a 5 day course in High Voltage Regulations (modules 1 to 10) conducted by Eskom – Southern Region
- ✓ Successfully completed training on, and obtained authorization for, live line installation of Bird Flappers

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX K:

Heritage Report

HERITAGE IMPACT ASSESSMENT:
SCOPING AND ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF THE SKEERHOK PV3 SOLAR ENERGY FACILITY ON SMUTSHOEK 395/REMAINDER, KENHARDT MAGISTERIAL DISTRICT, NORTHERN CAPE PROVINCE

SAHRA Case No.: 11820

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

Report for:

CSIR – Environmental Management Services
P.O. Box 320, Stellenbosch, 7599
Tel: 021 8882432
Email: kstroebel@csir.co.za

On behalf of:

juwi Renewable Energies (Pty) Ltd

Dr Jayson Orton
ASHA Consulting (Pty) Ltd
40 Brassie Street, Lakeside, 7945
Tel: (021) 788 8425 | 083 272 3225
Email: jayson@asha-consulting.co.za

25 January 2018

Specialist declaration

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

HIA: Scoping and Environmental Impact Assessment for the proposed development of three 100 MW Solar Photovoltaic Facilities (Skeerhok PV 1, PV 2, & PV 3) & 132 kV overhead transmission line near Kenhardt in the Northern Cape Province

Specialist:	**ASHA Consulting (Pty) Ltd**		
Contact person:	**Dr Jayson Orton**		
Postal address:	40 Brassie Street, Lakeside		
Postal code:	7945	Cell:	083 272 3225
Telephone:	(021) 788 8425	Fax:	
E-mail:	jayson@asha-consulting.co.za		
Professional affiliation(s) (if any)			

Project Consultant:	Council for Scientific and Industrial Research		
Contact person:	Kelly Stroebel		
Postal address:	PO Box 320, Stellenbosch		
Postal code:	7599	Cell:	082 660 1907
Telephone:	021 888 2432	Fax:	021 888 4693
E-mail:	Kstroebel@csir.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, JAYSON ORTON declare that -- General

declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

ASHA Consulting (Pty) Ltd

Name of company (if applicable):

24 / 01 / 2018

Date:

EXECUTIVE SUMMARY

ASHA Consulting (Pty) Ltd was appointed by juwi Renewable Energies (Pty) Ltd to assess the potential impacts to heritage resources that might occur through the proposed construction of the 100 MW Skeerhok PV3 Solar Energy Facility, located some 41 km northeast of Kenhardt, !Kheis Local Municipality, Kenhardt Magisterial District, Northern Cape (S29° 02' 45" E21° 24' 35"). The project would be constructed on the farm Smutshoek 395, portion 0.

A survey of the area showed it to be flat with occasional gravel areas and generally light vegetation cover. Archaeological material was found to be very sparsely distributed across the study area but one site complex of medium to high significance was located a short distance to the west of the study area and at least 600 m away from the proposed development footprint. Impacts in the development footprint are expected to be of very low significance with no mitigation required. Palaeontological impacts are highly unlikely to occur and are of no concern. Impacts are expected to be of very low significance. The single likely graves cannot be avoided and will require testing to establish whether human remains are present and then possibly exhumation. The potential impact significance was rated as being very high but with mitigation it would reduce to low. No other specific heritage resources were identified on site but the broader landscape carries a degree of heritage significance. Because of the already existing 'electrical layer' on this landscape and the fact that it has been identified for a hub of solar development, the significance of impacts to this landscape are considered to be low both before and after mitigation. Cumulative impacts are likely to be of essentially the same significance as the construction impacts because of the very low density of significant heritage resources on the broader landscape.

Because the impacts to the potential grave can be managed and no other significant impacts are envisaged, it is recommended that planning and construction of the proposed Skeerhok PV3 solar energy facility should be authorised but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- Fencing around the facility is to be visually permeable;
- The use of white paint on structures should be minimised with earthy tones favoured;
- The likely grave site at SHK2017/004 should be tested for human remains and if confirmed as a grave an exhumation process should be followed. Public consultation may be required by SAHRA;
- A final archaeological walk down survey of both the facility footprint and any associated linear features must be carried out at least six months in advance of construction;
- Staff must be made aware of the small possibility of locating buried fossils and should this occur they must be left in place and immediately reported to the ECO and/or the heritage authorities; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Glossary

Background scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency.

Contact site: An archaeological site that is essentially Stone Age in character but which includes historical materials obtained via trade or exchange with, or wages from, Europeans.

Diagnostic: Artefacts bearing features identifying them to a particular period of time.

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Hand-axe: A bifacially flaked, pointed stone tool type typical of the Early Stone Age.

Holocene: The geological period spanning the last approximately 10-12 000 years.

Hominid: a group consisting of all modern and extinct great apes (i.e. gorillas, chimpanzees, orangutans and humans) and their ancestors.

Hominin: a smaller group consisting of modern humans, extinct species of humans and all their immediate ancestors.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

BAR: Basic Assessment Report

CSIR: Council for Scientific and Industrial Research

CRM: Cultural Resources Management

DEA: Department of Environmental Affairs

ECO: Environmental Control Officer

EIA: Environmental Impact Assessment

ESA: Early Stone Age

GPS: global positioning system

HIA: Heritage Impact Assessment

MSA: Middle Stone Age

LSA: Later Stone Age

NBKB: Ngwao-Boswa Ya Kapa Bokoni

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

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

NID: Notification of Intent to Develop

PPP: Public Participation Process

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

SKA: Square Kilometre Array

Compliance with Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R326 (7 April 2017)	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.4 Appendix 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii (Preliminary Section of this report)
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 4, 5, 6, 7 and 8.2
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying alternatives;	Section 1.1.1
g) an identification of any areas to be avoided, including buffers;	Section 10.2
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 10.2
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3.5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Section 9
l) any conditions for inclusion in the environmental authorisation;	Section 14
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity and activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 14
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 12
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Please refer to Appendix G of the Draft EIAR for comments from SAHRA.
q) any other information requested by the competent authority.	Please refer to Appendix H of the Draft EIAR
2. Where a government notice gazetted by the Minister provides for any protocol of minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply	n/a

Contents

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by juwi Renewable Energies (Pty) Ltd to assess the potential impacts to heritage resources that might occur through the proposed construction of the 100 MW Skeerhok PV3 Solar Energy Facility, located some 41 km northeast of Kenhardt, !Kheis Local Municipality, Kenhardt Magisterial District, Northern Cape (S29° 02' 45" E21° 24' 35"). The project would be constructed on the farm Smutshoek 395, portion 0 (Figures 1 & 2). Note that the grid connection for this project is being assessed in a separate Basic Assessment Report (BAR) process.

1.1. Project description

The project is being developed with a maximum possible installed capacity of 114 MWdc which produces 100 MWac of electricity. Generation is expected to continue for a period of at least 20 years. Although approximately 400 ha of land was assessed, the facility would require about 300 ha of land for the entire development footprint, panels and associated infrastructure. The project would include the following components:

- ≤250 ha PV array with panels up to about 5 m high and mounted via either free field single-axis trackers or fixed tilt PV solar module mounting structures comprised of galvanised steel and aluminium;
- Inverters, transformers, mini-substations and on-site collector substation;
- Below ground electrical cables linking the above components;
- A 32 m high telecommunications mast within the collector substation area;
- Site office and operations and maintenance buildings covering approximately 1 ha and including storage areas, parking, offices, ablution facilities, septic tank, water storage facility and central waste collection area;
- Permanent and temporary laydown areas covering approximately 1 ha;
- A battery storage facility up to 8 m high;
- ≤ 15 km of internal gravel access road ≤ 8 m wide linking the Transnet Service road to the site;
- ≤ 10 km of gravel service roads ≤ 8 m wide within the facility;
- ≤3.5 km length of water supply pipeline connecting existing boreholes to storage, alternatively water will supplied by the local municipality;
- Stormwater drainage; and
- Perimeter fencing 3m high with access gate and guard house.

In addition, the following temporary facilities would be required for the construction period only:

- ≤1 ha site office area;
- ≤ 10 ha laydown area; and
- ≤1 ha concrete batching plant

1.1.1. Aspects of the project relevant to the heritage study

All aspects of the proposed development are relevant since roads and excavations for foundations, cables or pipelines may impact on archaeological and/or palaeontological remains, while the above-ground aspects create potential visual (contextual) impacts to the cultural landscape and any significant heritage sites that might be visually sensitive.

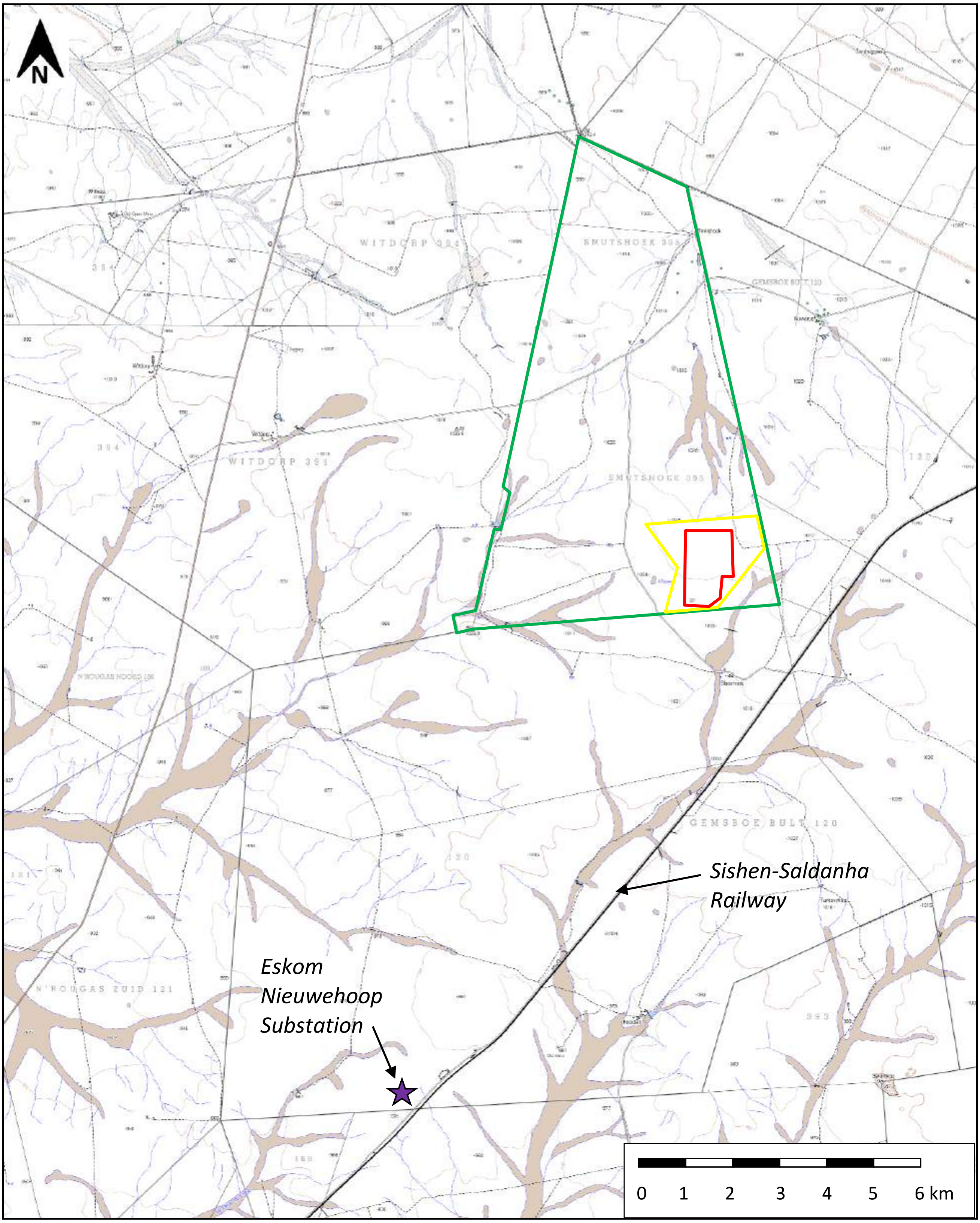

Figure 1: *Extract from 1:50 000 topographic maps 2821CD & 2921AB showing the location of the layout (red polygon), study area (yellow polygon) and farm portion (green polygon). Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.*

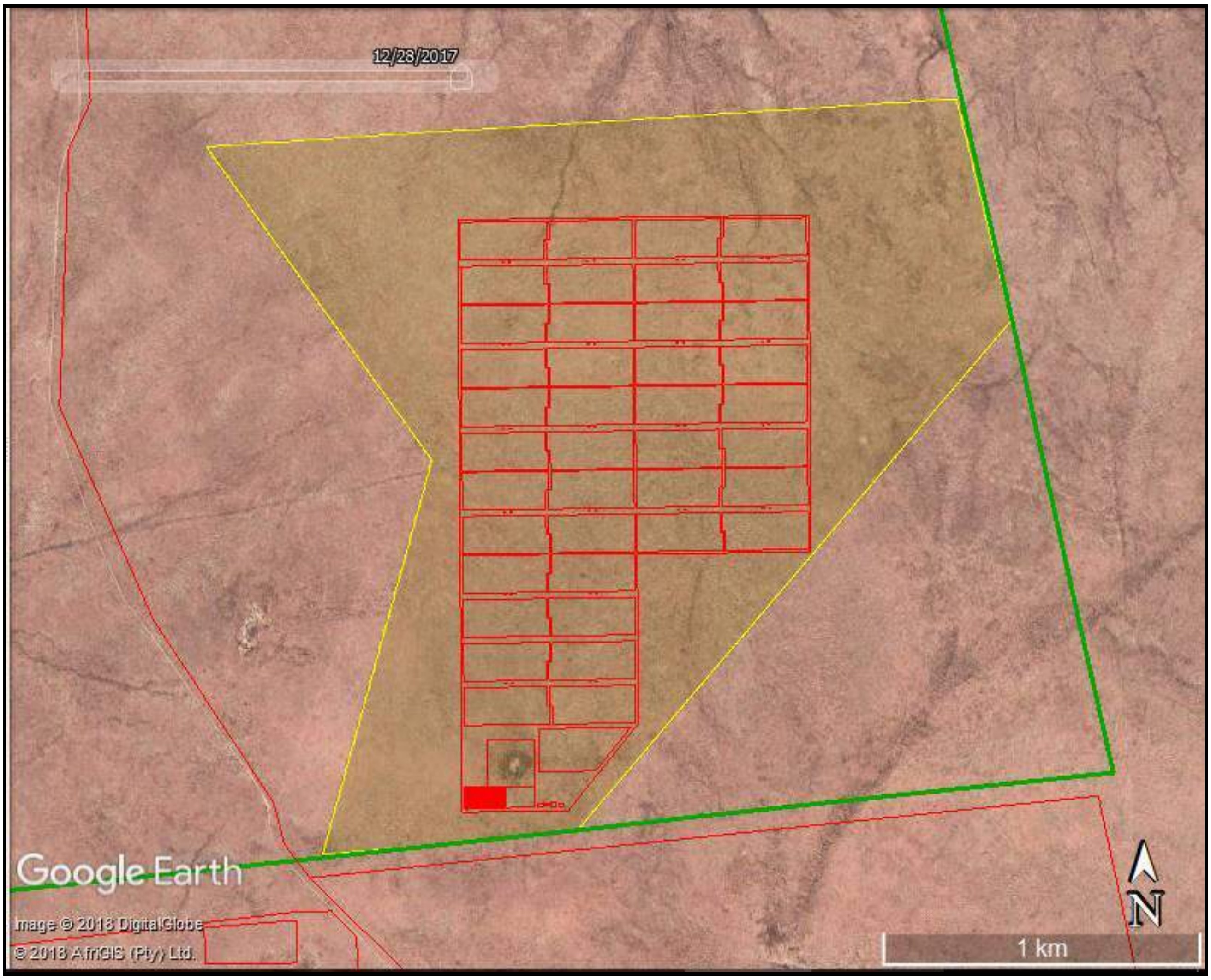

Figure 2: *Aerial view of the study area showing the proposed facility layout (red outlines), the assessed development area (yellow polygon) and the farm portion boundary (green).*

1.2. Terms of reference

ASHA Consulting was asked to compile a heritage impact assessment (HIA) that included all relevant aspects of heritage, but particularly including palaeontology, archaeology and the cultural landscape which were seen as likely to be the most significant aspects.

The South African Heritage Resources Agency (SAHRA) was notified of the proposed project and the scoping report was submitted to them. SAHRA, in a letter dated 10 November 2017, requested the submission of a full HIA that included an assessment of the impacts to archaeology and palaeontology and also considered the potential visual impacts to heritage resources. This HIA is being submitted to SAHRA at the time of the release of the Draft EIAR for public comment.

It should also be noted, however, that following S.38(3) of the National Heritage Resources Act (No. 25 of 1999), even though certain specialist studies may be specifically requested, all heritage resources should be identified and assessed.

1.3. Scope and purpose of the report

A heritage impact assessment (HIA) is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued for consideration by the National Department of Environmental Affairs (DEA) who will review the Environmental Impact Assessment (EIA) and grant or withhold authorisation. The HIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.4. The author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in South Africa (primarily in the Western Cape and Northern Cape provinces) since 2004 (please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP; Member #43) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: “any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith”;
- Palaeontological material: “any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace”;
- Archaeological material: a) “material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures”; b) “rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose

rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation"; c) "wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation"; and d) "features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found";

- Grave: "means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place"; and
- Public monuments and memorials: "all monuments and memorials a) "erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government"; or b) "which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual."

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

Section 38(8) of the NHRA states that if an impact assessment is required under any legislation other than the NHRA then it must include a heritage component that satisfies the requirements of S.38(3). Furthermore, the comments of the relevant heritage authority must be sought and considered by the consenting authority prior to the issuing of a decision. Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to an EIA. The present report provides the heritage component. Ngwao-Boswa Ya Kapa Bokoni (Heritage Northern Cape; for built environment and cultural landscapes) and the South African Heritage Resources Agency (SAHRA for archaeology and palaeontology) are required to provide comment on the proposed project in order to facilitate final decision making by the DEA.

3. METHODS

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The 1:50 000 map and historical aerial images were sourced from the Chief Directorate: National Geo-Spatial Information.

3.2. Field survey

The site was subjected to a detailed foot survey on 2 and 3 July 2017. The survey was during mid-winter, although seasonality in this part of South Africa, where vegetation is minimal at all times of the year, had no material effect on the fieldwork. During the survey the positions of finds were recorded on a hand-held Global Positioning System (GPS) receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

3.3. Impact assessment

For consistency, the impact assessment was conducted through application of a scale supplied by the CSIR. The impact assessment methodology used for this HIA can be found in Chapter 4 of the Draft EIAR.

3.4. Grading

Section 7 of the NHRA provides for the grading of heritage resources into those of National (Grade 1), Provincial (Grade 2) and Local (Grade 3) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade 1 and 2 resources are intended to be managed by the national and provincial heritage resources authorities, while Grade 3 resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended under S.7(2) that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. SAHRA (2007) has formulated its own system[1] for use in provinces where it has commenting authority. In this system sites of high local significance are given Grade IIIA (with the implication that the site should be preserved in its entirety) and Grade IIIB (with the implication that part of the site could be mitigated and part preserved as appropriate) while sites of lesser significance are referred to as having 'General Protection' and rated with an A (high/medium significance, requires mitigation), B (medium significance, requires recording) or C (low significance, requires no further action).

3.5. Assumptions and limitations

The study was carried out at the surface only and hence any completely buried archaeological sites or palaeontological occurrences will not be readily located. Similarly, it is not always possible to determine the depth of archaeological or palaeontological material visible at the surface. Due to the large size of the site (and others surveyed during the same project) it was impractical to cover the entire area in detail. This means that the results of the survey are indicative of the types of heritage resources likely to be present. It should be noted, however, that all obvious features such as pans and rocky hills were covered in greater detail such that the chances of having missed important heritage resources are very small. Because they were not available for study at the time of the survey, linear features such as the proposed access road alternatives and the water pipeline route were not examined in the field.

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts within a 20 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of twelve other PV plants (Figure 3), the already constructed Eskom Nieuwehoop Substation (Figure

[1] The system is intended for use on archaeological and palaeontological sites only.

3) and various associated power lines. However, it is notable that the DEA has issued a statement that a maximum of six PV facilities in this area will be issued with preferred bidder status due to the potential negative impacts on the Square Kilometre Array (SKA).

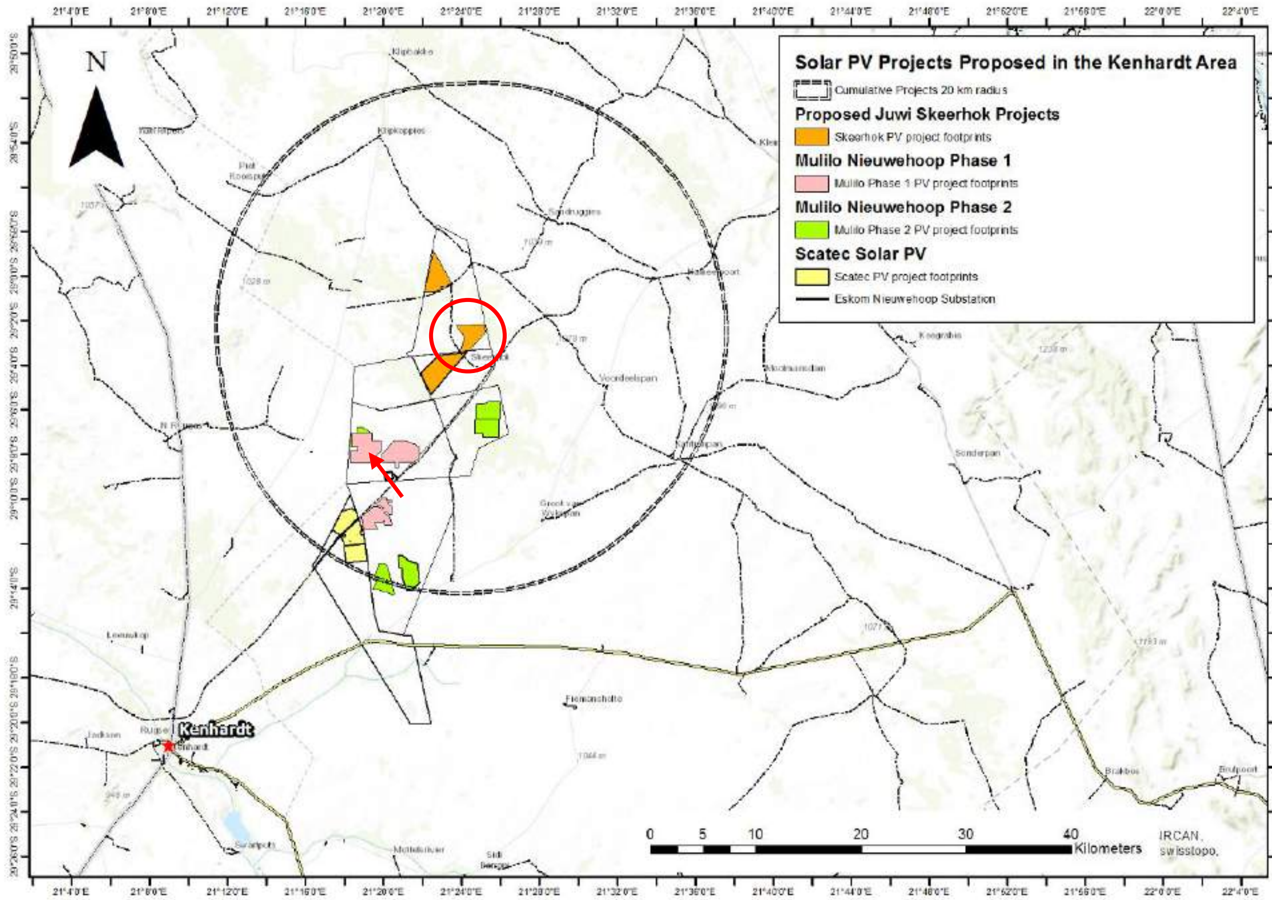

Figure 3: *Map of the broader area around the Nieuwehoop Substation (marked by a red arrow) showing the various solar energy facilities proposed. The present study area is ringed in red.*

3.6. Consultation processes undertaken

The NHRA requires consultation as part of an HIA but, since the present study falls within the context of an EIA which includes a public participation process (PPP), no dedicated consultation was undertaken as part of the HIA. Interested and affected parties would have the opportunity to provide comment on the heritage aspects of the project during the PPP.

Although not formal consultation, it is noted that contact was made with a local resident who knew the locations of some rock art sites. These sites were visited with the resident as part of the general background study but, owing to their distance from the study area, they have no direct relevance on the present assessment.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The site is located in a rural area, some 43 km northeast of Kenhardt. However, the Sishen-Saldanha railway line transporting iron ore, its gravel service road, the large, new Eskom Nieuwehoop Substation and some power lines do occur in the general vicinity. The land is otherwise used for grazing of both small stock and wild game.

4.2. Site description

Like much of the broader landscape in this area, the site is very flat. Vegetation consists of grass and low bushes punctuated by occasional taller bushes, especially in ephemeral drainage lines and around shallow pans (Figures 4 & 5). Rare quiver trees also occur in the vicinity. The surface is generally sandy, although areas of igneous rock were occasionally seen exposed at the surface (Figure 6). A low rocky hill with a pan alongside it was present just outside the study area to its west (Figure 7).

Figure 4: *View southwards across the site showing typical grass cover as well as taller bushes.*

Figure 5: *View southwards across the site showing typical grass cover as well as taller bushes.*

Figure 6: *View north-westwards across the site showing igneous bedrock exposed at the surface.*

Figure 7: *View north-westwards across the pan and rocky hill just to the west of the study area.*

5. ARCHAEOLOGICAL AND HISTORICAL CONTEXT

This section of the report contains the desktop study and establishes what is already known about heritage resources in the vicinity of the study area. What was found during the field survey as presented below may then be compared with what is already known in order to gain an improved understanding of the significance of the newly reported resources.

5.1. Archaeological Aspects

Bushmanland is well known for the vast expanses of gravel that occur in places and which frequently contain stone artefacts in varying densities (Beaumont *et. al* 1995). Such material is often referred to as 'background scatter' and is generally of limited significance (Orton 2016i). At times, however, the scatter can become very dense and mitigation work is occasionally called for. The artefacts located in these contexts are largely Early Stone Age (ESA) and Middle Stone Age (MSA) and date to the middle to late Pleistocene. They are not associated with any other archaeological materials, since these would have long since decomposed and disappeared. Previous experience in the general vicinity suggests that such dense accumulations of background scatter artefacts are unlikely to occur in this part of Bushmanland.

Of potentially more significance, however, are Later Stone Age (LSA) sites which are commonly located along the margins of water features in Bushmanland. These features include both pans and ephemeral drainage lines. Such sites have been identified in the broader vicinity in association with pans but artefact scatters associated with drainage lines are rare (Orton 2014a, 2014b, 2014c, 2016b, 2016c, 2016d, 2016e, 2016f, 2016g, 2016h, 2016j, 2016k, 2016l). These sites would typically contain mostly stone artefacts, but fragments of ostrich eggshell (from eggs used as water containers and also as a food source) and pottery are also found at times, while bone is rare and likely confined to sites that are very recent. While no sites have ever been sampled in the vicinity of the present study area, excavations to the northeast of Pofadder at sites adjacent to small water holes demonstrate this pattern well (Orton 2016a). Similar LSA sites can also be found in association with rocky outcrops. Because of their positions along water courses and adjacent to rocky areas, many of these sites get avoided by development proposals because of the need to avoid the relevant natural features. Despite the increased likelihood of locating archaeology along streams, Morris (2009) noted that a search along the banks of the Hartebeest River close to Kenhardt, where he expected elevated frequencies of archaeological material, revealed virtually nothing. This is in contrast to a section of river bank some 23 km south of the present study area along which a dense concentration of LSA and historical sites (including contact sites) was found (Orton 2016d).

Another kind of archaeological site fairly commonly encountered in Bushmanland is small rock outcrops that have been quarried as a source of stone material for making stone tools. Several such occurrences – usually of quartz – have been seen in the general area but these are not significant sites.

A few rock engravings and paintings are known from the broader area (Louw Roux Bushmanland 2013). From the limited information available and from observations made along the Hartebees River by the present author, the engravings tend to be naturalistic images produced by the Bushmen, while the paintings are geometric images, produced by the Khoekhoen. The latter are not well known from the area (Orton 2013), although examples have been seen in the region (David Morris, pers. comm. 2015; Orton 2016g). Painted art is also very rare but again, examples are known, particularly on large granite boulders like that recorded by Orton (2016g) some 9 km south of the present study area (Figure 9).

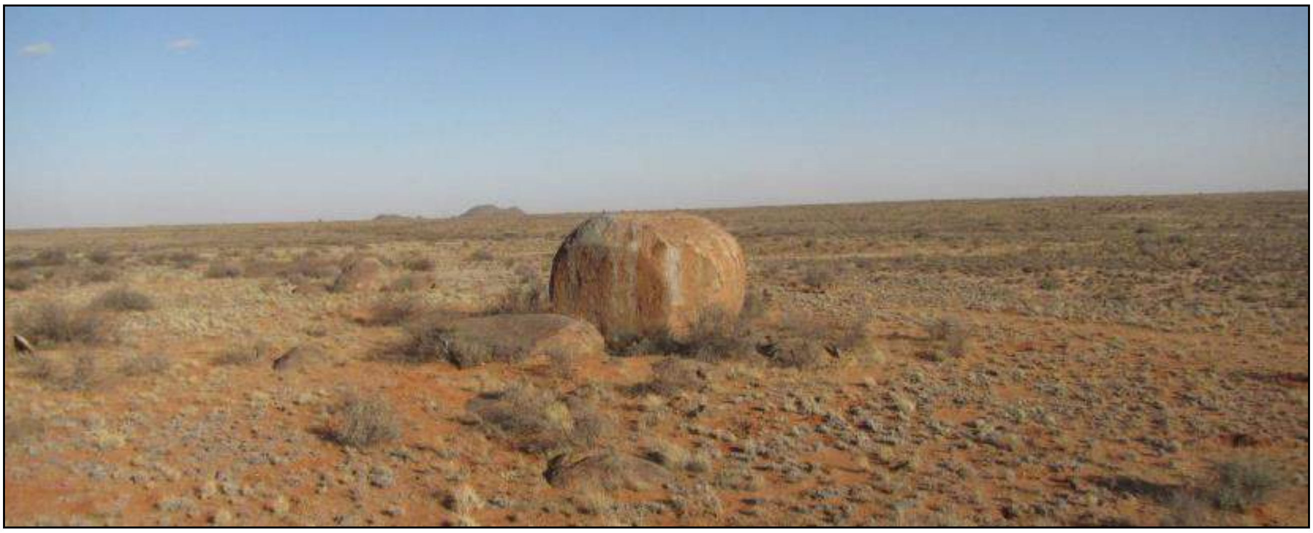

Figure 9: *View of the context of the one painted site known from within the vicinity of the study area. It is evident from the photograph that such contexts are rare in this very flat landscape.*

5.2. Historical Aspects

The Anglo-Boer War was fought across much of the Northern Cape interior, but information on the role of Kenhardt appears difficult to locate. The town was occupied by the Boers in late February 1900 after they convinced the magistrate that they had a large gun and would fire on the town if it did not surrender. They later surrendered to the British who occupied the town on 31st March 1900.

By mid-1900 there were perhaps 100 Cape Rebels detained in a camp outside of Kenhardt (Grobler 2004). The British raised a local force known as the Border Scouts in Upington in May 1900. Many were mixed-race individuals, some local farmers, others Kalahari hunters, but all disliked the Boers. The scouts were responsible for a large area of the north-western Cape Colony centred on Upington and Kenhardt. They eventually numbered 786 by January 1901 and were under the command of Major John Birbeck (AngloBoerWar.com 2015; Rodgers 2011). At the beginning of 1902 there were 150 Border Scouts stationed at Kenhardt. Two boers, H.L. Jacobs and A.C. Jooste, were accused of treason and executed in the town on 24 July 1901 (Grobler 2004). A memorial stands there to their honour (Green Kalahari n.d.). Events around Kenhardt were likely not that important and this execution does not even feature in the Boer War timeline provided by Packenham (1993: 291-294).

No major action appears to have taken place around Kenhardt, although the Boers are known to have attacked a patrol on 17th May 1901, while the British attacked a Boer position on 25th June 1901 (AngloBoerWar.com 2015).

From an archaeological point of view the only material remains possibly related to occupation around the time of the Boer War are the series of contact period river bank scatters mentioned above. On one of these was a rusted pen knife handle with the portrait and name of Paul Kruger on it. This may indicate that a Boer commando had camped there (Orton 2016d).

5.3. Built Environment

The built environment is sparsely represented in rural Bushmanland because the farms tend to be so large. The vast majority of structures appear to be quite recent in age (20th century) and are of very limited heritage significance. In any case, the development will not directly affect any buildings.

5.4. Graves

Graves are also very rare. Some older farm complexes have small graveyards located close to their farm buildings, while suspicious isolated rocks, perhaps planted upright, may mark historical graves of early mobile farmers (the so-called *trek boers*). An example has been seen some 21 km to the southwest (Orton 2016j). Unmarked pre-colonial graves can, in theory, be located anywhere, although they are generally more common in sandy areas where excavation of graves was easier and in more productive areas where population densities would have been higher.

6. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project. Table 1 provides a list of those resources recorded, identifying which are within the potential impact zone and which not. Figure 10 maps these finds.

Table 1: *List of findings made during the field survey. Note that sites located more than 30 m from the proposed project footprint are highlighted in grey. Such sites may be within the assessed area or in close proximity to it and could thus still be vulnerable to indirect impacts.*

Waypoint	GPS co-ordinates	Site name	Description	Significance (Mitigation)
894	S29 02 13.5 E21 23 56.5	---	Fragments of a saucer and a small metal 'cap' of some sort of container. This material is likely 20th century and probably not old enough to be archaeology.	Very low
905	S29 02 26.2 E21 24 38.3	SHK2017/004	Grave with a small headstone and several stones packed flat. That it is not natural outcrop is revealed by the variable colouring of the rocks.	High
882	S28 59 46.5 E21 23 08.3	---	An area of slightly higher density background scatter. Mostly quartz with some quartzite.	Very low
886	S29 00 20.0 E21 23 10.9	---	An area of slightly higher density background scatter. Mostly quartz with some quartzite.	Very low
Waypoints 895 to 904 represent a complex of LSA sites focused on a pan and rocky hill about 350 m outside of the study area and 600 m outside of the proposed footprint.				
895	S29 02 59.1 E21 23 49.8	SHK2017/005	Very dense LSA artefact scatter along the edge of a pan. About 10 m by 30 m. Stone materials include quartz, quartzite, CCS, other. One possible adze seen. Many dolerite manuports present. Also minimal ostrich eggshell, glass and metal.	Medium (3 days)
896	S29 02 57.1 E21 23 47.7	SHK2017/006	Many artefacts in burrow mounds at the base of the hill suggesting subsurface archaeology. Quartz, quartzite and CCS present.	Low
897	S29 02 57.9 E21 23 47.5			
898	S29 02 58.6 E21 23 48.8	SHK2017/007	Very dense LSA artefact scatter along the edge of the pan, directly across from 895. The scatter lies atop a low mound and includes quartz, quartzite and CCS. There are also many manuports.	Medium (2 days)
899	S29 02 59.0 E21 23 49.2		Point marking pan.	---
900	S29 02 59.3 E21 23 48.5	SHK2017/008	Small LSA artefact scatter as for 898	Low-Medium (2 hours)
901	S29 03 01.3 E21 23 45.6	---	Light grinding groove on an angled boulder.	Low
902	S29 02 57.3 E21 23 45.2	SHK2017/009	Very dense LSA artefact scatter in a small 'clearing' on the top of the rocky hill to the northwest of the pan. Also a very light grinding patch on a flat boulder.	Medium (1 day)
903	S29 02 56.5 E21 23 45.9	---	A gravel area with background scatter artefacts included.	Low
904	S29 02 55.5 E21 23 46.1	---	Widespread, low density artefact scatter. No obvious concentration anywhere. Probably dense background scatter.	Low

6.1. Archaeology

Archaeological resources were found to be very sparsely distributed across the study area. While no waypoints were made to mark Stone Age resources, there were isolated background scatter artefacts found throughout the study area (Figure 11). A single waypoint (894) marked a scatter of historical material that is likely less than 100 years old (i.e. probably not archaeology as defined in the NHRA). This scatter was comprised mostly of fragments of a single saucer (Figure 12).

One significant set of archaeological sites was discovered but it was located at least 350 m outside of the study area and 600 m from the proposed development footprint area, to their west. It is represented by waypoints 895-904 (Figure 12). It consists of an endorheic pan surrounded by artefact scatters and a low rocky hill with another site on top of it. Figure 13 shows an example of the context of the scatters around the pan and Figure 14 the surface appearance of these sites. The rocky hill alongside the pan had a small but dense artefact scatter on its crest contained within a small 'clearing' in the grass (Figures 20 & 21). Whether this area was cleared by people or naturally occurring is not known. It is possible that the site is fairly recent (last few hundred years) and that the grass cover has never recovered from the anthropogenic disturbance due to continued wind deflation of the cleared area. The potential exists for subsurface materials of greater age to be present, although none was seen at the surface.

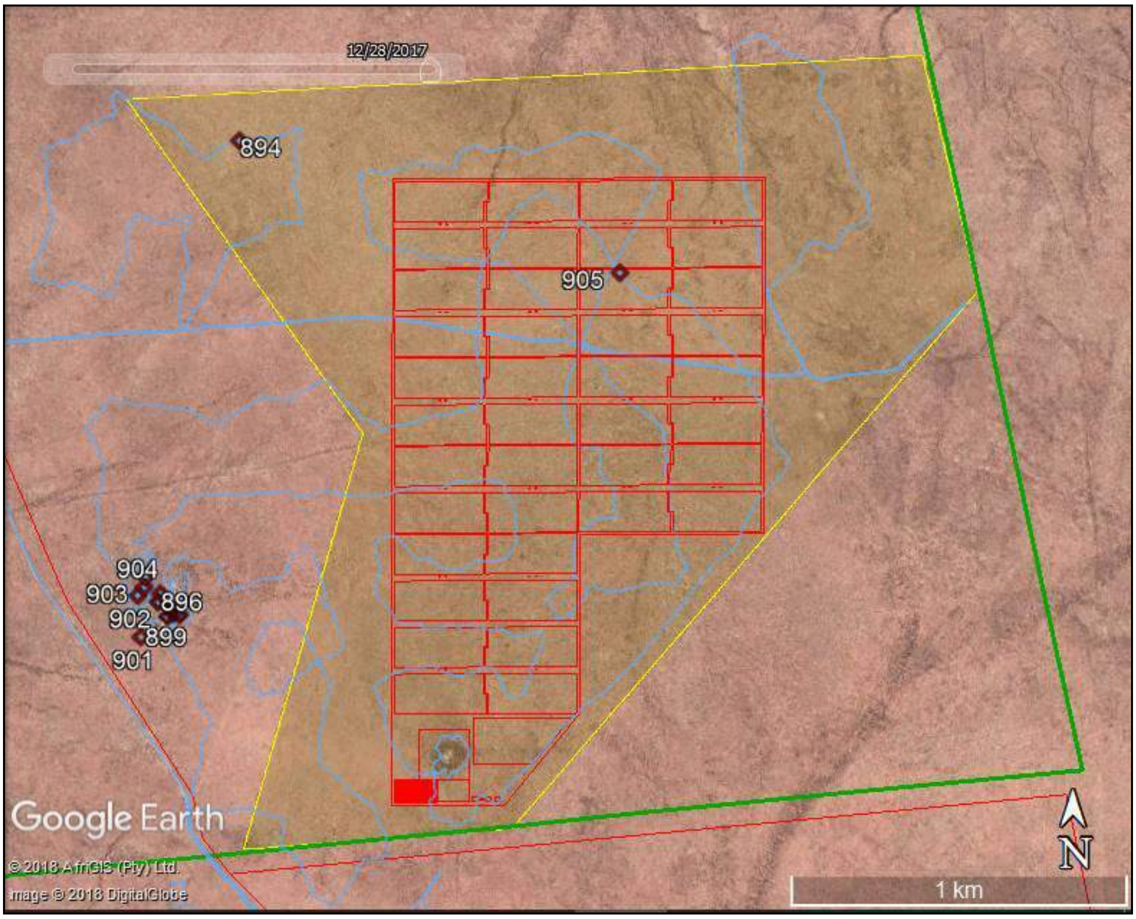

Figure 10: *Map showing the distribution of heritage resources (numbered symbols). The green line is the western and southern edges of the farm portion, the yellow polygon is the study area, while the red polygons represent the proposed facility layout. Blue lines denote the survey tracks.*

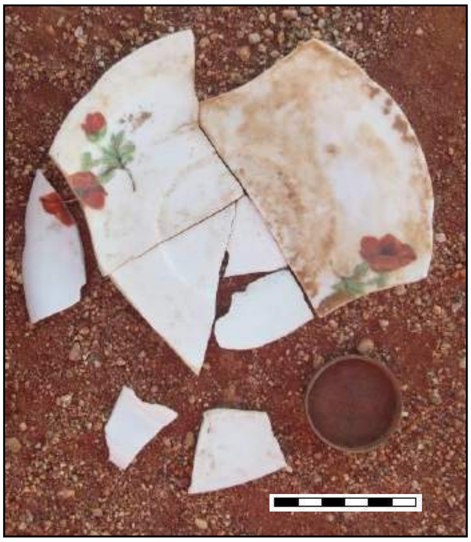

Figure 11: *Examples of isolated background scatter stone artefacts found across the study area. They are likely mostly MSA materials.*

Figure 12: *20th century items from waypoint 904. Scale in cm.*

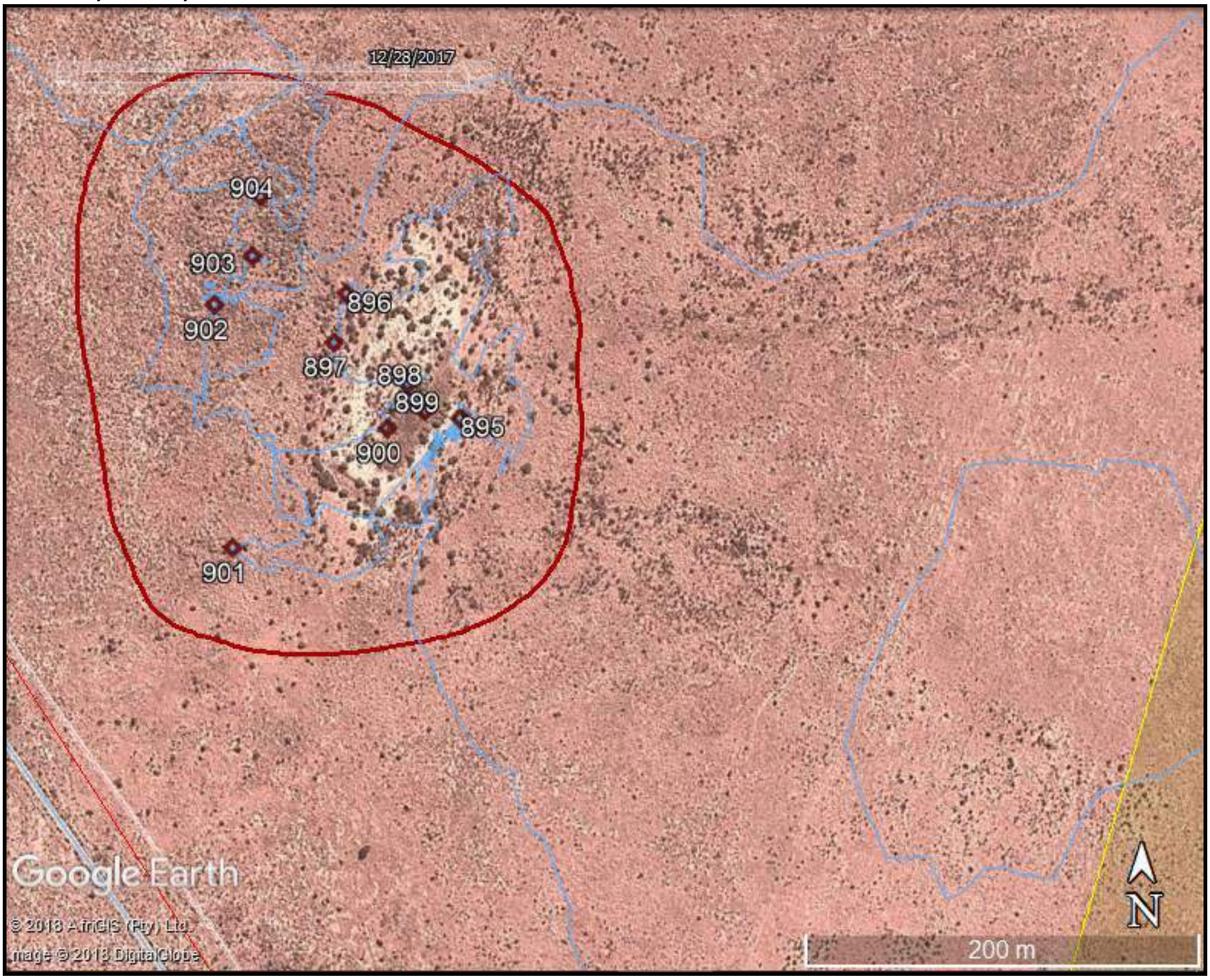

Figure 12: *Close-up aerial view of the archaeological sites to the west of the study area which is visible in the southeast. See Figure 10 for key.*

Figure 13: *View of the context of the artefact scatter at waypoint 895. The pan is arrowed.*

Figure 14: *View of the artefact and manuport scatter at waypoint 895.*

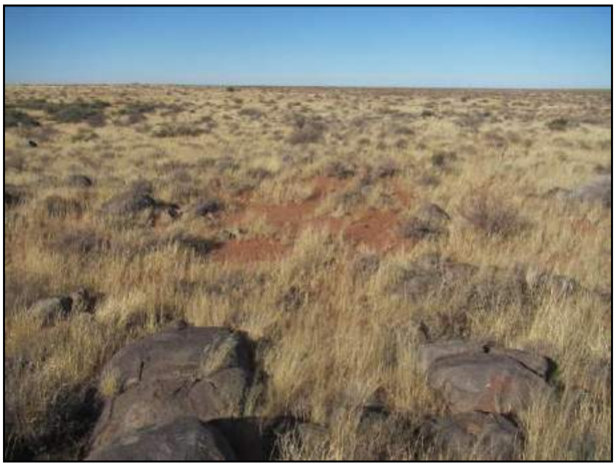

Figure 15: *View across the site at waypoint 902 on the crest of the rocky hill. The small 'clearing' housing the artefact scatter is visible in mid-picture.*

Figure 16: *Close-up view of the surface of the site at waypoint 902 showing stone artefacts.*

Because SAHRA requested that the visual impact on heritage resources be considered, it is pertinent to note that the only visually sensitive archaeological site known to the author in the broader area is a rock art site located 9 km south of the footprint area. This is the site on the boulder depicted in Figure 9.

6.2. Palaeontology

Although the SAHRIS Palaeosensitivity Map (Figure 17) shows the study area to be largely of moderate sensitivity, the nature of the area in terms of palaeontology is such that a full palaeontological study was not deemed necessary by the appointed specialist. Nevertheless, because SAHRA had requested an evaluation of the palaeontological impacts, a desktop study was compiled for the greater project and is briefly summarised here.

Figure 17: *Extract from the SAHRIS Palaeosensitivity map showing the study area to be of generally moderate palaeontological sensitivity (green shading) but with one area regarded as unknown (no shading).*

The broader area is underlain by metamorphic rocks that are entirely unfossiliferous. The overlying Late Cenozoic superficial sediments are generally of low palaeontological sensitivity, although small, isolated pockets of high sensitivity can be found when fossils are trapped within alluvium related to pans and river terraces along larger water courses (Almond 2017).

Almond (2017) has listed the possible fossils that might be found in the area, although he notes that none have been found there to date. Isolated bones and teeth (e.g. of mammals, fish, amphibians), ostrich eggshell fragments, freshwater molluscs, crabs, trace fossils (e.g. burrows), petrified wood, stromatolites, diatoms and pollen are all possible finds but deemed highly unlikely.

6.3. Graves

One likely grave was found within the study area. It consists of a number of rocks that have been deliberately placed side by side on the ground (Figure 18). That they are not part of a natural outcrop is evidenced by the variable colour of the rocks. While a number of similar features have been identified as likely graves in the region, none have been excavated. It is possible that further graves could occur in the area but these features are generally hard to spot.

Figure 18: *A stone feature thought likely to be a grave (waypoint 905).*

6.4. Built environment

No built environment features were found within the study area. No structures were visible from the study area with the nearest house being the Skeerhok farmstead 1.7 km south of the PV layout area. This is the landowner's residence. The structures are 20th century in age and are of low significance. Only one structure was present in 1945 (Figure 19). It was not visited during the field assessment. The farm complex would not be affected in any way, although one of the access road alternatives passes about 130 m north of the complex.

Figure 19: *Aerial views of the Skeerhok Farm Complex dating to 1945 (Job 083, strip 4, photograph 02372) and 2013 (Google Earth). The only structure present in 1945 is ringed in green in both images.*

6.5. Cultural landscape and visual concerns

The cultural and natural landscape is also of concern. However, the cultural landscape is very poorly developed in this area with fences, water troughs and wind pumps being the primary anthropogenic features. The primary sense of place is one of remoteness rather than of a farming landscape. This remoteness has already been impacted upon by the presence of the railway line, Nieuwehoop Substation and all associated power lines. The natural landscape lacks visually interesting and sensitive features. In addition, the proposed site is a long distance from any important roads (it is 25 km from the R27) and is highly unlikely to be visible to anyone other than local residents making use of the gravel road along the railway line. Solar PV facilities are not very tall and, if an earthy coloured paint is used for the buildings where feasible, they can be almost invisible from as little as 1 km away.

A pan 3.6 km north of the study area was cultivated during the mid-20th century (Figure 20). This shows the low intensity, opportunistic subsistence agriculture practiced in a pan when sufficient rain had fallen. All other activities in the broader area relate to small stock grazing.

It is notable that the landscape in the vicinity of the study area already has an electrical layer comprised of a large substation and several power lines (Figure 21). It is because of the substation that the development location has been chosen.

Figure 20: *1944 (Job 83, strip 001, photograph 02633) and modern (Google Earth) aerial photographs showing the pan to have been under cultivation during the mid-20th century but excavated out to facilitate water catchment by the late 20th century.*

Figure 21: *Evening view of the large Eskom substation located some 16 km south of the proposed project.*

6.6. Summary of heritage indicators

A primary indicator of concern here is archaeological sites. Although no significant sites were located within the proposed development footprint, the chance still exists that one could occur there and be damaged or destroyed by the proposed development. The survey has ensured, however, that no large and potentially highly significant sites would be impacted. The other main concern relates to the single likely grave which, after scoping, the developer has indicated cannot be avoided. Other graves could also occur but the chances are small. The chances of impacting on significant palaeontological resources are considered minimal. The only other issue is visual impacts to the cultural landscape but this issue is unavoidable and of little heritage concern, especially given the other power lines and substation already in existence in the area.

6.7. Statement of significance and provisional grading

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

The archaeological resources within the development footprint are deemed to have low cultural significance for their scientific value (provisional grade: General Protection C), although it is noted that a complex of sites of potentially medium to high significance (provisional grade: IIIB) lies a short distance outside the footprint.

Graves are deemed to have high cultural significance for their social value. Although not confirmed as a grave, the stone feature recorded as a likely grave is assigned a provisional grading of IIIA.

The cultural landscape is of fairly low significance because it is extensive and quite monotonous. This makes it fairly well-suited to the proposed development because there are no strong cultural features to it that would be irreversibly harmed by it. Furthermore, there is an electrical layer already present with the potential for this to be expanded.

7. ISSUES, RISKS AND IMPACTS

7.1. Summary of issues identified during the Scoping Phase

The main heritage issues identified during the scoping phase were:

- The potential damage to or destruction of archaeological sites;
- The potential damage to or destruction of palaeontological materials; and
- The potential visual or contextual impacts to the cultural landscape.

On submission of the scoping report to SAHRA, they responded as follows:

> *SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit notes that a Heritage Scoping Input has been submitted, and therefore awaits the pending Heritage Impact Assessment (HIA) as part of the draft EIA Phase.*
>
> *The pending HIA must assess all heritage resources as defined in section 3(2) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) and the report must comply with section 38(3) of the NHRA. The Archaeological and Palaeontological components of the HIA must comply with the SAHRA 2006 Minimum Standards for Archaeological and Palaeontological Components of Impact Assessments and the 2012 Minimum Standards: Palaeontological Components of Heritage Impact Assessments. Additionally, the Visual Impact of the proposed development on heritage resources and any comments provided by the public regarding heritage resources must be taken into consideration. The Scoping report appendices, the draft EIA with all appendices must be submitted along with the heritage reports in order for further comments to be issued.*

The present HIA meets the requirements of SAHRA in that it assesses all relevant aspects of heritage and aims to satisfy Section 38(3) of the NHRA. The archaeological and palaeontological components have been prepared by specialists, while visual impacts to heritage resources are also considered (note that a separate visual impact assessment is also available as part of the overall EIA). No other heritage-related comments were received during the public participation process (PPP) for the scoping report.

7.2. Identification of potential impacts/risks

Based on both fieldwork and desktop research as well as the concerns of SAHRA, the potential heritage-related impacts identified during the EIA assessment are:

Construction Phase

- Potential direct impacts to archaeological resources
- Potential direct impact to palaeontological resources
- Potential direct impacts to graves
- Potential direct and visual impacts to the cultural landscape
- Potential visual impacts to all visually sensitive heritage resources

Operational Phase

- Potential direct and visual impacts to the cultural landscape
- Potential visual impacts to all visually sensitive heritage resources

Decommissioning Phase

- Potential direct and visual impacts to the cultural landscape
- Potential visual impacts to all visually sensitive heritage resources

Cumulative impacts

- Potential direct impacts to archaeological resources
- Potential direct impact to palaeontological resources
- Potential direct impacts to graves
- Potential direct and visual impacts to the cultural landscape
- Potential visual impacts to all visually sensitive heritage resources

8. IMPACT ASSESSMENT

Note that although SAHRA identified the need to assess the impacts to visually sensitive heritage resources, none were found to occur within the study area and surrounds. This aspect is thus not considered further in this section although impacts to the cultural landscape are visual in nature and are assessed.

Note also that linear aspects such as the water pipeline and access road are subsumed within the assessments below because the level of impacts expected would at all times be less than or equal to that for the PV facility. Furthermore, these alignments were not surveyed in the field because their locations were only available during the impact assessment phase of the project.

8.1. Direct Impacts

8.1.1. Construction Phase

Construction phase impacts are assessed in Table 2.

Potential impacts to archaeology

Archaeological resources are sparsely distributed on the landscape with important sites being rare. Nevertheless, direct impacts in the form of destruction of or damage to sites and materials may occur if construction machinery operates outside of the demarcated areas or if further as yet undiscovered archaeological sites are present. Because of the low likelihood of finding further significant archaeological resources in the proposed development footprint and the generally low density of sites in the wider landscape, the overall impacts to archaeology are expected to be low before mitigation. Potential mitigation measures include conducting a final footprint survey and then excavating or sampling any important archaeological material found to occur within the footprint. The chances of further such material being found, however, are considered to be very small. After mitigation, the overall impact significance would likely be very low.

Potential impacts to palaeontology

The desktop study showed that the probability of finding and damaging or destroying significant palaeontological material during development is extremely unlikely. As such, the potential impacts to palaeontology are considered to be very low. The only measure that needs to be put in place is to ensure that the environmental control officer is alerted if any fossil material is found and that such material gets reported to SAHRA. A palaeontologist may need to inspect the find or conduct further research. The impact significance after mitigation remains very low.

Potential impacts to graves

The single likely grave found during the survey cannot be avoided by the proposed development which means there is a high (definite) probability of this feature being impacted. The chances of uncovering further graves during construction is extremely unlikely. Because one likely grave was found, the significance of potential impacts before mitigation is deemed to be very high. Mitigation would include following the appropriate exhumation process that should include a public consultation process if the grave is suspected to be historical. The impact significance after mitigation is low. Because it is not certain that the feature is in fact a grave, the confidence level in this prediction is medium.

Potential impacts to the cultural landscape

Although impacts to the cultural landscape, in the form of the addition of features not considered generally compatible with a rural landscape, would definitely occur, the very limited heritage significance of this landscape and the current existence of a large substation and power lines means that the consequence is only seen as moderate. Although minimising the surface footprint and the amount of white structures visible would reduce impacts, they are considered to be of low significance both before and after mitigation.

8.1.2. Operation Phase

Operation phase impacts are assessed in Table 3. Because no changes to the substrate are expected during operation, impacts relate solely to the presence of the facility in the landscape.

Potential impacts to the cultural landscape

Although impacts would definitely occur if the facility is constructed, because the cultural landscape is only weakly developed and of low heritage significance, the overall impact significance is rated as being low. The only reason it is not seen as very low is because of the long duration over which the impact would occur. After construction there is nothing that can be done by way of mitigation measures to further reduce impacts so no change to the significance assessment is required.

8.1.3. Decommissioning Phase

Decommissioning phase impacts are assessed in Table 4. Because no changes to undisturbed substrate are expected during decommissioning, impacts relate solely to the removal of the facility from the landscape and the subsequent rehabilitation period.

Potential impacts to the cultural landscape

The visual impact of the proposed solar energy facility would remain static until decommissioning. At this time, however, there would be an increased visual impact due to the equipment brought onto site to dismantle the plant and the rehabilitation work which would result in much dust. These impacts would, however, be temporary. After the decommissioning is complete, the landscape would then also be scarred but allowed to recover with time. The cleared but scarred landscape would result in less impacts than the actual dismantling of the plant so the assessment in Table 4 reflects the dismantling activities. While minimising the time taken to effect the decommissioning and employing dust suppression measures are appropriate mitigation measures, they are unlikely to result in any change in significance to the impact ratings. The impacts are deemed to be of low significance.

8.1.4. Cumulative impacts

Cumulative phase impacts are assessed in Table 5. They are effectively all the same impacts as would be experienced during the construction phase of the proposed project.

Potential impacts to archaeology

Archaeological resources are sparsely distributed on the wider landscape with important sites being rare. Nevertheless, direct impacts in the form of destruction of or damage to sites and materials may occur at any of the proposed facilities in the area, especially if construction machinery operates outside of the demarcated areas or if further as yet undiscovered archaeological sites are present. Because of the low likelihood of finding further significant archaeological resources in the relevant areas proposed for development and the generally low density of sites in the wider landscape the overall impacts to archaeology are expected to be of low significance before mitigation. Potential mitigation measures include conducting final footprint surveys and then excavating or sampling any important archaeological material found to occur within the footprints. The chances of further such material being found, however, are considered to be small, even across multiple development areas. After mitigation, the overall impact significance would likely be very low. It is considered unlikely that the cumulative impacts to archaeological resources would differ if six or fourteen solar energy facilities were constructed in the area.

Potential impacts to palaeontology

The desktop study showed that the probability of finding and damaging or destroying significant palaeontological material during the construction of renewable energy facilities in this area is extremely unlikely. Areas in and along water courses tend to be of slightly higher sensitivity but such areas are routinely avoided anyway during the formulation of development proposals. As such, the potential impacts to palaeontology are considered to be very low. The only measure that generally needs to be put in place is to ensure that the environmental control officer is alerted if any fossil material is found and that such material gets reported to SAHRA. A palaeontologist may need to inspect the find or conduct further research. The impact significance after mitigation remains very low. It is considered unlikely that the cumulative impacts to palaeontological resources would differ if six or fourteen solar energy facilities were constructed in the area.

Potential impacts to graves

Although one likely grave was found during the survey for the present project, the probability of uncovering graves during construction anywhere in the surrounding landscape is generally extremely unlikely because of their rarity. Despite their importance and the presence of one likely grave in the current footprint area, the significance of potential impacts to graves more broadly is assessed to be low. Mitigation of any grave found would include following the appropriate exhumation process that should include a public consultation process if the grave is suspected to be historical. The impact significance after mitigation is very low. It is considered unlikely that the cumulative impacts to graves would differ much if six or fourteen solar energy facilities were constructed in the area. Given the difficulty in identifying graves, there is a small chance that a slightly greater impact could be experienced if fourteen facilities are built.

Potential impacts to the cultural landscape

Although impacts to the cultural landscape, in the form of the addition of features not considered generally compatible with a rural landscape, would definitely occur, the very limited heritage significance of this landscape means that the consequence is only seen as moderate. Although minimising the surface footprint and the amount of white structures visible would reduce impacts, they are considered to be of low significance both before and after mitigation. It is considered unlikely that the cumulative impacts to the cultural landscape would differ much if six or fourteen solar energy facilities were constructed in the area. This is mainly due to the quite isolated location of the Nieuwehoop Substation and the various projects proposed around it.

8.2. Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many vantage points is undesirable. Because of the height of the majority of the proposed development, such an impact is not envisaged.

Table 2: Impact assessment summary table – Construction Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Clearing of site and excavation of foundations and construction of the facility	**Loss of / damage to archaeological sites**	Negative	Site	Permanent	Severe	Very unlikely	Non-reversible	High	Final footprint survey, excavation if needed	Low	Very low	5	High
	Loss of / damage to palaeontological materials	Negative	Site	Permanent	Severe	Extremely unlikely	Non-reversible	High	Chance finds procedure	Very low	Very low	5	High
	Loss of / damage to graves	Negative	Site	Permanent	Extreme	Very likely	Non-reversible	High	Exhumation process	Very high	Low	4	Medium
	Impacts to the cultural landscape	Negative	Local	Short term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	Minimise footprint, minimise white-painted surfaces	Low	Low	4	High

Table 3: Impact assessment summary table – Operation Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Presence of the solar energy facility on the landscape and occasional access by maintenance vehicles	**Impacts to the cultural landscape**	Negative	Local	Long term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	None	Low	Low	4	High

Table 4: Impact assessment summary table – Decommissioning Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Presence of the solar energy facility on the landscape, frequent access by construction vehicles, creation of dust and landscape scarring	**Impacts to the cultural landscape**	Negative	Local	Short term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	Minimise work time, Use dust suppression measures	Low	Low	4	High

Table 5: Impact assessment summary table – Cumulative impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Clearing of sites, excavation of foundations and construction of the facilities	**Loss of / damage to archaeological sites**	Negative	Site	Permanent	Severe	Very unlikely	Non-reversible	High	Final footprint survey, excavation if needed	Low	Very low	5	High
	Loss of / damage to palaeontological materials	Negative	Site	Permanent	Severe	Extremely unlikely	Non-reversible	High	Chance finds procedure	Very low	Very low	5	High
	Loss of / damage to graves	Negative	Site	Permanent	Extreme	Extremely unlikely	Non-reversible	High	Exhumation process	Low	Very low	5	Medium
	Impacts to the cultural landscape	Negative	Local	Short term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	Minimise footprint, minimise white-painted surfaces	Low	Low	4	High

9. LEGISLATIVE AND PERMIT REQUIREMENTS

Once Environmental Authorisation has been granted there are no further legal requirements that the developer has to meet so long as all conditions stipulated by the heritage authority have been complied with. If there is any archaeological mitigation work to be carried out then the appointed archaeologist would need to apply for and be granted a permit to allow them to carry out the work. This includes mitigation activities related to the likely grave. This permit would be issued in the name of the archaeologist and it remains their responsibility to ensure that they have met the requirements that may be imposed on them as conditions on the permit. The permit application process allows the heritage authorities to ensure that a suitably qualified and experienced archaeologist undertakes the work and that the proposed excavation/sampling methodology is acceptable. The final comment issued by the heritage authority in response to the permit report would, however, still be needed by the developer to prove compliance with the heritage-related authorisation conditions.

In the event of any archaeological or palaeontological material or graves being exposed during construction it may be necessary for a specialist to apply for a permit as described above in order to effect rescue of the relevant material.

10. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

The EMPr should include all mitigation and management actions suggested in this report as well as make provision for further actions that may become necessary after a final 'walkdown' survey of the various project component footprints. Monitoring would entail the ECO ensuring that any protected sites remain undisturbed throughout the duration of the construction period.

10.1. Mitigation requirements

At this point there are no specific archaeological mitigation requirements because no significant sites were located within the project footprint. However, because it was not practical to conduct a comprehensive survey of the entire study area and the linear feature layouts were not available for field study, it is suggested that a pre-construction walk down survey be carried out. The ECO will need to ensure that this survey is commissioned at least 6 months in advance of construction in order to allow for a mitigation process to be carried out in the unlikely event that this becomes necessary.

There is a requirement to test the likely grave site located in the proposed footprint area. The ECO will need to ensure that such work is commissioned at least 6 months in advance of construction so that all necessary processes can be completed in time. The appointed archaeologist will need to test the site to see if human remains are present. If human remains are found, then the grave should be closed up and, if it still cannot be avoided by the development, SAHRA should be consulted on the proper course of action to follow. If no human remains are found then a simple record of the feature should be made and a testing report submitted to SAHRA for approval.

10.2. Monitoring requirements

The significant cluster of archaeological sites is located far enough from the proposed development footprint to not be of concern and does not need to be cordoned off (Figure 22). The ECO should, nevertheless, be aware of its location and any activities that might have the potential to impact the site. Furthermore, whenever the ECO is on site they should be aware of any potential heritage material that may still be undiscovered. Graves are the main potential issue here. Any such material found would require immediate *in situ* preservation and reporting to SAHRA.

Although the chances of locating palaeontological material are extremely small, the ECO should make staff aware of this possibility and ensure that a reporting procedure is followed. The 'Chance Fossil Finds Procedure' included in the palaeontological specialist study (see Appendix 2) should be followed.

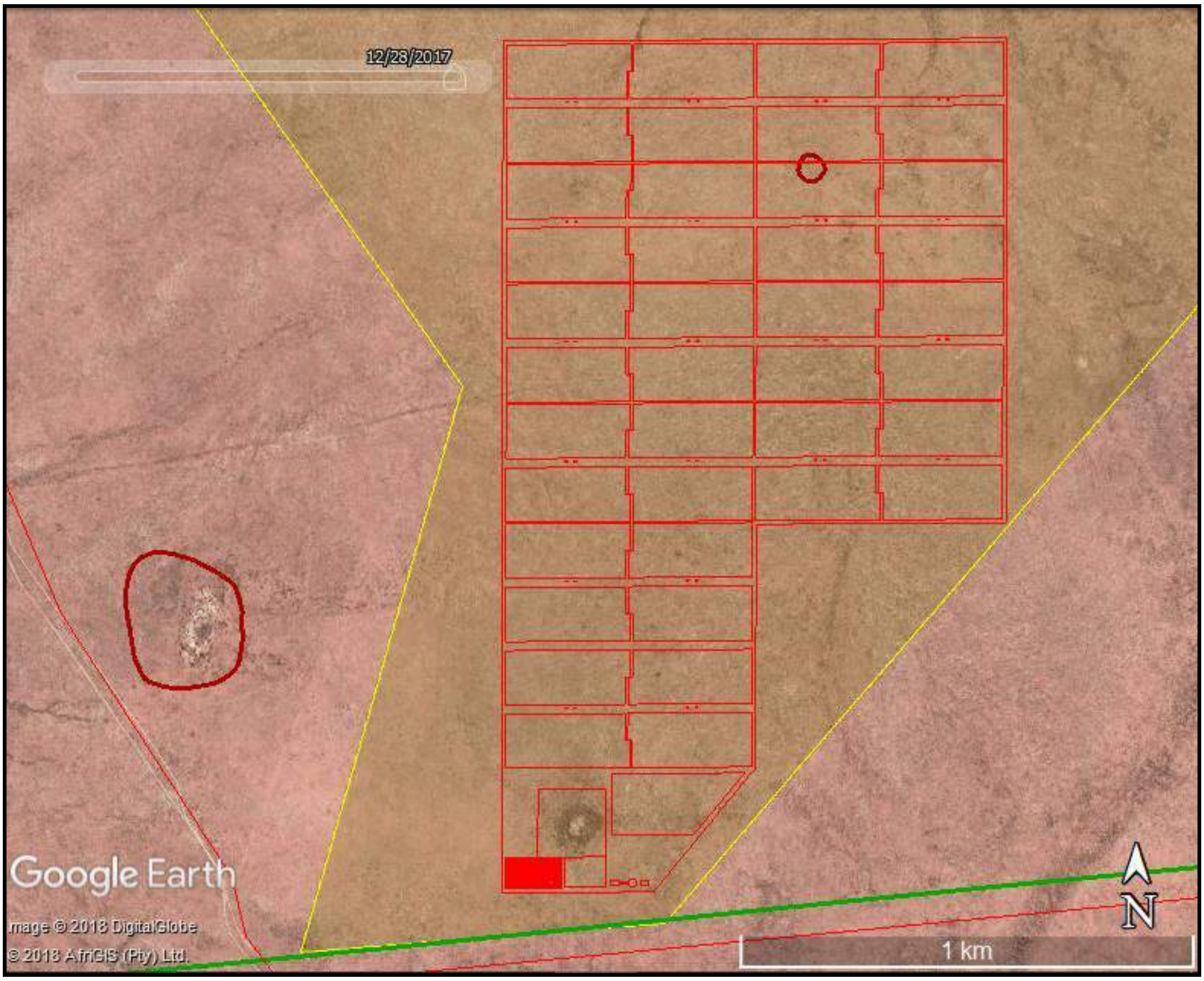

Figure 22: *Aerial view of the proposed development footprint (red outlines) showing the cluster of important heritage sites located in close proximity (large maroon outline; sites SHK2017/005-009) and the location of the likely grave (small maroon outline; site SHK2017/004).*

11. EVALUATION OF IMPACTS RELATIVE TO SUSTAINABLE SOCIAL AND ECONOMIC BENEFITS

Section 38(3)(d) of the NHRA requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

The provision of electricity is important to South Africa in terms of both growing the economy to provide jobs and providing electricity to households. Because no significant heritage resources would be impacted by the proposed development it is considered that the social and economic benefits outweigh any minor impacts to heritage.

12. CONSULTATION WITH HERITAGE CONSERVATION BODIES

No formal consultation was carried out as part of this HIA because the report would be part of the legislated public participation process (PPP) that will be carried out as part of the EIA (see section 3.6 above).

13. CONCLUSIONS

Only two significant heritage resources have been identified in the vicinity of the proposed solar energy development. One is a complex of archaeological sites associated with a pan and a low rocky hill (Figure 22), while the other is a likely grave. It has been indicated after the scoping phase that the grave cannot be avoided so it will require testing and exhumation if confirmed as a grave. Although human remains are always significant, the present possible grave is very isolated and the chances of identifying the deceased are likely zero. This makes exhumation more acceptable, although it would, of course, still be desirable to avoid the feature. Aside from these, so long as a final walk down survey is carried out, there are no reasons to prevent development of this site from proceeding. There is no favoured alternative in terms of access roads.

14. RECOMMENDATIONS

Because the impacts to the potential grave can be managed and no other significant impacts are envisaged, it is recommended that planning and construction of the proposed Skeerhok PV3 solar energy facility should be authorised but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- Fencing around the facility is to be visually permeable;
- The use of white paint on structures should be minimised with earthy tones favoured;
- The likely grave site at SHK2017/004 should be tested for human remains and if confirmed as a grave an exhumation process should be followed. Public consultation may be required by SAHRA;
- A final archaeological walk down survey of both the facility footprint and any associated linear features must be carried out at least six months in advance of construction;

- Staff must be made aware of the small possibility of locating buried fossils and should this occur they must be left in place and immediately reported to the ECO and/or the heritage authorities; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

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Cell Phone:	083 272 3225
Email:	jayson@asha-consulting.co.za
Birth date and place:	22 June 1976, Cape Town, South Africa
Citizenship:	South African
ID no:	760622 522 4085
Driver's License:	Code 08
Marital Status:	Married to Carol Orton

Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science)	1997
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP) membership number: 43

- Accredited Professional Heritage Practitioner

➢ *Memberships and affiliations:*

South African Archaeological Society Council member	2004 – 2016
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
UCT Department of Archaeology Research Associate	2013 –
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –
Kalk Bay Historical Association	2016 –
Association of Professional Heritage Practitioners member	2016 –

Fieldwork and project experience:

Extensive fieldwork and experience as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

<u>Feasibility studies:</u>
- Heritage feasibility studies examining all aspects of heritage from the desktop

<u>Phase 1 surveys and impact assessments:</u>
- Project types
    - Notification of Intent to Develop applications (for Heritage Western Cape)
    - Desktop-based Letter of Exemption (for the South African Heritage Resources Agency)
    - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
    - Archaeological specialist studies
    - Phase 1 archaeological test excavations in historical and prehistoric sites
    - Archaeological research projects
- Development types
    - Mining and borrow pits
    - Roads (new and upgrades)
    - Residential, commercial and industrial development
    - Dams and pipe lines
    - Power lines and substations
    - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

<u>Phase 2 mitigation and research excavations:</u>
- ESA open sites
    - Duinefontein, Gouda, Namaqualand
- MSA rock shelters
    - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
    - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
    - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
    - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
    - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
    - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
    - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
    - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

Awards:

Western Cape Government Cultural Affairs Awards 2015/2016: Best Heritage Project.

APPENDIX 2 – Palaeontological study

PALAEONTOLOGICAL HERITAGE DESKTOP INPUT:

Kenhardt PV Solar Energy Facility, Farms Gemsbok Bult 120 and 120/9 near Kenhardt, Northern Cape and associated powerline to the existing Nieuwehoop Substation

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December 2017

1. GEOLOGICAL CONTEXT

The study area for the proposed Kenhardt PV Solar Energy Facility on Gemsbok Bult Farm 120 and Farm 120/9, located some 40 km northeast of Kenhardt, is situated at an elevation of *c*. 1000 m amsl. in semi-arid, flat-lying terrain of the Bushmanland region of the Northern Cape (Northern Cape Pan Veld geomorphic region of Partridge *et al.* 2010). The region is drained by a dendritic network of shallow, southwesterly-flowing tributary streams of the Hartbeesrivier such as the Rugseersrivier and other unnamed drainage lines. The geology of the study area is shown on adjoining 1: 250 000 geology sheets 2920 Kenhardt and 2820 Upington (Council for Geoscience, Pretoria) (Figure 1). The entire area is underlain at depth by a variety of Precambrian basement rocks that are *c*. 2 billion years old and are assigned to the **Namaqua-Natal Province**. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses of the **Keimoes Suite** (granitoids) *plus* high grade metasediments of the **Jacobmynspan Group** (*e.g.* gneisses of the **Sandnoute Formation**) – are listed in the legend to Figure 1. The various basement rock units are described in the Kenhardt and Upington 1: 250 000 sheet explanations by Slabbert *et al.* (1999) and Moen (2007) respectively and are placed in the context of the Namaqua-Natal Province by Cornell *et al.* (2006). They generally crop out as scattered, low surface exposures rather than elevated *koppies*. The Precambrian crustal rocks are transected by the NW-SE trending Boven Rugzeer Shear Zone which trends NW-SE to the southwest of the core solar development study area and will be transected by the associated powerline connection to Nieuwehoop Substation (Figure 2). The shear zone is a band of large-scale tectonic deformation which separates two major crustal blocks in Bushmanland known as the Kakamas Terrane and Areachap Terrane (Cornell *et al.* 2006, their fig. 18).

A large proportion of the basement rock outcrop in the PV Solar Energy Facility project area is mantled by a range of superficial sediments of Late Caenozoic age, some of which are included within the **Kalahari Group**. These predominantly thin, unconsolidated deposits include small patches of calcretes (soil limestones), gravelly to sandy river alluvium, pan sediments along certain watercourses, surface gravels as well as – especially – Quaternary to Recent aeolian (wind-blown) sands of the **Gordonia Formation** (**Kalahari Group**). The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw (1991), Haddon (2000) and Partridge *et al.* (2006). The thickness of the unconsolidated Kalahari sands in the Bushmanland area is variable and often uncertain. The Gordonia Formation dune sands were previously considered to range in age from the Late Pliocene/Early Pleistocene to Recent, dated in part from enclosed Middle to Late Stone Age stone artefacts (Dingle *et al*., 1983, p. 291). Following the recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back to 2.588 Ma the older Gordonia Formation sands are now dated to the Pleistocene Epoch. A number of older Kalahari formations underlie the young wind-blown surface sands in the main Kalahari depository to the north of the study area. However, at the latitude of the study area near Kenhardt (*c*. 29° S) Gordonia Formation sands less than 30 m thick are likely to be the main, or perhaps only, Kalahari sediments present (*cf* isopach map of the Kalahari Group, Figure 6 *in* Partridge *et al*., 2006). These unconsolidated sands will be locally underlain by thin subsurface gravels along the buried palaeosurface and also perhaps by calcretes of Pleistocene or younger age.

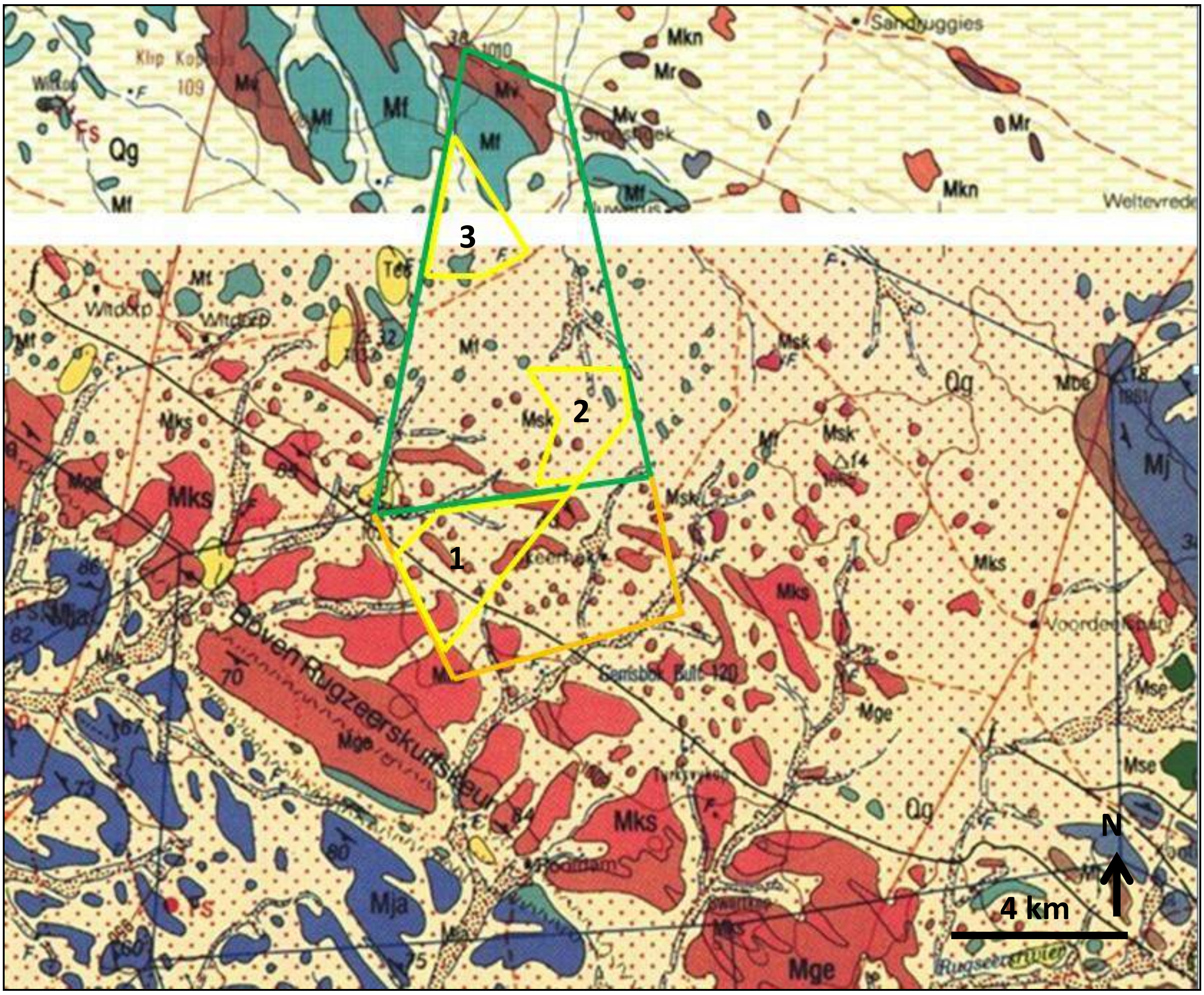

Figure 1. Extract from adjoining 1: 250 000 scale geological map sheets 2920 Kenhardt (below) and 2820 Upington (above) (Council for Geoscience, Pretoria) showing the geology of the Kenhardt PV Solar Energy Facility study area on Gemsbok Bult 120 (green polygon) and Gemsbok Bult 120/9 (orange polygon), situated *c*. 40 km to the NE of Kenhardt, Northern Cape. The three solar development areas under consideration (1, 2 and 3) are indicated by the small yellow polygons. The main geological units represented within the broader project area include:

PRECAMBRIAN BASEMENT ROCKS

KEIMOES SUITE

- **Brown (Mge) = Gemsbokbult Granite**

- Dark brown (Mv) = Vaalputs Granite
- Red (Mks) = Klipkoppies Granite
- Red (Msk) = Skierhoek Granite
- Blue-grey (Mf) =Friersdale Charnockite

  JACOBMYNS PAN GROUP
- Dark blue (Mja) = Jacobmyns Pan Group

LATE CAENOZOIC SUPERFICIAL SEDIMENTS
- Pale yellow with sparse red stipple or dashed ornament (Qg) = aeolian sands of the Gordonia Formation (Kalahari Group)
- Pale yellow with dense black stipple = alluvial and pan sediments
- Dark yellow (Tec) = calcrete

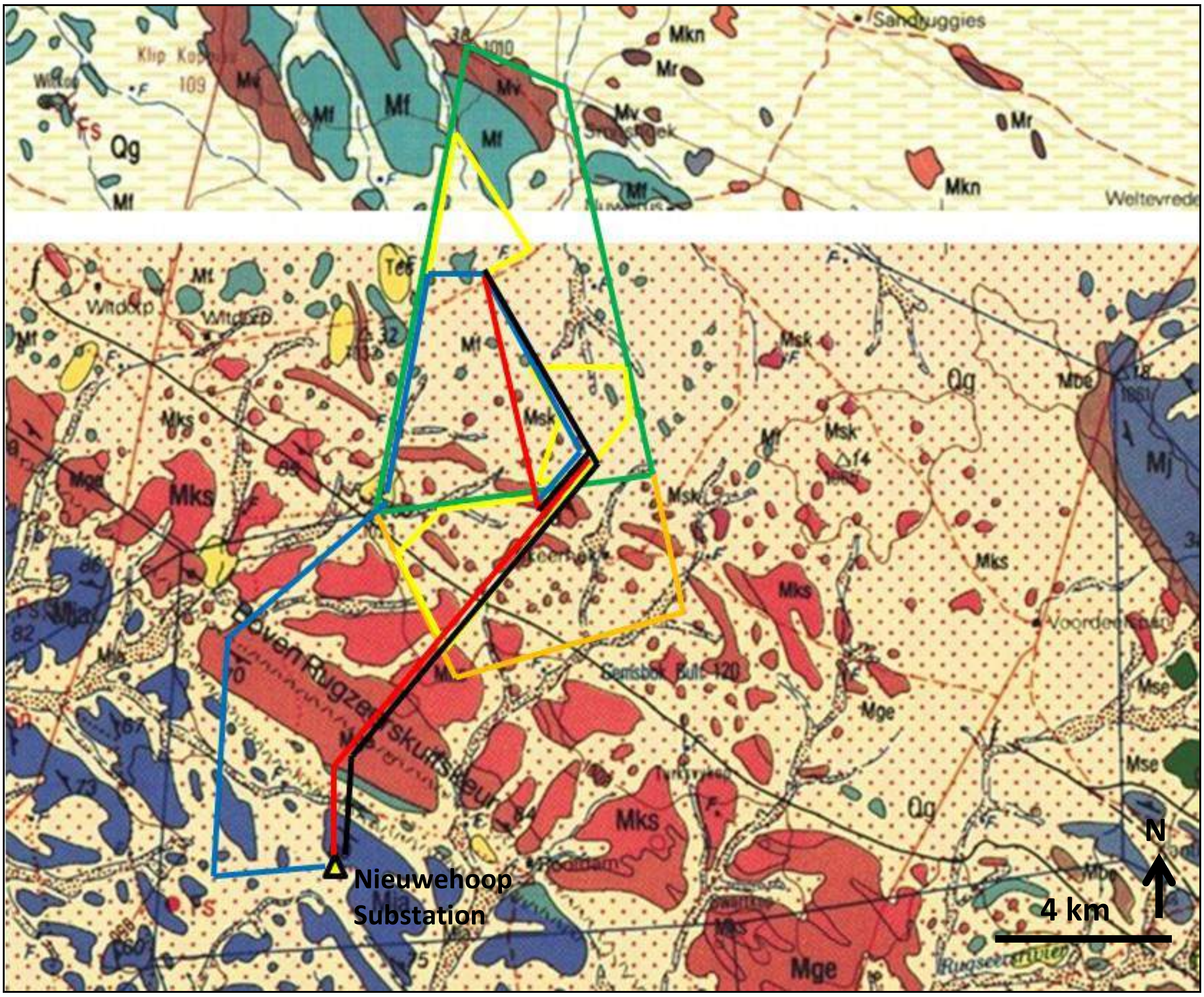

Figure 2. Extract from adjoining 1: 250 000 scale geological map sheets 2920 Kenhardt (below) and 2820 Upington (above) (Council for Geoscience, Pretoria) showing the geology of the study areas for the three power line route options (1- black; 2 – red; 3 – blue) between the Kenhardt PV solar development areas and the existing Nieuwehoop Substation. See legend to Figure 1 for a list of the relevant rock units.

2. PALAEONTOLOGICAL HERITAGE

The Precambrian basement rocks of the **Namaqua-Natal Province** represented within the study area are igneous and high grade metamorphic rocks that were last metamorphosed some 1 billion years ago and are entirely unfossiliferous.

The fossil record of the **Kalahari Group** as a whole is generally sparse and low in diversity; no fossils are recorded here in the Kenhardt and Upington geology sheet explanations by Slabbert *et al.* (1999) and Moen (2007). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from underlying lime-rich bedrocks may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*), tortoise remains and shells of land snails (*e.g. Trigonephrus*) (Almond in Macey *et al.* 2011, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*), ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels. The younger (Pleistocene to Recent) fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain many, if any, substantial fossil or subfossil remains.

It is concluded that both the Precambrian bedrocks and the Late Caenozoic superficial sediments underlying the study area are generally of ZERO to LOW palaeontological sensitivity, although isolated, and largely unpredictable, pockets of high sensitivity (*e.g.* mammalian remains) may occur sporadically (Table 1). Note that, to the author's knowledge, there are no fossil records from the broader Kenhardt PV Solar Energy Facili**ty** project area itself and no palaeontological fieldwork has been undertaken here.

Table 1: Fossil heritage recorded from the major rock units that are represented within the PV Solar Energy Facility study area near Kenhardt

GEOLOGICAL UNIT	ROCK TYPES AND AGE	FOSSIL HERITAGE	PALAEONT-OLOGICAL SENSITIVITY
LATE CAENOZOIC SUPERFICIAL SEDIMENTS, **especially** **ALLUVIAL AND PAN SEDIMENTS**	**fluvial, pan, lake and terrestrial sediments, including diatomite (diatom deposits), pedocretes (*e.g.* calcrete), colluvium (slope deposits such as scree), aeolian sands (Gordonia Formation, Kalahari Group)** **LATE TERTIARY, PLEISTOCENE TO RECENT**	**bones and teeth of wide range of mammals (*e.g.* mastodont proboscideans, rhinos, bovids, horses, micromammals), fish, reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*e.g.* calcretised termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, stromatolites, diatom floras, peats and palynomorphs.**	**GENERALLY LOW BUT LOCALLY HIGH** **(*e.g.* Tertiary alluvium associated with large old river courses)**
Basement granites and gneisses **NAMAQUA-NATAL PROVINCE**	**Highly-metamorphosed sediments, intrusive granites** **PRECAMBRIAN / MID-PROTEROZOIC (*c*.1- 2 billion years old)**	**None**	**ZERO**

3. CONCLUSIONS

- **Solar Development Areas**

Area 1: The area is underlain at depth by unfossiliferous Precambrian basement rocks of the Namaqua-Natal Province (*e.g.* Klipkoppies and Gemsbokbult Granites) as well as Late Caenozoic superficial sediments (Kalahari sands, alluvium, surface gravels) that are, at most, very sparsely fossiliferous (Fig. 1). The palaeontological sensitivity of the area is accordingly VERY LOW, as is the impact significance of the proposed small-scale PV solar development. Pending the discovery of fossil material within the development footprint before or during the development phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

Area 2: The area is underlain at depth by unfossiliferous Precambrian basement rocks of the Namaqua-Natal Province (*e.g.* Skierhoek Granite, Friersdale Charnockite) as well as Late Caenozoic superficial sediments (Kalahari sands, alluvium, surface gravels) that are, at most, very sparsely fossiliferous (Fig. 1). The palaeontological sensitivity of the area is accordingly VERY LOW, as is the impact significance of the proposed small-scale PV solar development. Pending the discovery of fossil material within the development footprint before or during the development phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

Area 3: The area is underlain at depth by unfossiliferous Precambrian basement rocks of the Namaqua-Natal Province (*e.g.* Friersdale Charnockite) as well as Late Caenozoic superficial sediments (Kalahari sands, alluvium, surface gravels) that are, at most, very sparsely fossiliferous (Fig. 1). The palaeontological sensitivity of the area is accordingly VERY LOW, as is the impact significance of the proposed small-scale PV solar development. Pending the discovery of fossil material within the development footprint before or during the development phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

- **Powerline route options**

All three powerline route options traverse broadly similar geological terrain comprising a range a Precambrian igneous and metamorphic rocks of the Namaqua-Natal Province that are extensively mantled by Late Caenozoic superficial sediments such as Kalahari sands, alluvium and surfacegravels. The palaeontological sensitivity of all the powerline route option corridors underconsideration is equally VERY LOW, as is the impact significance of the proposed small-scale powerline development. There is no preference on fossil heritage grounds for any particular route option. Pending the discovery of fossil material within the development footprint before or during the development phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

Cumulative impact significance

Several previous desktop palaeontological heritage studies submitted for alternative energy projects in the area northeast of Kenhardt have concluded that the impact significance of developments in this area is negligible to very low as far as fossil heritage is concerned (See reports by Almond under references). The potentially-fossiliferous Late Caenozoic sedimentary units represented here are generally of widespread occurrence in Bushmanland. It is concluded that the anticipated cumulative impact of the proposed new solar PV projects in the context of other alternative energy developments in the region is of LOW significance.

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QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Gauteng, KwaZulu-Natal, Mpumalanga, Northwest and Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has been a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

John E. Almond

Dr John E. Almond
Palaeontologist
***Natura Viva* c**

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: Kenhardt PV Solar Energy Facility, Farms Gemsbok Bult 120 and 120/9 near Kenhardt, Northern Cape and associated powerline to the existing Nieuwehoop Substation</td></tr>
<tr><td>Province & region:</td><td colspan="2">NORTHERN CAPE, KENHARDT DISTRICT</td></tr>
<tr><td>Responsible Heritage Resources Authority</td><td colspan="2">SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.
Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Kalahari Group (esp. Gordonia Formation sands, alluvial and pan deposits, calcretes)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">bones and teeth of mammals, fish, reptiles, ostrich egg shells, fish, freshwater and terrestrial molluscs, crabs, trace fossils (e.g. calcretised termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, stromatolites, diatom floras, peats and palynomorphs.</td></tr>
<tr><td rowspan="4">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation
• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
• Photograph fossils against a plain, level background, with scale
• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
• Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
</table>

	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX M:

Visual Report

VISUAL IMPACT ASSESSMENT

Scoping and Environmental Impact Assessment for the proposed development of three 100 MW Solar Photovoltaic Facilities (Skeerhok PV 1, PV 2, & PV 3) & 132 kV overhead transmission line near Kenhardt in the Northern Cape Province

Prepared by:
Council for Scientific and Industrial Research
Stellenbosch, South Africa

Contact person:
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January 2018

Scoping and Environmental Impact Assessment for the proposed development of three 100 MW Solar Photovoltaic Facilities, near Kenhardt in the Northern Cape Province	
Visual Impact Assessment: Environmental Impact Assessment Phase Input	
CSIR Report Number	CSIR/IU/021MH/ER/2017/0013/A
Prepared by	Luanita Snyman-van der Walt (CSIR)
Version	Draft, version 2
Date	January 2018

SPECIALIST EXPERTISE

LUANITA SNYMAN-VAN DER WALT
MSc Environmental Science (NWU)
Pr. Sci. Nat. Environmental Science

Specialisation: Environmental Assessment and Management; Geographic Information Systems; Landscape & Urban Ecology

Luanita commenced work at CSIR in January 2014, after completing a BSc. Botany-Zoology-Tourism, a BSc. Hons. in Environmental Science, as well as a MSc. in Environmental Science at the North West University, Potchefstroom Campus. She is pursuing a MSc. In Geographical Information Science at Vrije Universiteit Amsterdam, and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (Reg. no. 400128/16).

Her work at the CSIR involves strategic environmental assessment and management, with a focus on Geographic Information System (GIS) analyses for environmental assessment and decision-making.

QUALIFICATIONS

2017 - current	MSc. Geographic Information Science	Vrije Universiteit, Amsterdam, Netherlands
2013	MSc. Environmental Science *(Cum Laude)*	North West University, Potchefstroom, South Africa
2010	BSc. Hons. Environmental Science	North West University, Potchefstroom, South Africa
2009	BSc. Botany- Zoology-Tourism	North West University, Potchefstroom, South Africa

PROJECT TRACK RECORD

Completion	Description	Role	Client
In progress	GEF funded biodiversity and land use projects	Project management, technical/specialist support, and mentoring	SANBI
In progress	Scoping and Environmental Impact Assessment for the proposed development of the Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape	Specialist study: Aquatic Ecology	juwi Renewable Energies
In progress	Sustainable Development Goal Lab on “Mainstreaming resilience into climate change adaptation and disaster risk planning.”	Project leader	Future Earth; Stockholm Resilience Centre; University of Tokyo (funders)
In progress	Strategic Environmental Assessment Aquaculture Development in South Africa	Project member – Technical GIS and mapping	Department of Environmental Affairs
June 2017	Strategic Environmental Assessment for the development of Shale Gas in South Africa	Project officer	Department of Environmental Affairs
December 2017	Guidance for Resilience in the Anthropocene: Investments for development (GRAID) – African Cities.	Project member: Sustainability assessment guideline	Stockholm Resilience Centre (funder)
January 2017	Environmental and Social Impact Assessment for the Floating Liquid Natural Gas project near Kribi, Cameroon.	Project member – Technical GIS and mapping, ecology inputs	Golar
October 2016	Environmental Screening Study for the Giyani Waste Oil Boiler, Limpopo: Environmental management plan for the Hi-Hanyile essential oil distillery	Project manager	CSIR Enterprise Creation for Development

Completion	Description	Role	Client
September 2016	Scoping and Environmental Impact Assessment for 5 x 100 MW Solar PV facilities near Dealesville, Free State.	Project manager	29 Solar
June 2016	Environmental and Social Impact Assessment for the Bomono Early Field Development Project, Cameroon.	Project member - Technical GIS and mapping, ecology inputs	EurOil
May 2016	Scoping and Environmental Impact Assessment for the proposed Development of a 7 x 75 MW Solar Photovoltaic Facilities near Kenhardt, Northern Cape	Project member - Technical GIS and mapping	Mulilo
April 2016	Scoping and Environmental Impact Assessment for the Proposed Development 3 x 75 MW Solar Photovoltaic Facilities near Kenhardt, Northern Cape	Project member - Technical GIS and mapping	Scatec
April 2016	Strategic Environmental Assessment for identification of electricity grid infrastructure development corridors in South Africa	Project member - Technical GIS and mapping	Department of Environmental Affairs
February 2016	Environmental Impact Assessment for the development of 12 Solar PV projects near Dealesville, Free State.	Project member - Technical GIS and mapping, ecology inputs, stakeholder engagement	Mainstream Renewable Energy
September 2015	Environmental Screening Study for the Proposed Vaayu Energy SA Wind Energy Facility near Wesley, Eastern Cape	Project leader	Vaayu Energy
February 2015	Environmental Screening Study for Biochar- and Composting facilities in the Umzimvubu Catchment	Project member - Technical GIS and mapping & ecology inputs	Department of Environmental Affairs
March 2015	Strategic Environmental Assessment for identification of renewable energy zones for wind and solar PV projects in South Africa	Project member - Technical GIS and mapping	Department of Environmental Affairs
November 2014	Rapid environmental screening study for WASA wind monitoring masts (11-15) in the eastern cape, Kwazulu-Natal and Free State provinces, South Africa	Project member - Technical GIS and mapping	CSIR Built Environment
August 2014	Environmental Screening Study for the importation of Liquid Natural Gas into the Western Cape	Project member - Technical GIS and mapping, ecology inputs	Western Cape Government
March 2014	Environmental Screening Study for a Proposed LNG Terminal at Saldanha and associated pipeline infrastructures to Atlantis and Mossel Bay, Western Cape	Project member - Technical GIS and mapping, ecology inputs	PetroSA

SPECIALIST DECLARATION

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

VISUAL IMPACT ASSESSMENT: Scoping and Environmental Impact Assessment for the proposed development of three 100 MW Solar Photovoltaic Facilities (Skeerhok PV 1, PV 2, & PV 3) & 132 kV overhead transmission line near Kenhardt in the Northern Cape Province

Specialist:	Council for Scientific and Industrial Research		
Contact person:	Luanita Snyman-van der Walt		
Postal address:	PO Box 320, Stellenbosch		
Postal code:	7599	Cell:	072 182 9718
Telephone:	021 888 2490	Fax:	021 888 4693
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Professional affiliation(s) (if any)	SACNASP - Pr. Sci. Nat.		

Project Consultant:	Council for Scientific and Industrial Research		
Contact person:	Kelly Stroebel		
Postal address:	PO Box 320, Stellenbosch		
Postal code:	7599	Cell:	082 660 1907
Telephone:	021 888 2432	Fax:	021 888 4693
E-mail:	Kstroebel@csir.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, LUANITA SNYMAN-VAN DER WALT declare that --

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

Name of company (if applicable):

12 / 02 / 2018

Date

EXECUTIVE SUMMARY

This document constitutes the Visual Impact Assessment (VIA) as part of the Environmental Impact Assessment (EIA) for the juwi Skeerhok Solar Photovoltaic (PV) development, consisting of Skeerhok PV1, Skeerhok PV2, Skeerhok PV3, and associated 132 kV powerline (Skeerhok PV – Transmission Line). This assessment draws on VIAs conducted for other solar PV developments in the direct vicinity of the juwi Skeerhok Solar PV development.

The proposed juwi Skeerhok PV development project area is situated approximately 40 km north-east of Kenhardt, Northern Cape. The landscape is characterised as a semi-desert steppe, sparsely vegetated by grassland with patchy occurrence of low shrubs, with a very slight elevation profile, and is mainly used for sheep farming. Existing approvals for solar PV developments, the construction of high-voltage electricity infrastructure in the direct surroundings of the project area, and the Saldanha-Sishen railway with overhead powerlines entails that the rural / pastoral landscape has been transformed by existing infrastructure to have a more industrial/electrical character. Furthermore, the landscape sensitivity, as determined by a Strategic Environmental Assessment which informed the establishment of Renewable Energy Development Zones for South Africa, is classified as low from a visual, scenic, aesthetic and amenity perspective.

The following impact drivers/pathways may lead to visual intrusion impacting on the views of potential sensitive visual receptors:

- Clearance of vegetation for solar field, laydown areas, buildings and roads
- Increased traffic
- Night lighting
- Dust
- Veld fires
- Established infrastructure
- Cumulative effects of the abovementioned impact drivers from all the proposed solar PV development in the proposed project area

A Viewshed Analysis was conducted using ArcMap 10.5 software. The height of the tallest structure on site and the boundary of the farm portions on which the juwi Skeerhok PV development is proposed was used as the extent of the development to simulate 'worst case' conditions.

The impact of visual intrusion to the views of potential sensitive visual receptors is expected to be moderate to low (before mitigation) and moderate to very low, with the effective implementation of the mitigation and management actions outlined in this report.

Due to the existing landscape character, and foreseeable trend of renewable energy and associated electricity infrastructure development in the area, the cumulative impacts to the views of potential sensitive visual receptors are expected to be moderate, if all the proposed solar PV developments in the area implement proposed mitigation measures and best practice to reduce visual impacts.

Based on the findings in this VIA it has been concluded that the juwi Skeerhok PV development, including its associated electricity infrastructure, from a visual, scenic, aesthetic and amenity perspective, may receive EA with adherence to the mitigation and management measures set out in this report.

LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
I&AP	Interested and Affected Party
kV	Kilovolt
NEM:PAA	National Environmental Management: Protected Areas Act (Act 57 of 2003)
NHRA	National Heritage Resources Act (Act 25 of 1999)
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
SACAD	South African Conservation Areas Database
SAPAD	South African Protected Areas Database
SEA	Strategic Environmental Assessment
SKA	Square Kilometre Array
VIA	Visual Impact Assessment

GLOSSARY

Definitions	
Landscape baseline	Existing elements, features, characteristics, character, quality and extent of the landscape (GLVIA, 2002).
Landscape character	Distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It creates the particular sense of place of different areas of the landscape (GLVIA, 2002).
Viewer sensitivity	The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.
Viewshed	A viewshed is an area of land, water, and other environmental elements that is visible from a fixed vantage point. In digital imaging, a viewshed is a binary raster indicating the visibility of a viewpoint for an area of interest. A pixel with a value of unity indicates that the viewpoint is visible from that pixel, while a value of zero indicates that the viewpoint is not visible from the pixel.
Visual impact assessment	A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts on receptors.
Visual intrusion	The level of compatibility of the project with the particular qualities of the area – its 'sense of place'. This is related to the idea of context and maintaining the integrity of the landscape (Oberholzer, 2005).
Visual receptors	Viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible.
Visual resource	The visible landscape and its recognisable elements which, through their coexistence, result in a particular landscape and visual character

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R326 of NEMA EIA Regulations as amended (7 April 2017)	**Where addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Pg 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pg 2
c) an indication of the scope of, and the purpose for which, the report was prepared; (ca) an indication of the quality and age of base data used for the specialist report; (cb) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.1 – 1.2 Section1.5 Section 2 Section 6.8
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Not applicable, the short vegetation will offer minimal screening and therefore the same impacts are expected throughout the year.
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	Section 2.5 Section 6.1
g) an identification of any areas to be avoided, including buffers;	None
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 2.3 Section 6.1
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6 Section 7 Section 9
k) any mitigation measures for inclusion in the EMPr;	Section 6 Section8
l) any conditions for inclusion in the environmental authorisation;	None
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (ia) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	None
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None at this stage of the EIA process
q) any other information requested by the competent authority.	Peer Review conducted

	(See Appendix A to this report)
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	None

TABLE OF CONTENTS

TABLES AND FIGURES

VISUAL IMPACT ASSESSMENT

1. INTRODUCTION AND METHODOLOGY

1.1 Scope and Objectives

juwi Renewable Energies is proposing the development of three 100 MW solar photovoltaic (PV) facilities on Smutshoek Farm 395 (Skeerhok PV1 and Skeerhok PV3) and Portion 9 of Gemsbok Bult Farm 120 (Skeerhok PV2), as well as overhead 132 kilovolt (kV) powerlines on farms Smutshoek Farm 395 and Portions 3, 5, and 9 of Gemsbok Bult Farm to connect to the existing Eskom Nieuwehoop substation on Portion 3 of Gemsbok Bult Farm 120, near Kenhardt in the Northern Cape.

Although separate Environmental Impact Assessment (EIA) and Basic Assessment (BA) processes were conducted for the respective Skeerhok PV 1, PV 2, PV 3 projects (full scoping and EIA) and the electricity infrastructure (BA), this VIA report is representative of the entire development, hereafter referred to as the “proposed juwi Skeerhok PV development”. This combined approach is due to the cumulative visual consideration of the development. The farm portions on which the juwi Skeerhok PV development is proposed, are collectively referred to as the “project area”.

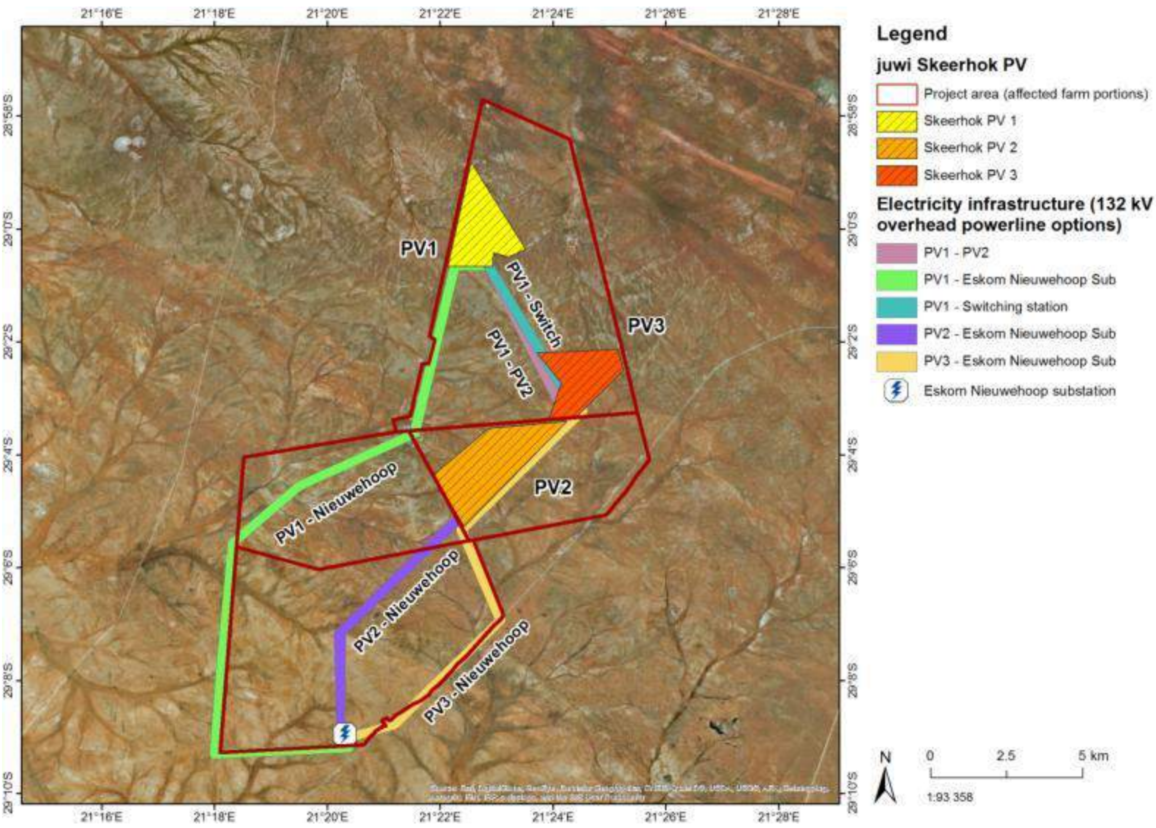

Figure 1: Layout of the proposed juwi Skeerhok solar PV development and 132 kV overhead powerlines.

This document constitutes the Visual Impact Assessment (VIA) as part of the EIA for the juwi Skeerhok PV development, and draws on VIAs conducted for other solar PV developments in the direct vicinity of the solar PV developments proposed by juwi.

1.2 Terms of Reference

The Terms of Reference for this VIA include:

- A desktop review of existing literature (e.g. including the EIAs of neighbouring PV developments);
- Mapping of potential sensitive visual receptors;
- Geographic Information System (GIS) analysis using ArcMap software (Esri Inc., 2017) to determine the visibility of the proposed juwi solar PV development (Viewshed Analysis);
- Impact assessment and cumulative impact assessment;
- Recommendations for mitigation, management and monitoring actions as input to the Environmental Management Programme (EMPr).

1.3 Approach and Methodology

This VIA has been conducted in accordance with the requirements of Appendix 6 of the 2014 NEMA EIA Regulations, and follows guidelines for VIA provided by the Provincial Government of the Western Cape and CSIR (Oberholzer, 2005), and the Landscape Institute of the UK (GLVIA, 2002).

1.3.1 Landscape description

A desktop study was conducted to establish and describe the landscape character of the receiving environment. A combination of data analysis using GIS and a review of existing literature was used to identify and describe landscape elements and character in relation to the visual environment. Potential areas of scenic interest and sensitive visual receptors were also identified.

1.3.2 Viewshed Analysis

A Viewshed Analysis was conducted for the surrounding region of the proposed project area and components of the development relevant to the assessment of the potential visual impact (in a 10 km radius) using ArcMap software (Esri Inc., 2017).

1.3.3 Sensitivity assessment

High-level sensitivity assessment was based on the Strategic Environmental Assessment (SEA) for wind and solar photovoltaic energy in South Africa (DEA, 2015). At a finer scale, potential sensitive visual receptors and/or scenic resources were identified. These generally include: Topographic features; major rivers, water bodies, wetlands; private reserves/resorts; human settlements; national and provincial roads; scenic routes and passes; passenger rail lines; cultural landscapes; national parks; and nature reserves (Oberholzer et al., 2016).

1.3.4 Assessment of impacts and identification of management actions

The consequence of an impact and the likelihood of its occurrence were the main factors in determining the significance of impacts to potentially sensitive visual receptors. The consequence rating also takes into account aspects such as extent and duration of the impact, as well as the sensitivity of the receiving visual environment. Management actions were drawn from best practice and VIAs conducted for other solar PV developments in the region (e.g CSIR, 2015; CSIR, 2016a, CSIR, 2016b).

1.4 Assumptions and Limitations

1.4.1 Consultation

No consultation, apart from that undertaken as part of the formal EIA process, was undertaken. No specific comments or additional issues have been raised by I&APs specifically relating to visual impacts. Furthermore, it is assumed that the potential changes to the current landscape character and impacts to visual receptors have been deemed acceptable to Interested and Affected Parties (I&APs) that participated in the EIA for other approved solar PV projects in the direct vicinity of the proposed Skeerhok PV development.

1.4.2 Desktop assessment

This study is a desktop assessment, drawing on the findings and recommendations of the extensive VIAs as part of EIA reports that have been compiled for the area where the juwi Skeerhok PV development is proposed (e.g. see CSIR, 2015; CSIR, 2016a, CSIR, 2016b).

1.4.3 Mitigation measures

Mitigation measures in this report will assume that construction activities are managed and performed in such a way as to minimise its impact on the receiving environment. The following assumptions, in particular, apply since they are relevant to minimising visual impact during the construction phase:

- Good housekeeping will be maintained on site to avoid litter and minimise waste;
- Construction boundaries will be demarcated and areas of surface disturbance will be minimised;
- Existing roads will be used where possible;
- Vegetation removal and surface disturbance will be minimised and take advantage of existing clearings;
- Topsoil from the site will be stripped, stockpiled, and stabilised before excavating earth for the construction of the facility;
- Plant material from indigenous vegetation removal will be mulched and applied to disturbed/exposed soil to aid in the rehabilitation process;

- Plans will be set in place to control and minimise erosion risks, and rehabilitate cleared areas as soon as possible; and
- Plans will be in place to minimise fire hazards and dust generation.

1.4.4 Cumulative impacts

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 20 km radius. The existing and proposed developments that were taken into consideration for cumulative visual impacts include solar PV developments in direct vicinity of the juwi Skeerhok PV development project area:

- Three 75 MW solar PV facilities proposed by Mulilo Renewable Project Developments in 2014 – all of which have received Environmental Authorisation (EA) (CSIR, 2015);
- Seven 75 MW solar PV facilities proposed by Mulilo Renewable Project Developments in 2015 – four of which have received EA (CSIR, 2016a); and
- Three 75 MW solar PV facilities proposed by Scatec Solar SA in 2015– all of which have received EA (CSIR, 2016b).

The Department of Environmental Affairs (DEA) has indicated that, due to the potential impact of renewable energy development to the Square Kilometre Array (SKA), it envisages that no more than six approved renewable energy developments will be awarded preferred bidder status in the Kenhardt area. This being said, the cumulative visual impact assessment was based on the precautionary approach and assumed that all projects will be developed (i.e. 'worst case scenario') within the area for the cumulative impact assessment, and provides a statement on how the cumulative impacts would differ if only six projects were to be constructed.

1.4.5 Accuracy of spatial data

The most recent available and obtainable spatial data was utilised for this VIA. It must be noted that the spatial data originate from different sources and have been created at various scales and resolutions. Discrepancies and scale incompatibilities may exist. Furthermore, data from the SPOT Building Count (see Table 1) has been used to identify potential sensitivity visual receptors. However, it must be noted that not all structures recorded in the SPOT Building Count are necessarily occupied, and have not been verified as part of this VIA.

1.4.6 Viewshed Analysis

Viewsheds were calculated using a 20 m resolution Digital Elevation Model (DEM). The viewshed calculations do not take into account the potential screening effect of other vertical structures in the landscape, such as vegetation and buildings. Due to the relatively low vegetation cover in the region and the size and extent of the solar energy facility, the screening potential of vegetation is likely to be minimal over most distances.

The maximum height of the highest component of the entire development (i.e. Skeerhok PV areas and associated electricity infrastructure (see Table 3)) was used for the viewshed analysis to simulate a worst-case scenario. The boundary of the farm portions on which the juwi Skeerhok PV development is proposed (project area) was used as the extent of the development, again to simulate 'worst case' conditions.

1.5 Information sources

1.5.1 Literature

The following literary information was used for conducting this VIA:

- Documentation supplied by the developer and the CSIR Environmental Assessment Practitioner;
- SEA for wind and solar photovoltaic energy in South Africa (DEA, 2015); and
- EIA reports for surrounding PV developments (CSIR, 2015, 2016a, 2016b).

1.5.2 Spatial data

The spatial data sets used for the landscape description and viewshed analysis are presented in Table 1 below.

1.5.3 Software

The following software was used for the landscape description and viewshed analysis included in this VIA:

- Esri ArcMap software (Esri Inc., 2017); and
- Google Earth (Google Inc., 2015).

Table 1: Spatial data utilised for the juwi Skeerhok PV development Visual Impact Assessment.

Data	Date	Description	Resolution/ scale	Format	Source
South African National Land Cover	2014	The land-cover dataset covers the whole of South Africa and is presented in a map-corrected, raster format. The dataset contains landcover classes, ranging from natural to man-made landscape characteristics.	30 m	Raster	South African Department of Environmental Affairs
Digital Elevation Model	2002	20m digital contours, spotheights, coastline and inland water area data captured from South African 1:50 000 scale topographical mapping.	20 m	Raster	
Roads	2006	Geometric location and attribute information of road centrelines.	1:50 000	Vector (polyline)	South African Department of Rural Development and Land Reform
Railways	2006	Geometric location and attribute information of rail centrelines.	1:50 000	Vector (polyline)	South African Department of Rural Development and Land Reform
SPOT Building Count	2011	The location of dwelling units/building structures or dense informal areas mapped using SPOT 2.5 m natural colour satellite imagery.	2.5 m	Vector (points)	Eskom
Towns	2004	Extent of town allotments.	1: 25 000	Vector (polygon)	South African Chief Surveyor General

Data	Date	Description	Resolution/ scale	Format	Source
South African Protected Areas and South African Conservation Areas	2017	The South African Protected Areas Database (SAPAD) and Conservation Areas Database (SACAD) contains spatial data for the conservation estate of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. Quarter 3 of 2017.	1: 5 000	Vector (polygon)	South African Department of Environmental Affairs
South African Renewable Energy EIA Application Database	2017	The South African Renewable Energy EIA Application Database contains spatial data for renewable energy applications for environmental authorisation. It includes spatial and attribute information for both active (in process and with valid authorisations) and non-active (lapsed or replaced by amendments) applications. Quarter 3 of 2017.	1: 5 000	Vector (polygon)	South African Department of Environmental Affairs

2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The proposed juwi Skeerhok PV development project area is situated approximately 40 km north-east of Kenhardt, Northern Cape – a sparsely populated town with approximately 4 843 people living at a density of 30.39 per km^2 (StatsSA, 2011).

2.1 Land cover

The landscape is characterised as a semidesert steppe that is sparsely vegetated by grassland with patchy occurrence of low shrubs (Mucina et al., 2006) (Figure 2). The low vegetation and flat terrain provides very limited screening from infrastructure features situated in the landscape/

Figure 2: Photograph depicting the patchy grassland and low shrubland vegetation (CSIR, 2016a; photo credit: Henry Holland).

2.2 Elevation and slope

The elevation characteristics of the project area are very slight (ranging from ~ 900 m – 1050 m) (Figure 3) with an average of slope of 0.5 %, an elevation gain of approximately 27 m on the north-east profile (across 14 km) and 31 m on the east-west profile (across 6 km) (Figure 4) (Google Inc., 2015).

The rolling terrain provides wide open views. Incisions in the terrain would offer limited screening from infrastructure.

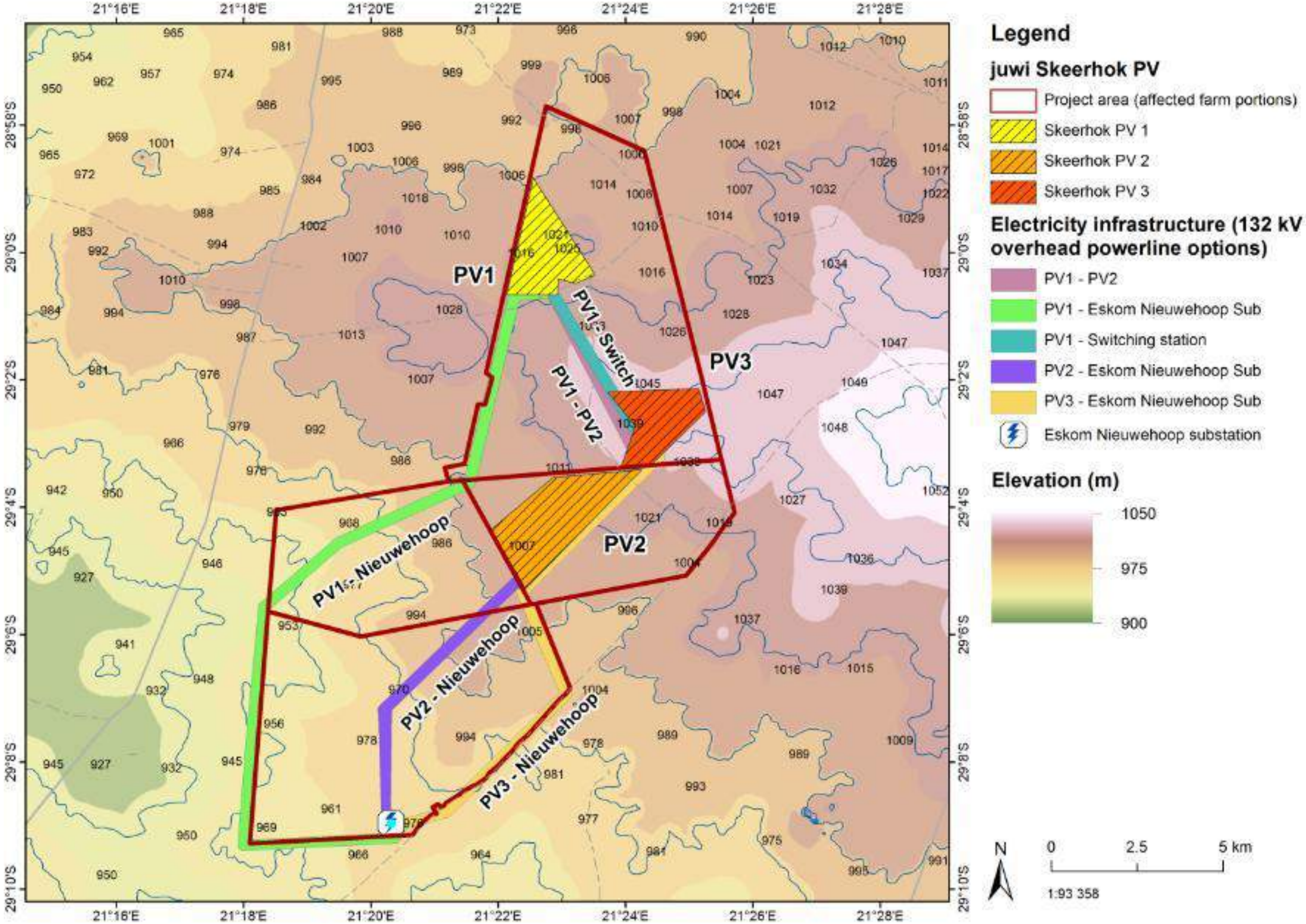

Figure 3: juwi Skeerhok PV1, PV2 and PV3, and associated electricity infrastructure connecting to the existing Eskom Nieuwehoop substation.

a)

b)

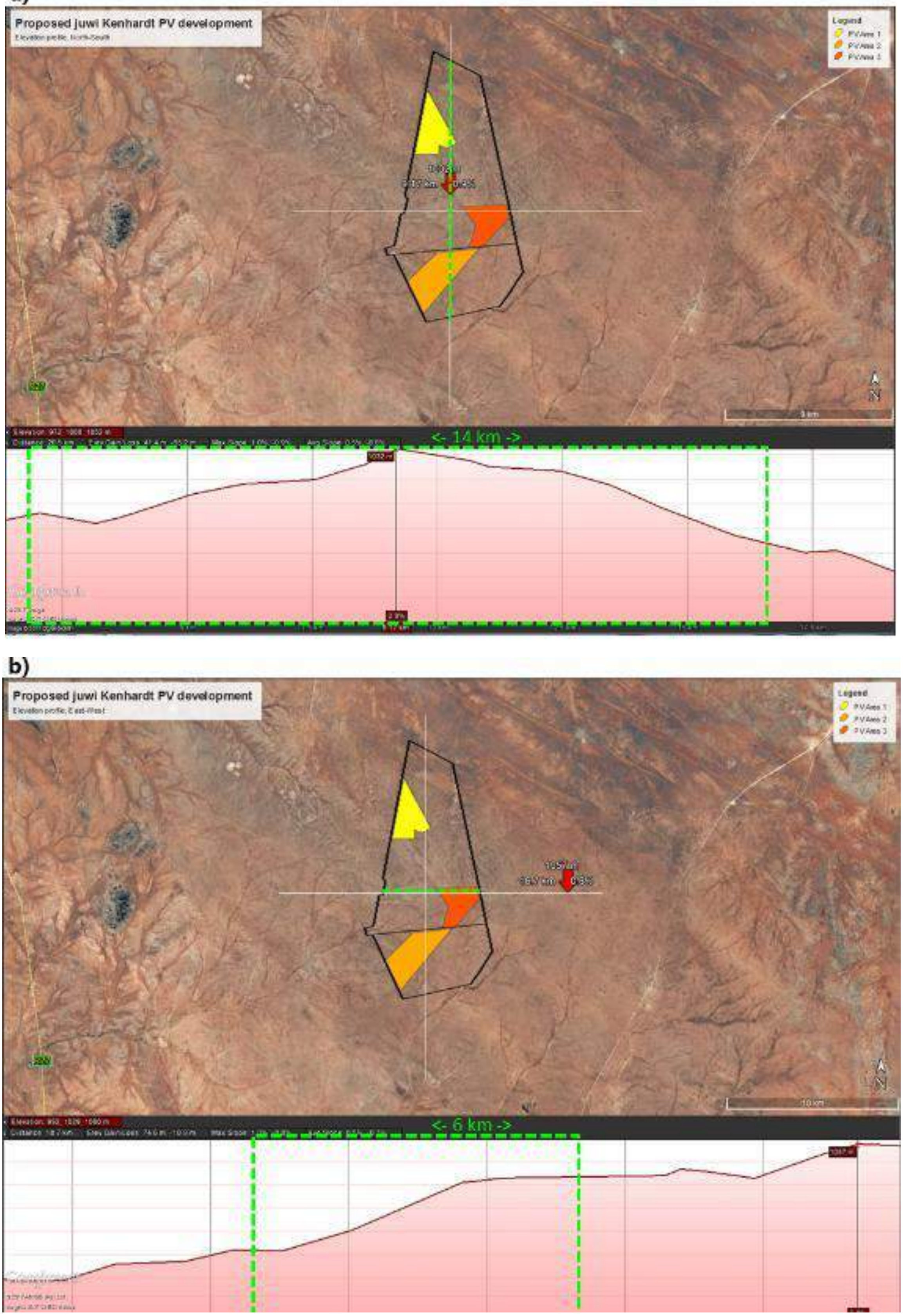

Figure 4: Image indicating the location and position of the juwi Skeerhok PV development project area in the landscape. The green dotted lines indicate the position of the project area in the landscape. There is an elevation gain of approximately a) 27 m on the north-east profile (a) and approximately 31 m on the east-west profile (b) (Google Inc., 2015).

2.3 *Infrastructure and land-use*

2.3.1 Road

The project area is situated approximately 20 km east of the R27 major provincial road and 20 km north of the R383 secondary road. The R27 connects Upington to Cape Town and may are often utilised by tourists visiting towns along the Orange River valley.

2.3.2 Rail

The south-eastern side of the project area is bordered by the Sishen-Saldanha iron ore railway line that is electrified with overhead lines (Figure 5). A gravel access road runs parallel to the railway line.

Figure 5: Photograph depicting Saldanha-Sishen iron ore railway bordering the south-eastern side of the project area (CSIR, 2016a; photo credit: Henry Holland).

2.3.3 Electricity

The project area does not currently have any high-voltage electricity infrastructure constructed on it. The closest distribution lines are situated approximately 7 km west of the project area, with the high-voltage transmission line that supplies Kenhardt with electricity more than 60 km to the south. A new high-voltage substation, Eskom Nieuwehoop, is currently being constructed just 7 km south of the project area (Figure 6; Figure 8) and will most probably have high-voltage transmission lines connecting to it in the future.

Figure 6: Photograph depicting the Eskom Nieuwehoop substation under construction (CSIR, 2016a; photo credit: Henry Holland).

2.3.4 Buildings/Structures

According to the SPOT Building Count (Eskom, 2011) there are several buildings/structures within 10 km of the project area. At this stage, these are assumed to be mostly farmsteads which are typical of a rural or pastoral environment. It is possible that existing views from these buildings/structures may be affected by the proposed juwi Skeerhok PV development.

2.4 Cultural landscape

Primary features characterising the cultural landscape include fences, water troughs and wind pumps. The sense of place may be described as a remoteness, which has been disturbed by the presence of the Saldanha-Sishen railway, Eskom Nieuwehoop Susbtation and electricity transmission lines (ASHA Consulting, 2018). No visually interesting features exist in the landscape. It is unlikely that the proposed development is visible to anyone other than local residents travelling on the gravel road next to the railway line, or inhabitants of the farms on which the juwi Skeerhok PV development is proposed.

2.5 Visual character

The landscape characteristics described in Sections 2.1 - 2.4 collectively constitute the visual character of the area (Figure 7). The short and sparse vegetation, flat terrain with wide open views characterise this remote rural / pastoral landscape. However, the Eskom Nieuwehoop Substation, along with sufficient solar resource, may be seen as a driver for renewable energy projects, specifically solar PV projects, in the Kenhardt area. A cluster of ten approved 75 MW PV developments are proposed directly towards the south-west of the proposed juwi Skeerhok

PV development. Although construction on these proposed developments has not yet commenced, it is reasonable to assume that they will be constructed in the future (5 – 10 years). Since these projects have all received EA, it is also assumed that the potential changes to the current landscape character and impacts to visual receptors have been deemed acceptable to Interested and Affected Parties (I&APs) that participated in the EIA for the approved solar PV projects.

The approval of solar PV developments and construction of high-voltage electricity infrastructure in the direct surroundings of the project area would contribute to the evident transformation of a rural / pastoral landscape towards a more industrial/electrical landscape character.

Rural / pastoral	**Scattered buildings/structures**	**Patchy grassland and low shrubland**
Saldanha-Sishen industrial railway	**Eskom Nieuwehoop Substation**	**Solar PV developments**

Figure 7: Summary of the key landscape elements that characterise the proposed juwi Skeerhok PV development project area and surrounds.

2.6 Visual receptors

The potential visual receptors that may be impacted by the proposed juwi Skeerhok PV development that have been identified in this desktop Scoping investigation mainly include:

- National protected/conservation areas;
- Residents of farms in and around the project area;
- Residents of towns within the vicinity of the project area; and
- Road users of the R27, R383 and other access roads in and around the project area.

Based on the distances of the project area from protected areas, tourist and major access routes, and the town of Kenhardt (Table 2; Figure 8) it is unlikely that the views of these potential visual receptors will be significantly adversely affected by the proposed juwi Skeerhok PV development. The greatest risk of visual impact would be to residents of farms in and around the project area.

Table 2: Potential visual receptors that may be impacted by the proposed juwi Skeerhok PV development.

Potential sensitive visual receptor	Distance and direction from project area
Residents of farms in and around the project area	17 structures are seemingly present on the proposed project area, with multiple present within 20 km of the project area. Not all of these structures are necessarily occupied. And discrepancies in the SPOT building count data may also register farm dams or kraals as buildings.
Motorists on other major access - R383	19 km south
Motorists on tourist routes - R27	20 km west
Residents of towns – Kenhardt	26 km south west
Visitors to and residents/staff of protected/conservation areas	48 km north west (Tierberg Nature Reserve)

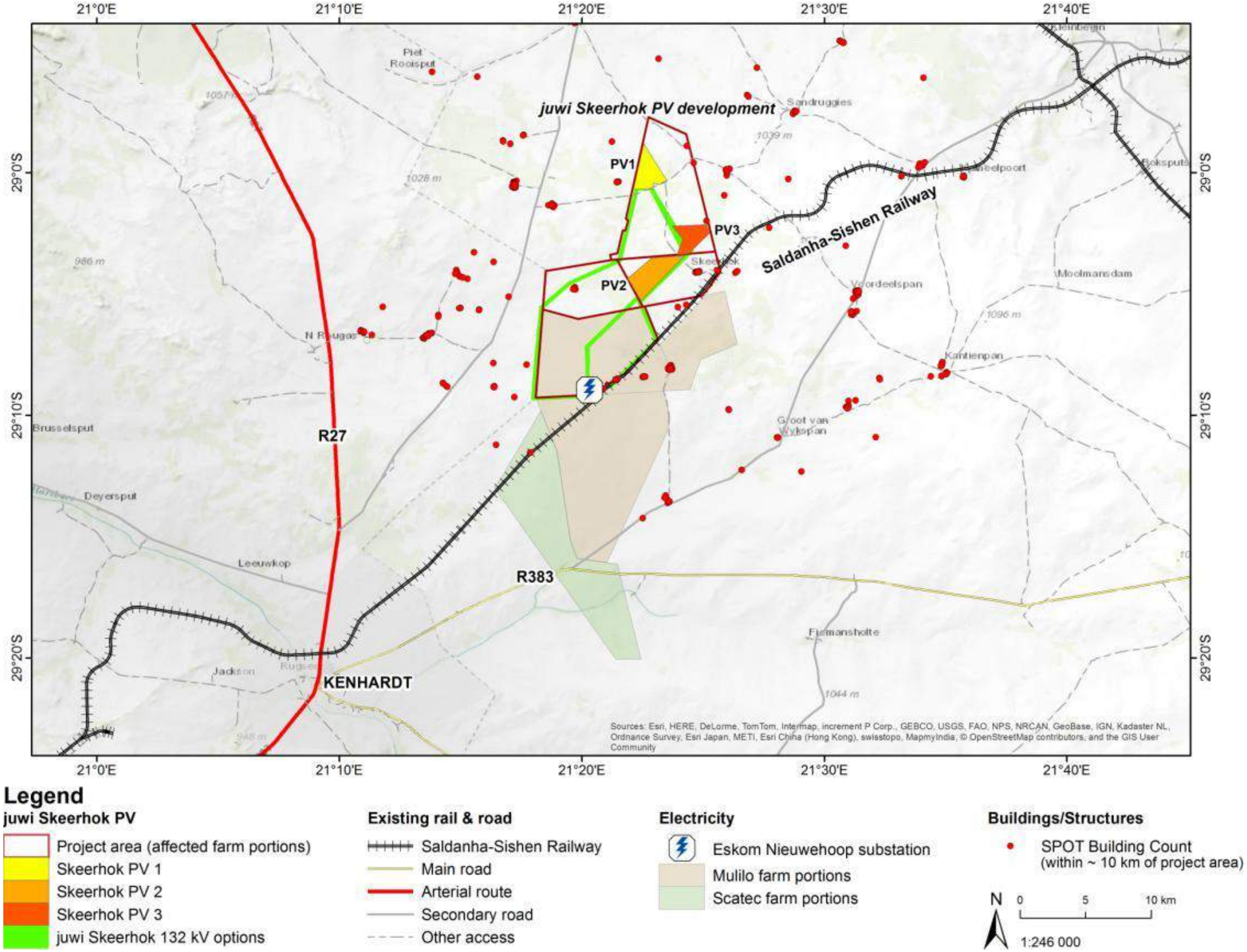

Figure 8: Summary of key landscape features and potential sensitive visual receptors in the project area and surrounds.

2.7 Sensitivity

The juwi Skeerhok PV development is situated within a Renewable Energy Development Zone (REDZ) – specifically the Upington REDZ - which was investigated as part of the SEA for wind and solar photovoltaic energy in South Africa commissioned by the DEA (DEA, 2015). The SEA included an assessment of the landscape sensitivities of features within REDZ which considered visual, scenic, aesthetic and amenity value. "Landscape sensitivity was determined as part of this study through the identification of natural, scenic and cultural resources which have aesthetic and economic value to the local community, the region, and society as a whole." (DEA, 2015: part 3, section 2, pg 2).

The landscape/visual sensitivity of the area where the juwi Skeerhok PV development is proposed, has been classified as having a low sensitivity to solar PV development (Figure 9).

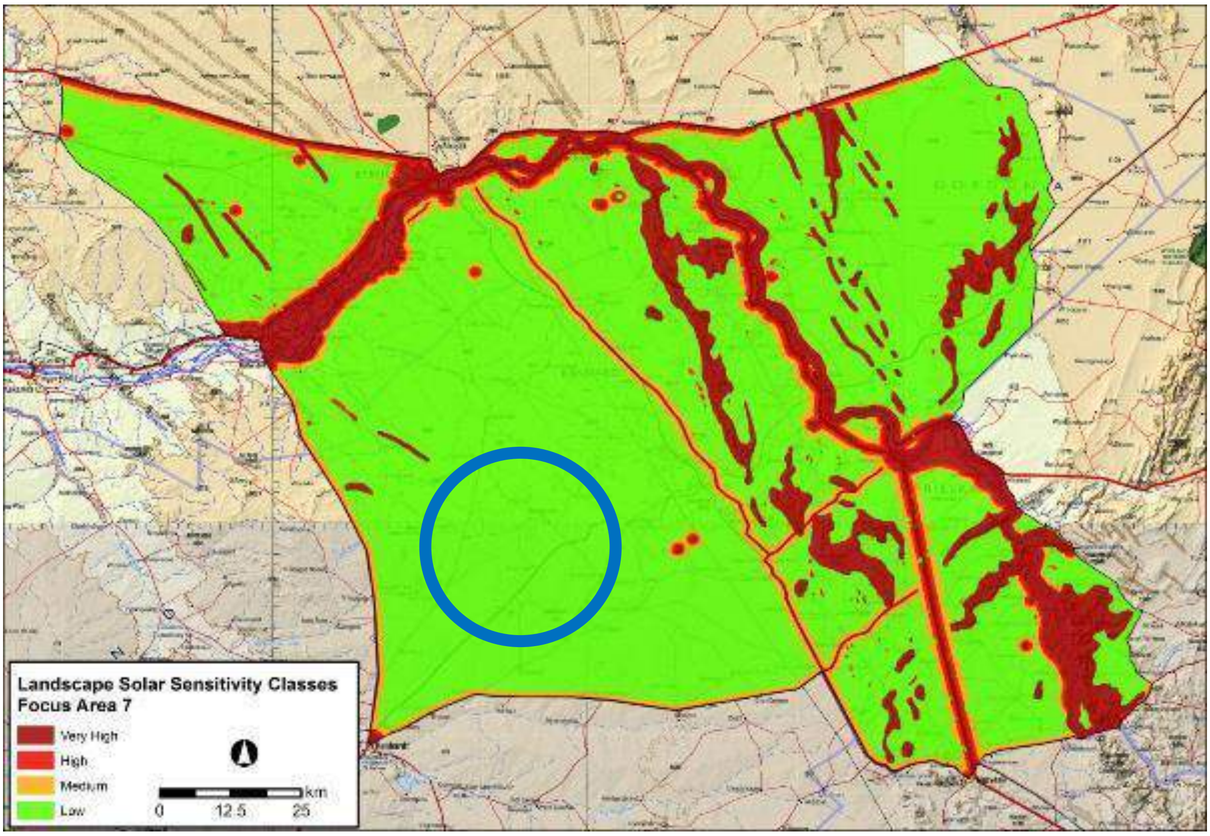

Figure 9: Landscape sensitivity of the Upington REDZ. The blue circle indicates the approximate location of the juwi Skeerhok PV development within an area classified as having low sensitivity to solar PV development (DEA, 2015).

3. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO VISUAL IMPACTS

Project aspects that may result in impacts to sensitive visual receptors mainly include established vertical infrastructure components and other features in stark contrast with the rest of the landscape (Table 3) that will be visible in the flat landscape with low growing vegetation.

Table 3: Height specifications of the juwi Skeerhok PV development infrastructure. The maximum height (i.e. 32 m) was used for the viewshed analysis.

Component	Maximum Height
SOLAR PV AREA	
Solar Panels	5 m
Operations and Management buildings	8 m
Security Fencing	3 m
Battery storage systems	8 m
ELECTRICITY INFRASTRUCTURE	
On-site collector substation	30 m
132 kV overhead power line	30 m
Telecommunication tower	32 m

The maximum height (i.e. 32 m) was used for the viewshed analysis as a worse-case scenario. However at a height of 5 m, it's not expected that the solar fields will cause significant visual impact to an observer on the ground.

4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

No specific legislation or permits pertaining to visual resources and/or the protection of scenic resources currently exists in South Africa. However, the legislation presented in Table 4 may be of relevance to scenic resources (Oberholzer et al., 2016).

Table 4: National legislation relating to the protection of scenic resources (Oberholzer et al., 2016).

<table>
<tr><th colspan="2">Instrument</th><th>Objective</th></tr>
<tr><td rowspan="2">National</td><td>National Environmental Management: Protected Areas Act, (Act 57 of 2003) (NEMA:PAA)</td><td>The Minister / MEC may restrict or regulate development in a 'protected environment' that may be inappropriate for the area given the purpose for which the area was declared (Section 5).</td></tr>
<tr><td>National Heritage Resources Act (Act 25 of 1999) (NHRA)</td><td>Includes protection of national and provincial heritage sites, as well as areas of environmental or cultural value, and proclaimed scenic routes.</td></tr>
</table>

Provincial	NEM:PAA Section 17	Local authority zoning schemes can be used to protect natural and cultural heritage resources through 'Conservation Areas', 'Heritage Overlay Zones' and 'Scenic Overlay Zones' including scenic routes.

5. IDENTIFICATION OF KEY ISSUES

5.1 Key Issues Identified During the Scoping Phase

The following impact drivers/pathways may lead to visual intrusion to the views of sensitive visual receptors:

- Clearance of vegetation for solar field, laydown areas, buildings and roads
- Increased traffic
- Night lighting
- Dust
- Veld fires
- Established infrastructure
- Cumulative effects of the abovementioned impact drivers of all proposed solar PV development in the proposed project area

The Draft Scoping Report containing the VIA input was released for a 30-day comment period from 20 September - 23 October 2017. To date, no specific comments or additional issues have been raised by I&APs specifically relating to visual impacts.

5.2 Identification of Potential Impacts

The vertical infrastructure components associated with the powerline, and potentially stark contrast of the solar field with the rest of the landscape will facilitate changes to the landscape character and impact on the views of potential sensitive visual receptors. However, the existing approvals for solar PV developments and the construction of high-voltage electricity infrastructure in the direct surroundings of the project area will establish a new status quo industrial/electrical landscape character, should they be constructed. The potential risks to sensitive visual receptors have been extensively investigated during the EIA processes for the Mulilo (CSIR, 2016a; 2015) and Scatec (CSIR, 2016b) solar PV developments (. The VIAs for these proposed developments have established the following:

- The landscape has a rural agricultural character which has been transformed by extensive stock farming and large scale infrastructure in the form of the Sishen-Saldanha ore railway line and the Eskom Nieuwehoop Substation;
- Identified sensitive visual receptors include:

- Residents and viewpoints on farms surrounding the proposed development site. These are highly sensitive visual receptors since they have an active interest in their surrounding landscape; and
  - Motorists using the R383 and the Transnet Service Road (Loop 14) adjacent to the ore railway line. Motorists are classified as low sensitivity visual receptors since they pass through the landscape and their attention is mostly focused on the road.
- Visual intrusion on the existing views of highly sensitive visual receptors will be moderate since the development will be noticed but the quality of views is already compromised by large existing structures. The significance of the impact is moderate before mitigation and low if mitigation is successful. Mitigation measures should lower the consequence of the impact from substantial to moderate and the significance of the impact to low.
- The impact of night lighting of the facility on the nightscape (during the operational phase) is likely to be negligible compared to that of the nearby substation if a lighting plan is prepared which minimises light spill onto adjacent properties and avoids glaring lights which may affect visual receptors in the surrounding landscape.
- Cumulative visual impact on sensitive visual receptors is low due to the existing and new structures which have severely limited potential scenic views in the region. Furthermore, the landscape is rapidly changing due to the introduction of large scale and highly visible rail and electrical infrastructure.
-

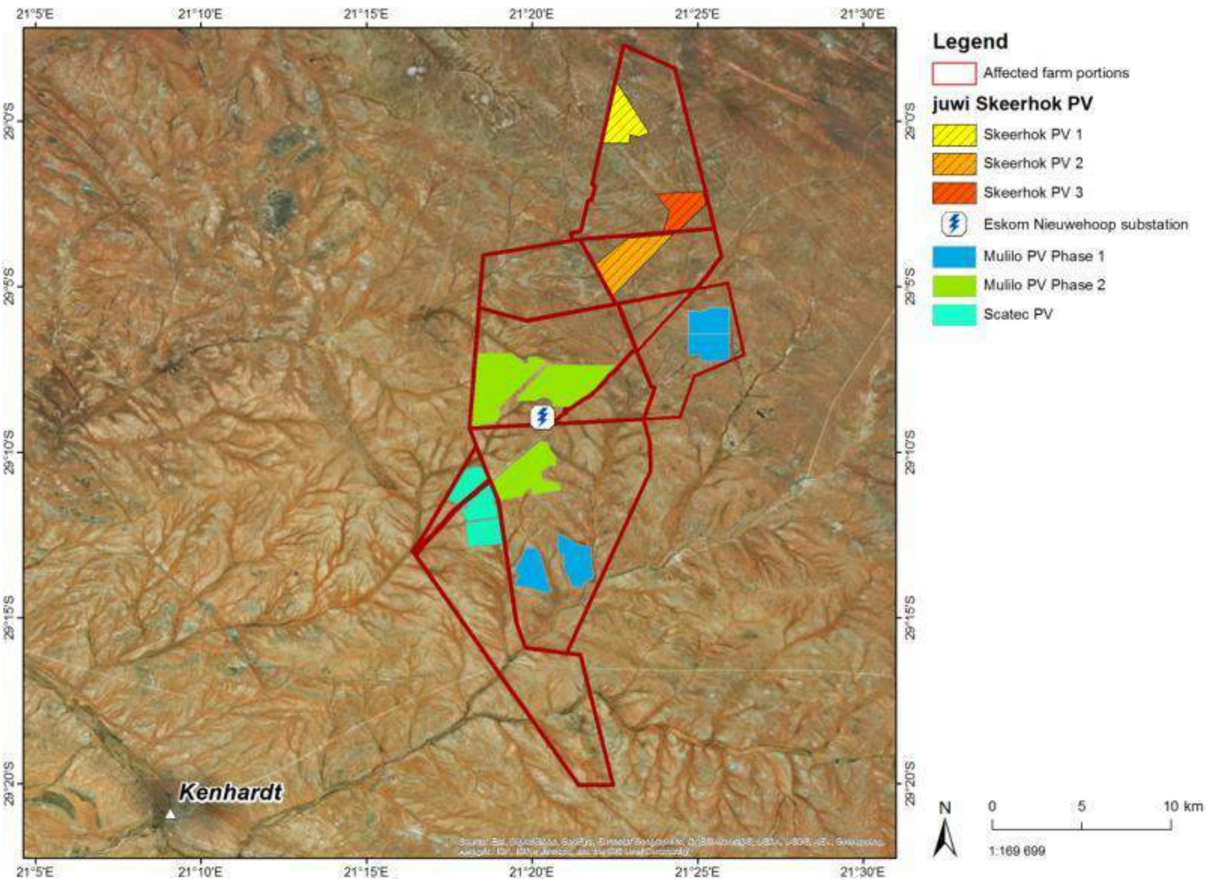

Figure 10: Solar PV developments in direct vicinity of the juwi Skeerhok PV development project area include the proposed Mulilo PV Phase 1, Mulilo PV Phase 2, and Scatec PV. These were considered for the cumulative impact assessment.

Key impact drivers that may intrude the views of sensitive visual receptors are presented in

Table 5.

Table 5: Key project aspects may result in impacts to the views of sensitive visual receptors and the associated project phase.

Impact	Impact pathway/driver	Project phase		
		Construction	Operation	Decommissioning
Visual intrusion to the views of sensitive visual receptors	Clearance of vegetation for solar field, laydown areas, buildings and roads	X		X
	Construction/decommissioning activities (all infrastructure, incl. roads, substations and transmission lines)	X		X

Increased traffic	X	X	X
Night lighting	X	X	X
Dust	X	X	X
Veld fires	X		X
Established infrastructure (vertical electricity infrastructure; contrasting solar field)		X	
Cumulative effects of the abovementioned impact drivers of all proposed solar PV development in the proposed project area	X	X	X

6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

6.1 Viewshed Analysis

A Viewshed Analysis was conducted using ArcMap 10.5 software (Esri, 2017). The height of the tallest structure on site was used to simulate 'worst case' conditions. The tallest structure proposed as part of the juwi Skeerhok PV development is the telecommunication tower at 32 m (refer to Table 3). It was assumed that potential visual receptors will have an average height of 1.7 m. The boundary of the farm portions on which the juwi Skeerhok PV development is proposed (project area) was used as the extent of the development, again to simulate 'worst case' conditions, as well as to ensure that the results of the assessment are independent of the final placement of any infrastructure on site.

The Earth's surface curves out of sight at a distance of 5 km (Wolchover, 2012). The visual assessment zone used for the Viewshed Analysis is 10 km. The gradual nature of the landscape (i.e. no steep slopes) as well as the uncomplicated, low-growing vegetation (refer to Section 2), entailed that no additional environmental structures, that may screen the development from the view of potential receptors (e.g. tall trees), were considered in the analysis.

6.1.1 Results of the Viewshed Analysis

The result of the Viewshed Analysis produces a spatial output which indicates from where in the landscape the proposed juwi Skeerhok PV development would theoretically be visible (Figure 11). Due to the distances from potentially sensitivity visual receptors, specifically motorists on the

R27 and residents of the town of Kenhardt, it is unlikely that the juwi Skeerhok PV development will negatively impact these visual receptors. The juwi Skeerhok PV development will be visible from some buildings/structures, especially those situated on site and within 2.5 km of the project area.

6.1.2 Results of the cumulative Viewshed Analysis

To determine potential cumulative impacts, the Viewshed analysis was also conducted for the proposed Mulilo, Scatec and juwi Skeerhok PV developments. The visual 'footprint' of the juwi Skeerhok PV development overlaps mostly with those of the Mulilo and Scatec developments, and the addition of the juwi Skeerhok PV development extends towards the north, even farther away from Kenhardt and the R27 road (Figure 12).

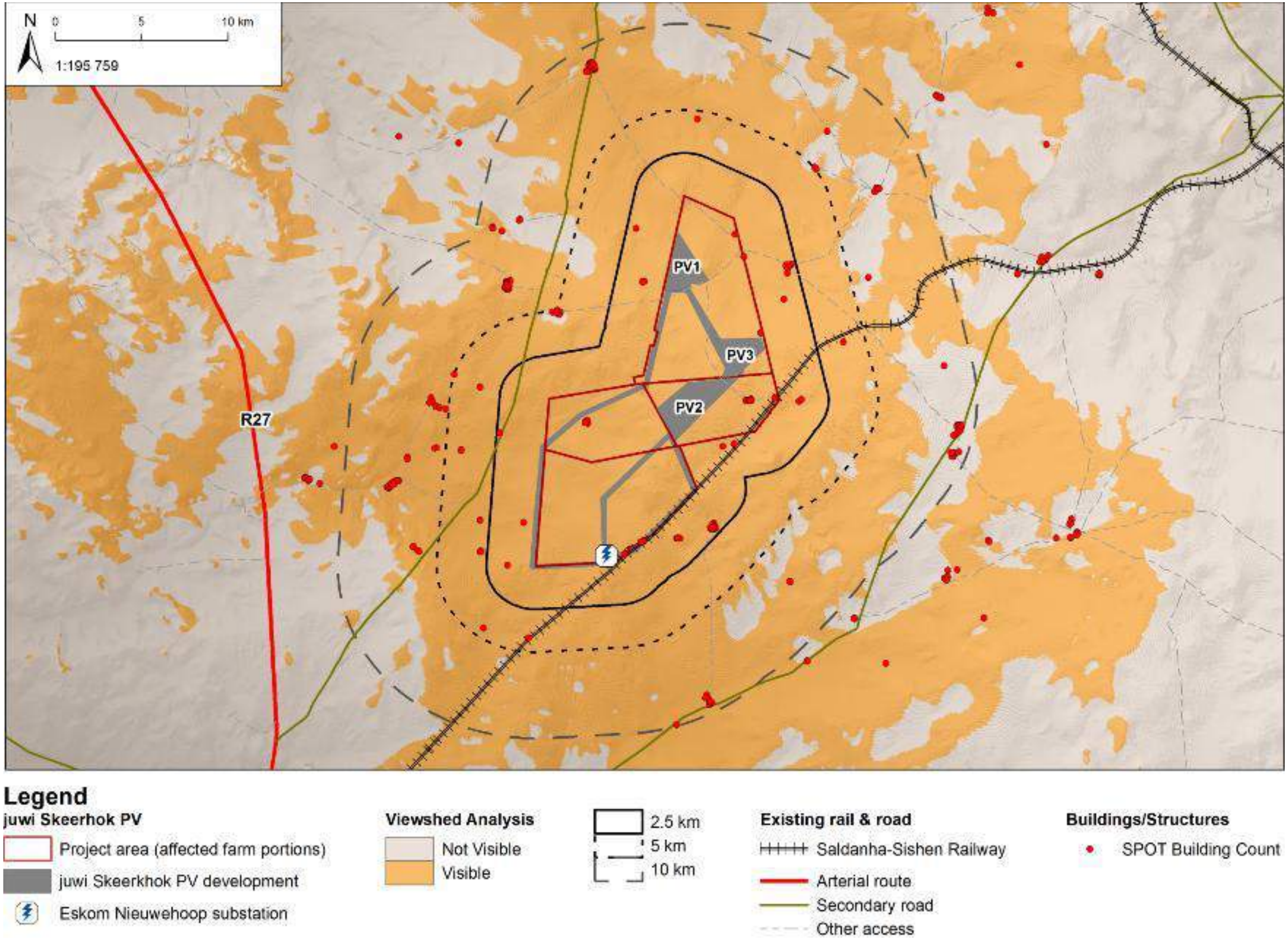

Figure 11: Viewshed Analysis for the juwi Skeerhok PV development.

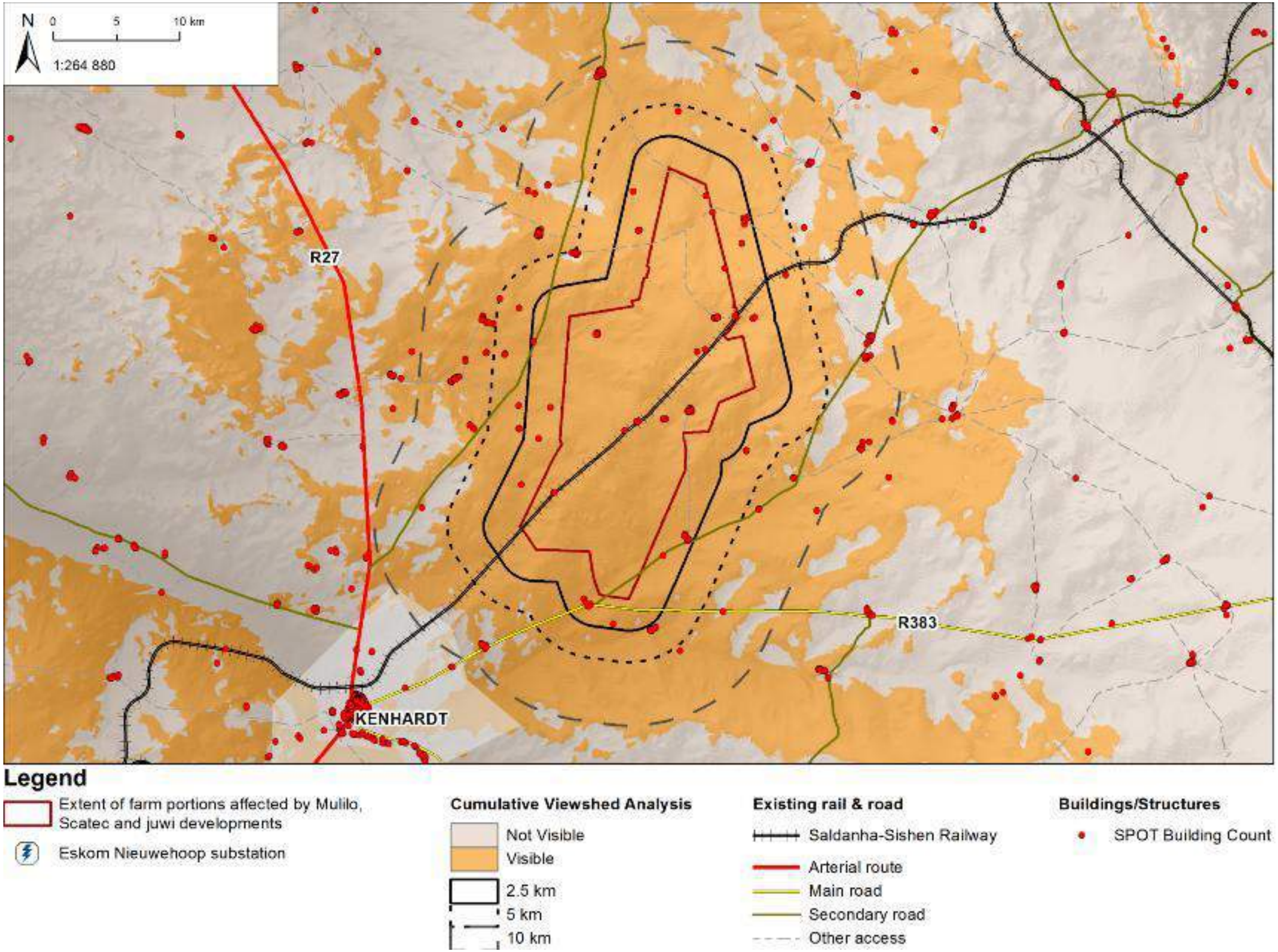

Figure 12: Cumulative Viewshed Analysis for the proposed Mulilo (CSIR, 2015 & 2016a) and Scatec (CSIR, 2016b) PV developments, together with the proposed juwi Skeerhok PV development.

6.2 Potential Impact: Clearance of vegetation

CLEARANCE OF VEGETATION

Project phases

- Construction.
- Decommissioning.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *vegetation clearance* may have a local impact. The probability of vegetation clearance is very likely, and the consequence substantial. However, the disturbance is expected to be of short-to-medium term duration – during the construction and decommissioning phases only.

Proposed mitigation measures

- Minimise the footprint of cleared vegetation.
- Where possible, laydown areas and temporary construction equipment and camps should be placed in already disturbed areas in order to minimise vegetation clearing.
- Phased clearance of the area for solar field in order to reduce the amount and duration of bare soil exposure.
- Commence with restoration of disturbed, cleared land as soon as possible.
- Maintain rehabilitated surfaces until vegetation is established, sustainable and blends well with surrounding vegetation. No new disturbance should be created during operations without approval by the Environmental Control Officer (ECO).

Significance of impact

Before mitigation	With mitigation
Moderate	Low

6.3 Potential Impact: Increased traffic

INCREASED TRAFFIC

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *increased traffic* may have a regional impact. The probability of increased traffic is likely, and the consequence moderate. The disturbance is expected to be of long-term duration – and may be expected to be most pronounced during the construction and decommissioning phases.

Proposed mitigation measures

- Plan trips so that it occurs during the day and where possible avoid construction vehicles movement on the regional road during peak time
- Demarcate and strictly control permitted roads for use and parking areas so that vehicles are limited to specific areas only.

Significance of impact

Before mitigation	With mitigation
Moderate	Low

6.4 Potential Impact: Night lighting

NIGHT LIGHTING

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *night lighting* may have a regional impact. The probability of night lighting is likely, and the consequence moderate. The disturbance is expected to be of long-term duration – and may be expected to be most pronounced during the construction and decommissioning phases.

Proposed mitigation measures

- Develop a lighting plan that:
  - documents the design, layout and technology used for lighting;
  - indicates how nightscape impacts will be minimised;
  - includes a process for quick and effective resolution of lighting complaints; and
  - Do not exceed the minimum lighting requirement for effective safety and security.
- Minimise bright light (uplighting and glare) with appropriate screening.
- Reduce light pollution through the use of low-pressure sodium light sources.
- Light fittings for security at night should reflect the light toward the ground and prevent light spill.
- Avoid light spilling beyond the project boundary.
- Install timer switches or motion sensors to control the lighting of areas that do not require constant lighting.
- Switch off lights when not in use.

Significance of impact

Before mitigation	**With mitigation**
Low	Very low

6.5 Potential Impact: Dust generation

DUST GENERATION

Project phases

- Construction.
- Operation
- Decommissioning.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *dust generation* may have a local impact. The probability of dust generation is very likely, and the consequence slight. The disturbance is expected to be of long-term duration – mainly during the construction and decommissioning phases, with potential dust generation by maintenance vehicles during operation..

Proposed mitigation measures

- Implement standard construction site dust control methods (i.e. dampening with water) as required.

Significance of impact

Before mitigation	**With mitigation**
Low	Very low

6.6 Potential Impact: Veld fires

VELD FIRES

Project phases

- Construction.
- Decommissioning.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *veld fires,* which can cause smoke and burnt vegetation, may have a local impact. The probability of veld fires is unlikely, and the consequence slight. The disturbance is expected to be of short-to-medium term duration – during the construction and decommissioning phases.

Proposed mitigation measures

- Implement fire risk reduction and containment measures, including:
  - worker awareness;
  - designated, safe smoking areas;
  - fire breaks; and
  - appropriate and working firefighting equipment.

Significance of impact

Before mitigation	**With mitigation**
Low	Very low

6.7 Potential Impact: Established Infrastructure

ESTABLISHED INFRASTRUCTURE:
VERTICAL ELECTRICAL INFRASTRUCTURE

Project phases

- Operation.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *established infrastructure* may have a regional impact. The probability of established vertical infrastructure is very likely, and the consequence moderate. The disturbance is expected to be of long-term duration – during the operation phase.

Proposed mitigation measures

- Use appropriate coloured materials for structures to blend in with the backdrop of the area where this is technically feasible and where the colour or paint will not negatively affect the functionality of the structures.
- Maintain painted features and repainted when colours fade or paint flakes.
- Choose materials, coatings and paints with minimum reflectivity where possible.
- Paint grouped structures the same colour to reduce colour contrast.
- Construct powerline towers to be similar to those already existing in the landscape, where possible.

Significance of impact

Before mitigation	**With mitigation**
Moderate	Moderate

ESTABLISHED INFRASTRUCTURE:
CONTRASTING SOLAR FIELD INFRASTRUCTURE

Project phases

- Operation.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *established infrastructure* may have a local impact. The probability of the impact of contrasting solar field infrastructure is very likely and the consequence moderate. The disturbance is expected to be of long-term duration – during the operation phase.

Proposed mitigation measures

- Use appropriate coloured materials for structures to blend in with the backdrop of the area where this is technically feasible and where the colour or paint will not negatively affect the functionality of the structures.
- Maintain painted features and repainted when colours fade or paint flakes.
- Choose materials, coatings and paints with minimum reflectivity where possible.
- Paint grouped structures the same colour to reduce colour contrast.

Significance of impact

Before mitigation	**With mitigation**
Moderate	Moderate

6.8 *Cumulative impacts*

CUMULATIVE IMPACTS

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Visual intrusion to the views of sensitive visual receptors due to *cumulative impacts of many solar PV facilities and electricity infrastructure* may have a regional impact. The probability of cumulative impact is very likely, and the consequence moderate. The disturbance is expected to be of long-term duration.

The DEA has indicated, due to the impact to the SKA, it envisages that no more than six approved renewable energy developments will be awarded preferred bidder status in this area. This VIA was based on the precautionary approach and assumes that all projects will be developed (i.e. 'worst case scenario') within the area for the cumulative impact assessment. However, the cumulative visual impact to the views of sensitive visual receptors is dependent on both *where* projects are located, and on *how many* are present. For example, several projects clustered within close proximity of each other may have an overlapping viewshed and smaller visual "footprint" than fewer projects that area spread out which may have a larger overall visual "footprint". The visual "footprint" of the juwi Skeerhok PV development largely overlap with those of the proposed Scatec and Mulilo developments, and extend the cumulative visual 'footprint' towards the north.

A cluster of ten approved 75 MW PV developments (Mulilo and Scatec) are proposed directly towards the south-west of the proposed juwi Skeerhok PV development. Although construction on these proposed developments has not yet commenced, it is reasonable to assume that they will be constructed in the future (5 – 10 years). Since these projects have all received EA, it is also assumed that the potential changes to the current landscape character and impacts to visual receptors have been deemed acceptable to I&APs that participated in the EIAs for the aforementioned approved projects. The approval of these solar PV developments and the construction of high-voltage electricity infrastructure (e.g. the Eskom Nieuwehoop Substation and associated 400kV powerlines) in the direct surroundings of the project area, together with the Saldanha-Sishen railway with overhead powerlines, contribute to the degradation of the rural pastoral character of the surrounds.

Proposed mitigation measures

- Adequate implementation of proposed mitigation measures and best practice to reduce visual impacts by all solar PV facilities in the vicinity.

Significance of impact

Before mitigation	**With mitigation**
Moderate	Moderate

7. IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommended mitigation measures, as discussed in Section 6, are collated in

Table 6 -

Table 9.

Table 6: Impact assessment summary table for the construction phase.

CONSTRUCTION PHASE Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
Clearance of vegetation for solar field, laydown areas, buildings and roads	**VISUAL INTRUSION TO VIEWS SENSITIVE OF VISUAL RECEPTORS**	Negative	Local	Short-term	Substantial	Very Likely	Moderate	Low	- Minimise the footprint of cleared vegetation. - Phased clearance of the area for solar field in order to reduce the amount and duration of bare soil exposure. - Where possible, laydown areas and temporary construction equipment and camps should be placed in already in disturbed areas in order to minimise vegetation clearing. - Commence with restoration of disturbed, cleared land as soon as possible. - Maintain rehabilitated surfaces until vegetation is established, sustainable and blends well with surrounding vegetation. No new disturbance should be created during operations without approval by the Environmental Control Officer (ECO).	**Moderate**	**Low**	4	High
Increased traffic		Negative	Local	Long-term	Moderate	Likely	High	Low	- Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak time - Demarcate and strictly control permitted roads for use and parking areas so that vehicles are limited to specific areas only	**Moderate**	**Low**	4	High
Night lighting		Negative	Regional	Long-term	Moderate	Likely	High	Low	- Develop a lighting plan that: - documents the design, layout and technology used for lighting; - indicates how nightscape impacts will be minimised; - includes a process for quick and effective resolution of lighting complaints; and - Do not exceed the minimum lighting requirement for effective safety and security. - Minimise bright light (uplighting and glare) with appropriate screening. - Reduce light pollution through the use of low-pressure sodium light sources. - Light fittings for security at night should reflect the light toward the ground and prevent light spill. - Avoid light spilling beyond the project boundary. - Install timer switches or motion sensors to control the lighting of areas that do not require constant lighting. - Switch off lights when not in use.	**Low**	**Very Low**	5	High

CONSTRUCTION PHASE Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Dust		Negative	Local	Short-term	Slight	Very Likely	Very high	Low	- Implement standard construction site dust control methods (i.e. dampening with water) as required.	**Low**	**Very Low**	5	High
Veld fires		Negative	Local	Long-term	Slight	Unlikely	Very high	Low	- Implement fire risk reduction and containment measures, including: - worker awareness; - designated, safe smoking areas; - fire breaks; and - appropriate and working firefighting equipment.	**Low**	**Very Low**	5	High

Table 7: Impact assessment summary table for the operation phase.

OPERATION PHASE Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
Increased traffic	**VISUAL INTRUSION TO VIEWS SENSITIVE OF VISUAL RECEPTORS**	Negative	Local	Long-term	Moderate	Likely	High	Low	- Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak. - Demarcate and strictly control permitted roads for use and parking areas so that vehicles are limited to specific areas only.	**Moderate**	**Low**	4	High
Night lighting		Negative	Regional	Long-term	Moderate	Likely	High	Low	- Develop a lighting plan that: - documents the design, layout and technology used for lighting; - indicates how nightscape impacts will be minimised; - includes a process for quick and effective resolution of lighting complaints; and - Do not exceed the minimum lighting requirement for effective safety and security. - Minimise bright light (uplighting and glare) with appropriate screening. - Reduce light pollution through the use of low-pressure sodium light sources. - Light fittings for security at night should reflect the light toward the ground and prevent light spill. - Avoid light spilling beyond the project boundary. - Install timer switches or motion sensors to control the lighting of areas that do not require constant lighting. - Switch off lights when not in use.	**Low**	**Very Low**	5	High
Established infrastructure • **Vertical electrical infrastructure** • **Contrasting solar field infrastructure**		Negative	Local	Long-term	Moderate	Very Likely	Moderate	Low	- Use appropriate coloured materials for structures to blend in with the backdrop of the area where this is technically feasible and where the colour or paint will not negatively affect the functionality of the structures. - Maintain painted features and repainted when colours fade or paint flakes. - Choose materials, coatings and paints with minimum reflectivity where possible. - Paint grouped structures the same colour to reduce colour contrast. - Construct powerline towers to be similar to those already existing in the landscape, where possible.	**Moderate**	**Moderate**	4	High

Table 8: Impact assessment summary table for the decommissioning phase.

DECOMMISSIONING PHASE Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
Clearance of vegetation for solar field, laydown areas, buildings and roads	VISUAL INTRUSION TO VIEWS SENSITIVE OF VISUAL RECEPTORS	Negative	Local	Short-term	Substantial	Very Likely	Moderate	Low	- Minimise the footprint of cleared vegetation. - Phased clearance of the area for solar field in order to reduce the amount and duration of bare soil exposure. - Where possible, laydown areas and temporary construction equipment and camps should be placed in already in disturbed areas in order to minimise vegetation clearing. - Commence with restoration of disturbed, cleared land as soon as possible. - Maintain rehabilitated surfaces until vegetation is established, sustainable and blends well with surrounding vegetation. No new disturbance should be created during operations without approval by the Environmental Control Officer (ECO).	**Moderate**	**Low**	4	High
Increased traffic		Negative	Local	Long-term	Moderate	Likely	High	Low	- Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak time. - Demarcate and strictly control permitted roads for use and parking areas so that vehicles are limited to specific areas only	**Moderate**	**Low**	4	High
Night lighting		Negative	Regional	Long-term	Moderate	Likely	High	Low	- Develop a lighting plan that: - documents the design, layout and technology used for lighting; - indicates how nightscape impacts will be minimised; - includes a process for quick and effective resolution of lighting complaints; and - Do not exceed the minimum lighting requirement for effective safety and security. - Minimise bright light (uplighting and glare) with appropriate screening. - Reduce light pollution through the use of low-pressure sodium light sources. - Light fittings for security at night should reflect the light toward the ground and prevent light spill. - Avoid light spilling beyond the project boundary. - Install timer switches or motion sensors to control the lighting of areas that do not require constant lighting. - Switch off lights when not in use.	**Low**	**Very Low**	5	High
Dust		Negative	Local	Short-term	Slight	Very Likely	Very high	Low	- Implement standard construction site dust control methods (i.e. dampening with water) as required.	**Low**	**Very Low**	5	High

DECOMMISSIONING PHASE Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Veld fires		Negative	Local	Long-term	Slight	Unlikely	Very high	Low	- Implement fire risk reduction and containment measures, including: - worker awareness; - designated, safe smoking areas; - fire breaks; and - appropriate and working firefighting equipment.	**Low**	**Very Low**	5	High

Table 9: Impact assessment summary table for cumulative impacts.

CUMULATIVE Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Cumulative Impacts	**VISUAL INTRUSION TO VIEWS SENSITIVE OF VISUAL RECEPTORS**	Neutral	Regional	Long-term	Moderate	Very Likely	High	Low	- Adequate implementation of proposed mitigation measures and best practice to reduce visual impacts by all solar PV facilities in the vicinity.	**Moderate**	**Moderate**	4	High

8. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

The mitigation and management recommendations outlined in Section 6 should be included in the EMPr. Implementation of the recommended mitigation and management actions, for all development phases, should be monitored and reported on by the ECO. Furthermore, it important to educate workers on-site and raise awareness to the issues and required actions highlighted in this report.

9. CONCLUSION AND RECOMMENDATIONS

This document constitutes the VIA as part of the EIA, and draws on VIAs conducted for other solar PV developments in the direct vicinity of the juwi Solar PV development.

The changes to the landscape character that may be brought about by the proposed juwi Skeerhok PV development can have impacts on the views of potential sensitive visual receptors. However, the existing approvals for solar PV developments, the construction of high-voltage electricity infrastructure in the direct surroundings of the project area, and the Saldanha-Sishen railway with overhead powerlines entails that an industrial/electrical character has encroached on the rural / pastoral landscape. Furthermore, the landscape sensitivity, as determined by the SEA which informed the REDZ, is classified as low from a visual, scenic, aesthetic and amenity perspective.

A Viewshed Analysis was conducted using ArcMap 10.5 software (Esri, 2017). The height of the tallest structure on site, and the boundary of the farm portions on which the juwi Skeerhok PV development is proposed was used as the extent of the development, was used to simulate 'worst case' conditions. Due to the flat terrain the zone of visibility is extensive. However, limited potentially sensitive visual receptors exist.

The impact of visual intrusion to the views of potential sensitive visual receptors is expected to be moderate to low (before mitigation) and moderate to very low with the effective implementation of the mitigation and management actions outlined in this report. The impacts vary depending on the impact pathway being assessed.

Due to the existing landscape character, and foreseeable trend of renewable energy and associated electricity infrastructure development in the area, the cumulative impacts to the views of potential sensitive visual receptors are expected to be moderate, if all solar PV developments implement proposed mitigation measures and best practice to reduce visual impacts.

Based on the findings in this VIA it has been concluded that the juwi Skeerhok PV development, including its associated electricity infrastructure, from a visual, scenic, aesthetic and amenity perspective, may receive EA with adherence to the mitigation and management measures set out in this report.

10. REFERENCES

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Established 1952

Council for Scientific and Industrial Research
PO Box 320
Stellenbosch
7599

Your reference
Our reference 14941
Date 07 February 2018

ATTENTION: Kelly Stroebel

Dear Kelly

EXTERNAL PEER REVIEW OF THE VISUAL IMPACT ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF THREE 100 MW SOLAR PHOTOVOLTAIC FACILITIES (SKEERHOK PV 1, PV 2, & PV 3) NEAR KENHARDT IN THE NORTHERN CAPE PROVINCE

The Council for Scientific and Industrial Research (CSIR) was appointed by juwi Renewable Energies to undertake the Environmental Impact Assessment (EIA) for the proposed development of three 100 MW Solar Photovoltaic (PV) Facilities and the associated infrastructure near Kenhardt in the Northern Cape Province. As part of the EIA process an in-house Visual Impact Assessment (VIA) was undertaken by the CSIR, and as a result this VIA report needs to be reviewed by an external visual specialist.

This letter outlines the findings of the external peer review which was undertaken by SiVEST SA (Pty) Ltd for the following report:

- Snyman-van der Walt, L. 2018. Visual Impact Assessment: Scoping and Environmental Assessment for the proposed development of three 100 MW Solar Photovoltaic Facilities (Skeerhok PV 1, PV 2, PV 3) near Kenhardt in the Northern Cape Province. CSIR: Stellenbosch. (Draft VIA_v2_juwvi Skeerhok_25Jan2018)

1. Review Summary

The review was based on SiVEST's experience and knowledge of undertaking VIAs, the requirements stipulated in Appendix 6 of the of the EIA Regulations 2014 (as amended) and the requirements stipulated by the Department of Environmental Affairs (DEA) as outlined in the table below.

DEA Peer Review Requirements	Peer Reviewer Response
A CV clearly showing expertise of the peer reviewer.	A CV of the peer reviewer is attached to this letter.
Acceptability of the terms of reference.	The terms of reference is considered acceptable, however the limitations of undertaking a desktop assessment should be noted within the report.

Is the methodology clearly explained and acceptable.	The methodology is acceptable, however the limitations of undertaking a desktop assessment should be noted within the report. In addition, the methodology should also explain the sensitivity assessment, assessment of impacts and identification of management actions.
Evaluate the validity of the findings.	Most of the findings are considered to be valid however the following is noted and should be addressed: ▪ SiVEST disagrees with the statement that "*the existing landscape has an industrial / electrical character*". This should be reworded to note that the existing landscape has a rural / pastoral visual character which has been transformed by existing infrastructure. ▪ The impacts of the electrical infrastructure and solar facility should not be rated together, but should be assessed separately. ▪ SiVEST disagrees that the potential impact of the *Established Infrastructure* can be rated as *low* with the implementation of mitigation measures. This should be changed to be *medium*. ▪ SiVEST disagrees that the potential *Cumulative Impact* can be rated as *low* with the implementation of mitigation measures. This should be changed to be *medium*.
Discuss the suitability of the mitigation measures and recommendations.	The mitigation measures and recommendations described are acceptable.
Identify any short comings and mitigation measures to address the short comings.	Additional mitigation measures have been recommended. These include: ▪ Where possible, laydown areas and temporary construction equipment and camps should be placed in already in disturbed areas in order to minimise vegetation clearing. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.
Evaluate the appropriateness of the reference literature.	The reference literature is considered to be appropriate. It should just be ensured that all literature is referenced in the text and included within the list of references.
Indicate whether a site-inspection was carried out as part of the peer review.	No site visit was undertaken for the peer review.
Indicate whether the article is well-written and easy to understand	The report supplied to SiVEST is considered well written and easy to understand.

General recommendations for improving the report were also provided as comments within the report and these include but are not limited to the following:

- Inclusion of a brief project description section with a map showing the layout of the proposed PV facility and power line routes.
- Section 2 *Description of the Affected Environment* should be more applicable to the visual environment.

- Inclusion of a visual character and cultural landscape section that clarifies the visual character within the area.
- Define the visual assessment zone / affected project area.

SiVEST is of the opinion that overall the VIA report compiled by the CSIR was unbiased and fair and that the methodology used was transparent. Provided the suggested changes are made to the report the findings are considered valid and the mitigation measures are appropriate.

Should you have any queries or comments regarding the peer review, please do not hesitate to contact Andrea Gibb on 011 798 0600.

Yours sincerely

Andrea Gibb
Senior Manager
SiVEST Environmental

encl: CV of Peer Reviewer

CURRICULUM VITAE

Name	Andrea Gibb
Profession	Environmental Practitioner
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Senior Manager Environmental Division
Years with Firm	7 Years
Date of Birth	29 January 1985
ID Number	8501290020089
Nationality	South African

Education

Matriculated 2003, Full Academic Colours, Northcliff High School, Johannesburg, South Africa

Professional Qualifications

BSc (Hons) Environmental Management (University of South Africa 2008-2010)
Coursework: Project Management, Environmental Risk Assessment and Management, Ecological and Social Impact Assessment, Fundamentals of Environmental Science, Impact Mitigation and Management, Integrated Environmental Management Systems & Auditing, Integrated Environmental Management, Research Methodology.
Research Proposal: Golf Courses and the Environment

BSc Landscape Architecture (with distinction) (University of Pretoria 2004-2007)
Coursework: Core modules focused on; design, construction, environmental science, applied sustainability, shifts in world paradigms and ideologies, soil and plant science, environmental history, business law and project management.
Awards: Cave Klapwijk prize for highest average in all modules in the Landscape Architecture programme, ILASA book prize for the best Landscape Architecture student in third year design, Johan Barnard planting design prize for the highest distinction average in any module of plant science.

ArcGIS Desktop 1 (ESRI South Africa December 2010)
Environmental Impact Assessment (EIA) 2014 Legal Regime Workshop (Imbewu 2015)

Employment Record

Aug 2010 – to date	SiVEST SA (Pty) Ltd: Environmental Practitioner
Jan 2008 – July 2010	Cave Klapwijk and Associates: Environmental Assistant and Landscape Architectural Technologist
Feb 2006 – Dec 2006	Cave Klapwijk and Associates: Part time student

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Fluent	Fluent	Fluent

Key Experience

Specialising in the field of Environmental Management and Visual Assessment.

Andrea has 10 years' work experience and is employed by SiVEST Environmental as the Senior Manager heading up the Johannesburg office. She is primarily involved with managing large scale multifaceted Environmental Impact Assessments (EIAs) and Basic Assessments (BAs) (incl. Amendment Applications), undertaken according to International Finance Corporation (IFC) standards and Equator Principles, within the renewable energy generation and electrical distribution sectors. Andrea has extensive experience in overseeing public participation and stakeholder engagement processes and has also been involved in environmental feasibility and sensitivity analyses. She further specialises in undertaking and overseeing visual impact and landscape character assessments.

Skills include:

- Project Management (MS Project)
- Environmental Impact Assessment (EIA)
- Basic Assessment (BA)
- Public Participation Management
- Visual Impact Assessment (VIA)
- Landscape Assessment
- Strategic Environmental Planning
- Documentation / Quality Control
- Project Level Financial Management

Projects Experience

Aug 2010 – to date

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) / BASIC ASSESSMENT (BA)

- EIA for the proposed construction of the Grasskoppies Wind Farm near Loeriesfontein, Northern Cape Province.
- EIA for the proposed construction of the Ithemba Wind Farm near Loeriesfontein, Northern Cape Province.
- EIA for the proposed construction of the Hartebeest Leegte Wind Farm near Loeriesfontein, Northern Cape Province.
- EIA for the proposed construction of the !Xha Boom Wind Farm near Loeriesfontein, Northern Cape Province.
- Application for an Amendment of the Environmental Authorisation (EA) for the proposed construction of the Droogfontein II PV Plant near Kimberley, Northern Cape Province.
- Amendment and Resubmission of the FBAR for the Eskom Longdown Substation and Vyeboom 66kV Turn-in Power Lines near Villiersdorp, Western Cape Province.
- BA for the proposed construction of the Leeuwbosch Power Plant near Leeudoringstad, North West Province.
- BA for the proposed construction of the Wildebeestkuil Power Plant near Leeudoringstad, North West Province.
- EIA for the proposed development of the Tlisitseng 1 and 2 75MW Solar Photovoltaic (PV) Energy Facilities near Lichtenburg, North West Province.
- EIAs for the proposed development of the Sendawo 1, 2, and 3 75MW Solar PV Energy Facilities near Vryburg, North West Province.
- EIA for the proposed construction of the Sendawo Common Collector Substation and power line near Vryburg, North West Province.
- EIA for the proposed construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province.

- Application for an Amendment of the Environmental Authorisation (EA) for the proposed construction of the 100MW Limestone Solar Thermal Power Project near Danielskuil, Northern Cape Province.
- Applications for the Amendment of the EAs for the proposed construction of three 75MW solar PV facilities near Prieska, Northern Cape Province.
- Applications for the Amendment of the EAs for the proposed construction of the 75MW Arriesfontein and Wilger Solar Power Plants near Danielskuil, Northern Cape Province.
- Completion and submission of the final EIA report for the proposed Rooipunt PV Solar Power Park Phase 1 and proposed Rooipunt PV Solar Power Park Phase 2 near Upington, Northern Cape Province.
- EIAs for the proposed construction of the Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province.
- EIA for the proposed construction of the Nokukhanya 75MW Solar PV Power Plant near Dennilton, Limpopo Province.
- EIA for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province.
- BA for the proposed construction of two 132kV power lines and associated infrastructure from the Redstone Solar Thermal Power Project site to the Olien MTS near Lime Acres, Northern Cape Province.
- BA for the proposed construction of two 132kV power lines and associated infrastructure from Silverstreams DS to the Olien MTS near Lime Acres, Northern Cape Province.
- BA for the proposed Construction of the SSS1 5MW Solar PV Plant on the Western Part of Portion 6 (Portion of Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province.
- BA for the proposed Construction of the SSS2 5MW Solar PV Plant on the Eastern Part of Portion 6 (Portion of Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province.
- BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the proposed Bophirima Substation to the existing Schweizer-Reneke Substation, North West Province.
- BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the Mookodi Substation to the existing Magopela Substation, North West Province.
- BA for the proposed Mookodi Integration Phase 2: Proposed Construction of the Mookodi - Ganyesa 132kV power line, proposed Ganyesa Substation and Havelock LILO, North West Province.
- Amendment of the Final Environmental Impact Report for the Proposed Mookodi 1 Integration Project near Vryburg, North West Province.
- BA for the proposed 132kV power line and associated infrastructure for the proposed Redstone Solar Thermal Energy Plant near Lime Acres, Northern Cape Province.
- BA for the proposed construction of a 132kV power line and substation associated with the 75MW PV Plant on the Farm Droogfontein (PV 3) in Kimberley, Northern Cape Province.
- BA for the proposed establishment of a Learning and Development Retreat and an Executive Staff and Client Lodge at Mogale's Gate, Gauteng Province.
- Application for an Amendment of the EA to increase the output of the proposed 40MW PV Facility on the farm Mierdam to 75MW, Northern Cape Province.
- BA for the proposed construction of a power line and substation near Postmasburg, Northern Cape Province.
- BA for the proposed West Rand Strengthening Project – 400kV double circuit power line and substation extension in the West Rand, Gauteng.
- EIA for the proposed construction of a wind farm and PV plant near Prieska, Northern Cape Province.
- Public Participation assistance as part of the EIA for the proposed Thyspunt Transmission Lines Integration Project – EIA for the proposed construction of 5 x 400kV transmission power lines between Thyspunt to Port Elizabeth, Eastern Cape Province.
- EIA assistance for the proposed construction of three Solar Power Plants in the Northern Cape Province.

- Public Participation as part of the EIA for the proposed Delareyille Kopela Power Line and Substation, North West Province.
- Public Participation as part of the EIA for the Middelburg Water Reclamation Project, Mpumalanga Province.

VISUAL IMPACT ASSESSMENT (VIA)

- VIA for the proposed construction of the Grasskoppies Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed construction of the Ithemba Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed construction of the Hartebeest Leegte Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed construction of the !Xha Boom Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed Phezukomoya Wind Energy Facility near Noupoort, Northern Cape Province.
- VIA for the proposed San Kraal Wind Energy Facility near Noupoort, Northern Cape Province
- VIA for the proposed Assagay Valley Mixed Use Development, KwaZulu-Natal Province.
- VIA for the proposed Kassier Road North Mixed Use Development, KwaZulu-Natal Province.
- VIA for the proposed construction of a power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces.
- VIA (Scoping Phase) for the proposed construction of a 3000MW Wind Farm and associated infrastructure near Richmond, Northern Cape Province.
- VIA for the proposed construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province.
- VIA for the proposed construction of a power line and associated infrastructure for the proposed Rooipunt Solar Thermal Power Plant near Upington, Northern Cape Province.
- VIAs (Impact Phase) for the proposed construction of the Sendawo 1, 2 and 3 solar PV energy facilities near Vryburg, North West Province.
- VIA (Impact Phase) for the proposed construction of the Sendawo substation and associated power line near Vryburg, North West Province.
- VIAs (Impact Phase) for the proposed construction of the Tlisitseng 1 and 2 solar PV energy facilities near Lichtenburg, North West Province.
- VIA for the proposed construction of the Tlisitseng substation and associated 132kV power line near Lichtenburg, North West Province.
- VIA (Scoping Phase) for the proposed construction of the Sendawo substation and associated power line near Vryburg, North West Province.
- VIA (Scoping Phase) for the proposed construction of the Sendawo 1, 2 and 3 solar PV energy facilities near Vryburg, North West Province.
- VIA (Scoping Phase) for the proposed construction of the Tlisitseng 1 and 2 solar PV energy facilities near Lichtenburg, North West Province.
- Visual recommendations for Phase 1 of the proposed Renishaw Estate Mixed Use Development, KwaZulu-Natal Province.
- VIA for the proposed Tinley Manor South Banks Development, KwaZulu-Natal Province.
- VIAs (Impact Phase) for the proposed construction of the Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province.
- VIA (Scoping Phase) for the proposed construction of the Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province.
- Visual Due Diligence Report for the possible rapid rail extensions to the Gauteng network, Gauteng Province.
- Visual Status Quo and Constraints Report for the possible rapid rail extensions to the Gauteng network, Gauteng Province.
- VIA for the proposed agricultural components of the Integrated Sugar Project in Nsoko, Swaziland.

- VIA for the proposed Tweespruit to Welroux power lines and substation, Free State Province.
- VIA for the proposed construction of the Nokukhanya 75MW Solar PV Power Plant near Dennilton, Limpopo Province.
- VIA (Impact Phase) for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed amendment to the authorised power line route from Hera Substation to Westgate Substation, Gauteng Province.
- VIA (Impact Phase) for the Eastside Junction Mixed Use Development near Delmas, Mpumalanga Province.
- VIA for the proposed construction of two 132kV power lines and associated infrastructure from the Redstone Solar Thermal Power Project site to the Olien MTS near Lime Acres, Northern Cape Province.
- VIA for the proposed construction of two 132kV power lines and associated infrastructure from Silverstreams DS to the Olien MTS near Lime Acres, Northern Cape Province.
- VIA (Scoping Phase) for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed Rorqual Estate Development near Park Rynie on the South Coast of KwaZulu Natal.
- VIA (Scoping Phase) for the proposed construction of a Coal-fired Power Station, Coal Mine and Associated Infrastructure near Colenso, KwaZulu-Natal Province.
- VIA for the proposed Mookodi Integration Phase 2: Proposed Construction of the Mookodi - Ganyesa 132kV power line, proposed Ganyesa Substation and Havelock LILO, North West Province.
- VIA for the proposed construction of the Duma transmission substation and associated Eskom power lines, KwaZulu-Natal Province.
- VIA for the proposed construction of the Madlanzini transmission substation and associated Eskom power lines, Mpumalanga Province.
- VIA for the proposed rebuild of the 88kV power line from Normandie substation to Hlungwane substation, Mpumalanga and KwaZulu-Natal Provinces.
- VIA for the proposed construction of the Nzalo transmission substation and associated Eskom power lines, KwaZulu-Natal Province.
- VIA for the proposed construction of the Sheepmoor traction substation with two 20MVA transformer bays and a new associated 88kV turn-in power line, Mpumalanga Province.
- VIA for the proposed rebuild of the 88kV power line from Uitkoms substation to Antra T-off, Mpumalanga Province.
- VIA for the proposed rebuild of the 88kV power line from Umfolozi substation to Eqwasha traction substation including an 88kV turn-in power line to Dabula traction substation, Kwazulu-Natal Province.
- VIA for the proposed construction of the new 88/25kV Vryheid traction substation with two 20MVA transforma bays and a new associated 88kV turn-in power line, KwaZulu-Natal Province.
- VIA for the proposed construction of a 132kV power line and substation associated with the 75MW PV Plant on the Farm Droogfontein (PV 3) in Kimberley, Northern Cape Province.
- VIA (Impact Phase) for the proposed Construction of a Solar PV Power Plant near De Aar, Northern Cape Province.
- VIA for the (Impact Phase) proposed Construction of the Renosterberg Wind Farm near De Aar, Northern Cape Province.
- VIA for the (Impact Phase) proposed Construction of the Renosterberg Solar PV Power Plant near De Aar, Northern Cape Province.
- VIA for the proposed construction of a 132kV power line for the Redstone Thermal Energy Plant near Lime Acres, Northern Cape Province.
- VIA for the proposed Mookodi Integration phase 2 132kV power lines and Ganyesa substation near Vryburg, North West Province.
- VIA for the proposed 132kV power lines associated with the PV Plants on Droogfontein Farm near Kimberley, Northern Cape Province.
- VIA (Scoping phase) for the Eastside Junction Mixed Use Development near Delmas, Mpumalanga Province.

- VIA for the proposed development of a learning and development retreat and an executive and staff lodge at Mogale's Gate, Gauteng Province.
- VIA for the proposed construction of a substation and 88kV power line between Heilbron (via Frankfort) and Villiers, Free State Province.
- Visual Status Quo Assessment for the Moloto Development Corridor Feasibility Study in the Gauteng Province, Limpopo Province and Mpumalanga Province.
- VIA the West Rand Strengthening Project – 400kV double circuit power line and substation extension in the West Rand, Gauteng.
- VIA for the proposed construction of a wind farm and solar photovoltaic plant near Loeriesfontein, Northern Cape Province.
- Visual sensitivity mapping exercise for the proposed Mogale's Gate Expansion, Gauteng.
- VIA (Scoping Phase) for the proposed Renosterberg Solar PV Power Plant and Wind Farm near De Aar, Northern Cape Province.
- Scoping level VIAs for the proposed construction of three Solar Power Plants in the Northern Cape Province.
- VIAs for the Spoornet Coallink Powerline Projects in KZN and Mpumalanga.
- Visual Constraints Analysis for the proposed establishment of four Wind Farms in the Eastern and Northern Cape Province.
- VIA (Scoping Phase) for the proposed development of a solar energy facility in De Aar, Northern Cape.
- VIA (Scoping Phase) for the proposed development of a solar energy facility in Kimberley, Northern Cape.

STRATEGIC ENVIRONMENTAL PLANNING

- Assistance with the Draft Environmental Management Framework for the Mogale City Local Municipality, Gauteng Province.
- Sensitivity Negative Mapping Analysis for the proposed Mogale's Gate Development, Gauteng Province.

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX N:

1. Soils and Agricultural Impact Statement
2. Traffic Impact Statement
3. Social Impact Statement

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX N1:

Soils and Agricultural Impact Statement

Statement prepared by:

CSIR – Environmental Management Services
PO Box 320
Stellenbosch, 7599
South Africa

Statement reviewed by:

Johann Lanz – Soil Scientist
P.O. Box 6209
Stellenbosch, 7599
South Africa

December 2017

Cover letter: Review of Soils and Agricultural Impact Statement

I hereby confirm that I have reviewed the Soils and Agricultural Impact Statement for the Skeerhok solar energy projects, which was prepared by the CSIR, and agree with its contents, conclusions and recommendations.

Johann Lanz (Pri.Sci.Nat)

26/01/2018

CONTENTS

Tables

Figures

SOILS AND AGRICULTURAL POTENTIAL IMPACT STATEMENT

1 INTRODUCTION

juwi Renewable Energies (PTY) Ltd is proposing to develop three 100 Megawatt (MW) Solar Photovoltaic (PV) power generation facilities and associated electrical infrastructure (132 kV transmission lines for each 100 MW facility) on Portion 0 of Smutshoek Farm 395 and Portion 9 of Gemsbok Bult 120, and the connection points to the Eskom Nieuwehoop Substation on the Portion 3 of Gemsbok Bult Farm 120, approximately 80 km south of Upington and 30 km north-east of Kenhardt within the !Kheis Local Municipality, Northern Cape Province.

As per the Plan of Study included in Final Scoping Report (September 2017) and subsequently approved by the Department of Environmental Affairs (DEA) on 30 November 2017, it was indicated that **a Soils and Agriculture Impact Statement** will be produced to identify potential impacts of the proposed development on agricultural resources including soils and agricultural production potential for the proposed Skeerhok PV 1, Skeerhok PV 2, and Skeerhok PV 3 solar energy projects, as well as the proposed Skeerhok PV – Transmission Line Basic Assessment project near Kenhardt in the Northern Cape.

Various projects have been approved within the same area as the proposed Skeerhok PV facilities (see map below, Figure 1) and all the previous Environmental Impact Assessments (EIAs) included Soils and Agricultural Potential Studies. There is therefore a large amount of existing information on the soils and agriculture potential of the area and therefore, the impacts of solar PV facilities on soils and agricultural is well known and documented. For this reason, it was proposed that a full specialist impact assessment is not deemed necessary for these projects.

This impact statement has been compiled by the CSIR using existing information and reviewed by Mr Johann Lanz. The studies used as a reference for this impact statement are listed in Section 3.7 below.

1.1 Terms of Reference

The Impact Statement includes the following considerations:

- The identification of any significant soils and agricultural features or disturbances, as well as any sensitive features and receptors in the wider project area;
- Assessment of the existing soil and agricultural potential data for the wider project area;
- Environmental risks to the soils and agricultural land and potential, as well as the consequences thereto;
- Topography of the site;
- Available water sources for agriculture;
- Historical and current land use, agricultural infrastructure, as well as possible alternative land use options;
- Erosion, vegetation and degradation status of the land;
- Agricultural sensitivity to development across the site.

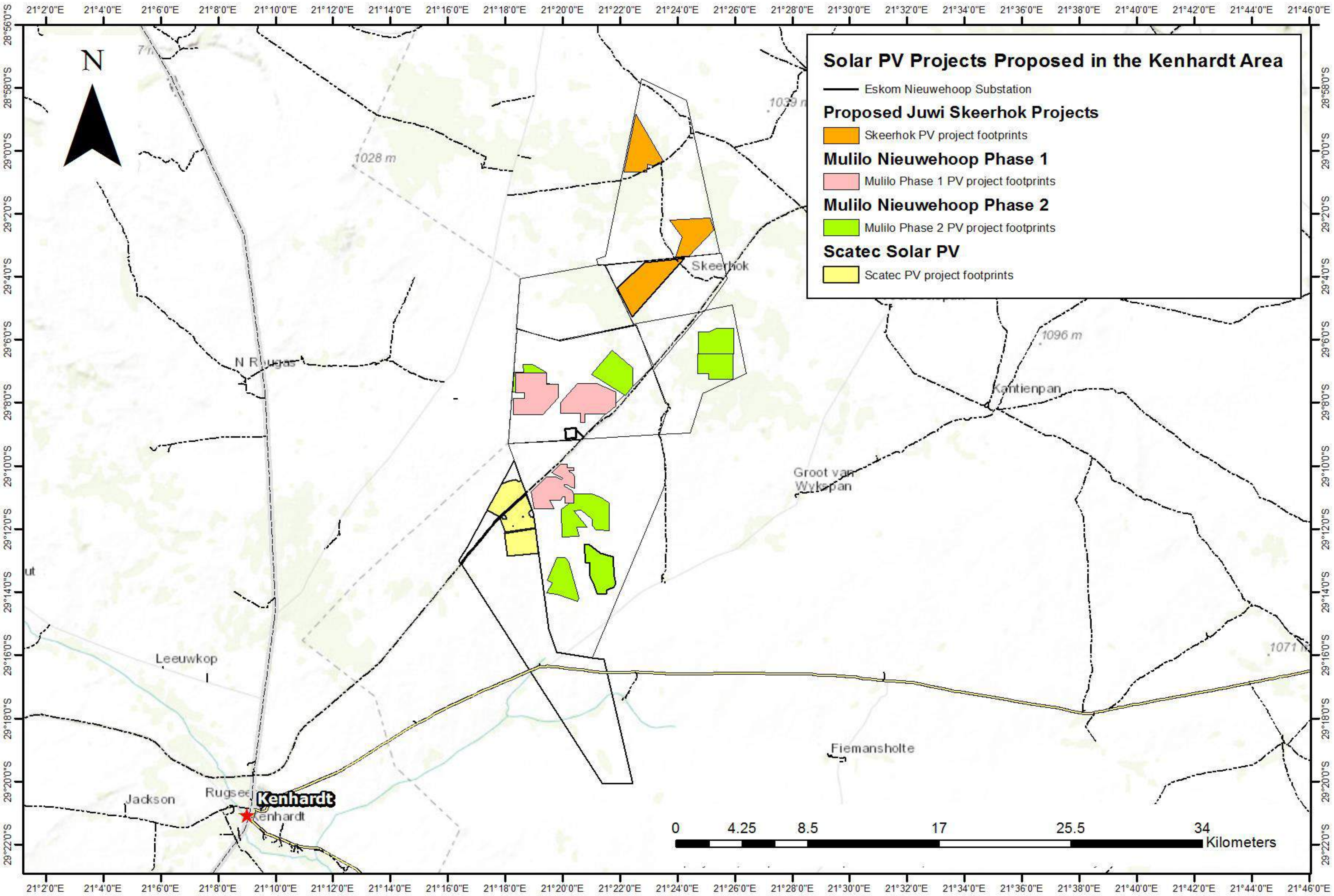

Figure 1: Cumulative locality map for the proposed three juwi Skeerhok Solar PV Projects, and the two reference studies (three Scatec Kenhardt Solar PVs and seven Mulilo Kenhardt Solar PVs) near Kenhardt in the Northern Cape.

1.2 Assumptions and Limitations

This impact statement has been based on soils and agricultural studies that have been done for other renewable energy projects in the immediate area of this proposed project. The following assumptions were used in this impact statement:

- It was assumed that water is not available anywhere on the site for irrigation. Given the very severe moisture constraints of the environment and that no suitable water has ever been identified by farmers in the area, this is a fair assumption; and
- The cumulative impact assessment assumes that a total of **six** approved renewable energy developments will be awarded preferred bidder status in the surrounding area, as stipulated by the DEA within the Scatec Environmental Authorization letter for 14/12/16/3/3/2/837, "Conditions of this Environmental Authorization", Scope of Authorization, Point 2 (07/08/2017).

The following limitations were identified in this study:

- Soils were not mapped in detail for the project area. However detailed soil mapping has little relevance to an assessment of agricultural potential in this environment, as the limitations are overwhelmingly climatic. In other words, even where soils suitable for cultivation may occur, they cannot be utilised because of the aridity constraints. The study had more than sufficient information on the soils to make an assessment on the impacts of the development on agriculture, and so this is not seen as a limitation; and
- The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

2 METHODOLOGY

The key steps followed in this assessment are:

- Review of available desktop information, including the soils and agricultural specialist studies mentioned above for similar projects; and
- Existing Agricultural Geo-Referenced Information System (AGIS) data, as well as satellite imagery for the site.

The Final Scoping Report was submitted to the National DEA on 3 November 2017 for decision-making. The Scoping Report was accepted by the National DEA on 30 November 2017. As part of the acceptance, the National DEA had the certain requirements for the Soils and Agricultural Potential Impact Statement, as shown in Table 1 below.

Table 1: National DEA Requirements for the Soils and Agricultural Potential Impact Statement (Acceptance of Scoping letter – 30 November 2017)

DEA Requirement	Feedback from Specialist/sub-section where this is addressed
x. The specialist input referred to in comment (viii) of the comments on the draft scoping report signed 19 October 2017; must additionally address the following:	
• indicate whether the recommendation by the EAP	Yes, the recommendation is acceptable.

DEA Requirement	Feedback from Specialist/sub-section where this is addressed
that detailed studies are not required is acceptable;	
• indicate whether the methodology used to arrive at the conclusion that detailed studies are not required is clearly explained and acceptable;	Yes this is adequately explained in Section 1 and is acceptable.
• Discuss the suitability of the proposed mitigation measures and recommendations, if any. Further, provide input to the EMPr, including additional mitigation and monitoring requirements to ensure that identified impacts are eliminated;	Suitable mitigation measures and monitoring requirements are comprehensively given in Section 3.4 of the report.
• Evaluate the appropriateness of the reference literature used;	The reference literature is appropriate and adequate.
• Indicate details and conclusions of the site-inspection if one was carried out as part of the specialist input	No site inspection was carried out for the impact statement for this proposed project, however, the reference studies conducted by Johann Lanz (2016) included site inspection(s). Please refer to Section 2 below for a description of the methodology used in the reference studies.
• Indicate if the studies being referred to covers the preferred site; and	Although the proposed Skeerhok PV 1, 2 and 3 cover different development footprints compared to the reference studies, they are in extremely close proximity and are on the same greater farms. Thus the land use is similar and the impacts can be extrapolated. See locality map above (Figure 1).
• Provide an indication on the cumulative impacts of these studies in relation to the proposed development.	Refer to Section 3.4.3 and Table 1.3 below.
• Must be conducted or input provided on by a suitably qualified specialist in the field	Refer to Appendix A for the full CV of the specialist.

3 AFFECTED ENVIRONMENT

3.1 Climate and Water Availability

Rainfall for the area is given as a very low 183 mm per annum, with a standard deviation of 71 mm according to the South African Rain Atlas (Water Research Commission, undated). One of the most important climate parameters for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. Moisture availability is classified into six categories across the country, the proposed development site falls within Class 6, which is described as a very severe limitation to agriculture.

Water for stock is obtained from wind pumps on the farms in the area. There is insufficient water available for any form of irrigation.

3.2 Terrain, Topography and Drainage

The proposed development is located on level plains with some relief in the Northern Cape interior at an altitude of between 900 and 1000 meters. Slopes across the site are almost entirely less than 2%. The underlying geology is migmatite, gneiss and granite of the Namaqualand Metamorphic Complex with abundant calcrete.

There are no perennial drainage courses within the proposed Skeerhok PV 1, 2 and 3 project areas. There are temporary drainage courses, typical of arid environments, where surface run-off would accumulate and flow, but this would only occur very occasionally, immediately after high rainfall events.

3.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The proposed Skeerhok developments are located on a single land type, Ag5. This land type comprises predominantly shallow, red sands to loamy sands on underlying rock, hard-pan carbonate, or hard-pan dorbank. The soils fall into the arid Silicic, Calcic, and Lithic soil groups according to the classification of Fey (2010). The field investigation (Lanz, 2016) confirmed that the soils in the area are shallow, red sandy soils on underlying rock and hard-pan carbonate. Actual soil forms vary within short distances depending on rock ridges that run across the area and the extent of calcrete formation. There are numerous outcrops of rocky ridges at the soil surface across the entire area. All investigated sample points across the area were one of four soil forms: Coega, Mispah, Plooysberg or Hutton. However there is very little practical difference between these different soil forms. All have a clay content of approximately 7%, are shallow and are underlain by a hard impenetrable layer (either rock or hard-pan carbonate). The land has low to moderate water erosion hazard, mainly due to the low slope, but is susceptible to wind erosion because of the sandy texture of the soil.

3.4 Agricultural Capability

Land capability is the combination of soil suitability and climate factors. The area has a land capability classification, on the eight category scale, of Class 7 - non-arable, low potential grazing land. The limitations to agriculture are aridity and lack of access to water in addition to the shallow soil depth and rockiness. Because of these constraints, agricultural land use is restricted to low intensity grazing only. The natural grazing capacity is low, at mostly 31 - 40 hectares per animal unit. The current farmer uses an average stocking rate of 10 hectares per sheep.

3.4.1 Land Use and Development on and Surrounding the Site

The proposed sites (Skeerhok PV 1, 2 and 3, and Skeerhok – transmission line) are located within a sheep farming agricultural region and land use for the farm and surrounding area is sheep farming only. There is no cultivation or any history of cultivation on the farm. The Sishen-Saldanha railway line with its associated infrastructure runs through the farm to the south of the PV site. Apart from fences and one stock watering point, there is no agricultural infrastructure on the site. There are no buildings on the site.

3.4.2 Status of the Land

The biome classification for the site is Bushmanland Arid Grassland. The natural vegetation is grazed, veld conditions are very sparse but there is no evidence of significant erosion or other land degradation on the site.

3.3.1 Possible Land Use Options for the Site

Because of both the climate and soil limitations, the site is not suitable for any agricultural land use other than low intensity grazing.

The site is within one of South Africa's eight proposed Renewable Energy Development Zones (REDZs), and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. These factors include an assessment of the significance of the loss of agricultural land. Renewable energy development is therefore a very suitable land use option for the site.

3.4.3 Agricultural Sensitivity

Agricultural potential is uniformly low across the farms in the area and the choice of placement of the facility on the chosen farms therefore has no influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the assessed area, and so no parts of it need to be avoided by the development. No buffers are required.

3.5 Key Issues and Potential Impacts

The following have been identified by the specialist (Lanz, 2016) as potential impacts on agricultural resources and productivity for projects in the proposed Skeerhok PV area.

3.5.1 Construction and Decommissioning Phases only

1. Degradation of veld vegetation beyond the direct footprint of the proposed PV facility due to construction and decommissioning disturbance and potential trampling by vehicles.
2. Loss of topsoil due to poor topsoil management (burial, erosion, etc.) during construction and decommissioning related soil profile disturbance (levelling, excavations, road surfacing etc.) and resultant decrease in that soil's capability for supporting vegetation.

3.5.2 All Phases – Construction, Operation and Decommissioning

1. Loss of agricultural land use due to direct occupation by the infrastructural footprint of the proposed development for the duration of the project (all phases). This will take affected portions of land out of agricultural production.
2. Soil erosion by wind or water due to alteration of the land surface characteristics. Alteration of surface characteristics may be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard standing areas, surfaces and roads. Erosion will cause loss and deterioration of soil resources and may occur during all phases of the project.
3. Generation of additional land use income through the rental of the land for the proposed solar energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability. This is rated as a positive impact.

3.5.3 Cumulative Impacts

Cumulative impacts due to the regional loss of agricultural land resources as a result of other developments on agricultural land in the region. Note that the cumulative impact assessment will take into account the presence of **6 approved renewable energy facilities** to receive preferred bidder status by the DoE.

3.6 Assessment of Impacts and Identification of Management Actions

The potential impacts identified are assessed in table format in Tables 2 and 3 below.

The proposed developments are located on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable and important for agricultural production. The proposed site is however on land which has very low agricultural potential and is only suitable for low intensity grazing.

All impacts are evaluated in terms of their consequence for agricultural production, not in terms of the impact *per se*. This is because it is agricultural production that must be the focus of an agricultural assessment. Because the undisturbed site already has extremely limited agricultural potential, it means that the consequence of any impact for agricultural production is limited with the result that the consequence and significance of agricultural impacts is low. Furthermore, the poor, very shallow soil conditions reduce the significance of loss of topsoil and the low slope gradients reduce the significance of potential erosion impacts.

Irreplaceability of resources is considered low because the resource that is being impacted is non-arable, low potential grazing land which is not a scarce resource in the country. The confidence level of the assessment is considered high because there is certainty about the low agricultural potential of the land and the impacts are fairly easy to understand and predict. There are a large number of other potential projects in the area that will also lead to a loss of agricultural land. Although the loss of individual project portions of land has low significance, as discussed above, the cumulative impacts of land loss regionally becomes more significant. However, despite this cumulative impact, it is still agriculturally strategic from a national perspective to steer as much of the country's renewable energy development as possible to regions such as this one, with very low agricultural potential. It is preferable to incur a higher cumulative loss in such a region, than to lose agricultural land with a higher production potential elsewhere in the country.

Mitigation measures are also included in Table 2. Recommendations for the monitoring and review of all identified mitigation measures are described below, as well as the EMPr (Part B of this Draft EIA Report).

Table 2: Impact assessment summary table

Aspect/Impact pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation/ Management Actions	Significance		Ranking of Residual Impact	Confidence Level
										Without Mitigation	*With Mitigation*		
CONSTRUCTION AND DECOMMISSIONING PHASES (DIRECT IMPACTS)													
Vehicle traffic and dust generation	Veld degradation	Negative	Site	Medium term	Slight	Likely	Moderate (i.e. Partially)	Low	1. Minimize footprint of disturbance. 2. Confine vehicle access on roads only. 3. Control dust generation during construction and decommissioning activities by adopting standard construct site dust control methods (such as dampening surfaces with water), where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem.	Very Low	Very Low	5	High
Constructional and decommissioning activities that disturb the soil profile.	Loss of topsoil	Negative	Site	Medium term	Slight	Likely	Moderate (i.e. Partially)	Low	1. Strip and stockpile topsoil from all areas where soil will be disturbed. 2. After cessation of disturbance, re-spread topsoil over the surface. 3. Dispose of any sub-surface spoils from excavations where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.	Very Low	Very Low	5	High
CONSTRUCTION, OPERATIONAL AND DECOMMISSIONING PHASES (DIRECT IMPACTS)													
Occupation of the land by the project infrastructure	Loss of agricultural land use	Negative	Site	Long term	Slight	Very Likely	High	Low	None	Very Low	Not applicable	5	High
Change in surface characteristics and surface cover.	Erosion	Negative	Site	Long term	Slight	Likely	Low	Low	Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	Low	Very Low	5	High

Aspect/Impact pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation/ Management Actions	Significance		Ranking of Residual Impact	Confidence Level
										Without Mitigation	*With Mitigation*		
CONSTRUCTION AND DECOMMISSIONING PHASES (DIRECT IMPACTS)													
Project rental	Additional land use income	Positive	Site	Long term	Slight	Very Likely	High	Low	None	Very Low	Not applicable	5	High

Table 3: Cumulative impact assessment summary table

Aspect/Impact pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation/ Management Actions	Significance		Ranking of Residual Impact	Confidence Level
										Without Mitigation	*With Mitigation*		
Occupation of the land by the infrastructure of multiple projects	Regional loss of agricultural land	Negative	Regional	Long term	Likely	Likely	Moderate (i.e. Partially)	Moderate	None	Moderate	Not Applicable	3	Low

3.7 Input to the Environmental Management Programme

The following main mitigation measures and monitoring requirements are proposed for inclusion in the EMPr:

- Minimize the footprint of disturbance during construction and decommissioning activities.
- Confine vehicle access to roads only.
- Control dust generation during construction and decommissioning activities by implementing suitable, standard construction site dust control measures.
- Strip and stockpile topsoil from all areas where soil will be disturbed.
- After cessation of disturbance, re-spread topsoil over the surface.
- Dispose of any sub-surface spoil material, generated from excavations, where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.
- Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.

The following main monitoring requirements are proposed for inclusion in the EMPr:

- Undertake a periodic site inspection to verify the occurrence of off-road vehicle tracks surrounding the site.
- Establish an effective record keeping system for each area where soil is disturbed for constructional and decommissioning purposes. Recommendations for the recording system are included in the EMPr (Part B of the EIA Report).
- Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.

3.4 Conclusion and Recommendations

The proposed Skeerhok PV 1, 2 and 3, and Skeerhok PV – Transmission Line developments are on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the investigated site is on land which is of very low agricultural potential and is not suitable for cultivation.

Because of the low agricultural potential of the site, the development should, from an agricultural impact perspective, be authorised. Authorisation is promoted by the fact that the sites falls within a proposed renewable energy development zone, where such land use has been assessed as very suitable in terms of a number of factors, including agricultural impact. It is preferable to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.

No agriculturally sensitive areas occur within the wider project area and it is therefore assumed (with high confidence) that no part of it is therefore required to be set aside from the development. Because the sites are uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed sites. The following management and mitigation measures should be included in the EMPr:

- Minimize the footprint of disturbance during construction and decommissioning activities.
- Confine vehicle access to roads only.

- Control dust generation during construction and decommissioning activities by implementing suitable, standard construction site dust control measures (i.e. dampening with water) where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem.
- Strip and stockpile topsoil from all areas where soil will be disturbed.
- After cessation of disturbance, re-spread topsoil over the surface.
- Dispose of any sub-surface spoil material, generated from excavations, where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.
- Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.

3.5 Information Sources

The information used for the compilation of this impact statement was drawn from the following sources:

1. Lanz, J. (2016). Agricultural and Soils Impact Assessment for proposed Scatec Solar PV Energy Facilities near Kenhardt, Northern Cape Province. Johann Lanz, Stellenbosch.
2. Lanz, J. (2016). Soils and Agricultural Potential Assessment for the proposed Solar Energy Facilities of the Phase 1 and 2 Nieuwehoop Solar PV Park near Kenhardt. Johann Lanz, Stellenbosch.
3. Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated).
4. Satellite imagery of the site available on Google Earth was also used for evaluation.

3.6 Declaration of Independence of Specialist

Mr Johann Lanz has reviewed this statement. Please refer to Appendix A of this Impact Statement for the Curriculum Vitae of Mr. Johann Lanz and his letter (page 1), which confirms that this impact assessment is suitable for this project and in lines with his previous studies' findings. The declaration of independence by the specialist is provided below:

DECLARATION OF INDEPENDENCE

I, Johann Lanz, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Skeerhok PV 1, 2 and 3, and Skeerhok – Transmission Line Projects, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

JOHANN LANZ
26/01/2018

Appendix A: Curriculum Vitae of the Specialist

Johann Lanz

Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1999
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12, and am a member of the Soil Science Society of South Africa.

Soil Science Consultant	**Self employed**	**2002 - present**

I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:

Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: Aurecon; CSIR; SiVEST; SRK Consulting; Juwi Renewable Energies; Mainstream Renewable Power; Subsolar; Tiptrans; Planscape; Afrimat; Savannah Environmental; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Haw & Inglis.

Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Cederberg Wines; Unit for Technical Assistance - Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; Goedgedacht Olives;, Lourensford Fruit Company; Kaarsten Boerdery; Wedderwill Estate; Thelema Mountain Vineyards; Rudera Wines; Flagstone Wines; Solms Delta Wines; Dornier Wines.

I have conducted several research projects focused on conservation farming, soil health and carbon sequestration.

Soil Science Consultant	**Agricultural Consultors International (Tinie du Preez)**	**1998 - end 2001**

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist	**De Beers Namaqualand Mines**	**July 1997 - Jan 1998**

Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX N2:

Traffic Impact Statement

WSP ref.: 24405

2018/01/23

PUBLIC

Kelly Stroebel, Environmental Assessment Practitioner (EAP)
CSIR Stellenbosch
PO Box 320
Stellenbosch
7599

Dear Madam:

Subject: Review of Skeerhok PV Traffic Impact Statement

This letter confirms that I have reviewed the Skeerhok PV Traffic Impact Statement (TIS) prepared by the CSIR.

I agree with the contents of the TIS.

Yours sincerely,

Digitally signed by Bredenhann, Christo
Date: 2018.01.24 11:25:06 +02'00'

Christo Bredenhann
Associate - Traffic and Transportation Engineer

The Pavilion, 1st Floor
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South Africa

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Statement prepared by:

CSIR – Environmental Management Services
PO Box 320

Stellenbosch, 7599
South Africa

Statement reviewed by:

Christo Bredenhann Pr Eng.
Associate - Traffic & Transportation Engineer
WSP Group Africa (Pty) Ltd
Cnr Portswood and Beach Road, Waterfront
Cape Town, 8001
South Africa

December 2017

CONTENTS

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Photos

TRAFFIC IMPACT STATEMENT

1 INTRODUCTION

juwi Renewable Energies (PTY) Ltd is proposing to develop three 100 Megawatt (MW) Solar Photovoltaic (PV) power generation facilities and associated electrical infrastructure (132 kV transmission lines for each 100 MW facility) on Portion 0 of Smutshoek Farm 395 and Portion 9 of Gemsbok Bult 120, and the connection points to the Eskom Nieuwehoop Substation on the Portion 3 of Gemsbok Bult Farm 120, approximately 80 km south of Upington and 30 km north-east of Kenhardt within the !Kheis Local Municipality, Northern Cape Province.

As per the Plan of Study included in Final Scoping Report (September 2017) and subsequently approved by the Department of Environmental Affairs (DEA) on 30 November 2017, it was indicated that a **Traffic Impact Statement (TIS)** will be produced to identify the traffic related potential impacts of the proposed development on the local road network and environment. The TIS will be undertaken for the proposed Skeerhok PV 1, Skeerhok PV 2, and Skeerhok PV 3 solar energy projects, as well as the proposed Skeerhok PV – Transmission Line Basic Assessment project near Kenhardt in the Northern Cape. Various projects have been approved within the same area as the proposed Skeerhok PV facilities (see locality map below, Figure 1) and all the previous Environmental Impact Assessments (EIAs) included Traffic Studies. There is therefore a large amount of information regarding traffic impacts associated with PV projects in the Kenhardt area and these impacts are well known and documented. For this reason, it was proposed that a full specialist impact assessment is not deemed necessary for these projects.

This impact statement has been compiled by the CSIR using existing information and reviewed by Mr. Christo Bredenhann Pr. Eng, a qualified Traffic and Transportation Engineer. The studies used as a reference for this impact statement are listed in Section 7.

1.1 Terms of Reference

The key issues associated with the construction and operational phases of the project that will be assessed as part of the TIS are:

- Increase in traffic generation throughout the lifetime of the project;
- Decrease in air quality; and
- Increase in road maintenance required.

1.2 Assumptions and Limitations

The TIS has been based on the traffic information provided by similar PV projects in the area, as well as traffic information provided by the Applicant, juwi Renewable Energies.

The cumulative impact assessment assumes that a total of **six** approved renewable energy developments will be awarded preferred bidder status in the surrounding area, as stipulated by the DEA within the Scatec Environmental Authorization letter for 14/12/16/3/3/2/837, “Conditions of this Environmental Authorization”, Scope of Authorization, Point 2 (07/08/2017). However, as a precautionary approach, all developments were included in the cumulative impact assessment.

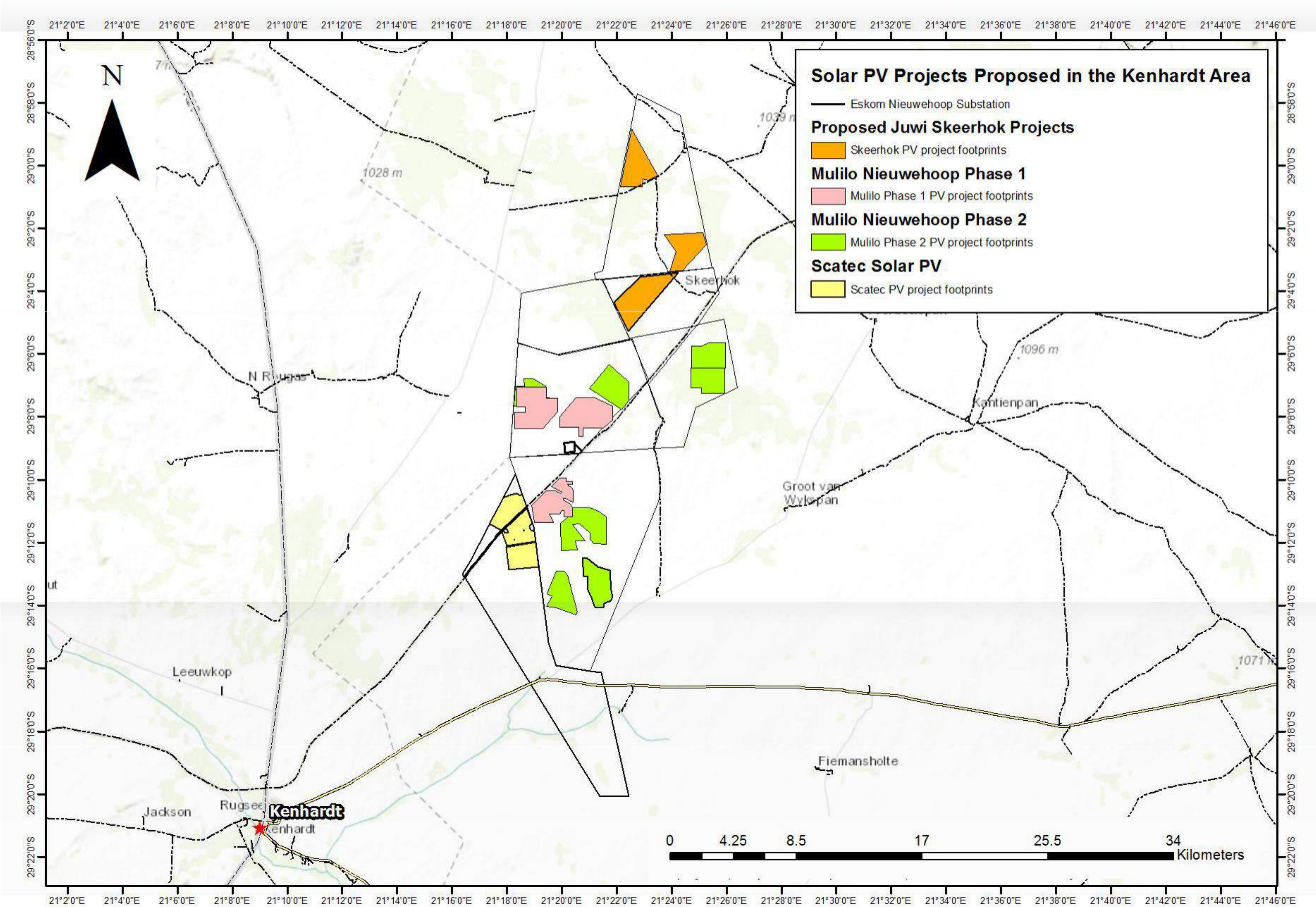

Figure 1: Cumulative locality map for the proposed three juwi Skeerhok Solar PV Projects, and the two reference studies (three Scatec Kenhardt Solar PVs and seven Mulilo Kenhardt Solar PVs) near Kenhardt in the Northern Cape.

2 APPROACH AND METHODOLOGY

2.1 Objectives

- Determine the current traffic conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Identify potential impacts and cumulative impacts that may occur during the construction, operational and decommissioning phases of development;
- Provide recommendations with regards to potential monitoring programmes;
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts; and
- Incorporate and address all issues and concerns raised by I&APs and the public (if applicable)..

2.2 Methodology

The key steps followed in this statement are:

- Review of available desktop information, including the South African National Roads Agency (SANRAL) National traffic count information and google earth images;
- Review and assimilate information from similar projects (see sources below in Section 7).

The Final Scoping Report was submitted to the National DEA on 3 November 2017 for decision-making. The Scoping Report was accepted by the National DEA on 30 November 2017. As part of the acceptance, the National DEA had certain requirements for the TIS, as shown in Table 1.1 below.

Table 1.1: National DEA Requirements for the Traffic Impact Statement (Acceptance of Scoping letter – 30 November 2017)

DEA Requirement	Feedback from Specialist/sub-section where this is addressed
x. The specialist input referred to in comment (viii) of the comments on the draft scoping report signed 19 October 2017; must additionally address the following:	
▪ indicate whether the recommendation by the EAP that detailed studies are not required is acceptable;	Agreed, the TIS adequately investigates the traffic impacts of the development
▪ indicate whether the methodology used to arrive at the conclusion that detailed studies are not required is clearly explained and acceptable;	Agreed.
▪ Discuss the suitability of the proposed mitigation measures and recommendations, if any. Further, provide input to the EMPr, including additional mitigation and monitoring	Appropriate mitigation measures are proposed for the development.

requirements to ensure that identified impacts are eliminated;	
▪ Evaluate the appropriateness of the reference literature used;	Sufficient literature and baseline information has been utilised.
▪ Indicate details and conclusions of the site-inspection if one was carried out as part of the specialist input	Although the reference studies used in compiling this TIS covered a different development footprint, the access roads and routes will be the same as they fall on the same farm (s). In addition, due to the fact that the Skeerhok projects will be using the same technology, similar traffic volumes can be expected.
▪ Indicate if the studies being referred to covers the preferred site;	Although the reference studies used in compiling this TIS covered a different development footprint, the access roads and routes will be the same as they fall on the same farm (s). In addition, due to the fact that the Skeerhok projects will be using the same technology, similar traffic volumes can be expected.
▪ Provide an indication on the cumulative impacts of these studies in relation to the proposed development;	Refer to Section Table 1.2 below.
▪ Must be conducted or input provided by a suitably qualified specialist in the field	Refer to Appendix A for the full CV of the specialist.

3 AFFECTED ENVIRONMENT

During all phases (construction, operation and decommissioning) of the project, additional traffic will be generated. The highest traffic volumes will be created during the construction phase. This includes activities associated with:

- Site preparation and transporting the construction materials and associated infrastructure to the site; and
- Transportation of employees to and from the site on a daily basis.

The proposed project site can be accessed via an existing gravel road (an unnamed farm road) and the existing Transnet Service Road (private). Both access routes will be considered in the design of the facility and have been included in the proposed project. The R27 extends from Keimoes (in the north) to Vredendal in the south. The R27 is a 6 m wide surfaced road with 1 lane per direction and unsurfaced shoulders. It has a 45 m road reserve. This National Road is designed for minimum daily traffic exceeding 1000 vehicle units. The Transnet Service Road can be accessed from the R27. The existing gravel road can be accessed from the R383 Regional Road also via the R27 National Road. The Transnet Service Road and unnamed farm road are both 7-8 m wide, however in certain sections, the unnamed farm road is believed to be about 2- 3 m wide. It is currently proposed that existing roads will be used as far as possible, to avoid the construction of new roads for the proposed Skeerhok PV 1, PV 2 and PV 3 facilities.

Photographs (taken from the TIS – Source 1 below) are included (Photo 1.1-1.44) to show the intersection of the Transnet Service Road with the R27 and the condition of the roads.

Photo 1.1: R27 towards the south (taken towards Kenhardt). The board shows "Loop 14", located to the left, which is accessed via the Transnet Service Road. (Image source: Google, 2010)

Photo 1.2: The intersection of the R27 and Transnet Service Road, going towards Kenhardt. As can be seen on this image, the R27 was being upgraded in 2010 (Image source: Google, 2010)

Photo 1.3: The intersection of the R27 and Transnet Service Road, going towards Keimoes (Image source: Google, 2010)

Photo 1.4: The access point to the Transnet Service Road (Image taken: July 2014)

Historic traffic volume figures are not available within the study area; however, the resultant traffic volumes has been assumed to be below the allowed maximum average daily traffic limit of 1000 veh/day. Although the proposed development is expected to generate trips during the construction, operation and decommissioning phases, the traffic generated will be low, based on similar studies conducted within the study area.

4 TRANSPORT INFORMATION

The general current limitations on road freight transport are:

- Axle load limitation of 7,7t on front axle, 9,0t on single rear axles;
- Axle unit limitations are 18t for dual axle unit and 24t for 3 axle unit;
- Gross vehicle mass of 56t. This means a typical payload of about 30t;
- Maximum vehicle length of 22m for interlink, 18,5m for horse and trailer and 13,5 for a single unit;
- Width limit of 2,6m; and
- Height limit 4,3m.

Abnormal permits are required for vehicles exceeding these limits.

4.1 Solar Farm Freight

Anticipated materials and equipment transported to the site comprise of:

- Building materials (concrete aggregates, cement and gravel);
- Construction equipment such as piling rigs and cranes;
- Solar panels (panels and frames); and
- Transformer and cables. The following is anticipated:

A. Building materials comprising of concrete materials for strip footings or piles will be transported using conventional trucks which would adhere to legal limits listed above.
B. Solar Panels and frames will probably be transported in containers using conventional heavy vehicles within the legal limits. The number of loads will be a function of the capacity of the solar farm and the extent of the frames (the anticipated number of loads are discussed below).
C. Transformers will be transported by abnormal vehicles.

4.2 Traffic Generation

The traffic generation estimates have been based on similar studies conducted within the study area. The estimated traffic generated includes the Scatec Kenhardt project and the Skeerhok PV 1, 2 and 3 projects. The generated traffic for the Skeerhok PV 1, 2 and 3 projects are anticipated to be similar to the Scatec Kenhardt projects. The trip generation was calculated based on Client information and the Scatec project information.

- ***Construction Phase (per development Skeerhok 1/2/3)***

Approximately 800 x 40ft containers resulting in approximately 800 double axel trucks will come to site during the construction phase of 18 months. In addition to this, more or less 20 light load trucks will

come from and go to site on a daily basis during the construction phase. It is estimated that a total of 18 800 vehicle trips to and from the site.
It is assumed that construction will take place 5 days a week for a total of 235 standard working days per year, over a period of 18 months. A total of 353 construction days.

The maximum possible total trips per day will occur when containers are delivered to site during the 18-month construction period.

Containers:	+/- 1 truck every 2 days = 2 trips (In + Out)
Light trucks:	40 trips per day (In + Out)
Water trucks:	1 truck every 2 days = 2 trips (In + Out)
Total:	44 trips per day (In + out)

This is regarded as negligible traffic. Note that full Traffic Impact Assessments (TIA) are normally only required for developments that will generate more than 50 vehicle trips (In + Out) during any peak hour.

- ***Operational Phase (per development Skeerhok 1/2/3)***

More or less 4 light load trucks will come from and go to site on a daily basis and 1 small single axel truck to and from site on a weekly basis. For water supply, the current estimate is that 2 trips per month will be made by a water truck.

The lifetime of the project is assumed as the maximum 20 years which means that the total amount of trips would be 61 440 over a 20-year operational life.

The maximum possible total trips per day to site during the operational phase will only occur if all scheduled vehicles arrive on the same day, as follows:

Single axle truck:	1 truck every week = 2 trips (In + out) Light trucks:
	8 trips per day (In + Out)
Water trucks:	1 trip every 2 weeks = 2 trips (In + Out)
Total:	10 trips per day (In + out)

This is regarded as negligible traffic.

- ***Decommissioning Phase (per development Skeerhok 1/2/3)***

As per the construction phase, approximately 800 x 40ft containers resulting in more or less 800 double axel trucks will come to site during the decommissioning phase. The decommissioning phase usually takes 12 months. In addition to this, more or less 20 light load trucks to and from site will come and go to site on a daily basis.

It is assumed that the decommissioning work will take place 5 days a week for a total of 235 standard working days per year, over a period of 12 months. A total of 235 days.

The maximum possible total trips per day will be as follows:

Containers:	7 trucks every 2 days = 14 trips (In + Out)
	= 7 trips per day (In + Out)
Light trucks:	40 trips per day (In + Out)
Total:	47 trips per day (In + out)

This is regarded as negligible traffic.

- ***Cumulative***

Although the 20km radius was considered for cumulative impact purposes, the worst case of all 6 approved developments proceeding simultaneously was used for the purpose of these calculations.. The cumulative impact assessment assumes that all the projects outlined within the cumulative impact section occur at the same time (Construction, operation and decommissioning phases). Even though there will most likely be overlap in the operational phases of these projects, it is unlikely that the construction phases for all these projects would occur at the same time. Since the construction phase will give rise to the most amount of trucks coming to site, this would be considered the worst case scenario in terms of traffic generation. The projects that have been approved to date within close proximity of each other are detailed within Table 1.2 below. Table 1.2 also includes the estimates for the three proposed Skeerhok PV projects. As noted above, the DEA has stated that no more than 6 projects will be approved in the area, as reflected in Table 1.2. The impact on this road is therefore not anticipated to be significant but should the Transnet Service Road be used for all the projects, a maintenance plan, agreed upon all parties involved must be implemented to ensure that the road's quality and integrity is maintained.

Table 1.2: Cumulative daily traffic generation estimates for all PV projects proposed north-east of Kenhardt, including the Skeerhok projects (Scatec, 2016)

Project name		Daily traffic generation estimates		
		Construction Phase (veh/day)	Operational Phase (veh/day)	Decommission Phase (veh/day)
1	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 1) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 1)	21	5	21
2	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 2) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 2)	21	5	21
3	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 3) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 3)	21	5	21
4 to 6	Proposed Construction of Skeerhok 300 MW Solar facilities - PV 1 / 2 / 3	44 x 3 = 132	10 x 3 = 30	47 x 3 = 141
	Total	**195**	**45**	**204**

5 IDENTIFICATION OF IMPACTS

The traffic impacts that are likely to be generated by the proposed facility are detailed below. The impacts will largely occur during the construction phase of the project, since this is when the highest amount of traffic will be generated by the proposed facility.

As per the table below, the impacts identified and assessed as part of the reference studies are:

1. Increase in traffic generation.
2. Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads.
3. Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment.
4. Decrease in quality of surface condition of the roads.
5. Cumulative impact of traffic generation of all six projects in the area, including Skeerhok 1 to 3. The cumulative impact during the construction and decommissioning phases of all 6 projects cannot be assessed, as it is unlikely that all projects will be constructed or decommissioned over the same periods.

Table 1.3: Traffic Impact Assessment Table

Aspect/ Impact Pathway	Nature of impact	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility	Irreplac-eability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confi-dence Level
										Without Mitigation	*With Mitigation*		
CONSTRUCTION AND DECOMMISSIONING PHASES													
Traffic gene-ration	Increase in traffic	Nega-tive	Regional	Short term	Moderate	Very likely	Yes	Replace-able	• A permit should be obtained from the PGNC Department of Public Works, Roads and Transport for any abnormal loads transported. • Provide a Transport Traffic Plan to SANRAL and the PGNC Department of Public Works, Roads and Transport. • Road and safety standards should be adhered to.	Low	Low	4	Medium
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Nega-tive	Local	Short term	Moderate	Likely	No	High irreplace-ability	• Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences (such as Animex fences) installed, if needed to direct animals to safe road crossings. • Adhere to all speed limits applicable to all roads used. • Implement clear and visible signage at access to site at R27 and Transnet Service Road intersection.	High	Moderate	3	Medium
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Nega-tive	Local	Medium term	Moderate	Likely	Yes	Replace-able	• Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles. • Postpone or reduce dust-generating activities during periods with strong wind. • Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased. • Ensure that all construction vehicles are roadworthy and adhere to vehicle safety standards implemented by the Project Developer. • Avoid using old and noisy construction equipment and ensure equipment is well maintained.	Moderate	Low	4	Medium

Aspect/ Impact Pathway	Nature of impact	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility	Irreplac-eability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confi-dence Level
										Without Mitigation	*With Mitigation*		
	Change in quality of surface condition of the roads	Nega-tive	Local	Short term	Slight	Likely	Yes	Replace-able	• Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage; • A Road Maintenance Plan should be developed for the section of the Transnet Service Road that will be used to addresses the following: – Grading requirements; – Dust suppressant requirements; – Drainage requirements; – Signage; and – Speed limits.	Low	Low	4	Medium
OPERATIONAL PHASE													
Traffic gene-ration	Increase in traffic	Nega-tive	Regional	Long term	Slight	Very likely	High	Replace-able	• Adhere to requirements made within Transport Traffic Plan; • Limit access to the site to personnel; • Increase traffic will be negligible.	Very low	Very low	5	Medium
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Nega-tive	Local	Long term	Moderate	Likely	No	High irreplace-ability	• Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences installed, if needed to direct animals to safe road crossings. • Adhere to all speed limits applicable to all roads used. • Due to negligible traffic increases, increase in accidents is minimal.	High	Moderate	3	Medium
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Nega-tive	Local	Medium term	Moderate	Likely	Yes	Replace-able	• Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; • Limit noisy maintenance/operational activities to daytime only.	Moderate	Low	4	Medium

Aspect/ Impact Pathway	Nature of impact	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility	Irreplac-eability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confi-dence Level
										Without Mitigation	***With Mitigation***		
	Change in quality of surface condition of the roads	Nega-tive	Local	Long term	Slight	Likely	Yes	Replace-able	• Implement requirements of the Road Maintenance Plan.	Low	Low	4	Medium
CUMULATIVE IMPACTS (Concurrent operational phase of all 6 developments)													
Traffic gene-ration	Increase in traffic	Nega-tive	Regional	Long term	Slight	Very likely	High	Replace-able	• Adhere to requirements made within Transport Traffic Plan; • Limit access to the site to personnel; Increase traffic will be negligible.	Very low	Very low	5	Medium
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Nega-tive	Local	Long term	Moderate	Likely	No	High irreplace-ability	• Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences installed, if needed to direct animals to safe road crossings. • Adhere to all speed limits applicable to all roads used. Due to negligible traffic increases, increase in accidents is minimal.	High	Moderate	3	Medium
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Nega-tive	Local	Mediu m term	Moderate	Likely	Yes	Replace-able	• Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; Limit noisy maintenance/operational activities to daytime only.	Moderate	Low	4	Medium

6 CONCLUSIONS AND RECOMMENDATIONS

Based on the assessment of the potential impacts that can be associated with the traffic to be generated during the construction, operation and decommissioning phases of the reference projects, the overall impact from traffic generation is anticipated to be low when implementing suitable mitigation measures. The highest traffic will be generated during the construction phase.

The measures included within the EMPr must be adhered to, with the main requirements outlined below:

- Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the PGNC Department of Public Works, Roads and Transport.
- Provide a Transport Traffic Plan to SANRAL and the PGNC Department of Public works, Roads and Transport.
- Ensure that roadworthy and safety standards are implemented at all time for all construction.
- Adhere to all speed limits applicable to all roads used.
- Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.
- Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles.
- Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage.
- A Road Maintenance Plan should be developed for the section of the Transnet Service Road.
- Ensure that road network is maintained in a good state for the entire operational phase..

7 INFORMATION SOURCES

The information used for the compilation of this impact statement was drawn from the following sources:

1. Laurie, S. (2016). Traffic Impact Assessment for proposed Scatec Solar PV Energy Facilities near Kenhardt, Northern Cape Province. Surina Laurie, CSIR, Stellenbosch.
2. Laurie, S. (2014). Traffic Impact Assessment for the proposed Solar Energy Facilities of the Phase 1 Nieuwehoop Solar PV Park near Kenhardt. Surina Laurie, CSIR, Stellenbosch.
3. Laurie, S. (2015). Traffic Impact Assessment for the proposed Solar Energy Facilities of the Phase 2 Nieuwehoop Solar PV Park near Kenhardt. Surina Laurie, CSIR, Stellenbosch.
4. South African National Roads Agency (SANRAL) National traffic count information.
5. Satellite imagery of the site available on Google Earth was also used for evaluation.

8 DECLARATION OF INDEPENDENCE OF SPECIALIST

Mr Christo Bredenhann has reviewed this statement. Please refer to Appendix A of this Impact Statement for the Curriculum Vitae of Mr. Bredenhann and his letter (page 1), which confirms that this impact assessment is suitable for this project and in lines with his previous studies' findings. The declaration of independence by the specialist is provided below:

DECLARATION OF INDEPENDENCE

I, Christo Bredenhann, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Skeerhok PV 1, 2 and 3, and Skeerhok – Transmission Line Projects, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Digitally signed by
Bredenhann,
Christo
Date: 2018.02.07
10:27:09 +02'00'

CHRISTO BREDENHANN

Appendix A: Curriculum Vitae of the Specialist

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

Transport and Infrastructure

Years with the firm

5 years

Years total

16 years

Areas of practice

Traffic and Transportation engineering

Languages

English

Afrikaans

CAREER SUMMARY

Mr Bredenhann is a professional engineer with over 16 years' experience specialising in the traffic and transportation engineering sector. He has extensive experience in traffic and transportation impact assessments and statements for a multitude of land uses, formal review of traffic impact assessments, transportation planning, micro and macro network and capacity analysis, transportation planning and design, road safety audits, traffic signal timing design, road signs and markings audits, multi-modal transport assessments, non-motorised transport analysis and design and transport management plans.

Relevant expertise includes project management, proposals, tender documentation and bid adjudication, public transport planning and operational management, procedure development for the monitoring of integrated rapid transit operations and public transport scheduling development.

Countries of work experience include South Africa, Ethiopia, Uganda and the United Kingdom.

EDUCATION

BEng (Hons) Traffic and Transportation Engineering, University of Pretoria	2010
BEng Civil Engineering, University of Johannesburg (RAU)	1996

ADDITIONAL TRAINING

Certificate in Road Safety Audits, South African Road Federation	2015

PROFESSIONAL MEMBERSHIPS

Professional Engineer, Engineering Council South Africa (20150149)	2015
Associate Member, South African Institute of Civil Engineering (201300003)	2013

PROFESSIONAL EXPERIENCE

- Ethiopian Agri-processing Plants Traffic Impact Assessment, Ethiopia (Current): Lead Transportation Engineer – Traffic impact assessment. Client: United Nations Office for Project Services. Project Value: Unknown. Fee Value: ZAR 135,000.
- IRT Phase 2A Trunk and Feeder Support Infrastructure Work Package E5 Stage 2 Road Safety Audit, City of Cape Town, Western Cape, South Africa (Current): Lead Road Safety Auditor - Road safety audit. Client: GIBB Engineering & Science. Fee Value: ZAR 25,000.
- Erf 228 Raithby Residential Development Traffic Impact Assessment, Somerset West, Cape Town, South Africa (Current): Lead Transportation Engineer – Residential development traffic impact assessment. Client: Ginana cc. Fee Value: ZAR 89,000.
- Bloemdal Hospital Traffic Impact Assessment, Bloemfontein, Free State Province, South Africa (Current): Lead Transportation Engineer - Traffic impact assessment. Client: Bloemdal Hospital. Fee Value: ZAR 25,000.
- Farm Bergendal 1706 Mixed-use Development Traffic Impact Assessment, Bloemfontein, Free State Province, South Africa (Current): Lead Transportation

Engineer - Traffic impact assessment for mixed-use development. Client: WSP Bloemfontein. Project Value: Unknown. Fee Value: ZAR 48,000.

- Ya Rona Mixed-Use Development Traffic Impact Assessment, Bloemfontein, Free State Province, South Africa (Current): Lead Transportation Engineer - Traffic impact assessment. Client: MSC Consulting. Fee Value: ZAR 70,000.
- Tsogo Sun Flagship Central Business District Traffic Impact Assessment, Cape Town, Western Cape, South Africa (Current): Lead Transportation Engineer - Traffic impact assessment. Client: Tsogo Sun. Fee Value: ZAR 132,000.
- R300 Industrial Estate Traffic Impact Assessment, Cape Town, Western Cape, South Africa (Current): Lead Transportation Engineer - Traffic impact assessment for the industrial estate. Client: V2 Investments. Fee Value: ZAR 90,000.
- Integrated Rapid Transit Phase 2A Trunk and Feeder Support Infrastructure Work Package E1 Stage 2 Road Safety Audit, City of Cape Town, Western Cape, South Africa (Current): Lead Road Safety Auditor - Road safety audit. Client: GIBB Engineering & Science. Fee Value: ZAR 18,000.
- Integrated Rapid Transit Phase 2A Trunk and Feeder Support Infrastructure Work Package E3 Stage 2 Road Safety Audit, City of Cape Town, Western Cape, South Africa (Current): Lead Road Safety Auditor - Road safety audit. Client: GIBB Engineering & Science. Fee Value: ZAR 19,000.
- Kap Vley Wind Power Plant, Northern Cape, South Africa (Current): Lead Transportation Engineer - Traffic impact assessments to support environmental impact assessments. Client: Juwi Renewable Energies. Fee Value: ZAR 60,000.
- Penhill Residential Development, Cape Town, South Africa (Current): Lead Traffic Engineer and Transportation Planner - Transportation input to development framework and layout, liaison with client and authorities. Undertake transport impact assessment for 192 ha residential development (approximately 10,000 units). Client: Western Cape Provincial Government Department of Human Settlements. Project Value: ZAR 33 m. Fee Value: ZAR 780,000.
- Athlone Power Station Redevelopment, Cape Town, South Africa (Current): Lead Traffic Engineer and Transportation Planner - Transportation input to development framework and layouts. Liaison with client, stakeholders and authorities. Develop and draft traffic impact assessment, including revisions, and Council approval for 35 ha mixed-use redevelopment of Athlone Power Station site as Transit Oriented Development. Client: City of Cape Town. Project Value: ZAR 2 m. Fee Value: ZAR 100,000.
- Deep Freeze Macassar Upgrading Informal Settlement Programme, South Africa (Current): Project Member - Transport scoping report and traffic impact assessment for proposed redevelopment of settlement. Project in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 380,000.
- McDonald's Traffic Impact Assessments, South Africa (Current): Project Member - Ongoing traffic impact assessments and transportation input to multiple sites' conceptual design. Client: McDonald's South Africa. Fee Value: ZAR 16,000 - ZAR 90,000 each.
- Port of Saldanha Bay Traffic Study, Saldanha Bay, Western Cape, South Africa (2017): Project Leader - Traffic study with specific focus on measures to improve efficiency and operation of all multi-purpose terminal traffic. Client: Transnet Port Terminals. Fee Value: ZAR 210,000.
- Bishop Lavis Urban Node Regeneration, Cape Town, Western Cape, South Africa (2017): Project Member - Transport scoping report and traffic impact

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Transport and Infrastructure

assessment for proposed upgrades of urban node and sports fields. Client: City of Cape Town. Fee Value: ZAR 275,000.

- Monwood Upgrading Informal Settlement Programme, South Africa (2017): Project Member - Transport scoping report and traffic impact assessment for proposed redevelopment of settlement. Project in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 1.4 m.
- Preller Mega Centre Extension Road Safety Audit, Bloemfontein, Free State Province, South Africa (2016): Lead Road Safety Auditor. Client: Preller Mega. Project Value: Unknown. Fee Value: ZAR 30,000.
- Biotherm Solar and Wind Power Plants, Northern and Western Cape, South Africa (2016): Lead Transportation Engineer - Traffic impact assessments to support environmental impact assessments. Client: Biotherm. Project Value: ZAR 100,000. Fee Value: ZAR 45,000.
- R27 Section 9 Road Safety Audit, Northern Cape, South Africa (2016): Lead Road Safety Auditor - Stage 3 road safety audit. Client: South African National Roads Agency. Project Value: ZAR 100,000. Fee Value: ZAR 100,000.
- N8 Section 13 Compulsory Truck Stop, Free State Province, South Africa (2016): Lead Road Safety Auditor - Stage 3 road safety audit. Client: South African National Roads Agency. Project Value: ZAR 7.9 m. Fee Value: ZAR 50,000.
- Conradie Better Living Model Exemplar Project, Cape Town, South Africa (2016): Lead Traffic Engineer and Transportation Planner - Transportation input to development framework and layouts. Liaison with client, stakeholders and authorities. Develop and draft traffic impact assessment, including revisions, and Council approval for 22 ha high-density residential and mixed-use Transit Oriented Development. Client: Provincial Government of Western Cape. Project Value: ZAR 2.5 m. Fee Value: ZAR 2.5 m.
- N7 Section 4 Road Safety Audit, Western Cape, South Africa (2016): Lead Road Safety Auditor - Stage 3 road safety audit. Client: South African National Roads Agency. Fee Value: ZAR 100,000.
- Public Transport Shelter and Stop Survey and Design, South Africa (2016): Project Member - Survey planning, implementation programming and contract administration. Client: City of Cape Town. Fee Value: ZAR 5.1 m.
- Botleng, Delmas Shopping Centre, South Africa (2015): Project Member - Traffic impact assessment for proposed development. Client: Nonya Properties. Fee Value: ZAR 45,000.
- Breswal AH Benoni Shopping Centre, South Africa (2015): Project Member - Traffic impact assessment for proposed development. Client: Nonya Properties. Fee Value: ZAR 40,000.
- Northmead Mall Extensions Traffic Impact Assessment, Ekurhuleni, Gauteng, South Africa (2015): Project Member - Traffic impact assessment for proposed extensions. Client: Bentel Properties. Fee Value: ZAR 50,000.
- Auckland Park Traffic Calming Study, South Africa (2015): Project Member - Traffic calming study for residential suburb. Client: Johannesburg Development Agency. Fee Value: ZAR 24,000.
- Gwigwi Mrwebi Street Johannesburg "Complete Streets" Traffic Study, South Africa (2015): Project Member - Traffic calming study for residential suburb. Client: Atterbury Properties. Fee Value: ZAR 32,000.
- Beach View Hout Bay Traffic Impact Assessment, South Africa (2014): Project Member - Transport scoping report for proposed development. Client: Private. Fee Value: ZAR 65,000.

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

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- AgriProtein Cape Town, Traffic Impact Assessment, South Africa (2014): Project Member - Traffic impact assessment for new development. Client: WSP Environmental. Fee Value: ZAR 40,000.
- Port of Saldanha Bay Traffic Study, South Africa (2014): Project Leader - Traffic study with specific focus on measures to improve Port traffic management and operations, preferred mitigation measures, revised traffic management plan, public transport/ shuttle services, access upgrades, vehicle washing facilities (pollution control), road (link) and intersection upgrades. Client: Transnet Port Terminals. Fee Value: ZAR 286,000.
- Saldanha Bay Local Area Plan, South Africa (2014): Project Member - Transport scoping report and transportation planning. Project in conjunction with lead consultant ARG Designs. Client: Department of Rural Development and Land Reform. Fee Value: ZAR 65,000.
- Signal Hill People Mover, South Africa (2014): Project Leader - Technical feasibility and risk assessments of proposed mechanical people mover between Strand Street quarry and Signal Hill summit. Client: SANParks. Fee Value: ZAR 1 m.
- Nando's Restaurants, South Africa (2014): Project Member - Traffic impact assessments and transportation input to conceptual design of multiple sites. Client: Nando's South Africa. Fee Value: ZAR 50,000.
- Central Johannesburg College Traffic Impact Assessment, South Africa (2014): Project Member - Traffic impact assessments with specific focus on non-motorised transport environment. Client: Stauch Vorster Architects. Fee Value: ZAR 1 m.
- Landdroskop Road upgrade, South Africa (2014): Project Member - Tender document preparation and adjudication, resident engineer, inspection, payment certificates and closeout report. Client: CapeNature. Fee Value: ZAR 1,4 m.
- NATREF CF2 Traffic Impact Assessment, South Africa (2013): Project Member - Traffic impact assessment for implementation of refinery upgrades. Client: Nemai Consulting. Fee Value: ZAR 90,000.
- Carletonville Police Station Traffic Impact Assessment, South Africa (2013): Project Member - Traffic impact assessment for new station. Client: Maluleke Luthuli Development Planners. Fee Value: ZAR 55,000.
- First in Spec Biofuels, Traffic Impact Assessment, Coega, South Africa (2013): Project Member - Traffic impact assessment for new development. Client: First in Spec Biofuels. Fee Value: ZAR 50,000.
- National Port Masterplan, South Africa (2014): Project Member - Transport assessment and road and rail masterplanning. Responsible for Port Nolloth, Port of Saldanha Bay, Port of Cape Town and Port of Mossel Bay. Client: Transnet Ports Authority. Fee Value: ZAR 1.8 m.
- Mfuleni Urban Node Regeneration, South Africa (2014): Project Leader - Transport scoping report and traffic impact assessment for proposed regeneration of urban node. Project in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 300,000.
- Tableview Beachfront Traffic Study, South Africa (2013): Project Member - Transport study and assessment including proposals for rationalisation of road network. Client: City of Cape Town. Fee Value: ZAR 180,000.
- Paarden Eiland Milnerton South Local Area Spatial Development Framework, South Africa (2013): Project Leader - Transport scoping report and input to design framework for Local Area Spatial Development Framework. Project

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CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

Transport and Infrastructure

undertaken in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 350,000.

- SAPREF CF2 Traffic Impact Assessment, South Africa (2013): Project Member - Traffic impact assessment for implementation of refinery upgrades. Client: Shell and BP South Africa Petroleum Refineries. Fee Value: ZAR 75,000.
- Polokwane South Shopping Centre Traffic Impact Assessment, South Africa (2012): Project Member - Traffic impact assessment. Client: Moolman Group Properties. Fee Value: ZAR 80,000.
- Kwa-Guqa Shopping Centre, Emalahleni Traffic Impact Assessment, South Africa (2012): Project Member - Traffic impact assessment. Client: Moolman Group Properties. Fee Value: ZAR 80,000.
- Transport Planning and Traffic Study Pearl Marina, Uganda (2013): Project Leader - High-level transport masterplan and traffic impact assessment for proposed 400,000 m^2 GLA mixed-use luxury residential and commercial development (12 km east of Entebbe, Uganda on undeveloped peninsula site with a shoreline on Lake Victoria). Client: Centum Investment Company Limited, Kenya. Fee Value: ZAR 40,000.
- Wits Gold DRM Transport Management Plan, South Africa (2013): Project Leader - Detailed transport management plan as part requirement of environmental impact assessment process for proposed new gold mine. Client: GCS Water and Environmental Consultants. Fee Value: ZAR 80,000.
- Integrated Rapid Transit (MyCITI) Milestone Zero, Operational Support, South Africa (2012): Project Leader - Operational support contractual monitoring, reporting of transgressions and potential penalties, development of procedures, rollout of electronic control and ticketing system. Client: City of Cape Town. Fee Value: ZAR 12 m.
- Closeout Reports for Reconstruction and Development Programme Housing Projects, Eastern Cape, South Africa (2011): Project Member - 26 detailed closeout reports of completed and ongoing housing projects undertaken on behalf of Department for districts and local municipalities. Client: Department of Human Settlements; Eastern Cape Province. Fee Value: ZAR 600,000.
- Johannesburg Inner City Pedestrian Malls Project, Johannesburg, South Africa (2010): Project Leader - Traffic impact assessment to determine feasibility of converting four road sections in Johannesburg's inner city to full or partial pedestrian malls. Study included SATURN modelling conducted by sub-consultant, GOBA. Client: Johannesburg Development Agency. Fee Value: ZAR150,000.
- Rural Transport Business Plan Development, North West Province, South Africa (2010): Project Member - Evaluation of identified transport projects in various regions, and formulation of business plans to assist implementation. Client: National Department of Transport. Fee Value: ZAR 200,000.
- Eveleigh Extension 22, Boksburg, South Africa (2012): Project Leader - Traffic impact assessment to address various traffic-related objections raised in rezoning application. Client: Bentel Property Group. Fee Value: ZAR 70,000.
- Johannesburg Inner City Traffic and Transportation Study, Johannesburg, South Africa (2010): Project Coordinator - Multi-modal transport assessment and travel demand management measures. Client: Johannesburg Development Agency. Fee Value: ZAR 600,000.
- Traffic Engineering Support for City Council of Ekurhuleni, South Africa (2009): Project Leader - Land use applications, traffic safety investigations, traffic impact studies, security access restrictions, directional and tourism signage. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 1.4 m.

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

Transport and Infrastructure

- Gautrain, South Africa (2010): Project Member - Traffic monitoring, site visits, secretary of Gautrain coordination committee of Ekurhuleni Metropolitan Municipality. Undertook revised traffic impact assessment of Rhodesfield and Metrorail Station. Client: Gauteng Department of Public Transport Roads and Works. Fee Value: ZAR 500,000.
- Traffic Engineering Support for City Council of Tshwane, South Africa (2009): Project Leader - Assessment of traffic impact studies with emphasis on public transport and land-use aspects Client: City of Tshwane. Fee Value: ZAR 1.2 m.
- 2010 FIFA World Cup, Johannesburg and Pretoria, South Africa (2009): Project Member - Parking, freight planning, fan parks, pedestrian accommodation, traffic impact studies, traffic safety and transportation planning. Client: City of Tshwane. Fee Value: ZAR 300,000.
- Project Management of Johannesburg Roads Agency Capital Expenditure, Johannesburg, South Africa (2007): Senior Engineer - Identification of projects, budget allocation and oversight of capital spending. Tender documentation, bid adjudication and final inspection at completion. Directional Signage and Tourism Signage. Applications were received, assessed on site where necessary, and processed. Client: Johannesburg Roads Agency. Project Value: Undisclosed.
- Management of JRA traffic safety, South Africa (2007): Project Leader - Traffic safety investigations and training of technicians. Liaison and site meetings with councillors, clients and applicants where applicable. Client: Johannesburg Roads Agency. Project Value: Undisclosed.
- Gautrain Passenger Rail, South Africa (2007): Senior Engineer - Traffic related aspects of Gautrain project. Client: Johannesburg Roads Agency. Project Value: Undisclosed.
- Network planning, Johannesburg, South Africa (2006): Engineer - Macro and micro network analysis of existing and proposed road network in vicinity of project. Trip generation, trip distribution, trip allocation of proposed project. Generating GIS maps consisting of aerial photographs and existing and future road networks. Client: Waterfall City Development and Riverglen Estate Development. Fee Value: ZAR 200,000.
- Carletonville Bypass, Carletonville, South Africa (2006): Engineer - Network study and planning of bypass route to Carletonville. Feasibility study, generating GIS maps, recommendations and final report. Client: Gauteng Department of Roads and Transport Fee Value: ZAR 50,000.
- Cradle of Humankind, North West Province, South Africa (2005): Engineer - Network study and route planning through Cradle of Humankind. Addendums to existing route determinations and/ or basic planning of affected routes. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 30,000.
- Strategic Major Road Network, Johannesburg, South Africa (2005): Engineer - Network study and route planning affected by possible re-alignment of K77. Determining possible extensions of route into Johannesburg CBD to ensure network continuity. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 26,000.
- Road Safety Audits, Eastern Cape Province, South Africa (2005): Engineer - Road safety audits of three provincial routes in Eastern Cape including fieldwork, road safety audits and assessments, remedial measures' reports including schedules of quantity, report writing and generating GIS maps of roads, highlighting all safety deficiency locations. Client: Province of Eastern Cape, Department of Transport. Fee Value: ZAR 65,000.
- Security Access Restrictions in Greater Johannesburg, South Africa (2005): Engineer - Traffic impact studies for various suburban areas in Greater

Johannesburg who wish to apply for Security Access Restrictions (SARS) in terms of Johannesburg Road Agency SARS policy. Assessment of Security Access Restrictions Applications. Client: Various. Fee Value: ZAR 300,000.

- Pennyville Extension 1, Johannesburg, South Africa (2005): Engineer - Traffic impact studies for new township in Soweto, specific emphasis on pedestrian movement, safety, and future inter-modal facility adjacent to site as part of Johannesburg Metro's SPTN network. Client: Bigen Africa/ Pennyville Zamamphilo Relocation. Fee Value: ZAR 110,000.
- Union Buildings, Pretoria, South Africa (2005): Engineer - Studies for upgrades to Union Buildings. Specific emphasis on pedestrian accommodation, parking requirements and VIP visitors during special events. Client: Office of the President. Fee Value: ZAR 20,000.
- New Road/ N1 Freeway Single Point access interchange, Johannesburg, South Africa (2005): Engineer - Traffic impact study undertaken to determine level of service, deficiencies and general operation of New Road/ N1 Freeway Single Point access interchange. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 50,000.
- BP Freeway Service Area at Beyers Naude/ N1 Freeway Access Interchange, Johannesburg, South Africa (2005): Engineer - Traffic impact study to determine transgressions, operation, accident hotspots, feasibility and deficiencies of BP Freeway Service Area at Beyers Naude/ N1 freeway access interchange. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 50,000.
- Residential Development and Killarney Mall Extension on Riviera Road and Oxford Road, Johannesburg, South Africa (2004): Engineer - Traffic impact study, SIDRA analysis of intersections, recommendations for required upgrades and temporary measures required during construction phase. Client: David Lieberman Architects. Fee Value: ZAR 77,000.
- Randburg - Sandton Link, Johannesburg, South Africa (2004): Engineer - Investigation of east-west linkage between areas. Evaluation of previous traffic impact study and confirmation of current status. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 24,000.
- Left-in Left-out Access Study, Gauteng, South Africa (2004): Engineer - Report on investigation of left-in/ left-out only accesses on arterial routes, CORSIM modelling of possibilities and recommendations of most suitable options. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 25,000.
- Mafikeng Airport Feasibility Study, Mafikeng, South Africa (2004): Engineer - Feasibility study to determine airport's economic survivability. Analysis of historical landing data and revenue streams. Client: Price Waterhouse Coopers. Fee Value: ZAR 35,000.
- Roundabouts Design Guide, Gauteng, South Africa (2004): Engineer - Investigation and design guide for roundabouts on provincial roads, including ARNDT modelling of approach speeds, volumes and geometry. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 64,000.
- N1 Toll Study, Pretoria, South Africa (2004): Engineer - Investigation of queue lengths, level of service and operation of carousel and Pumulani Plazas, analysis of historical data, queuing analysis and recommendations to improve operation. Client: Bakwena. Fee Value: ZAR 48,000.
- Building Lines Policy, Gauteng, South Africa (2003): Engineer - Generation of final Gauteng Department of Roads and Transport policy document regarding building lines adjacent to provincial roads. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 80,000.

- London Transport Underground Optimisation, United Kingdom (1998): Project Member - Transport traffic surveys and optimisation project for London underground system. Client: London Transport. Fee Value: ZAR 550,000.

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX N3:

Social Impact Statement

Statement prepared by:	*Statement reviewed by*:
CSIR – Environmental Management Services P O Box 320 Stellenbosch South Africa	Applied Science Associates (Pty) Ltd- Rudolph du Toit 3 Red Oak Lane, Welgevonden Stellenbosch South Africa

December 2017

APPLIED SCIENCE ASSOCIATES

26 January 2018

Mrs. Kelly Stroebel
CSIR Environmental Management Services
11 Jan Cillier Road
Stellenbosch
7600

RE: EXTERNAL REVIEW OF THE SOCIAL IMPACT STATEMENT PREPARED FOR THE PROPOSED SKEERHOK 1 SOLAR PHOTOVOLTAIC (PV) FACILITY ON FARM SKEERHOK 395, PORTION 0, KENHARTD, NORTHERN CAPE PROVINCE

This letter is submitted in response to a Department of Environmental Affairs (DEA) request for an external review of the Social Impact Statement (SIS) submitted by CSIR as part of the EIA application for the Skeerhok 1 Solar PV facility. Juwi Renewable Energies (Pty) Ltd (the Applicant) subsequently appointed Applied Science Associates (Pty) Ltd on 18 January 2018 to conduct the requisite external review.

1. Context of the review

The Kenhardt area has seen a significant increase in solar PV EIA applications over the past 3 years (at least 11 applications have been submitted to DEA). All the relevant applications are proposed on a small cluster of farms located to the north-east of Kenhardt. As a result, numerous EIA reports, with attendant Social Impact Assessments (SIA) have been completed for this comparatively small geographic area. The anticipated social impacts likely to occur as a result of the proposed Skeerhok 1 Solar PV application is therefore well understood and extensively documented. In light of this reality, DEA instructed Juwi Renewable Energies (Pty) Ltd to compile a SIS, which draws on the findings of existing SIAs rather than primary research, in order to identify social impacts and assess its relative significance.

Consequently, the review findings presented in this letter is provided within the context of the detail, content, and level of research which is commensurate with an impact statement; and not a full-scale impact assessment.

2. Structure of the review

DEA requested that the review should answer the following questions:

- Indicate whether the recommendation by the Environmental Assessment Practitioner (EAP), that detailed studies are not required, is acceptable;
- Indicate whether the methodology used to arrive at the conclusion that detailed studies are not required is clearly explained and acceptable;
- Discuss the suitability of the proposed mitigation measures and recommendations, if any. Further, provide input to the EMPr, including additional mitigation and monitoring requirements to ensure that identified impacts are eliminated; and
- Evaluate the appropriateness of the reference literature used.

DEA further resolved that the external review findings should be submitted in the form of a cover letter; and not a full review report as is customary for the review of SIAs.

3. Review findings

3.1 *Indicate whether the recommendation by the Environmental Assessment Practitioner (EAP), that detailed studies are not required, is acceptable*

The recommendation is acceptable. Social change processes are, in general, slow changing variables which are unlikely to have changed significantly over the past 3 years since the original SIAs were drafted. Slow rates of social change are also associated with communities which are relatively insulted from exogenous change and shocks. While the Kenhardt community is most certainly vulnerable to change and shock; it is, by virtue of its rural location and limited economic growth, relatively insulated from exogenous socio-economic change processes (This notably excludes climate-related shocks). Furthermore, none of the proposed solar PV facilities, which are the topic of the SIAs considered in the impact statement, have received preferred bidder status; nor have any of these facilities been constructed in the study area. As a result, the economic and labor force context of the study areas is unlikely to have changed significantly since 2015.

3.2 *Indicate whether the methodology used to arrive at the conclusion that detailed studies are not required is clearly explained and acceptable*

The methodology used is acceptable. The SIS is correct in concluding that the argument in support of an impact statement is based on: (*i*) the abundance of social impact research available for the study area; (*ii*) the relative recency of said social impact research; and (*iii*) the similarity of the proposed development to previously assessed facilities. These factors are self-explanatory and, if considered together, provides a clear rationale that detailed studies are not required.

However, the research methodologies employed in the original SIAs, though referenced, is not explained in the SIS. This exclusion places a reader who is unfamiliar with said methodologies at disadvantage; as the research findings presented in the SIS could be difficult to interpret in the absence of a methodological framework.

The SIS should be updated to include a brief summary of the research methodologies upon which the findings in the report is based; alternatively, all references to these methodologies should be removed from the SIS.

3.3 *Discuss the suitability of the proposed mitigation measures and recommendations, if any. Further, provide input to the EMPr, including additional mitigation and monitoring requirements to ensure that identified impacts are eliminated*

The proposed mitigation measures and recommendations are suitable within the context of the proposed Skeerhok 1 Solar PV facility.

3.4 *Evaluate the appropriateness of the reference literature used*

The reference material used is appropriate. However, the 2014 Integrated Development Plan (IDP), and the Statistics South Africa 2011 Census Report used in the SIS appears to be dated. The !Kheis Local Municipality recently released its 2017/2018 IDP document, while Statistics South Africa has released the 2016 Community Household Survey. All the figures and facts extracted from the 2014 IDP, and the 2011 Census Report should be reviewed by CSIR to ensure accuracy. In addition, CSIR should update the SIS reference list to include the latest version of the IDP and the Statistics South Arica 2016 Community Household Survey.

It should be noted that, although updating of the reference literature is required, the basic socio-economic data presented in the SIS is unlikely to have changed significantly (please refer to the explanation of slow social change processes provided under *3.1* above). However, should the new material introduce significantly different socio-economic data; such data must be stated in the SIS, the relevant impacts and mitigation measures should be amended accordingly, and the SIS should be resubmitted to for external review.

4. Review statement

The SIS prepared for the proposed Skeerhok 1 Solar PV facility appears to be accurate in terms of the identified social impacts, the relative significance of said impacts, and the mitigation measures proposed. The SIS will benefit from a summary of the research methodologies employed in the SIAs which form the basis of the impact statement's findings; or alternatively removing all references to said methodologies so as to avoid confusion. In addition, the reference documents used in the SIS must be updated to include the !Kheis Local Municipality 2017/2018 IDP, and the 2016 Statistics South Africa Community Household

Survey. Should the updated material introduce significantly different socio-economic data; the SIS should be updated accordingly and resubmitted for external review.

However, these limited deficiencies, though in need of correction, do not appear to vitiate the basic accuracy of the impact statement.

In light of the above, this external review concludes that should the proposed changes be applied, and should no significantly new data be forthcoming from the updated reference material; the findings, accuracy, content, and quality of the Skeerhok 1 Solar PV SIS is of an acceptable standard, and is fit for purpose.

Yours sincerely,

Rudolph du Toit

Managing Director
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0769026479

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SOCIAL IMPACT STATEMENT

1 INTRODUCTION

juwi Renewable Energies (PTY) Ltd is proposing to develop three 100 Megawatt (MW) Solar Photovoltaic (PV) power generation facilities and associated electrical infrastructure (a 132 kV transmission line for each 100 MW facility) on Portion 0 of Smutshoek Farm 395 and Portion 9 of Gemsbok Bult 120, and the connection points to the Eskom Nieuwehoop Substation on the Portion 3 of Gemsbok Bult Farm 120, approximately 80 km south of Upington and 30 km north-east of Kenhardt within the !Kheis Local Municipality, Northern Cape Province.

As per the Plan of Study included in Final Scoping Report (September 2017) and subsequently approved by the Department of Environmental Affairs (DEA) on 30 November 2017, it was indicated that a **Social Impact Statement** will be produced to identify potential social impacts of the proposed development for the proposed Skeerhok PV 1, Skeerhok PV 2, and Skeerhok PV 3 solar energy projects, as well as the proposed Skeerhok PV – Transmission Line Basic Assessment project near Kenhardt in the Northern Cape. Various projects have been approved within the same area as the proposed Skeerhok PV facilities (Figure 1) and all the previous Environmental Impact Assessments (EIAs) included Social Impact Assessments (SIAs). There is therefore a large amount of information regarding the social impacts associated with PV projects in the Kenhardt area and these impacts are well known and documented. For this reason, it was proposed that a full specialist impact assessment is not deemed necessary for these projects.

This impact statement has been compiled by the CSIR using existing information and reviewed by Mr. Rudolph du Toit of Applied Science Associates (Pty) Ltd. The studies used as a reference for this impact statement are listed in Section 7.

1.1 Terms of Reference

The Social Impact Statement includes:

- A review of existing information, and collecting and reviewing baseline social information etc.
- Data from conducted interviews with key affected parties, including local communities, local landowners, key government officials (local and regional) etc as part of the reference studies (undertaken as part of the previous SIAs).
- An identification and assessment of key social issues and potential impacts (negative and positive) associated with the construction, operational and decommissioning phases of the proposed projects.
- An identification of potential mitigation and enhancement measures.
- A statement which includes an assessment of the potential social impacts associated with the proposed projects.
- An outline of mitigatory measures and additional management or monitoring guidelines.
- Input for the Environmental Management Programme (EMPr), including mitigation and monitoring requirements to ensure that negative social impacts are limited.

The Final Scoping Report was submitted to the National DEA on 3 November 2017 for decision-making. The Scoping Report was accepted by the National DEA on 30 November 2017. As part of the acceptance, the National DEA had the certain requirements for the Social Impact Statement, as shown in Table 1.1 below.

Table 1.1: National DEA Requirements for the Social Impact Statement (Acceptance of Scoping letter – 30 November 2017)

DEA Requirement	Feedback from Specialist/sub-section where this is addressed
x. The specialist input referred to in comment (viii) of the comments on the draft scoping report signed 19 October 2017; must additionally address the following:	
• indicate whether the recommendation by the EAP that detailed studies are not required is acceptable;	Please refer to cover letter above.
• indicate whether the methodology used to arrive at the conclusion that detailed studies are not required is clearly explained and acceptable;	Please refer to cover letter above.
• Discuss the suitability of the proposed mitigation measures and recommendations, if any. Further, provide input to the EMPr, including additional mitigation and monitoring requirements to ensure that identified impacts are eliminated;	Please refer to cover letter above.
• Evaluate the appropriateness of the reference literature used;	Please refer to cover letter above.
• Indicate details and conclusions of the site-inspection if one was carried out as part of the specialist input	No site inspection was carried out for the impact statement for this proposed project, however, the reference studies conducted by CSIR (2016) included site inspection(s). Please refer to Section 1.3 below for a description of the methodology used in the reference studies.
• Indicate if the studies being referred to covers the preferred site; and	Although the reference studies used in compiling this TIS covered a different development footprint, the access roads and routes will be the same as they fall on the same farm (s). In addition, due to the fact that the Skeerhok projects will be using the same technology, similar loads and frequencies can be expected.
• Provide an indication on the cumulative impacts of these studies in relation to the proposed development.	Refer to Section Table 1.2 below.
• Must be conducted or input provided on by a suitably qualified specialist in the field	Refer to Appendix A for the full CV of the specialist.

1.2 Study approach and methodology

The SIAs used as reference for this statement consulted secondary data sources (published documentation) to obtain basic socio-economic baseline demographics. This secondary data was then augmented with primary data generated by a site visit to the proposed project site as well as the town of Kenhardt. The methodologies used in the reference studies included:

- *Applied Anthropological Methods*
    - Collection of primary data during the site visit was guided by a Participant Observation Methodology (Anderson & Taylor, 2002).
    - The interviews aimed to uncover the major livelihood strategies present in the study area, to understand the key socio-economic challenges, and gain insights into the 'constructed reality' of the Kenhardt community.
    - Observation of community members' lives, routines and living environments help to gain insight into practices, patterns and processes which community members may not be consciously aware of.

- *Systems Theory*
    - A holistic approach was adopted towards understanding and representing the affected environment.
    - Accordingly, the receiving environment and subsequent impacts thereon were viewed and interpreted as a coupled socio-ecological system (SES).
    - Typical socio-economic baseline data is then represented in a Causal Loop Diagram (CLD) to illustrate the systemic causal linkages between variables present in the SES in which the study area is located.

- *Vulnerability Context*
    - An Asset Pentagon was used to interpret the collected information. An Asset Pentagon is an assessment method developed within the discipline of Livelihoods Assessment, and aims to establish the vulnerability context of a given social grouping.
    - As a result, the research approach is descriptive in nature and uses indicative reasoning to reach its impact assessment findings.

1.3 Assumptions and Limitations

The following assumptions and limitations were listed in the SIAs and would therefore apply to this impact statement:

- Primary and secondary data on the study area is very limited. The site visit undertaken as part of the reference studies (CSIR, 2015) was therefore intended to gather sufficient primary data to guide the SIA. However, information gathered during the site visit generally carried a medium level of confidence as the SIA is an applied research method, as opposed to a scientific research method. This means that much less time and resources are available for primary research and the subsequent verification of findings. As a result, the majority of the significance ratings ascribed to both the potential positive and negative impacts of the proposed Kenhardt PV and Transmission Line projects were given a ***medium*** confidence rating.
- The SIAs assumed that the majority of socio-economic impacts will be experienced in the town of Kenhardt; due to its proximity to the project site. It is however possible for socio-economic

impacts to be experienced in other urban nodes close to the project site. The project boundary, in terms of socio-economics, is therefore arbitrarily constructed.

- The cumulative impact assessment assumes that a total of **six** approved renewable energy developments will be awarded preferred bidder status in the surrounding area, as stipulated by the DEA within the Scatec Environmental Authorisation letter for 14/12/16/3/3/2/837, "Conditions of this Environmental Authorization", Scope of Authorisation, Point 2 (07/08/2017). However, as a precautionary approach, all developments were included in the cumulative impact assessment.

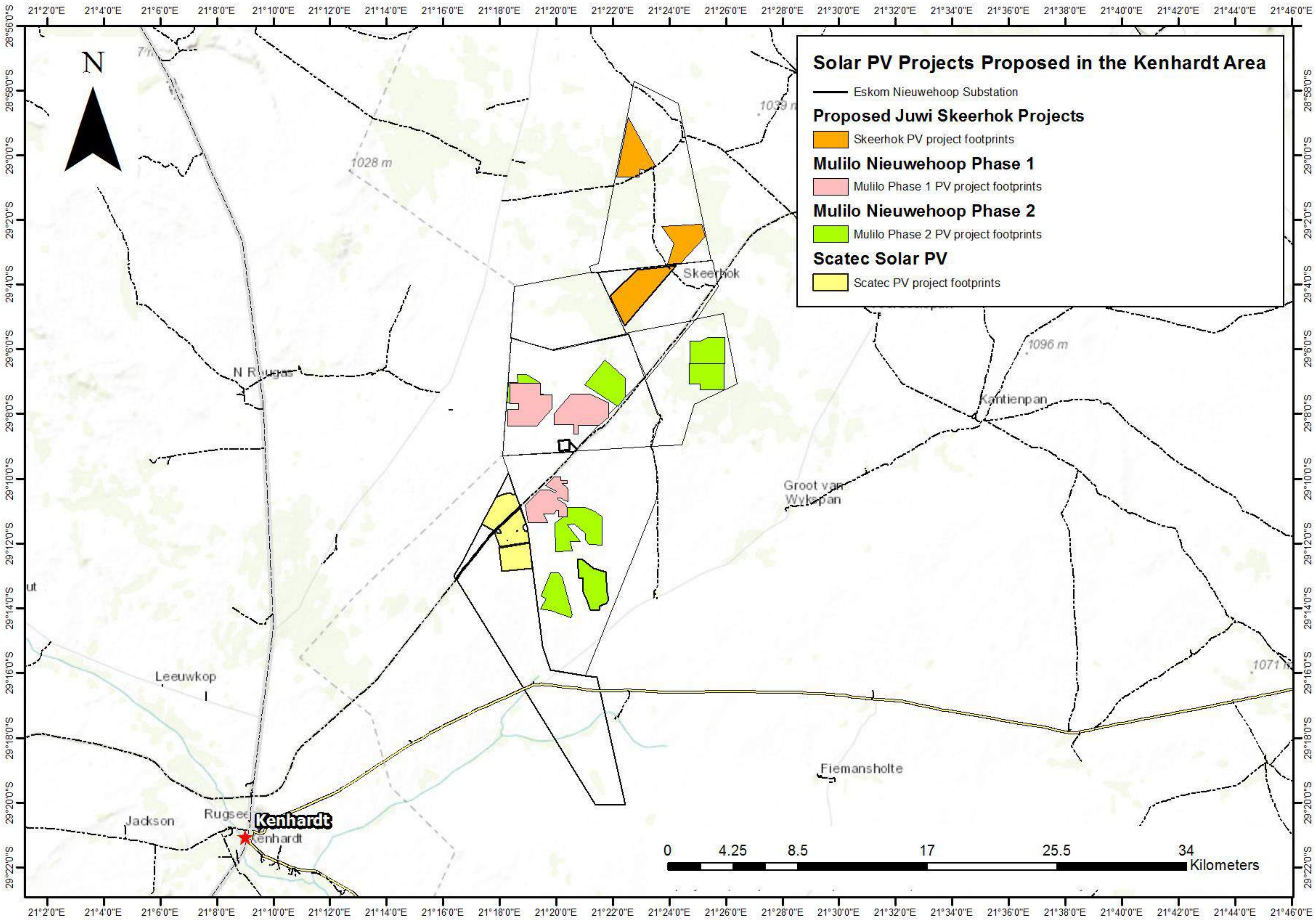


Figure 1: Cumulative locality map for the proposed three juwi Skeerhok Solar PV Projects, and the two reference studies (three Scatec Kenhardt Solar PVs and seven Mulilo Kenhardt Solar PVs) near Kenhardt in the Northern Cape

2 PROJECT CONTEXT (SOCIO-ECONOMICS)

2.1 Project Information

The current land use of the proposed project areas, as well as the surrounding land parcels is zoned for agricultural development and use (see locality in Figure 1 above). The construction phase of each proposed solar PV facility would last approximately 18 months. The construction phase of the proposed transmission line (which is subject to the BA Process) is expected to last 12 to 14 months. However, it should be noted that the construction period is subject to the final requirements of Eskom and the Renewable Energy Independent Power Producer Procurement Request for Proposal provisions at that point in time.

Employment opportunities created during the construction phase for the PV projects equates to 1600 (600 direct and 1000 indirect) employment during the construction period and 200 (50 direct and 150 indirect) employment opportunities during the operation period. Employment opportunities created during the construction phase of each transmission line project are estimated to range between 1 560 and 1 820 man months. It should be noted that the employment opportunities provided in this Statement are estimates taken from the reference studies and is dependent on the final engineering design and the REIPPPP Request for Proposal provisions at that point in time.

Employment opportunities to be created during the operational phase equate to approximately 4 800 man months (for skilled opportunities) and approximately 9 600 man months (for unskilled opportunities) per project (i.e. three 100 MW PV projects in total) over the 10 -20 year plant lifespan. A detailed project description is provided in Chapter 2 of the EIA Report and Section A of the BA Report.

3 AFFECTED SOCIO-ECONOMIC ENVIRONMENT

3.1 Socio-economic Baseline Data

3.1.1 Secondary Data

The study area is located within the ZF Mgcawu District Municipality (formally known as the Siyanda District Municipality) and the the !Kheis Local Municipality. However, the closest urban centre, Kenhardt, is located in the Kai !Garib Local Municipality. Given the proximity of the proposed projects to the town of Kenhardt; the focus of this Social Impact Statement will be on the Kai !Garib Local Municipality (Figure 1.2), as this is where the vast majority of potential project impacts (both positive and negative) might manifest. According to the Kai !Garib Final IDP (2017/18) and the Stats SA 2011 Census data, the total population of the Kai !Garib municipal area is 68 929; of which 6 679 resides in the Kenhardt area. A total of 16 703 households resides in the Kai !Garib Local Municipality, with 35% of households being female headed. The total female population dominates the total male population by 8.5% (Kai !Garib Draft IDP, 2017/18). Population of the working age demographic (15 to 65 years) makes-up 70.5% of the population, whereas those below 15 years of age comprises 24.4% of the population; the + 65 years age group makes-up 5.1% of the population. Accordingly, the dependency ratio (the economically active population vs the non-economically active population) is 41.9% (Stats SA, 2011). The official unemployment rate of 10% has decreased by 6.1% since the 2011 Census measurement of 16.1%. The economic sector is dominated by agriculture which provides 51.8% of jobs, followed by the Community and Government Services sector with 15.9%.

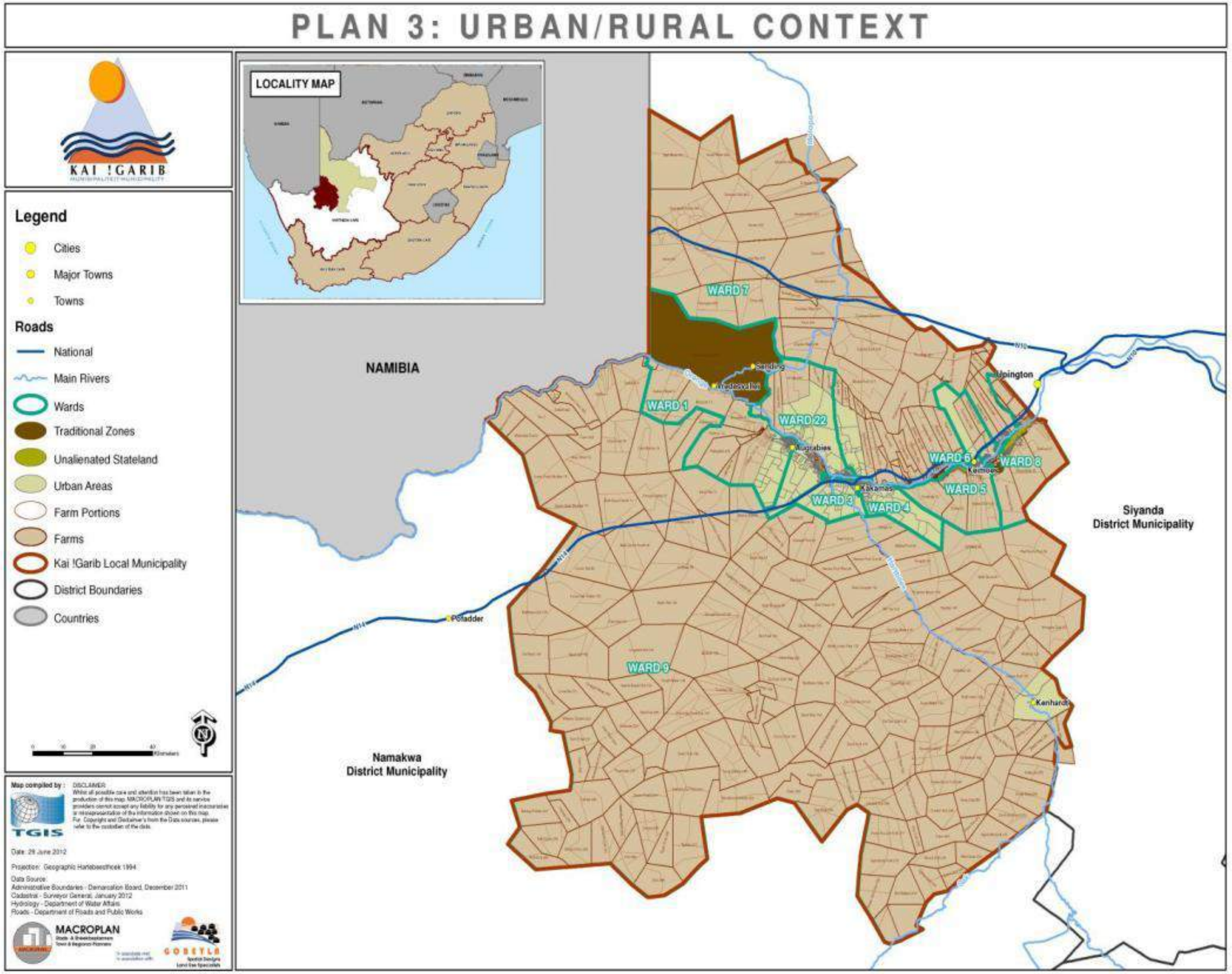


Figure 2: Kai !Garib Local Municipality (Source: Kai !Garib Draft IDP, 2017/18

The major social challenges faced in the Kai !Garib Municipal area include (Kai !Garib Draft IDP, 2014):

- Increases in drug abuse;
- Increases in children under 10 years abusing alcohol;
- Increases in teenage pregnancies;
- Increased crime linked to alcohol and drug abuse;
- High youth unemployment rates; and
- Increased prevalence of HIV & AIDS.

The Kenhardt community appears to have acceptable access to both Human and Social capital. Informants reported that community members are generally in very good health and that most young adults have a secondary education. The high level of unemployment and the increasing number of teenage pregnancies present in Kenhard requires robust social capital to prevent affected community members from falling into abject poverty. The relative success of the local community in preventing this, suggests that access to Social capital is satisfactory.

Access to pysical capital in Kenhardt seems average to low. The community has access to bulk services (water, electricity and waste collection), and a range of housing types ranging from formal to informal. Transport is not a significant factor within Kenhardt, due to its very small size; however, access to other urban areas (e.g. Keimoes, Kakemas and Upington) is limited to private transport. Informants also indicated that access to information and awareness of basic rights and public services are very low. Natural capital in Kenhardt is limited due to the harsh climatic conditions and general lack of irrigation water. As a result, community members appear to have limited access to productive natural assets. Finally, access to financial capital is very limited as the bulk of the vulnerable section of the Kenhardt community seems to be dependent on government subsidies and pensions.

4 IDENTIFICATION OF KEY ISSUES AND ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

By far the most significant driver of change likely to result from the proposed project is the influx of job seekers into the Skeerhok PV 1, 2 and 3 study area, and the corresponding increase in spending and employment. Such an influx of "strangers" into the receiving environment is likely to cause a disturbance in the order of the existing social structure and might also lead to increases in social deviance. Increased spending and employment (even though such employment might be short-term) generates positive impacts through the multiplier effect and by providing much needed financial relief in the area. However, it also creates significant, and often unrealistic, expectations regarding potential employment. **Table 3** below summarizes the impacts from each phase that are anticipated or expected to occur due to the proposed Skeerhok PV projects and transmission line.

The Draft Scoping Report was released for a 30-day comment period which extended from Wednesday 20th September 2017 to Monday 23rd October 2017. The Draft EIA Report is also being released for a 30-day comment period. To date, no specific comments have been raised by I&APs that relate to social impacts.

4.1 Identification of Potential Impacts

Based on the status quo conditions of the study area and the nature of the proposed development, the following social impacts were identified:

- Influx of jobseekers;
- Increases in social deviance;
- Increases in incidence of HIV/AIDS infections;
- Expectations regarding jobs;
- Local spending;
- Local employment;
- Human development resulting from the proposed Economic Development Plan; and
- Job losses at the end of the project life-cycle.

4.2 Residual Impacts

A number of potential negative socio-economic impacts resulting from the proposed Skeerhok projects are likely to persist regardless of proposed mitigation measures. Increases in social deviance are unlikely to be mitigated completely and a certain measure of social disruption and loss of social capital must be accepted as part of the proposed developments. Secondly, an influx of job seekers will occur in spite of the mitigation proposed. In-migration is a double edged sword; as not all in-migration necessary leads to social disruption.

4.3 Cumulative Impacts

Development of more solar energy facilities and associated electrical infrastructure (such as transmission lines) in the study area is likely to negatively impact on biodiversity, farming and tourism. These impacts might further negatively affect local industries, and consequently diminish certain livelihood strategies. However, the relationship of biodiversity, tourism and farming to the majority of local livelihood strategies is weak (CSIR, 2015). As a result, cumulative impacts on biodiversity, tourism and farming in the study area appear to be acceptable.

Similarly, the incidence and severity of the in-migration of job seekers as well as increases in social deviance might increase as more solar energy facilities and associated electrical infrastructure (such as transmission lines) are developed in the study area. This is of importance as several other solar energy developments are being proposed in the Kenhardt area (e.g. the Mulilo Renewable Project Developments (PTY) Ltd Nieuwehoop Phase 1 and Phase 2 solar energy developments). However, such increases are also associated with most other forms of economic and social development and should therefore be expected from any industrial scale developments in the study area.

Finally, the cumulative success of the proposed project and other projects offering significant socio-economic benefits are likely to present a major economic pull factor which might exacerbate in-migration into the study area as well as increases in social deviance. However, the cumulative socio-economic benefit offered by industrial scale development in the study area outweighs the negative impacts associated with economic growth. It should also be borne in mind that influx of job seekers does not necessarily equate in social deviance; i.e. influx of job seekers is a social disruptor which *could* result in social impacts. Given the relative balance between cumulative benefits and impacts, the significance rating ascribed to the cumulative impact of the proposed development is rated as being ***long term to medium term*** in duration, ***local*** in extent and of ***moderate significance*** (negative) rating.

Table 2: Impact rating table

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION AND OPERATIONAL PHASE													
Impact 1: Influx of job seekers into the Kenhardt area	Disruption of existing social structures	Negative	Local	Medium to Long-term	Substantial	Likely	Low	Moderate	• Develop and implement a Workforce Recruitment Plan • Reserve employment, where practical, for local residents • Clearly define and agree upon the PAP • Develop a database of PAP and their relevant skills and experience • Develop and implement a Stakeholder Engagement Plan	Moderate	Low	4	Medium
Impact 2: Outsiders moves into the Kenhardt area	Increases in social deviance	Negative	Local	Medium-term	Substantial	Likely	Low	Moderate	• Develop and implement a Workforce Recruitment Plan • Reserve employment, where practical, for local residents • Clearly define and agree upon the PAP • Develop a database of PAP and their relevant skills and experience • Develop and implement a Stakeholder Engagement Plan • Delivery on the Economic development Plan must be contractually binding on the proponent	Moderate	Low	4	Medium

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Impact 3: Expecta-tions created regarding possible employ-ment	Increased frustration in the local community	Negative	Local	Short-term	Moderate	Likely	High	Moderate to low	• Develop and implement the Stakeholder Engagement Plan	Low	Very low	5	Medium
Impact 4: Local spending	Socio-economic benefits as a result of the multiplier effect	Positive	Local	Medium to long-term	Moderate	Likely	n/a	n/a	• Procure goods and services, where practical, within the study area • Obtain regularly required goods and services from as large a selection of local service providers as possible	Low	Low	4	Medium
Impact 5: Local employ-ment	Socio-economic benefits	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	• Develop and implement a Workforce Recruitment Policy	Moderate	Moderate	3	High
Impact 6: Economic Develop-ment Plan	Contribute to local employment, local spending and human capacity development	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	• The proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Kenhardt community • Such skills and competencies should then be included in the Economic Development Plan • Where possible, align Economic development Plan with Local Municipality's IDP	Moderate	Moderate	3	High

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE													
Impact 7: Decom-missioning of the proposed develop-ment	Job losses	Negative	Local	Long-term	Substantial	Very likely	Moderat e	Moderate	• The proponent should comply with relevant South African labour legislation when retrenching employees • Juwi should also implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning • All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse	Moderate	Low	4	High
CUMULATIVE IMPACTS													
Exacer-bated in-migration	Disruption of social structures	Negative	Local	Medium to long-term	Substantial	Likely	Low	Moderate	n/a	Moderate	Moderate	3	Medium

5 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The key mitigation measures proposed by the specialist in the reference studies, and which needs to be included in the EMPr are listed below.

Construction and Operational Phase Mitigations:

- Develop and implement a Workforce Recruitment Plan;
- Reserve employment, where practical, for local residents;
- Clearly define and agree upon the Project Affected People (PAP);
- Develop a database of PAP and their relevant skills and experience, or use an existing legitimate database of skills and expertise;
- Develop and implement a Stakeholder Engagement Plan;
- Delivery on the Economic Development Plan must be contractually binding on the proponent;
- Procure goods and services, where practical, within the study area;
- Obtain regularly required goods and services from as large a selection of local service providers as possible;
- The proponent should engage with local NGOs, CBOs and local government structures in the Kenhardt community to identify and agree upon relevant skills and competencies required;
- Such skills and competencies should then be included in the Economic Development Plan; and
- Where possible, align the Economic Development Plan with Local Municipality's IDP.

Decommissioning Phase Mitigations

- The proponent should comply with relevant South African labour legislation when retrenching employees;
- juwi should also consider appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning; and
- All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse.

Monitoring recommendations for the above mitigation measures are included in the complete EMPr (included as Part B of the EIA Report).

6 CONCLUSION AND RECOMMENDATIONS

Very little socio-economic data is available for the study area. Census data and information from the Kai !Garib Local Municipality Draft IDP (2014) was obtained for the reference studies; however, these only deal with the larger municipal area and offer no site specific data on socio-economic conditions within and around the town of Kenhardt. Secondary data was subsequently supported by a site visit to Kenhardt during the previous SIAs undertaken. (CSIR, 2015). The site visit's outcome showed that Kenhardt is an area of low employment, substantial poverty and limited livelihood strategies. Access to Human and Social capital appears to be acceptable, while access to Physical capital seems average. However, access to Natural and Financial capital is limited. This constrained access to capital limits the ability of vulnerable members of the community to adapt livelihood strategies should it be required; which results in vulnerability.

The overall significance rating of the *negative* socio-economic impacts associated with the proposed project is ***low to moderate***; whereas the overall significance rating of the *positive* socio-economic impacts associated with the proposed development is ***moderate***.

It should be accepted that the development of the proposed projects is likely result in some form of negative social impact to the local community. However, such a negative impact needs to be weighed against the potential benefit likely to result from the same development. Given the overall medium significance negative impact of the project, as compared to the overall medium-high significance positive impact of the project; it can be concluded that the prospective socio-economic benefits of the proposed project outweighs the socio-economic losses/impacts. In addition, the local vulnerability context strongly suggests that acceptable, though declining, levels of Social and Human capital is present within the Kenhardt community, which should assist with the mitigation of potential negative socio-economic impacts resulting from the proposed project. Conversely, very limited Financial capital is available in the local community, which in turn adds to the erosion of existing Social and Human capital. Accordingly, there appears to be a clear need to invest in the development of Financial capital within the Kenhardt community in order to restore some level of balance between asset classes which in turn should facilitate more options to local community members in terms of viable livelihood strategies.

7 INFORMATION SOURCES

The information used for the compilation of this impact statement was drawn from the following sources:

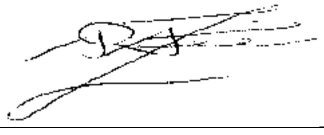
- Du Toit, R. (2015). Social Impact Assessment for proposed Scatec Solar PV Energy Facilities near Kenhardt, Northern Cape Province. Surina Laurie, CSIR, Stellenbosch.
- Du Toit, R. (2014). Social Impact Assessment for the proposed Solar Energy Facilities of the Phase 1 Nieuwehoop Solar PV Park near Kenhardt. Surina Laurie, CSIR, Stellenbosch.
- Du Toit, R. (2015). Social Impact Assessment for the proposed Solar Energy Facilities of the Phase 2 Nieuwehoop Solar PV Park near Kenhardt. Surina Laurie, CSIR, Stellenbosch
- The Kai !Garib Local Municipality Draft IDP of 2014.

8 DECLARATION OF INDEPENDENCE OF SPECIALIST

Mr. Rudolph du Toit has reviewed this statement. Please refer to Appendix A of this Impact Statement for the Curriculum Vitae of Mr. du Toit and his letter (page 1), which confirms that this impact assessment is suitable for this project and in line with his previous studies’ findings. The declaration of independence by the specialist is provided below:

BOX 1: DECLARATION OF INDEPENDENCE

I, Rudolph du Toit, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Skeerhok PV Facilities and Transmission Lines Project, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



RUDOLPH DU TOIT DATE: 26 January 2018

Appendix A: Curriculum Vitae of the Specialist

APPLIED SCIENCE ASSOCIATES

Curriculum Vitae: Rudolph du Toit

Personal information

Name:	Rudolph du Toit
Firm:	Applied Science Associates (Pty) Ltd
Position in Firm:	Managing Director
Date of Birth:	23 May 1978
Email:	rudolph@appliedscience.co.za
Telephone number:	076 902 6479

Tertiary qualifications

Undergraduate:

Bachelor of Arts (BA) in Environment and Development Studies
Department of Geography and Environmental Studies
University of Stellenbosch (US), 2003-2005

Honours:

Bachelor of Philosophy (B.Phil.) in Development Planning
School for Public Leadership
University of Stellenbosch (US), 2006

Masters:

Master of Philosophy (M.Phil.) in Development Planning
School of Public Leadership
University of Stellenbosch (US), 2007-2009

Academic honours

- Golden Key International Academic Honours Association invitee: 2003 to 2007

- Stellenbosch University Dean's List (Top 10% academic achievers): 2003
- Stellenbosch University Merit Bursary: 2004 & 2005
- Transnet Bursary: 2004
- South African National Energy Research Institute (SANERI) Bursary: 2007 & 2008

Employment experience

1. Organisation: Independent contractor for the CapeNature Working for Water Project
   Position: Team leader: Natural resource management (Alien clearing)
   Period: 1998 to 2001

3. Organisation: Strategic Environmental Focus (SEF) (Pty) Ltd.
   Position: Sustainability coordinator: Environmental planning & reporting
   Period: 2008 to 2010

4. Organisation: Council for Scientific and Industrial Research (CSIR)
   Position: Senior Environmental Planner
   Period: 2010 to 2017

5. Organisation: University of Stellenbosch
   Position: Guest lecturer: Development Planning and Environmental Analysis module (part-time)
   Period: 2013 to present

6. Organisation: University of Stellenbosch
   Position: External moderator of the Honours-level Development Planning course (School for Public Leadership) (part-time)
   Period: 2015 to present

7. Organisation: Applied Science Associates (Pty) Ltd
   Position: Managing Director
   Period: 2017 to present

Professional affiliations

Registered member of the South African Institute for Impact Assessment (IAIA) (Registration number 2779)

Research publications

- Contributing author to: Dalal-Clayton, B. (2013) ***The Role of Strategic Environmental Assessment in Promoting a Green Economy: Background document for the OECD DAC SEA task Team workshop on SEA & Green Economy, Lusaka, 17- 18 January 2013***. IIED, London
- Du Toit, R. (2009). ***Developing a Scorecard for Sustainable Transport: A Cape Town Application.*** Stellenbosch University Press
- Michelle Audouin, Mike Burns, Alex Weaver, David le Maitre, Patrick O'Farrell, Rudolph du Toit, Jeanne Nel. (2015). ***An Introduction to Sustainability Science and its Links to Sustainability Assessment.*** *In Morrison-Saunders, A. and Pope, J., Eds. Handbook of Sustainability Assessment.* Edward Elgar Publishing, 321 -349. ISBN 978-1-78347-136-2

Conference presentations & papers

- Du Toit, R. (2012). **Wind *Energy and Public Participation: A one-sided debate?*** Proceedings of the 17th Annual Conference of the International Association for Impact Assessment South Africa: "Urban Evolution", 27 - 29 August, 2012.
- Du Toit, R. & Van der Westhuizen, C. (2013). ***Strategic Environmental Assessment (SEA) as a means of building the Green Economy in South Africa: The development of a national wind and solar energy roll-out plan.*** Proceedings of the OECD DAC SEA Task Team Workshop on SEA & Green Economy, Lusaka (Zambia), 17- 18 January 2013.
- Burns, M., Du Toit, R. & Schreiner, G. (2013). ***Graphical Causal Loop modelling of socio-ecological systems to identify & evaluate key impact "strings".*** Proceedings of the 18th Annual Conference of the International Association for Impact Assessment South Africa: 16 - 18 September, 2013.

Key courses

- Advanced Facilitation & Experiential Learning: Team Building Institute (Pty) Ltd (2001)
- Clean Development Mechanism (CDM) Project Development Training: Danish Energy Management (Pty) Ltd (2008)
- Project Management Principles & Practice: University of Pretoria (2011)
- Integrating Sustainability with Environmental Assessment in South Africa (Presented by A. Morrison –Saunders & J. Pope): North-West University (2012)
- Science Communication and Working with the Media: Proof Communications/Jive Media Africa (2014)
- Sharpening the Tool: New techniques and methods in Environmental Impact Assessment: Sustainable Environmental Solutions (Pty) Ltd (2015)
- Effective Skills for Challenging Meetings & Engagements: Conflict Dynamics (2015)

Professional experience

The following table presents an abridged list of projects that I have been involved in, indicating my role in each project:

Environmental Impact Assessment (EIA) Experience		
Project	**Role**	**Date**
1. Basic Assessment: Bottelary Road Upgrade: Van der Merwe Venter Twenty Group and Silmore Trust	Environmental Control Officer	July 2009
2. MTN Remote Hub: Umbutho Civil & Electrical	Environmental Control Officer	July 2009
3. Basic Assessment: Hermanus (Overberg Municipality) substation upgrade & underground cable	Junior Environmental Manager and co-author	August 2009

Page **3** of **8**

Environmental Impact Assessment (EIA) Experience

Project	Role	Date
4. Basic Assessment for the InnoWind Swellendam wind energy project: Single test turbine construction	Project manager and lead author	January 2010
5. Basic Assessment for the InnoWind Heidelberg wind energy project: Single test turbine construction	Project manager and lead author	January 2010
6. Basic Assessment for the InnoWind Albertinia wind energy project: Single test turbine construction	Project manager and lead author	January 2010
7. Basic Assessment for the InnoWind Mossel Bay wind energy project: Single test turbine construction	Project manager and lead author	January 2010
8. EIA for InnoWind Swellendam wind energy project, Western Cape	Project manager and lead author	July 2010
9. EIA for InnoWind Heidelberg wind energy project, Western Cape	Project manager and lead author	July 2010
10. EIA for InnoWind Albertinia wind energy project, Western Cape	Project manager and lead author	July 2010
11. EIA for InnoWind Mossel Bay wind energy project, Western Cape	Project manager and lead author	July 2010
12. EIA for the Electrawinds (NL) Coega IDZ Wind Energy Project: Proposed construction of 75 MW installed capacity	Project manager	January 2010
13. EIA for Glencore Exploration (UK): On-shore and off-shore exploration drilling operation; Matanda Block, Cameroon	Project manager	November 2010
14. EIA for Noble Energy (Cameroon): Off-shore exploration drilling, Yoyo Concession and Tilapia Exploration Block, Cameroon	Management, integration and drafting of water quality section of the EIA report.	April 2011
15. EIA for the Vleesbaai Independent Power Producer (VIPP) Wind Energy Facility near Vleesbaai	Project manager and lead author	August 2012
16. Windlab Developments South Africa (Pty) Ltd Ishwati Emoyeni 140 MW Wind Energy EIA near Murrysburg in the Western Cape	Project manager	September 2014
17. EIA for the City of Cape Town 1500 MW Gas-to-power facility, Atlantis, Western Cape	Project leader	July 2015

Strategic Environmental Assessment (SEA) Experience		
Project	**Role**	**Date**
18. Strategic Environmental Assessment (SEA) for the Port of Saldanha: Transnet National Ports Authority (TNPA)	Project manager and lead author	July 2012
19. City of Cape Town Far South Strategic Environmental Assessment (SEA)	Project manager and lead author	June 2014

Social Impact Assessment (SIA) Experience		
Project	**Role**	**Date**
20. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
21. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
22. Mulilo Renewable Project Developments (Pty) Ltd Boven Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
23. Scatec (Pty) Ltd Rugseer Farm Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
24. Scatec (Pty) Ltd Rugseer Farm Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
25. Scatec (Pty) Ltd Rugseer Farm Solar PV3 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
26. SEA for the Square Kilometer Array (SKA) South Africa	Social engagement specialist for the CSIR	September 2015
27. Mainstream Renewable Energy (Pty) Ltd 2 x 140MW Wind Energy Facility EIA near Victoria West	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	April 2016
28. Afdaksrivier Trust Residential Development near Fisherhaven, Western Cape Province	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2017
29. CSIR National Aquaculture Strategic Environmental Assessment (SEA)	Contributing author to the socio-economic impacts chapter of the SEA.	October 2017

Environmental Law Experience		
Project	**Role**	**Date**
30. EIA for InnoWind Swellendam wind energy project, Western Cape	Drafting of appeal against EA refusal by Competent Authority	June 2011
31. EIA for InnoWind Heidelberg wind energy project, Western Cape	Drafting of appeal against EA refusal by Competent Authority	June 2011
32. EIA for InnoWind Albertinia wind energy project, Western Cape	Drafting of appeal against EA refusal by Competent Authority	June 2011
33. EIA for InnoWind Mossel Bay wind energy project, Western Cape	Drafting of appeal against EA refusal by Competent Authority	June 2011
34. Windlab Developments South Africa (Pty) Ltd Ishwati Emoyeni 140 MW Wind Energy EIA near Murrysburg in the Western Cape	Drafting of responding statement in rebuttal of appeal of EA buy I&APs	October 2015
35. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Drafting of appeal against EA refusal by Competent Authority	September 2016
36. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar PV3 75MW Solar Photovoltaic EIA in the Northern Cape	Drafting of appeal against EA refusal by Competent Authority	September 2016
37. Mulilo Renewable Project Developments (Pty) Ltd Boven Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Drafting of appeal against EA refusal by Competent Authority	September 2016
38. Scatec (Pty) Ltd Rugseer Farm Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Drafting of appeal against EA refusal by Competent Authority	October 2016
39. Scatec (Pty) Ltd Rugseer Farm Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Drafting of appeal against EA refusal by Competent Authority	October 2016
40. Scatec (Pty) Ltd Rugseer Farm Solar PV3 75MW Solar Photovoltaic EIA in the Northern Cape	Drafting of appeal against EA refusal by Competent Authority	October 2016
41. EIA for the City of Cape Town 1500 MW Gas-to-power facility, Atlantis, Western Cape	Drafting of appeal against EA refusal by Competent Authority	July 2016

Environmental Management & Sustainability Planning Experience		
Project	**Role**	**Date**
42. Working for Water (CapeNature) alien clearing project: Uniondale Poort	Team Leader: natural resource management	January 1998
43. Working for Water (CapeNature) alien clearing project: Avontuur area	Team leader: natural resource management	March 1999
44. Working for Water (CapeNature) alien clearing project: Prince Alfred	Team leader: natural resource management	January 2000

Environmental Management & Sustainability Planning Experience		
Project	**Role**	**Date**
Pass area		
45. Working for Water (CapeNature) alien clearing project: Langkloof farms	Team leader: natural resource management	February 2001
46. Qualitative Environmental Impact Analysis related to Major Incedent: PetroSA Mossel Bay GTL refinery	Project manager and lead author	October 2010
47. Maseve Platinum Sustainability Assessment, Rustenburg	Project manager	August 2011
48. Notice of Impacts Associated with Exploration Drilling in BHP Billiton Gabon's Licensed Areas of Okondja, Akieni & Lastoursville (Gabon)	Project manager	June 2011
49. PetroSA LNG Importation Pipeline Screening Study (Saldanha Bay to Mosselbay)	Responsible investigating and assessing planning impacts	March 2014
50. Department of Environmental Affairs (DEA) National Sustainable Development Strategy and Action Plan (NSSD) 1: Monitoring & Evaluation Report	Project manager and lead author	November 2013 (on-going)
51. Apollo Brick (Pty) Ltd energy efficiency and fuel switching CDM project	Investigation of possible conversation of the energy efficiency project to an accredited CDM project	January 2008
52. Mxit Lifestyle (Pty) Ltd carbon footprint audit	Carbon audit of Mxit Lifestyle (Pty) Ltd	January 2009
53. EIA for Addax Petroleum: Off-shore exploration/appraisal drilling; Ngosso Permit, Cameroon	Research team: collection of benthic macrofauna samples and bio-indicators for water quality analysis	August 2010
54. EIA for Glencore Exploration (UK): Off-shore exploration drilling, Bolongo Block, Cameroon	Research team: collection of benthic macrofauna samples and bio-indicators for water quality analysis	February 2011
55. Second Integrated State of the Environment Report for Namibia (Phase 1)	Project leader	June 2015
56. Windlab Developments South Africa (Pty) Ltd extension of Environmental Authorisation for the Ishwati Emoyeni 140 MW Wind Energy EIA near Murrysburg in the Western Cape	Project manager	October 2017
57. Calling Education (NPC) Environmental Statement for the proposed Calling Education Secondary School, in Stellenbosch, Western Cape Province	Project manager and lead author	November 2017

Language capability

LANGUAGES	Speaking	Reading	Writing
Afrikaans	Excellent	Excellent	Excellent
English	Excellent	Excellent	Excellent

References

Dr Michelle Audouin
Senior researcher: CSIR (Sustainability Science Group)
Tel: 021 888 2401
Email: maudouin@csir.co.za

Mr Gerhard Gerber
Director: Development Facilitation Unit (Department of Environmental Affairs & Development Planning; Western Cape)
Tel: 021 483 2787 / 083 226 9127
Email: Gerhard.Gerber@westerncape.gov.za

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX O:

Other

CONTENTS

1. Acknowledgement of Application from DEA

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X 447· PRETORIA · 0001· Environment House · 473 Steve Biko Road, Arcadia · PRETORIA

DEA Reference: 14/12/16/3/3/2/1035
Enquiries: Ms Salome Mambane
Tel: 012 399 9385 **E-mail:** SMambane@environment.gov.za

Kelly Stroebel
Council for Scientific and Industrial Research (CSIR)
PO Box 320
STELLENBOSCH
6065

Tel: 021 888 2432 / 021 888 2561
Email: kstroebel@csir.co.za

PER EMAIL / MAIL

Dear Sir/Madam

ACKNOWLEDGEMENT OF RECEIPT OF THE NEW APPLICATION FOR ENVIRONMENTAL AUTHORISATION (ENVIRONMENTAL IMPACT ASSESSMENT PROCESS) AND SCOPING REPORT FOR THE PROPOSED DEVELOPMENT OF A 100 MW SOLAR PHOTOVOLTAIC FACILITY (SKEERHOK PV 3) ON PORTION 0 SMUTSHOEK FARM 395, NORTH-EAST OF KENHARDT, NORTHERN CAPE PROVINCE

The Department confirms having received the Application for Environmental Authorisation and Draft Scoping Report for the abovementioned project on 19 September 2017. You have submitted these documents to comply with the Environmental Impact Assessment (EIA) Regulations, 2014, as amended.

Please take note of Regulation 40(3) of the EIA Regulations, 2014, as amended, which states that potential Interested & Affected Parties, including the Competent Authority, may be provided with an opportunity to comment on reports and plans contemplated in Regulation 40(1) of the EIA Regulations, 2014, as amended, prior to the submission of an application but must be provided an opportunity to comment on such reports once an application has been submitted to the Competent Authority.

Note that in terms of Regulation 45 of the EIA Regulations, 2014, as amended, this application will lapse if the applicant fails to meet any of the time-frames prescribed in terms of these Regulations, unless an extension has been granted by the Department in terms of Regulation 3(7) of the EIA Regulations, 2014, as amended.

You are hereby reminded of Section 24F of the National Environmental Management Act, Act No. 107 of 1998, as amended, that no activity may commence prior to an Environmental Authorisation being granted by the Department.

Kindly quote the abovementioned reference number in any future correspondence in respect of the application.

Yours sincerely

Guure

Mr Sabelo Malaza
Chief Director: Integrated Environmental Authorisations
Department of Environmental Affairs
Letter signed by: Ms Toinette van der Merwe
Designation: Environmental Officer: EIA Coordination, Strategic Planning and Support
Date: 21/09/2017

CC:	Cleo Forster	Juwi Renewable Energies (Pty) Ltd	Email: cleo.forster@juwi.co.za
	Ordain Riba	Department of Environment and Nature Conservation (Kimberly Head Office)	Email: Oriba@ncpg.gov.za / oriba.denc@gmail.com
	Mr Jenkins Esau	!Kheis Local Municipality	Email: Jenkins.esau@gmail.com

2

2. All comments received by SAHRA at the time of submission of this DEIAR

(Note: Full HIA was uploaded to SAHRIS at the same time as release of this DEAIR, any new comments received will be included in the FEIAR)

Scoping and Environmental Impact Assessment for the proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province
Our Ref:

an agency of the
Department of Arts and Culture

T. +27 21 462 4502 | F. +27 21 462 4509 | E. info@sahra.org.za
South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Natasha Higgitt
Tel: 021 462 4502
Email: nhiggitt@sahra.org.za
CaseID: 11820

Date: Friday November 10, 2017
Page No: 1

Interim Comment

In terms of Section 38(3), 38(8) of the National Heritage Resources Act (Act 25 of 1999)

Attention: Ms Cleo Forster
juwi Renewable Energies South Africa (Pty) Ltd

Linked to enhancing its operations within South Africa, the 100 MW Solar PV facility (i.e. Skeerhok PV 3) proposed by juwi will cover an approximate area of 300 hectares (ha). The site (farm) is a total of approximately 4332 ha. Due to the fact that this project only requires 300 ha of land, there is scope to avoid major environmental constraints through the final design of the facility within the development footprint. Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

The CSIR was appointed by juwi Renewable Energies (Pty) Ltd to conduct a Scoping and Environmental Impact Assessment (S&EIA) Process in support of an Environmental Authorisation Application for the Proposed Skeerhok PV 3, on portion 0 of the farm Smutshoek 395, near Kenhardt, Northern Cape Province.

A Scoping Report will be completed in terms of the National Environmental Management Act, 1998 (NEMA) and the 2017 EIA Regulations. The proposed development will comprise the construction of a 100MW Solar Energy Facility (SEF) with a total buildable area of 300 ha.

ASHA Consulting (Pty) Ltd has been appointed to conduct the Heritage Component of the S&EIA process.

Orton, J. 2017. Scoping Inputs for the Proposed Skeerhok PV 1, PV2 and PV3 Solar Energy Projects.

The Heritage Scoping Report identified one grave within the proposed development area.

Recommendations provided in the report include the following:

- It is recommended that the development avoid the grave;
- A walk-down of the final layout to determine if any significant sites will be affected.

Interim Comment

SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit notes that a Heritage Scoping Input has been

Scoping and Environmental Impact Assessment for the proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

Our Ref:

an agency of the
Department of Arts and Culture

T. +27 21 462 4502 | F. +27 21 462 4509 | E. info@sahra.org.za
South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Natasha Higgitt
Tel: 021 462 4502
Email: nhiggitt@sahra.org.za
CaseID: 11820

Date: Friday November 10, 2017
Page No: 1

Interim Comment

In terms of Section 38(3), 38(8) of the National Heritage Resources Act (Act 25 of 1999)

Attention: Ms Cleo Forster
juwi Renewable Energies South Africa (Pty) Ltd

Linked to enhancing its operations within South Africa, the 100 MW Solar PV facility (i.e. Skeerhok PV 3) proposed by juwi will cover an approximate area of 300 hectares (ha). The site (farm) is a total of approximately 4332 ha. Due to the fact that this project only requires 300 ha of land, there is scope to avoid major environmental constraints through the final design of the facility within the development footprint. Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

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A Scoping Report will be completed in terms of the National Environmental Management Act, 1998 (NEMA) and the 2017 EIA Regulations. The proposed development will comprise the construction of a 100MW Solar Energy Facility (SEF) with a total buildable area of 300 ha.

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Recommendations provided in the report include the following:

- It is recommended that the development avoid the grave;
- A walk-down of the final layout to determine if any significant sites will be affected.

Interim Comment

SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit notes that a Heritage Scoping Input has been

Scoping and Environmental Impact Assessment for the proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

Our Ref:

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T: +27 21 462 4502 | F: +27 21 462 4509 | E: info@sahra.org.za
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Enquiries: Natasha Higgitt
Tel: 021 462 4502
Email: nhiggitt@sahra.org.za
CaseID: 11820

Date: Friday November 10, 2017
Page No: 2

submitted, and therefore awaits the pending Heritage Impact Assessment (HIA) as part of the draft EIA Phase.

The pending HIA must assess all heritage resources as defined in section 3(2) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) and the report must comply with section 38(3) of the NHRA. The Archaeological and Palaeontological components of the HIA must comply with the SAHRA 2006 Minimum Standards for Archaeological and Palaeontological Components of Impact Assessments and the 2012 Minimum Standards: Palaeontological Components of Heritage Impact Assessments. Additionally, the Visual Impact of the proposed development on heritage resources and any comments provided by the public regarding heritage resources must be taken into consideration. The Scoping report appendices, the draft EIA with all appendices must be submitted along with the heritage reports in order for further comments to be issued.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully

Natasha Higgitt
Heritage Officer
South African Heritage Resources Agency

Phillip Hine
Acting Manager: Archaeology, Palaeontology and Meteorites Unit
South African Heritage Resources Agency

ADMIN:

3. Confirmation from DEA (Mr. Coenrad Agenbach) that any listed activities pertaining to battery storage are not triggered

From: Coenrad Agenbach [mailto:Cagenbach@environment.gov.za]
Sent: Monday, November 20, 2017 8:31 AM
To: van der Westhuizen, Corne
Cc: Franz Scheepers
Subject: RE: IQ/17/0449: Battery Storage

Dear Corné

Our telephone conversation last week and the e-mail below refer. I concur with the interpretation below. Battery storage was included in the EAs for the 3 Kronos projects and no risk assessment is required. As confirmed in our conversation, should any new applications be lodged, all infrastructure/components within the development footprint of the facility must be assessed, whether listed or not listed.

Regards

Coenrad Agenbach
Control Environmental Officer (Grade B):
Integrated Environmental Authorisations
Strategic Infrastructure Development
Department of Environmental Affairs
Private Bag X447
Pretoria
0001
South Africa

Telephone: + 27 12 399 9403

From: van der Westhuizen, Corne [mailto:corne.vanderwesthuizen@juwi.co.za]
Sent: 06 November 2017 11:39 AM
To: Coenrad Agenbach
Cc: Bellingham, Christopher; Muhammad Essop
Subject: FW: IQ/17/0449: Battery Storage

Hi Coenrad,

Please see below clarification from IQ. According to this clarification battery storage does not trigger the dangerous goods listed activities and would therefore not require a Risk Assessment or any additional assessment as part of the EIA process.

Please confirm this is also the EIA implementation unit's view.

Best regards,

Corné van der Westhuizen M.Sc. (Env), MBA
Project Development Manager
Tel. +27. (0)21. 831 6129 · Mobile +27 (0) 83 611 7073 · Fax. +27. (0) 21 831 6199 ·
corne.vanderwesthuizen@juwi.co.za<mailto:corne.vanderwesthuizen@juwi.co.za>

From: IQ [mailto:IQ@environment.gov.za]
Sent: Thursday, October 26, 2017 1:17 PM
To: van der Westhuizen, Corne
Cc: Susara Burger; Betty Mdala; Tinyiko Mboweni; Mary Katerere; Franz Scheepers
Subject: IQ/17/0449: Battery Storage

Dear Corne

Your enquiry below refers. Based on the information provided please note the following:-

- All 3 of the attached environmental authorisations (EAs) authorises a number of identified activities for the development of PV facility, including associated infrastructure such as service road, access road and collector substation with battery facility for grid storage. In this regard the EA already authorised the battery facility of the PV facility.
- It is important to note that the identified activities relating to storage of dangerous goods, such as Activity 14 of Listing Notice 1 and Activity 10 of Listing Notice 3, will not be triggered by the proposed battery facility installation in the scenario specified below, due to the following:-
    - A battery is not deemed to be a container.
    - Electrolytes that are used within battery storage facilities: their function is deemed to be similar to transformers within substations: converting high voltage electricity to lower voltage electricity for further distribution. The function of the battery is not for storage or storage and handling of a dangerous good.
- The IQ helpdesk is not in possession of a copy of the approved final site layout plan(s). If the battery facilities will be installed in line with the authorised project description and or the approved final site layout plan (i.e. there are no changes to e.g. location or size of the batteries), no application for amendment of the EAs will be required.
- Furthermore, all of the attached 3 EAs authorised the 'clearance of indigenous vegetation' activities. If such clearance will be done within the authorised project description and or the approved final site layout plan then such clearance of indigenous vegetation will not require a new EA as this is already authorised.
- In the scenarios specified below, if the battery facilities and the clearance of indigenous vegetation will be done outside the ambit of the authorised A, including the project description and or the approved final site layout plan then an amendment of the EAs will be required. Clause 5 of Scope of Authorisation of the attached EAs also provides that any changes or deviations to the project description must be approved by the Department before such changes or deviations are effected. If the proposed changes will not change the scope of the valid EAs then a Part 1 amendment will be required. However if the proposed changes will change the scope of the EAs a Part 2 amendment will be required.

Kind Regards,

Mary Katerere
Law Reform and Appeals: Framework and Policy Support
Environment House
Cnr. Steve Biko and Soutpansberg Road, Pretoria
Tel: 0123999181
Fax: 0123593693

From: van der Westhuizen, Corne [mailto:corne.vanderwesthuizen@juwi.co.za]
Sent: Tuesday, 24 October 2017 13:39
To: Mary Katerere
Subject: RE: Clarification - Battery Storage IQ/17/0449

Hi Mary,

Thanks for the quick reply. In response to your questions:

1. Please find EAs attached. You will see that it was a three phased development, thus 3 EIAs and 3 EAs.

2. DEA requested the additional assessment in terms of the battery storage in a rejection letter during the final decision making period on the FEIAR. See point (e) in the attached rejection letter.

3. No listed activities were actually removed. The intention was never for the battery storage facility to have more than 80m3 of dangerous goods, and therefore this activity was never listed and the risk assessment not undertaken as part of the EIA process.

4. Will be located next to the onsite substation in each of the phases. See dark areas demarcated next to substations in attached design plan.

Please let me know if you have any further question or need additional information.

Best regards,

Corné van der Westhuizen M.Sc. (Env), MBA
Project Development Manager
Tel. +27. (0)21. 831 6129 · Mobile +27 (0) 83 611 7073 · Fax. +27. (0) 21 831 6199 ·
From: Mary Katerere [mailto:MKaterere@environment.gov.za]
Sent: Tuesday, October 24, 2017 12:46 PM
To: van der Westhuizen, Corne
Subject: FW: Clarification - Battery Storage IQ/17/0449

Dear Corne

Further to our telephonic discussion and your email below please kindly provide us with the following additional information:-

- a copy of the EA.
- When did DEA request the removal of the battery storage facility, and associated Listed Activities? Please kindly provide us with this correspondence.
- Which associated Listed activities for the battery storage facility were removed from the assessment?
- Where will the battery storage facility be located in relation to the approved facility?

Kind Regards,

Mary

From: van der Westhuizen, Corne [mailto:corne.vanderwesthuizen@juwi.co.za]
Sent: Tuesday, October 24, 2017 9:37 AM
To: IQ
Subject: Clarification - Battery Storage

Dear IQ,

Can you please provide clarification on the following issue.

Background:

- As part of an EIA for a PV facility battery storage with its associated Listed Activities (i.e. storage of >80 m3 dangerous goods) were included in project description
- DEA requested the battery storage facility, and associated Listed Activities, to be removed due to inadequate assessment (i.e. the lack of a dedicated risk assessment study)
- The project was thus approved by DEA without the battery storage component.

Clarification Question:

- Can you please confirm our understanding that no further authorisations or amendments would be required if we intend on installing a battery storage facility that triggers no listed activities (i.e. small clearance footprint and dangerous goods less than the 80 m3 threshold outside protected or sensitive CBA areas)?

Looking forward to your response.

Best regards,

Corné van der Westhuizen M.Sc. (Env), MBA
Project Development Manager
Tel. +27. (0)21. 831 6129 · Mobile +27 (0) 83 611 7073 · Fax. +27. (0) 21 831 6199 ·
corne.vanderwesthuizen@juwi.co.za<mailto:corne.vanderwesthuizen@juwi.co.za>

4. Confirmation of provision of municipal services (Manager: Project Management Unit at Kai !Garib Municipality)

Munisipaliteit Kai !Garib Municipality

Munisipale Gebou
11de Laan
Tel 054 461 6400
Faks 086 516 9066
E-Pos: mm@kaigarib.gov.za
Privaatsak X 6
KAKAMAS
8870
BTW Reg Nr. 4170193371

KAI !GARIB

JG Lategan
Handel met hierdie saak

Municipal Building
11th Avenue
Tel 054 461 6400
Fax 086 516 9066
E-Mail: mm@kaigarib.gov.za
Private Bag X 6
KAKAMAS
8870
VAT Reg No. 4170193371

13 December 2017
Juwi Renewable Energies (Pty) Ltd
7 Walter Sisulu Avenue
Foreshore
CAPE TOWN
8001

SKEERHOK PF FACILITY: WATER, SEWERAGE AND WASTE REMOVAL REQUIREMENTS

Your email, dated Thursday, 07 December 2017, to Mr J Mac Kay, Director Planning & Development of Kai !Garib Municipality, has relevance.

Council hereby, in principle approve the supply of potable water for staff needs – which we will be able to meet during the construction and operational phases. Our agreement with the Department of Water & Sanitation prevent us from supplying water for construction – this you have to source from groundwater facilities in the area.

Our licensed solid waste site in Kenhardt are available for all solid waste as stipulated in the waste license attached. The removal of waste from your site will be done by your vehicles and delivered to the site at R524 per ton or part thereof.

The oxidation ponds are able to process the estimated volumes indicated in your letter but our honey sucker will not be able to service the plant due to the gravel road. Our tariffs are as follows:

1. Sewerage volume R300/kl
2. Distance from oxidation ponds R25/km

Please address any queries to Mr J Mac Kay.

Yours truly

JG LATEGAN
ACTING MUNICIPAL MANAGER

MUNISIPALITEIT KAI !GARIB - DIENSTETARIEWE 2017/18
BTW UITGESLUIT

Annexure B

KODE	ELEKTRISITEITVOORSIENING - STEDELIK	TARIEWE 2017/18		
		EENHEID	BASIES	PER KVA
	Voorafbetaal meters			
EP01	Huishoudelik: Hulpbehoewende verbruikers: Block 1 (0-350kwh)	134,30c		
	Huishoudelik: Hulpbehoewende verbruikers: Block 2 (> 351 kwh)	151,30c		
EP02	Huishoudelik: 1x60 amp: Block 1 (0 - 350kwh)	158,06c		
	Huishoudelik: 1x60 amp: Block 2 (> 350 kwh)	158,81c		
EP03	Kommersieel: 1x60 amp: Block 1 (0 - 350kwh)	190,81c		
	Kommersieel: 1x60 amp: Block 2 (> 351 kwh)			
EP04	Kommersieel: 3x60 amp	190,81c		
	Kleinmaat			
E001	Huishoudelik: 1x5 amp - 1x60 amp: Block 1 (0 - 350kwh)	135,85c	R 226,80	
	Huishoudelik: 1x5 amp - 1x60 amp: Block 2 (> 351 kwh)	149,73c		
E003	Huishoudelik: 3x5 amp - 3x60 amp: Block 1 (0 - 350kwh)	135,85c	R 352,00	
	Huishoudelik: 3x5 amp - 3x60 amp: Block 2 (> 351 kwh)	149,73c		
E005	Kommersieel: 1x5 amp - 1x60 amp:	146,31c	R 666,24	
E006	Kommersieel: 3x5 amp - 3x60 amp:	146,31c	R 1 116,59	
E015	Kommersieel: 3x70 amp - 3x100 amp:	146,31c	R 1 503,68	
	Grootmaat verbruikers			
E008/EK08	Grootmaat: Laagspanning metering : - 110 amp - 150 amp	87,33c	R 1 570,68	R 198,65
E009/EK09	Grootmaat: Hoogspanning metering : - > 150 amp	87,33c	R 1 570,68	R 198,65
	Verligting			
E010	Straatligte	33,00c	R 945,11	
E011	Hoërmasligte	92,85c	R 962,88	
	Ander			
E012	Beskikbaarheidsgelde: Residensieel		R 143,60	
E013	Beskikbaarheidsgelde: Besigheid en Nywerheid		R 143,60	

KODE	ELEKTRISITEITSVOORSIENING - LANDELIK	TARIEWE 2017/18		
		EENHEID	BASIES	PER KVA
	Voorafbetaal meters			
EP01	Huishoudelik: Hulpbehoewende verbruikers: Block 1 (0-350kwh)	134,30c		
	Huishoudelik: Hulpbehoewende verbruikers: Block 2 (> 351 kwh)	151,30c		
EP02	Huishoudelik: 1x60 amp: Block 1 (0 - 350kwh)	158,06c		
	Huishoudelik: 1x60 amp: Block 2 (> 351 kwh)	158,81c		
EP03	Kommersieël: 1x60 amp:	190,81c		
EP04	Kommersieël: 3x60 amp:	190,81c		
	Kleinmaat			
E021	Huishoudelik: 1x5 amp - 1x60 amp: Block 1 (0 - 350kwh)	135,85c	R 226,80	
	Huishoudelik: 1x5 amp - 1x60 amp: Block 2 (> 351 kwh)	149,73c		
E023	Huishoudelik: 3x5 amp - 3x60 amp: Block 1 (0 - 350kwh)	135,85c	R 352,00	
	Huishoudelik: 3x5 amp - 3x60 amp: Block 2 (> 351 kwh)	149,73c		
E026	Kommersieël: 1x5 amp - 1x60 amp	146,31c	R 666,24	
E027	Kommersieël: 3x5 amp - 3x60 amp:	146,31c	R 1 116,59	
E029	Kommersieël: 3x70 amp - 3x100 amp:	146,31c	R 1 503,68	
	Grootmaat verbruikers			
E030/EK30	Grootmaat: Laagspanning metering : - 110 amp - 150 amp	87,33c	R 1 570,68	R 198,65
E031/EK31	Grootmaat: Hoogspanning metering : - > 150 amp	87,33c	R 1 570,68	R 198,65

MUNISIPALITEIT KAI !GARIB - DIENSTETARIEWE 2017/18
BTW UITGESLUIT

Annexure C

KODE	WATERVOORSIENING	TARIEWE 2017/18		
		EENHEID	BASIES	
W001	Kleinmaat - (20 - 25 mm aansluiting)		R 69,00	
W002	Grootmaat (50 mm aansluiting)		R 367,58	
W003	Grootmaat (75 mm aansluiting)		R 2 336,27	
W004	Grootmaat (100 mm aansluiting)		R 6 093,58	
	Rouwater		R 277,03	
W006	Beskikbaarheid residensieel		R 69,00	
W007	Beskikbaarheid besighede en nywerhede		R 69,00	
	- Verbruik - 0 tot 6 kl/maand (6)	R 6,01		
	- Verbruik - 7 tot 20 kl/maand (14)	R 5,53		
	- Verbruik - 21 tot 30 kl/maand (10)	R 6,00		
	- Verbruik - 31 tot 50 kl/maand (20)	R 6,59		
	- Verbruik - Bo 50 kl/maand (>50)	R 7,77		
	Gesuiwerde Water - Prepaid			
	- "PREPAID" Verbruik - 0 tot 6 kl/maand (6)	R 6,60		
	- "PREPAID" Verbruik - 7 tot 20 kl/maand (14)	R 6,25		
	- "PREPAID" Verbruik - 21 tot 30 kl/maand (10)	R 7,20		
	- "PREPAID" Verbruik - 31 tot 50 kl/maand (20)	R 7,80		
	- "PREPAID" Verbruik - Bo 50 kl/maand (>50)	R 8,40		
	Flatrate		R 109,48	

Annexure D

KODE	RIOOLAFVALVERWYDERING	TARIEWE 2017/18		
		EENHEID	BASIES	
	SUIGTENKS			
S001	Basiese fooi		R 152,49	
	Suigtenk Vraggeld per kiloliter (vooraf betaalbaar):			
S001/S011	_Stedelik (Per KL)		R 8,00	
S002	_Landelik (Per KL)		R 300,00	
S003	Rittooie per kilometer (Vanaf die eerste 100km)		R 25,00	
S004	Sanitasiekamers		R 138,61	
	RIOOLGELDE			
A001	Residensieel: Stedelike Gebied		R 152,49	
A002	Kerke & Sale		R 152,49	
A003	Klein Besighede (<200kl/mnd)		R 446,77	
A004	Groot Besighede (>200kl/mnd); Kokerboom Resort, BK Oudehuis		R 959,75	
A005	Skole (<500kl/mnd), Koshuise, SAPD & Hotelle		R 2 799,06	
A006	Skole (>500kl/mnd), Hospitale		R 6 109,49	

Annexure E

KODE	REINIGINGSDIENSTE	TARIEWE 2017/18		
		EENHEID	BASIES	
R001	Huishoudelik, Klein kantore en Kerke (1verw/week)		R 94,55	
R002	Besighede, Skole, Koshuise, Hotelle en Verblyfsondernemings (2 verw/week)		R 257,88	
R003	Grootmaatvullis (Hokke)		R 386,51	
R004	Grootmaatvullis (Houers)		R 242,63	
R005	Grootmaatvullis (per ton)		R 524,00	

the denc

Department:
Environment & Nature Conservation
NORTHEN CAPE PROVINCE
REPUBLIC OF SOUTH AFRICA

Private Bag X6102, Kimberley, 8300, SASKO Building, Tel: 053-807 7430, Fax: 053-831 3530

Enquiries / Dipatlisiso / Navrae / Imibuzo : D Kgosi

Date / Letlha / Datum / Umhla : 31 October 2014

Reference / Tshupelo / Verwysing / Isalathiso : 16/2/7/D11/Z1/P452

The Municipal Manager
Kai! Garib Local Municipality
Private Bag X6
Kakamas
8870

Fax: (086) 502 8887

Dear License holder

WASTE LICENSE FOR THE OPERATION OF THE KENHARDT GENERAL WASTE DISPOSAL SITE, KAI! GARIB LOCAL MUNICIPALITY IN TERMS OF SECTION 20(b) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008

Please find hereto attached waste licence for Kai! Garib Local Municipality for the above mentioned activity. The license application form was submitted on the 20th February 2014 and the Pollution and Waste Management unit within the Environment Quality Management Directorate reviewed the documents submitted and concluded the application as per the National Environmental Management: Waste Act, 2008, (Act 59 of 2008)

This letter serves to inform you that your waste license application for the above mentioned activity in the location as per the coordinates in the application has been issued.

Yours Sincerely

PP

Mr B D Fisher
Acting Director: Environmental Quality Management
Date: 31 October 2014

Copy: ***Mr J van Huyssteen***
MBB Consulting engineering South (PTY) LTD

1

the denc

Department:
Environment & Nature Conservation
NORTHERN CAPE PROVINCE
REPUBLIC OF SOUTH AFRICA

Private Bag X6102, Kimberley, 8300, SASKO Building, Tel: 053-807 7430, Fax: 053-831 3530

Ref: 16/2/7/D530/D11/Z1/P452
Enquiries: Martha S. Molokwane
Tel: (054) 338-4800 **Fax:** (054) 331-1155 **Email:** mmolokwane@ncpg.gov.za

PERMIT NUMBER:	16/2/7/D530/D11/Z1/P452
CLASS:	G: C: B-
WASTE FACILITY:	KENHARDT GENERAL WASTE DISPOSAL SITE
LOCATION:	PART OF PORTION 1049 OF THE FARM KENHARDT, KENHARDT
PERMIT HOLDER:	KAI! GARIB MUNICIPALITY
ADDRESS:	PRIVATE BAG X6, KAKAMAS, 8870
CONTACT PERSON:	THE MUNICIPAL MANAGER
CONTACT DETAILS:	TEL: (054) 461 6400, FAX: (086) 502 8887

PERMIT IN TERMS OF SECTION 2O OF ENVIRONMENT CONSERVATION ACT, 1989 (ACT 73 OF 1989)

I, Bryan D. Fisher, in my capacity as Acting Director: Environmental Management Quality Management of the Department of Environment and Nature Conservation (hereinafter referred to as "the Department"), in terms of section 20(1) of the Environmental Conservation Act, 1989 (Act 73 of 1989) (as amended), hereby authorise the abovementioned Permit Holder to establish and operate the abovementioned waste disposal site, subject to the conditions specified herein.

PERMIT CONDITIONS

In this Permit, "Acting Director" means the Director of Environmental Quality Management of the Northern Cape Department of Environment and Nature Conservation who may both be contacted at the address below:

Director: Environmental Quality Management
Department of Environment and Nature Conservation
Private Bag X 6010
Kimberley
8301

In this Licence, "Director-General" means the Director-General of the Department of Water and Sanitation who may be contacted at the address below:

Director-General
Department of Water and Sanitation
Private Bag X 313
PRETORIA
0001

1. LOCATION

1.1 This Permit authorises the establishment, development and operation of a waste disposal site on part of Portion 1049 of the farm Kenhardt, Kai! Gaib Municipality, Z. F. Mgcawu District (hereinafter referred to as "the Site").

1.2 The location of the site must be according to co-ordinates submitted by the Permit holder on the 21 October 2014 is defined as follows:

Latitude	Longitude
3 245 389.208	14 616.018
3 245 400.548	14 705.301
3 245 251.743	14 724.200
3 245 240.404	14 634.918

2. PERMISSIBLE WASTE

2.1 The Site may be used for the disposal of all waste types, excluding those listed in Annexure I and excluding those where specific control has been established in terms of the Nuclear Energy Act, 1982 (Act 92 of 1982). Waste types controlled in terms of the Minerals Act, 1991 (Act 50 of 1991) and the Electricity Act, 1987 (Act 41 of 1987) are also excluded from disposal on the Site unless written permission has been obtained from the Regional Director.

2.2 The Permit Holder must take all reasonable steps to ensure that-

2.2.1 no organic or inorganic element or compound which may have a definite acute or chronic negative effect on human health and/or the environment, due to its toxic, physical, chemical or persistent characteristics and which corresponds with the UNEP definition of hazardous waste;

2.2.2 no medical waste; and

2.2.3 no scheduled pharmaceutical products registered in terms of the Medicines and Related Substances Control Act, 1965 (Act 101 of 1965) or associated containers, are disposed of on site.

3. CONSTRUCTION

3.1 The Site or any portion thereof may only be used for the disposal of permissible waste if the Site or any such portion has been constructed or developed according to condition 3 of this Permit.

3.2 Construction and further development within the Site shall be done under the supervision of a suitably qualified person proposed by the Permit Holder and approved by the Director-General.

3.3 After construction of the Site or further development within the Site, the Permit Holder shall notify the Director or/and the Director-General thereof, and the person referred to in condition 3.2 shall submit a certificate or alternatively a letter to the Director or/and the Director-General that the construction of the Site or further development within the Site, as proposed by the Permit Holder and approved by the Director or/and the Director-General, is in accordance with recognised civil engineering practice before disposal may commence on the Site. The completed construction works of the Site shall be inspected by an official of the Department and the person referred to in condition 3.2. If the Director or/and Director-General is satisfied with the construction of the Site or any further development within the Site and has given written permission, the Permit Holder may use the Site or any further development within the Site for the disposal of waste.

3.4 The Permit Holder shall take all reasonable steps, such as suitable zoning and/or written agreements with adjacent landowners, to establish and maintain an unbuilt area or "buffer zone" of 200 metres between the Site and the nearest residential and/or light industrial areas during the operative life of the Site. Heavy industries or industries which may create nuisance conditions may be permitted within the buffer zone in terms of the appropriate legislation.

3.5 Work shall be constructed and maintained on a continuous basis by the Permit Holder to divert and drain from the Site in a legal manner, all runoff water arising on land adjacent to the Site, which could be expected as a result of the estimated maximum precipitation during a period of 24 hours with an average frequency of one in every fifty years (50) (hereinafter referred to as the "estimated maximum precipitation"). Such works shall, under the said rainfall event, maintain a freeboard of half a metre.

3.6 Works shall be constructed and maintained on a continuous basis by the Permit Holder to divert and drain from the working face of the Site, all runoff water arising on the Site, which could be expected as a result of the estimated maximum precipitation and to prevent such runoff water from coming into contact with leachate from the Site. Such works shall, under the said rainfall event, maintain a freeboard of half a metre.

3.7 Runoff water referred to in condition 3.6 shall comply with the quality requirements of the General Standard, prescribed in terms of section 21(1) (a) of the Water Act, 1956 as published in Government Notice 991 of 18 May 1984, or with such quality requirements as may from time to time be determined by the Minister and shall be drained from the Site in a legal manner.

3.8 Runoff water referred to in condition 3.6 which does not comply with the quality requirements applicable in terms of condition 3.7 shall, by means of works which shall be constructed and maintained on a continuous basis by the Permit Holder –

3.9 be treated to comply with the aforementioned standard and discharged in a legal manner; and/or,

3.8.1 with the written approval of the Director-General be evaporated in dams and/or be evaporated by spraying over those portions of the Site which comply with the requirements set in terms of condition 3.1.

3.9 The Site shall be constructed in accordance with recognised civil engineering practice to ensure that it remains stable.

3.10 The maximum height of the Site above ground level shall not exceed 3.5 metres.

3.11 The slope of the sides of the Site shall be constructed in such a manner that little or no erosion occurs.

3.12 The Permit Holder shall make provision for adequate sanitation facilities on the Site.

4. ACCESS CONTROL

4.1 Weatherproof, durable and legible notices in at least three official languages applicable in the area, shall be displayed at each entrance to the site. These notices shall prohibit unauthorised entry and state the hours of operation, the name, address and telephone number of the Licence Holder and the person responsible for the operation of the Site.

4.2 The Site shall be fenced and/or secured to reasonably prevent unauthorised entry.

4.3 The Permit Holder shall take all reasonable steps to maintained service roads in a condition which ensures unimpeded access to the Site for vehicles transporting waste and keep the roads free of waste.

4.4 The Permit Holder shall ensure effective access control.

4.5 The Permit Holder shall take all reasonable steps to prevent the disposal of waste on the Site for which the Site has not been approved.

5. OPERATION

5.1 Waste disposed of on the Site shall be covered on a weekly basis with a minimum of 150 millimetres of soil or other material approved by the Director.

5.2 Waste disposed of on the Site may be reclaimed. The reclamation activity shall not interfere with the daily operational activities of the Site. The relevant Government Notice 926, National Norms and Standards for the storage of waste may be applicable.

5.3 The Permit Holder shall take all reasonable steps to ensure that the Site is operated in a manner that shall prevent the creation of nuisance conditions or health hazards.

5.4 The Permit Holder shall keep a record of the volume and nature of the waste materials which are reclaimed and report this on an annual basis to the Director.

6. MONITORING

6.1 Further monitoring

If, in the opinion of the Director, environmental pollution, nuisances or health risks may be or are occurring on the Site, the Licence Holder must initiate an investigation into the cause of the problem or suspected problem. Should the investigation reveal any unacceptable levels of pollution, the Licence Holder must submit mitigatory measures to the satisfaction of the Director.

7. METHODS OF ANALYSIS

7.1 The Permit Holder shall carry out all tests in accordance with methods prescribed by and obtainable from the South African Bureau of Standards (SABS), referred to in the Standard Acts, 1982 (Act 30 of 1982), to analyse the samples taken under the monitoring programmes specified in condition 6.

7.2 The Permit Holder shall only use another method of analysis if written proof that the method is equivalent to the SABS method, is submitted to the Director and/or Director-General.

8. AUDITING

8.1 DEPARTMENTAL AUDITS AND INSPECTIONS

8.1.1 The Department reserves the right to audit and/or inspect the site at any time and at a frequency decided by the Director.

8.1.2 The Licence Holder must make any records or documentation available to the Director: upon request, as well as any other information the Director may require.

8.1.3 The findings of these audits or inspections must be made available to the Licence Holder within 60 days of the end of the audit or inspection. Information from the audits must be treated in accordance with the Promotion of Access to Information Act, 2000 (Act 2 of 2000).

9. RECORDING

9.1 The Licence Holder must keep records and update all the information referred to in Annexure II and submit this information to the Director and/or Director-General on an annual basis.

10. REPORTING

10.1 The Licence Holder must, within 24 hours notify the Director and/or Director-General of the occurrence or detection of any incident on the Site, or incidental to the operation of the site, which has the potential to cause, or has caused pollution of the environment, health risks, nuisance conditions or water pollution.

10.2 The Licence Holder must within 14 days submit an action plan which must include a detailed time schedule, to the satisfaction of the Director on measures taken to –

(a) correct the impact resulting from the incident;

(b) prevent the incident from causing any further impact; and

(c) prevent a recurrence of a similar incident.

10.3 The Licence Holder must submit a written report to the Director and/or Director-General regarding any deviations from plans described in this Licence and must obtain written permission from the Director-General before such deviations may be implemented.

11. LEASING AND ALIENATION OF THE SITE

11.1 Should the Permit Holder want to alienate or lease the site, he/she must notify the Director and/or Director-General in writing of such an intention at least 60 days prior to the said transaction.

12. **GENERAL**

12.1 This Permit shall not be construed as exempting the Permit Holder from compliance with the provisions of the National Environmental Management Act, 1998 (Act 107 of 1998), the Health Act,1977 (Act 63 of 1977), the National Water Act, 1998 (Act 36 of 1998) or any other applicable act, ordinance, regulation or by-law.

Mr. B. D. FISHER

ACTING DIRECTOR- ENVIRONMENTAL QUALITY MANAGEMENT

DATE: 30-10-2014

ANNEXURE I

LIST OF HAZARDOUS OR TOXIC MATERIALS WHICH MAY NOT BE DISPOSED OF ON A GENERAL WASTE DISPOSAL SITE

1. Waste where specific control has been established in terms of the Nuclear Energy Act, 1999 (Act 46 of 1999).

2. Waste types controlled in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002) and the Electricity Act, 1987 (Act 41 of 1987), Nuclear Energy Act, 1999 (Act 46 of 1999), unless written permission has been obtained from the HOD.

3. Waste which is defined, according to the Minimum Requirements, as an extreme hazard or Hazard Group 1 (HG1); high hazard or Hazard Group 2 (HG2); moderate hazard or Hazard Group 3 (HG3) and low hazard or Hazard Group 4 (HG4).

4. Flammable wastes, with a closed cup flash point less than 61°C.

5. Corrosive substances, as defined and described in the Minimum Requirements as Class 8 (1998 edition: page 6-8, Diagram III).

6. Oxidising substances and organic peroxides, as defined and described in the Minimum Requirements as Class 5 (1998 edition: page 6-8, Diagram III).

7. Any waste with a substance which is a Group A and/or Group B carcinogen/mutagen. A carcinogens / mutagens have been proven in humans, both clinical and epidemiological. Group B Group carcinogens/mutagens have been proven without doubt in laboratory animals.

8. Any waste with a substance at a concentration greater than 1% where the substance is a Group C and/or Group D carcinogen/mutagen. Group C carcinogens/mutagens have shown limited evidence in animals. Group D carcinogen/mutagen - the available data is inadequate and doubtful

9. Any infectious waste which is generated during the diagnosis, treatment or immunisation of humans or animals; in the research pertaining to this; in the manufacturing or testing of biological agents including blood, blood products and contaminated blood products, cultures, pathological wastes, sharps, human and animal anatomical wastes and isolation wastes that contain infectious substances.

10. All materials which fall in Class 1 (explosives), Class 2 (compressed gases) and Class 7 (radioactive materials), as defined and described in the Minimum Requirements.

11. Any waste with a pH less than 6 or greater than 12.

12. Any waste which is difficult to analyse and classify.

13. Any complexes of heavy metal cations, paint and paint sludges, or laboratory chemicals.

14. Organic or inorganic element or compound which may have a definite acute or chronic negative effect on human health and/or the environment, due to its toxic, physical, chemical or persistent characteristics;

ANNEXURE II

INFORMATION WHICH SHALL BE SUBMITTED ON AN ANNUAL BASIS: CONDITION 9.1

* = *Indicate with an X. Please print legibly.*

NAME OF SITE: ____________________ DATE OF REPORT: ________ (yy/mm/dd)

1. Registered owner(s) of property on which disposal site is situated:

Name	Telephone	
Postal Address	Fax	
	Postal Code	

2. Operator in control of disposal site:

Name	Telephone	
Identity number	After hours	
Educational Qualifications (*)		

3. *Indicate the type of waste and approximate quantities of waste disposed of during the year:*

Type of waste	Quantity (m^3 $annum^{-1}$)	Compacted (C)	Uncompacted (U)
Household			
Garden refuse			
Building rubble			
Other (not hazardous) - Specify			
TOTAL			

4. *Indicate the applicable waste types and quantities salvaged during the year (*)*

Salvaging undertaken?		Yes	No		
Type	**Company sold/ given to**	**Quantity (m^3)**	**Type**	**Company sold/ given to**	**Quantity (m^3)**
Paper/wood fibre			Rubber		
Plastics			Textiles		
Glass			Iron		
Waste for composting			Food residues		

G: C: B -: Kenhardt General Waste Disposal Site

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Other			Other		

Receptor What is at risk? What do I wish to protect?	**Source** What is the agent or process with potential to cause harm?	**Harm** What are the harmful consequences if things go wrong?	**Pathway** How might the receptor come into contact with the source?	**Probability of exposure** How likely is this contact?	**Consequence** How severe will the consequences be if this occurs	**Magnitude of risk** What is the overall magnitude of the risk? (Low-Medium - High)	**Justification for magnitude** On what did I f my judgement?	**Risk Management** How can I best manage the risk to reduce the magnitude?	**Residual risk** What is the magnitude of the risk after management? This residual risk will be controlled by Compliance Assessment)
Local human population	Airbone dusts /particulars	Nuisance -dust on cars, clothing etc.	Deposition from air						
Local human population	Noise from machine	Nuisance loss of amenity, loss of sleep	Air transport						
Local human population	Fugitive releases, waste, litter and mud on roads	Nuisance loss of amenity.	Vehicles entering and leaving the Site. Waste escaping the Site						
Local human population	Odour	Nuisance loss of amenity.	Air transport						
Local human population	Scavenging birds and animals	Nuisance loss of amenity.	Air transport and over land						
	Pests (e.g flies)	Nuisance loss of amenity	Air transport and over land						
Local human population	Flooding of Site	If waste is washed off site it may cause contamination	Flood waters						
Groundwater and surface waters	Fire on site leading to run-off from polluted fire fighting waters.	Contaminating of groundwater and aquatic ecosystems	Direct and indirect run-off						
Local human population and/or livestock gaining unauthorised access to the activities	All non-site hazards-particularly relating to waste handling & storage activity	People/ livestock coming into contact with hazards	Direct physical contact						
		Arson and/or vandalism causing the release of polluting	Arson-air Liquids polluting watercourses and/or						

G: C: B -: Kenhardt General Waste Disposal Site

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		materials	groundwater						
Ground water	Contaminated run-off from waste	Contaminating of ground water	Soil to ground water to borehole.						
Local human population	Smoke from burning of waste in case of fire.	Nuisance, loss of amenity, loss of sleep. Respiratory irritation illness	Air transport						
EXPAND TABLE AS PER YOUR RISKS									

5. Comment on this application from SALT (South African Large Telescope)

From: Ramotholo Sefako [m ailto:rrs@saao.ac.za]
Sent: 18 December 2017 11:15 AM
To: Forster, Cleo
Subject: Re: Request for comment on a potential PV facility

Dear Cleo

Sorry that I was not able to reply to your em ail earlier. I don't think your PV facility will have effect on astronomy at the South African Astronomical Observatory and SALT near Sutherland in the Northern Cape. Your proposed facility is too far from us and well outside of the declared Sutherland Astronomical Advantage Areas for
Optical astronomy y. Your PV facility will not have any impact on SALT.

Regards
Ramotholo

From: Forster, Cleo
Sent: 04 December 2017 11:29 AM
To: 'rrs@saao.ac.za'
Subject: Request for comment on a potential PV facility

Dear Dr. Ramotholo Sefako,

I understand you have assisted juwi in the past with regard to a comment on the potential impact of renewable energy projects on SALT and I am hoping you will be able to do so again.

We are currently developing a potential multiphase PV development 40kms to the North- East of Kenhardt in the Northern Cape and although the study has been conducted on the impact on the SKA, with minimal impact anticipated, DEA has requested a comment from SALT on the possible impact. The project sits just within the astrological advantage area by our maps and I have attached a kmz of the location for your analysis.

Could you please let me know if you foresee any possible impact on the SALT from the development?

Many thanks,

Cleo Forster M.Arch (Sus Cities), B.Sc Eng
Project Development Manager * South Africa
Tel. +27. (0)21. 831 6117 * Mobile +27 (0) 79 892 7977 * Fax. +27. (0)21. 831 6199 *
cleo.forster@juwi.co.za<mailto:cleo.forster@juwi.co.za>

juwi Renewable Energies (Pty) Ltd * 24th Floor * Metropolitan Centre * 7 Walter Sisulu Avenue *
Foreshore * Cape Town * 8001 * South Africa * www.juwi.co.za<http://www.juwi.co.za/>

Managing Director: Greg Austin * Registration number: 2010/017943/07

Managing Director: Greg Austin * Registration number: 2010/017943/07

6. Comment from SKA on the Skeerhok PV 1, 2 and 3 projects

Square Kilometre Array (SKA) SA

www.ska.ac.za

Cleo Forster
Project Development Manager
Juwi Renewable Energy
Metropolitan Centre
7 Walter Sisulu Avenue
Cape Town
8001

Email: cleo.forster@juwi.co.za

6th February 2018

Dear Cleo,

Re: Development of Skeurhok PV Facility – Phase 1, 2 and 3

This letter is in response to your email request to provide an assessment on the potential development of the proposed Skeurhok PV Facility, to be established in three phases, and the risk it may pose on the Square Kilometre Array Project.

As input into this assessment, you have provided SKA South Africa (otherwise known as the South African Radio Astronomy Observatory) with detailed impact assessments, for each of the three phases, undertaken by an EMC consultant ITC Services. These assessment took into account a historical assessment that considered the cumulative impact of facilities proposed to be established at this same location, prepared by MESA Solutions.

An assessment of the detailed impact assessment has been conducted by SKA South Africa. This letter serves to confirm the outcomes of this assessment.

i. The detailed impact assessment includes a technology risk assessment, radio frequency measurements undertaken within a laboratory environment, and measurements undertaken at a representative photovoltaic facility (Dreunberg);

ii. The assessment for Skeurhok Phase 1 indicates that, based on the measurement data available and assuming up to six similar facilities in the vicinity are established, up to 20dB of attenuation will

Square Kilometre Array (SKA) SA

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be required to ensure no interference with the SKA (should only one facility be established in the vicinity, this would reduce to 12 dB);

iii. The assessment for Skeurhok Phase 2 indicates that, based on the measurement data available and assuming up to six similar facilities in the vicinity are established, up to 40dB of attenuation will be required to ensure no interference with the SKA (should only one facility be established in the vicinity, this would reduce to 32 dB);

iv. The assessment for Skeurhok Phase 3 indicates that, based on the measurement data available and assuming up to six similar facilities in the vicinity are established, up to 35dB of attenuation will be required to ensure no interference with the SKA (should only one facility be established in the vicinity, this would reduce to 27 dB);

v. Based on the assessments for all three phases, the required attenuation as identified above would be applied, primarily, to the tracker systems that are identified in the technology risks;

vi. It is likely that additional risks may be identified during the detailed design process of the facilities, such as design decisions concerning specific suppliers of equipment. These risks may result in a different RFI risk profile that needs to be accommodated during the design and construction of the proposed facilities;

vii. SKA South Africa supports the view that the required attenuation is achievable following appropriate design decisions and implementation of mitigation measures. In order to ensure that the identified risk of interference is mitigated, SKA South Africa requires that, as a special condition to environmental authorisations that may be considered for any, or all, of the proposed facilities, Juwi Renewable Energy be required to prepare and submit an EMC (Electromagnetic Compatability) Control Plan to SKA South Africa for approval prior to any detailed design and construction activities associated with the proposed facilities. This EMC Control Plan shall prescribe the manner in which Juwi shall achieve the required protection, including appropriate acceptance testing and verification processes prior to any construction activities of the proposed facilities being initiated.

This technical advice is provided by the South African SKA Project Office on the basis of the protection requirements of the SKA in South Africa, and does not constitute legal approval of the renewable energy projects in terms of the Astronomy Geographic Advantage Act, the Management Authority, and its regulations or declarations.

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+27 (0)21 506 7375

17 Baker Street, Rosebank Johannesburg, South Africa
+27 (0)11 442 2434
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Karoo Support Base
P.O. Box 69
Carnarvon, 8925
+27 (0) 21 506 7300

SKA AFRICA
SQUARE KILOMETRE ARRAY

Square Kilometre Array (SKA) SA

www.ska.ac.za

Regards,

Dr. Adrian Tiplady
Head: Strategy and Business Systems
SKA South Africa
Tel: 011 442 2434
Fax: 011 442 2454
atiplady@ska.ac.za

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Carnarvon, 8925
+27 (0) 21 506 7300

7. Title deed for Smutshoek 395

Printed: 2016/08/04 10:37

Deeds Office Property

windeed
information is our business

SMUTSHOEK, 395, 0 (CAPE TOWN)

GENERAL INFORMATION

Deeds Office	CAPE TOWN
Date Requested	2016/08/04 10:36
Information Source	DEEDS OFFICE
Reference	-

SearchInsure

PROPERTY INFORMATION

Property Type	FARM
Farm Name	SMUTSHOEK
Farm Number	395
Portion Number	0
Local Authority	KENHARDT DC
Registration Division	KENHARDT RD
Province	NORTHERN CAPE
Diagram Deed	T19917/1982
Extent	4332.0276H
Previous Description	-
LPI Code	C03600000000039500000

OWNER INFORMATION

Owner 1 of 1

Company Type	TRUST
Name	ERNESTUS CONNAN BELEGGINGSTRUST
Registration Number	418/2000
Title Deed	T25434/2004
Registration Date	2004/03/23
Purchase Price (R)	[redacted]
Purchase Date	2004/02/10
Share	
Microfilm Reference	2004 0348 4339
Multiple Properties	YES
Multiple Owners	NO

ENDORSEMENTS (6)

#	Document	Institution	Amount (R)	Microfilm
1	BC45642/1991	MINISTERS TOESTEMMING	UNKNOWN	1991 1358 0246
2	BC59997/1990	MINISTERS TOESTEMMING	UNKNOWN	1990 1750 0495
3	K1117/2010S	-	UNKNOWN	
4	K462/2016S	-	UNKNOWN	
5	FARM KE 395	-	UNKNOWN	1985 0042 0561
6	FROM-KE RD 120/1,109	/3	UNKNOWN	

HISTORIC DOCUMENTS (3)

#	Document	Owner	Amount (R)	Microfilm
1	B55372/1991	LANDBANK	UNKNOWN	2000 0049 3843
2	B49114/1999	-	UNKNOWN	2004 0348 4366
3	T19917/1982	CONNAN ERNESTUS	UNKNOWN	2004 0348 4389

DISCLAIMER

8. Description of the mitigation and management measures relating to battery storage

Although unlikely to occur, the operation of a battery storage on site does pose risks. The main risks and their possible sources are shown in Figure 1 and discussed Table 1 below. The table indicates the risks associated with the battery storage facility, the design measures and/or management measures to be implemented and a reference to the relevant section in the EMPr where these measures have been included. With the implementation of these management measures, the likelihood of the risks occurring is considered to be low.

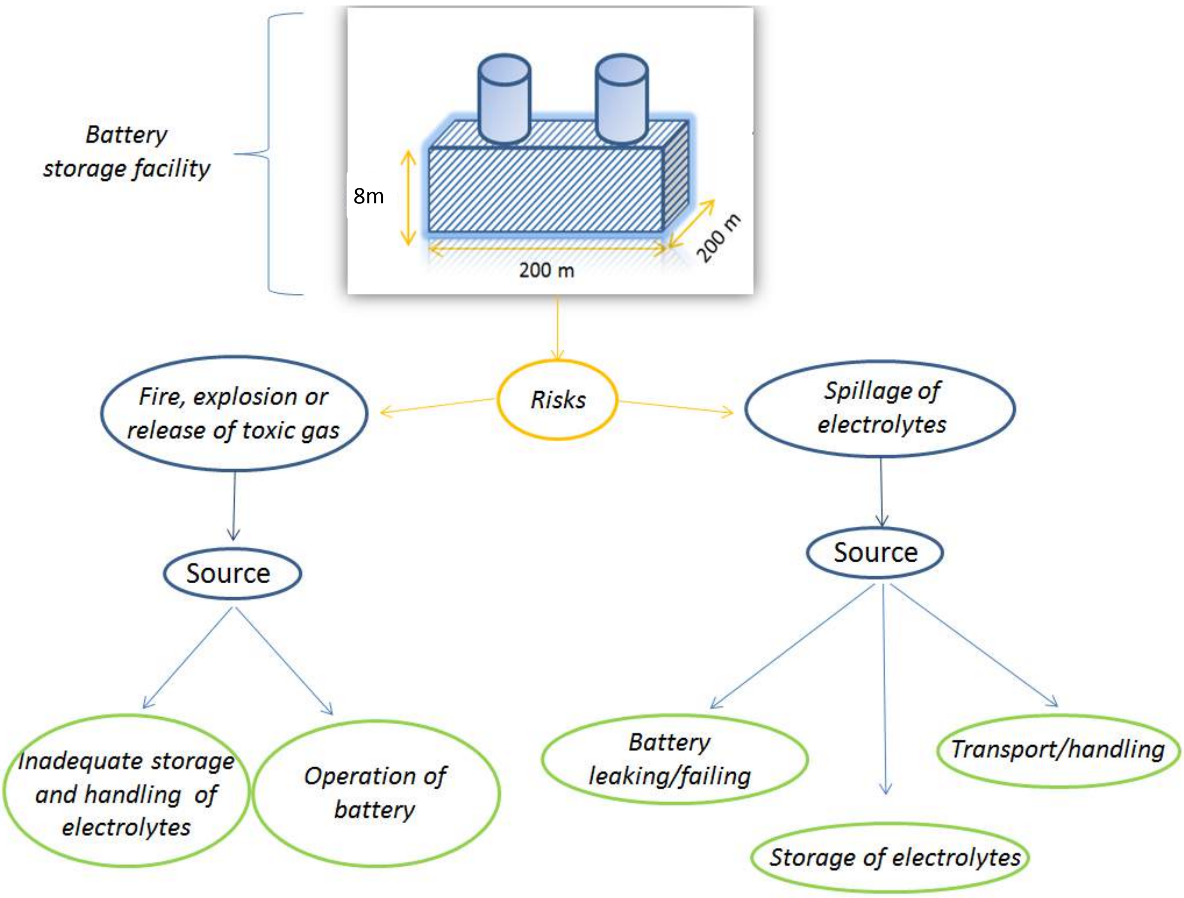

Figure 1: Environmental risks associated with the battery storage facility

Table 1: Risk Assessment summary for the Battery Storage Facility

Risk Source	Actions included in the design or additional measures determined as part of the EIA to manage risk	Reference in the draft EMPr where management measure is included
Spillage of electrolyte	**Design measures**	
	Adhere to the appropriate international standards and South African National Standards (SANS) requirements	**Section 10.3** (Section 10: Hazardous substances leakage or spillage monitoring system)
	Place battery on an impermeable barrier/layer (e.g. concrete surface with acid lining)	
	A secondary containment must be constructed with a capacity of at least 110% of the largest storage tank's capacity and the off-loading point must be located in the bunded area to ensure that any potential spill during the off-loading of the electrolyte solutions is contained	
	Additional measures	
	• The transport vehicle should be identified with symbols • Drivers and auxiliaries should be trained • Personal protection equipment should be provided • Used batteries must be transported inside containers and the containers must be well packed to the transport vehicle • A minimum set of equipment necessary to combat any simple spillage or leakage problems should be provided and the transport team trained on how to use it;	**Section 7.7** (Section 7: Traffic management plan including transportation plan) **Section 10.3** (Section 10: Hazardous substances leakage or spillage monitoring system)

	• Divert rainwater away from the bunded area to avoid rainwater mixing with electrolyte spillage potentially present within the secondary containment • Ensure that the containment area is sloped to a sump • All drains should be covered.	**Section 10.3** (Section 10: Hazardous substances leakage or spillage monitoring system)
	• Any spill/leakage from the battery storage facility must be attended to immediately and be handled in an environmental friendly manner (i.e. no discharge into the ground or any surface water body) and must be disposed of at an appropriate licensed hazardous waste disposal facility. • In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree of contamination, excavation and removal to a hazardous waste disposal site might be necessary. If the spillage is widespread, a specialist will need to be immediately appointed to deal with the issue, the DEA notified and the notification process stipulated in the National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GN 331, 2 May 2014) should be followed.	**Section 10.3 and Section 10.4** (Section 10: Hazardous substances leakage or spillage monitoring system)
Fire, explosion or release of toxic gas	**Design measures**	
	• Construct facility according to the supplier's design specifications • Adhere to the appropriate international standards and SANS requirements	**Section 11.2** (Section 11: Hazardous substances leakage or spillage monitoring system)
	Additional measures	

	• Should electrolyte solutions be stored on site, these should be stored away from incompatible materials such as all peroxides, such as hydrogen peroxide; chemicals that react with acid to generate a gaseous product, such as carbonate and bicarbonates, sulfites and bisulfites; strong reducing agents, such as alkaline metals (Li, Na, K) and alkaline earth metals (Be Mg Ca, Sr, Ba); reactive metals such as aluminum and zinc, all hydrides (such as $LiAlH_4$, $NaBH_4$), and some carbides (such as CaC_2). • The batteries should be placed in a well-ventilated area, include vents (where necessary and applicable).	**Section 11.14 and 11.2** (Section 11: Environmental awareness and fire management plan)

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

APPENDIX P:

SKA RFI Study

Interference Testing and Consultancy Services (Pty) Ltd

ITC SERVICES (PTY) LTD Reg
88/02032/07
Plot 44 Kameeldrift East, Pretoria
Private Bag X13 Lynn East 0039
Republic of South Africa
Tel (012) 808 1730 Int + 27 12 808 1730
Fax (012) 808 1733

REPORT ADDRESSING ELECTOMAGNETIC INTERFERENCE (EMI) FOR SKEURHOK PV PHASE THREE.

DOCUMENT NUMBER : **R 7373/17**

REVISION : **1.0**

DATE : **8 December 2017**

MASTER : **MASTER**

CONFIGURATION CONTROL

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ITC SERVICES Prepared By	C Fouché	Fouché	08/12/2017
ITC SERVICES Reviewed By	SM Gough	Gough	08/12/2017

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ii	1.0	17	1.0					
iii	1.0	18	1.0					
iv	1.0	19	1.0					
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2	1.0	21	1.0					
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14	1.0							
15	1.0							

ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
AM	Amplitude Modulation
CAL	Calibration
CCW	Counter Clockwise
CM	Common Mode
E-Fields	Electric Fields
EM	Electro Magnetic
EMPr	Environmental Management Programme
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
Eq	Equation
EUT	Equipment Under Test
Fr	Resonant frequency
H- Fields	Magnetic Fields
IEEE	Institute of Electrical and Electronic Engineers
ITM	Irregular Terrain Model
ITU	International Telecommunications Union
MIL-STD	Military Standard
PSU	Power Supply Unit
R&S	Rohde and Schwarz
RF	Radio Frequency
SE	Shielding Effectiveness
SELDS	Shielded Enclosure Leak Detection System
SKA	Square Kilometre Array

TABLE OF CONTENTS

1. INTRODUCTION

The proposed project area of the Skeurhok Photovoltaic (PV) Phase 3 project (there are three possible phases of 75MWac each) falls within the Astronomical Advantage Area of the SKA. In order to determine whether the proposed facilities could have any influence on the SKA, Juwi Renewable Energies (Pty) Ltd requested an initial risk evaluation of the proposed development to SKA activities. The frequency band of concern for SKA is 70MHz to 20GHz.

While it is committed for all internal communication to be in the form of fibre optic cabling, which will result in negligible emissions, it is also assumed that other external telecommunication services or networks that will potentially be established as part of the facility will be compliant with SKA requirements, and the emissions from such infrastructure has thus not been assessed in detail as part of this report. The requirement for compliant telecommunication infrastructure has, however, been included in the EMC Plan requirements.

1.1 REFERENCED AND APPLICABLE DOCUMENTS

[1] Regulations on Radio Astronomy Protection Levels in Astronomy Advantage Areas Declared for the Purposes of Radio Astronomy No.R 90. Government Gazette 10 February 2012 (35007).
[2] K0000-2001V1-02 R: SKA Standard for calculating RFI Threshold Levels – RT Lord 8 December 2010.
[3] CISPR 11: Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement.
[4] NTIA Report 82-100: A guide to the use of the ITS Irregular Terrain Model in the Area Prediction Mode
[5] EMC test report 110092-AU01+E01 – EMV TESTHAUS GmbH (Tracker test report)
[6] Electromagnetic Compatibility EMC Test Report 285952-1-2 – SGS Fimko Ltd (Inverter Test Report)
[7] NTIA TM-89-139 Single and Aggregate Emission Level Models for Interference Analysis
[8] SCA/16/01/29 - Cumulative Topographical Analysis of Proposed PV Projects in AGA Area MESA Solutions (Pty) Ltd

2. METHODOLOGY

This phase of assessment is based on laboratory tested radio frequency emissions to determine technology risks (power conversion, trackers control systems, etc.) of the renewable energy system and the measurements at a representative site (Dreunberg) as reported in [8]. A second phase of post-construction in-field measurements will be necessary to confirm results of this study or provide further input.

The proposed site of the renewable energy installation is plotted with reference to the MeerKAT, SKA Phase 1 and SKA Phase 2 telescope locations. The worst case point-to-point links are then identified using the SPLAT! RF propagation tool, i.e. the cases with the lowest total path loss between the proposed Skeurhok Phase1 stations and each of the three SKA phases. SARAS receiver protection levels against expected received amplitudes from the renewable power technology are determined and the required mitigation calculated. The CISPR11 Class A emission standards [3] are also provided as reference.

The expected loss as determined by the Irregular Terrain Model [4] (Longley Rice model applicable for frequencies between 20MHz and 20GHz) between the proposed site and nearest SKA stations is presented in Graph 1 to Graph 3. The reduction in power density of an electromagnetic wave as it propagates is a function of free-space loss (natural expansion of the wave front in free space (i.e. distance between source and receiver), diffraction loss (part of the wave front is obstructed by an obstacle, in this case terrain such as a hill), vegetation and foliage (environment) and the propagation medium (dry/ moist air in this case) to name a few.

Actual laboratory measured data are presented to confirm the source amplitude of the various components utilised in the Skeurhok design. Measurements made at Dreunberg, a representative facility has been compared to the laboratory data and was found to be of comparable amplitudes. The transient data of the Dreunberg facility is up to 20dB higher than the laboratory data.

Although reference is made to CISPR 11 and CISPR 22 in this document, it should be noted that the quasi-peak detector used for CISPR tests will result in low amplitudes being recorded for signals with a low pulse repetition rate. Due to the number of potential sources on the plant (120 inverters and 1093 tracker systems) and the characteristics of a radio telescope, peak detection (max hold function) has been used when evaluating impulse signals with low repetition rates.

This report is one of three to be used to evaluate possible Skeurhok PV phases with manageable impact on the SKA and to rank the phases in terms of potential impact on the SKA, therefore each phase is assessed independently.

3. TECHNOLOGY DESCRIPTION (SKEURHOK SOLAR ENERGY FACILITY)

Photovoltaic (PV) panels convert the energy delivered by the sun to direct current (DC) electric energy. The array of PV modules is connected to an inverter by means of a network of cables. The DC current is converted to alternating current (AC) power by a grid-tied inverter. The AC power can then be added to the national electricity network (grid). The voltage at which power is generated is stepped up to the required voltage of the point of connection to the national grid by using a transformer. The electricity is distributed from the on-site transformers (substation) via overhead power lines into the national grid. The infrastructure of the facility includes the ground-mounted structures, solar PV modules, cables, inverter rooms, access roads, auxiliary roads, an on-site substation, and a distribution line. The primary input of the system is sunlight, which is converted to electricity. The sun tracker technology utilizes auxiliary electricity from the national grid to power tracker motors in order to optimize the amount of sunlight on the solar PV infrastructure. In addition to auxiliary power being used for powering tracker motors, small amounts of auxiliary power would be used for on-site usage on items such as, but not limited to, security and site office energy requirements. The tracking system is ground-mounted and follows the sun's path with the use of dual-axis technology in order to maximize the amount of direct sunlight on the Solar PV modules.
Main industrial equipment in the PV plant used for this assessment is the following:

- Photovoltaic generator/module Model BYD 340P6D-36
- Insta Net DC combiner boxes E100-443
- Ideematec safeTrack HorizonPV tracker system
- ABB Inverters model PVS980-58-2000KVA
- Substation (transformer + MV cubicles)

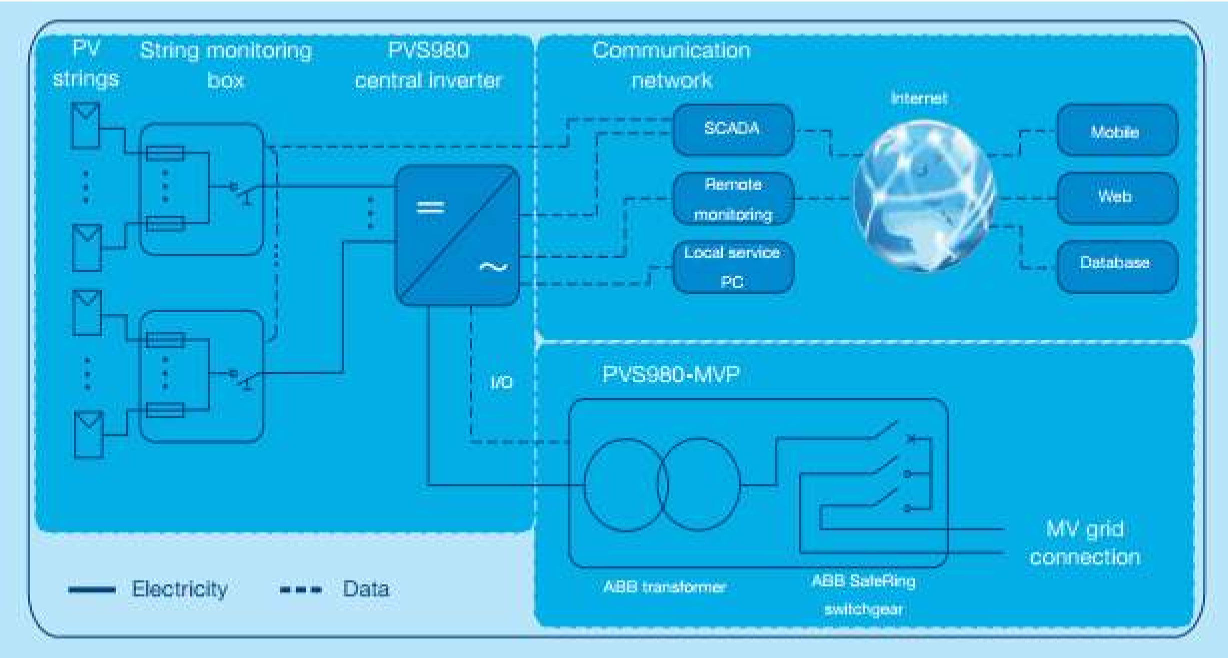


Figure 1: ABB System block diagram

4. RISK IDENTIFICATION

4.1 TECHNOLOGY RISKS

The following building blocks are viewed as potential interference sources:

- PV tracker system
- DC combiner boxes
- Inverters (AC as well as DC path)
- PV Generator control and management
- Control and operations centre (computer equipment)

4.1.1 PV Tracker and DC Combiner System

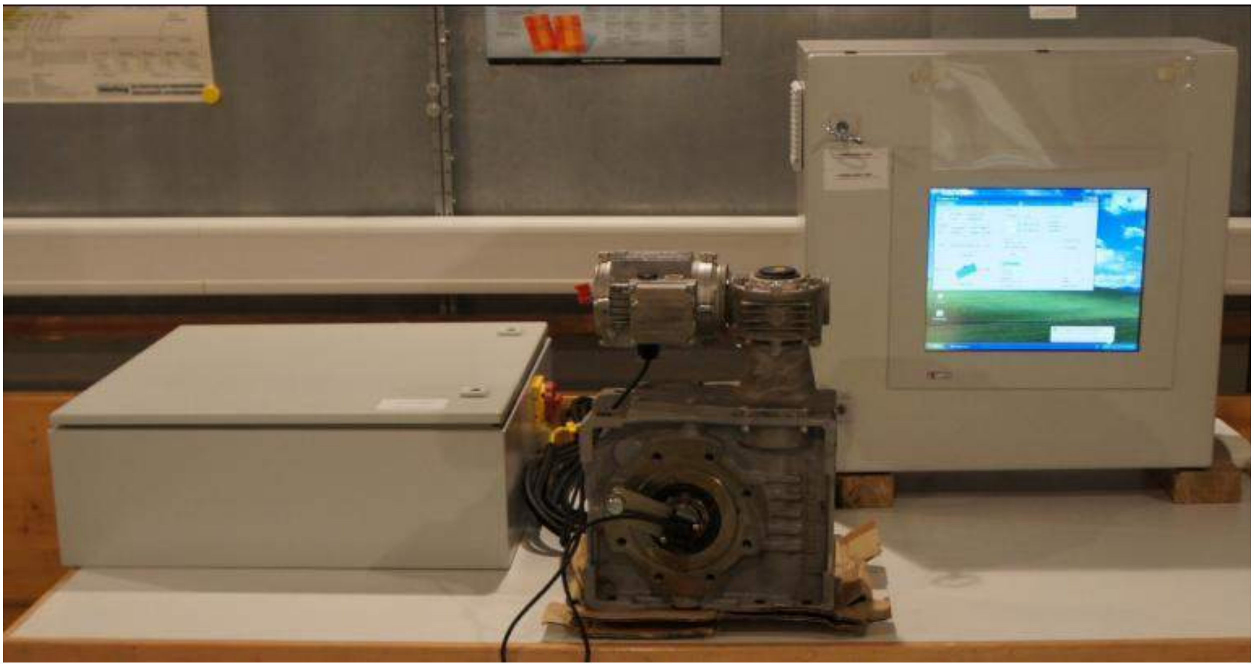


Figure 2: Tracker and DC combiner test set-up

The tracker system and DC combiner system was tested as a system [5] as shown in Figure 2 and complies to CISPR 22 Class B.

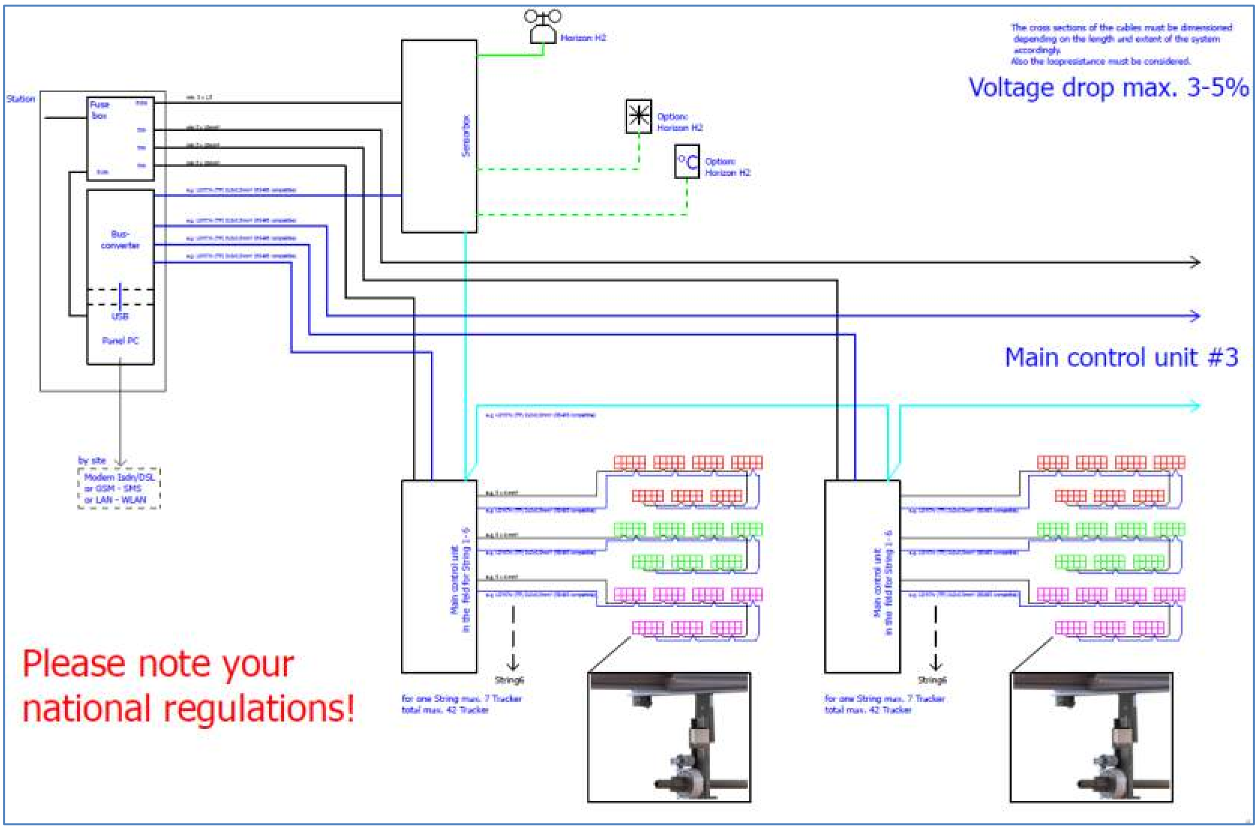


Figure 3: Tracker Single line diagram

4.1.2 Inverter

Figure 4: Inverter test set-up

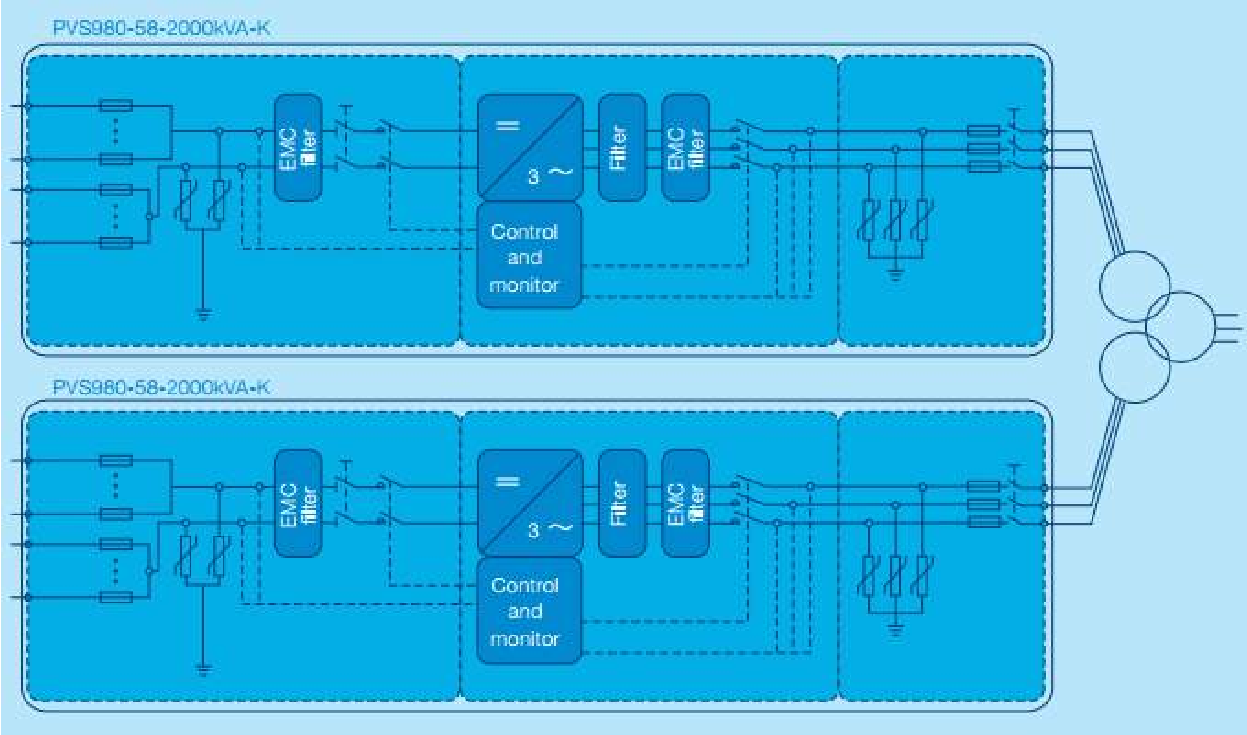


Figure 5: Inverter block diagram

The inverter system was tested as a complete system [6] as shown in Figure 4 and complies with CISPR 22 Class A (40dBuV/m @10m < 230MHz and 47dBuV/m @10m 230MHz to 1GHz) at frequencies above 80MHz. Worth noting is that the ABB inverter has EMC filtering on both the DC input and AC output side.

4.1.3 PV Generator control and management

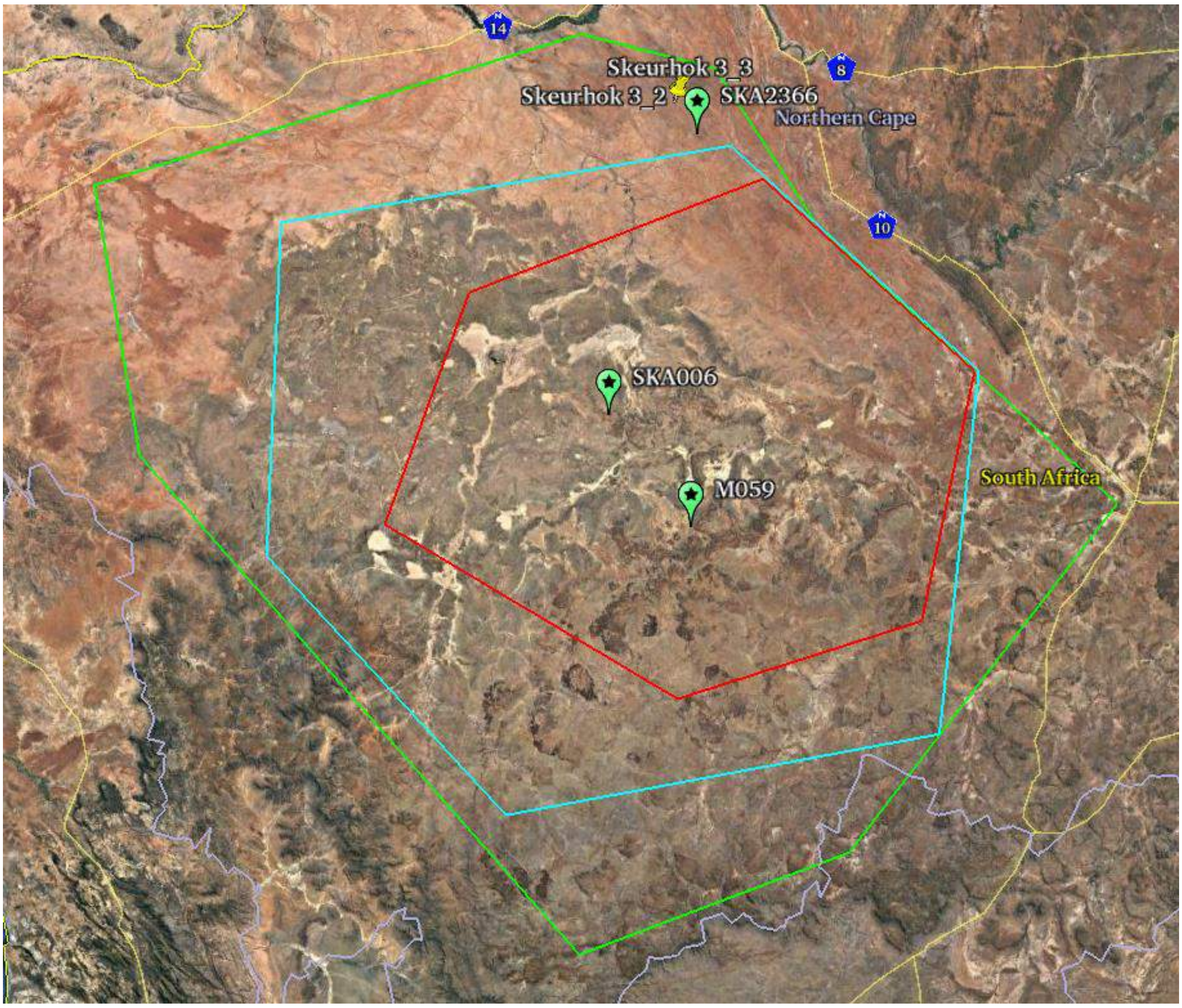
All communication infrastructure to enable the transfer of information between the various elements connected to the network, such as the local office of the SCADA and PLCs will be connected via optical fibre (as per Par 10 of Design Summary sheet attached as Appendix C refers). The RFI emissions from such fibre optic infrastructure are negligible.

4.1.4 Cumulative emissions

A large number of non-correlated noise sources (inverters, PV panel controls etc.) could increase the noise floor at a receiving site distant from the noise sources. Due to the relatively high source density, the accepted approximation on $10 \times logN$where N is the total number of noise sources was used to estimate the cumulative impact.

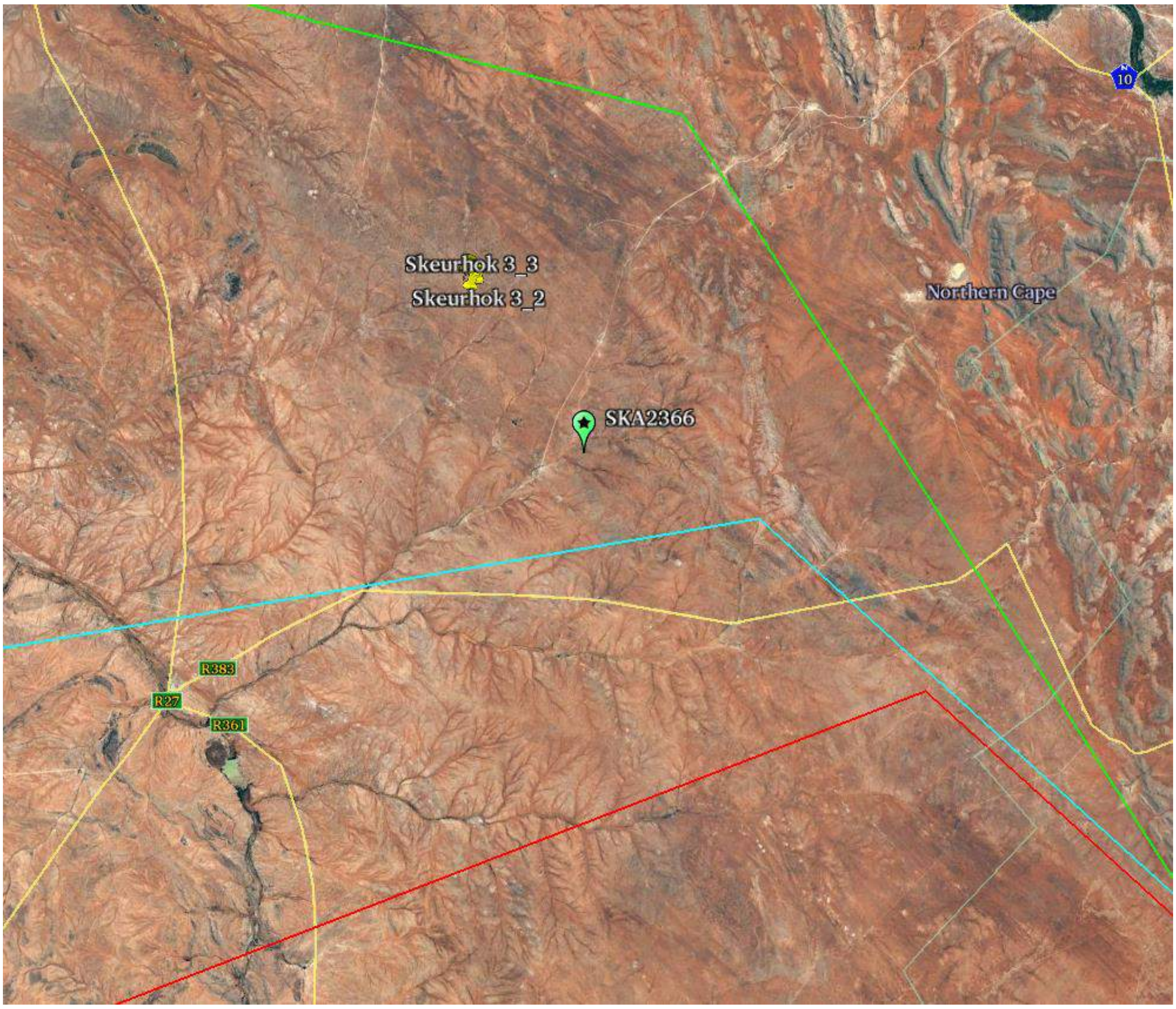
4.2 SITE LOCATION

4.2.1 Area Map



Picture 1: Area Map showing Skeurhok Phase 3 and SKA KCAAA as well as the worst effected SKA dishes in terms of MeerKAT, SKA Phase1 and SKA Phase2

4.2.2 Local Map



Picture 2: Local map showing closest SKA station (SKA Phase 2)

4.2.3 Elevation Maps

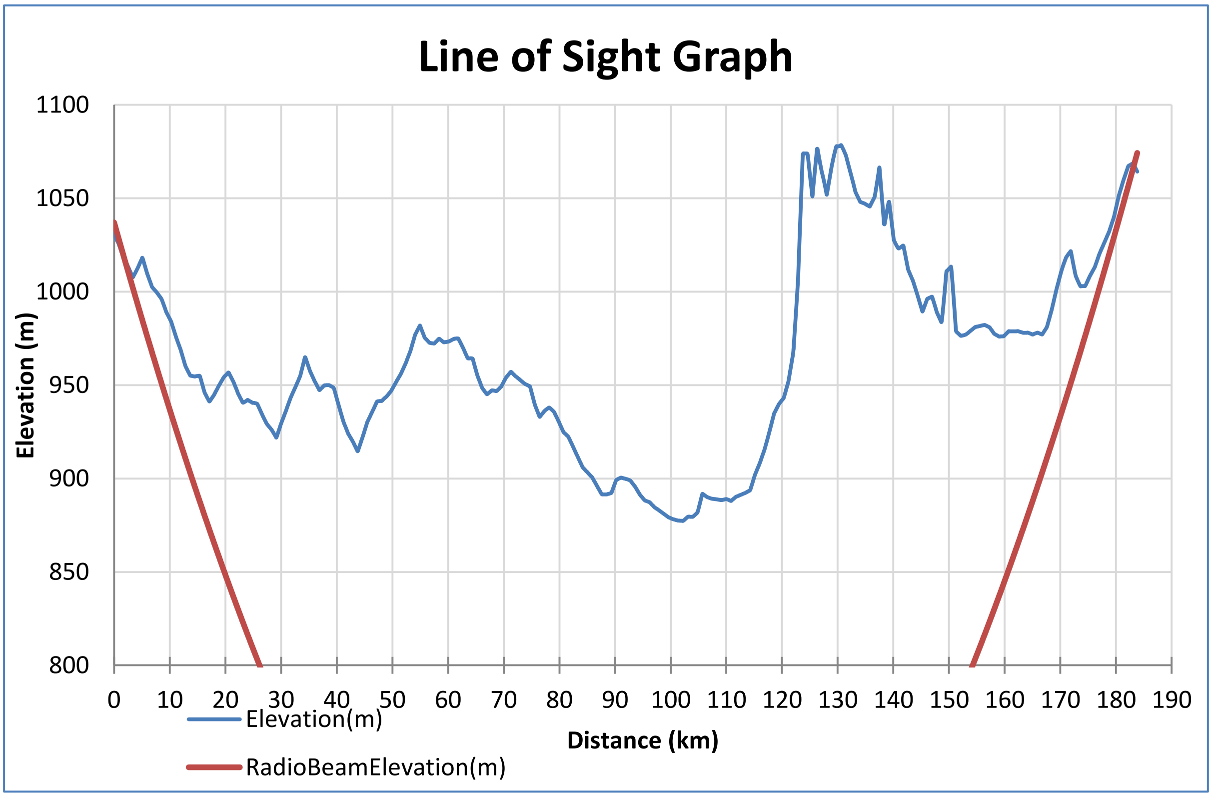


Figure 6: Skeurhok 3_3 to MeerKAT ID M059

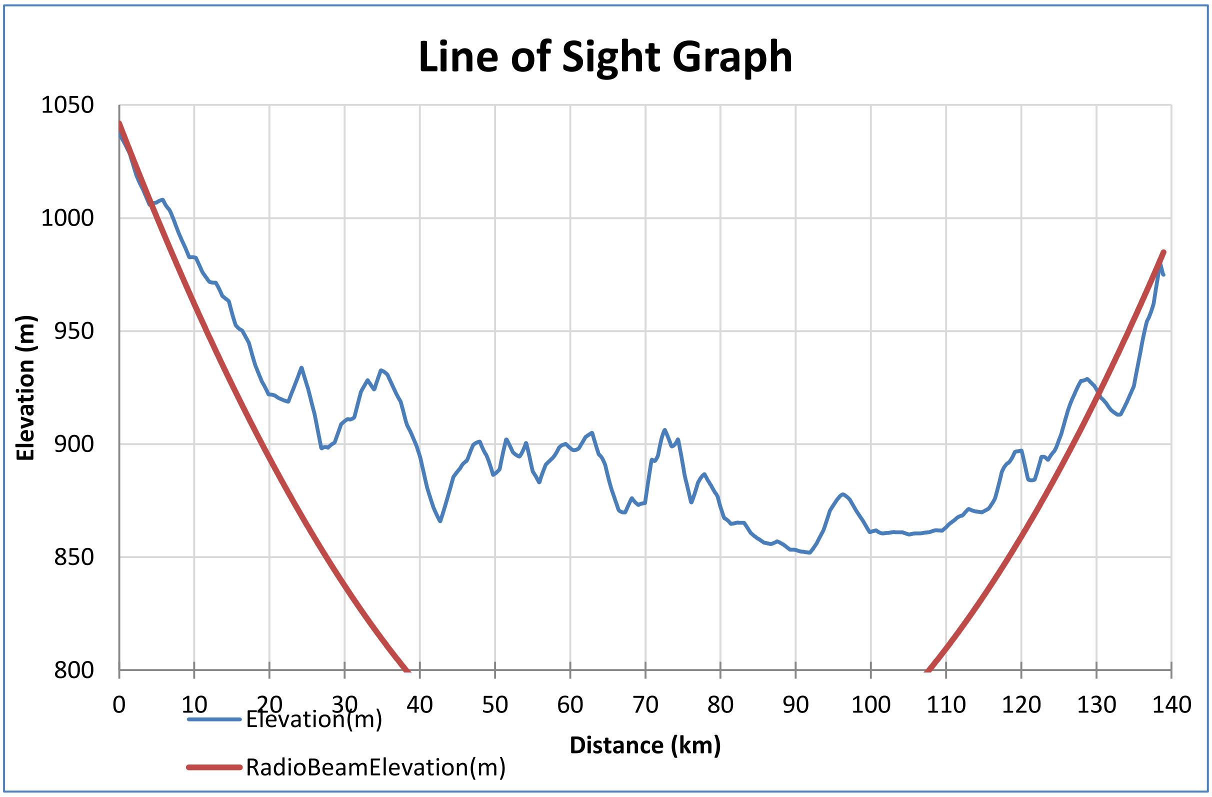


Figure 7: Skeurhok 3_2 to SKA ID 006

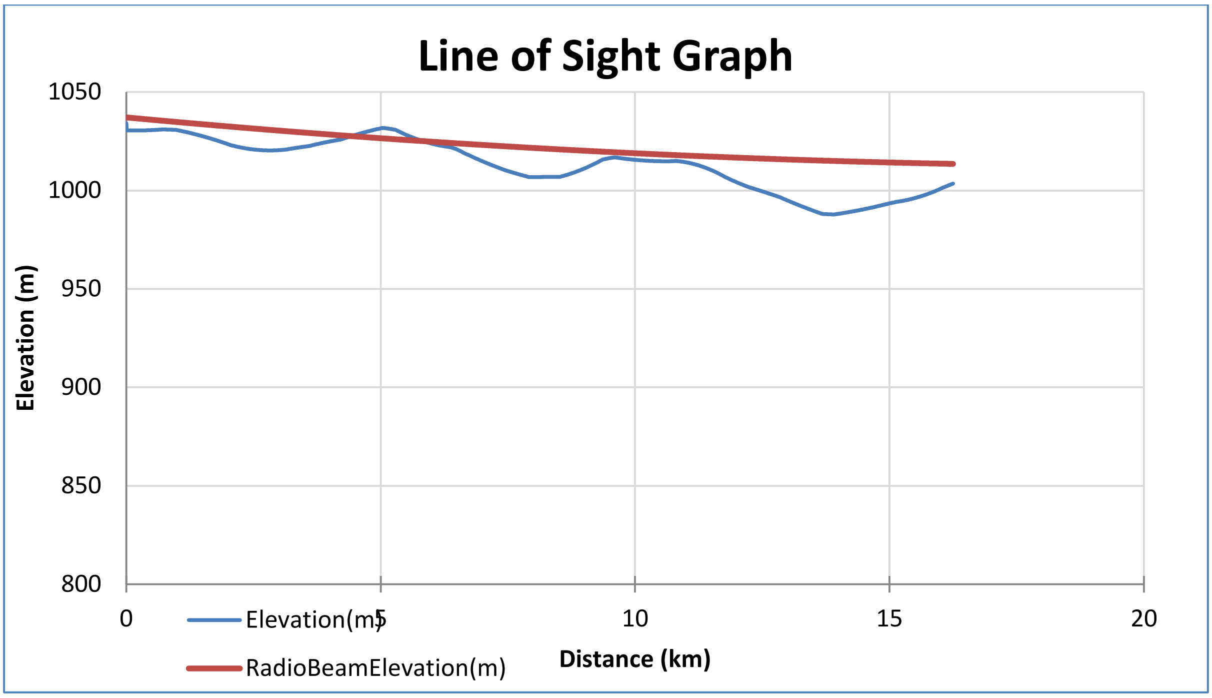


Figure 8: Skeurhok 3_3 to SKA ID 2366

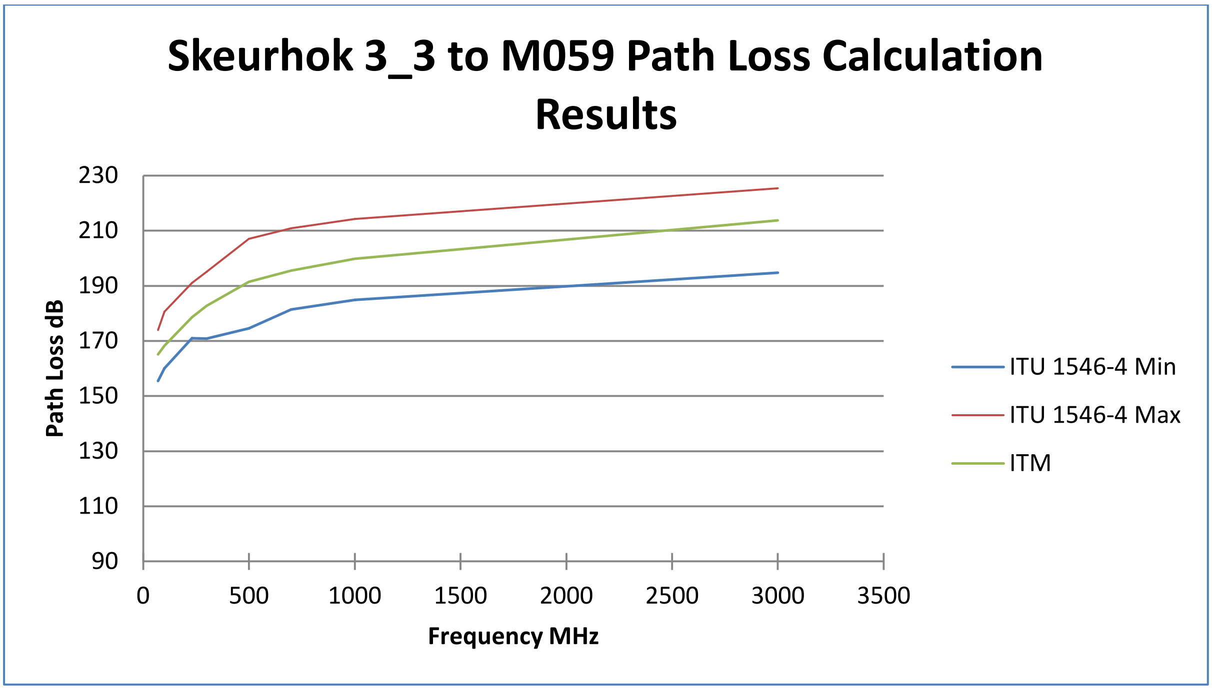
4.3 INPUT DATA

Parameter	Description	Quantity	Comment
Source/ Victim separation distance	Skeurhok 3_3 to M059 Skeurhok 3_2 to SKA006 Skeurhok 3_3 to SKA2366	183.66 km 138.80 km 16.21 km	No direct line of sight conditions
Frequency	Frequencies (MHz) assessed for: Trackers Inverter	100; 230; 300; 500; 700; 1000 100; 230; 300; 500; 700; 1000; 3000; 6000	Free space loss increases with frequency. The assessed frequencies are in the ranges where the risk for SKA interference is anticipated to be the greatest, and the results in these ranges are assumed to be representative of risk in the SKA ranges of interest from 70MHz to 20GHz.
TX Power	Measured data (EN CISPR 11 Class A >20kVA @ 10m) Measured data SCATEC	50 dBµV/m for <100MHz 35 dBµV/m for >100MHz 35 dBµV/m	Based on the measured inverter data [6] Inverter (Par 2.7.2 SCA/16/01/29/REV1
SARAS	Protection level	dBm/Hz = -17.2708 log 10 (f) -192.0714 for f<2GHz	Government Gazette 10 February 2012
RX height	All SKA receivers	10m	Height used for SKA receive horn

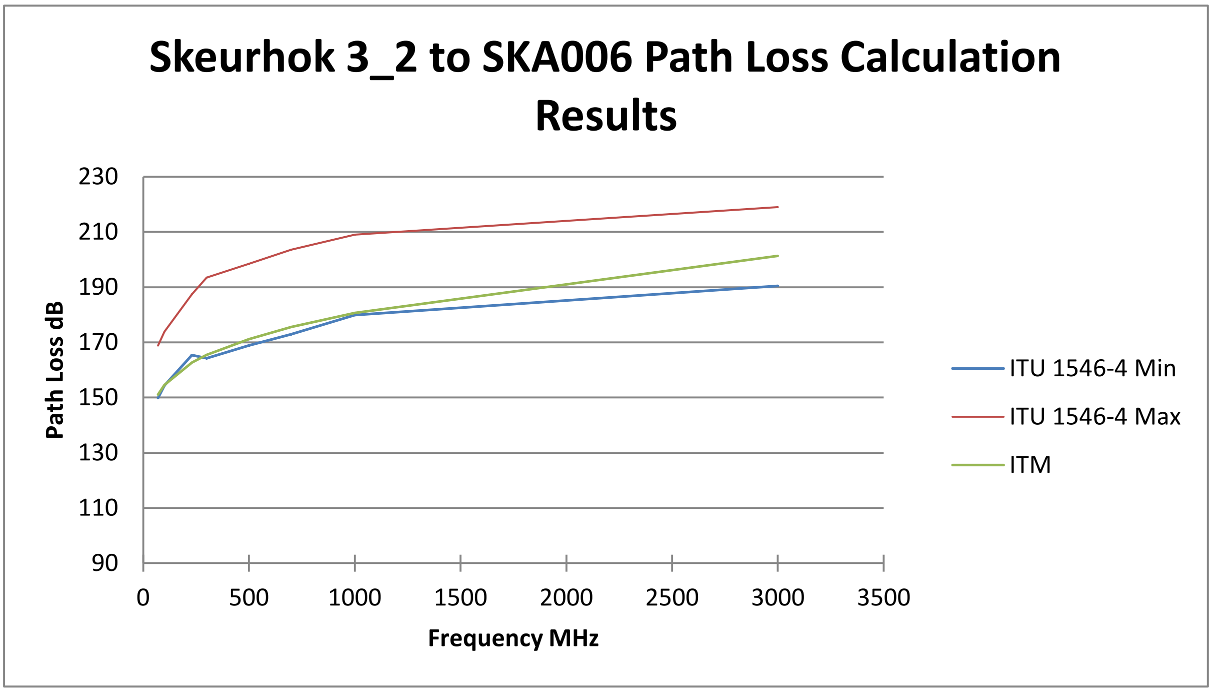
Table 1: Input data for path loss calculations

4.4 PATH LOSS CALCULATIONS (ITU-R P.1546-4 AND ITM)

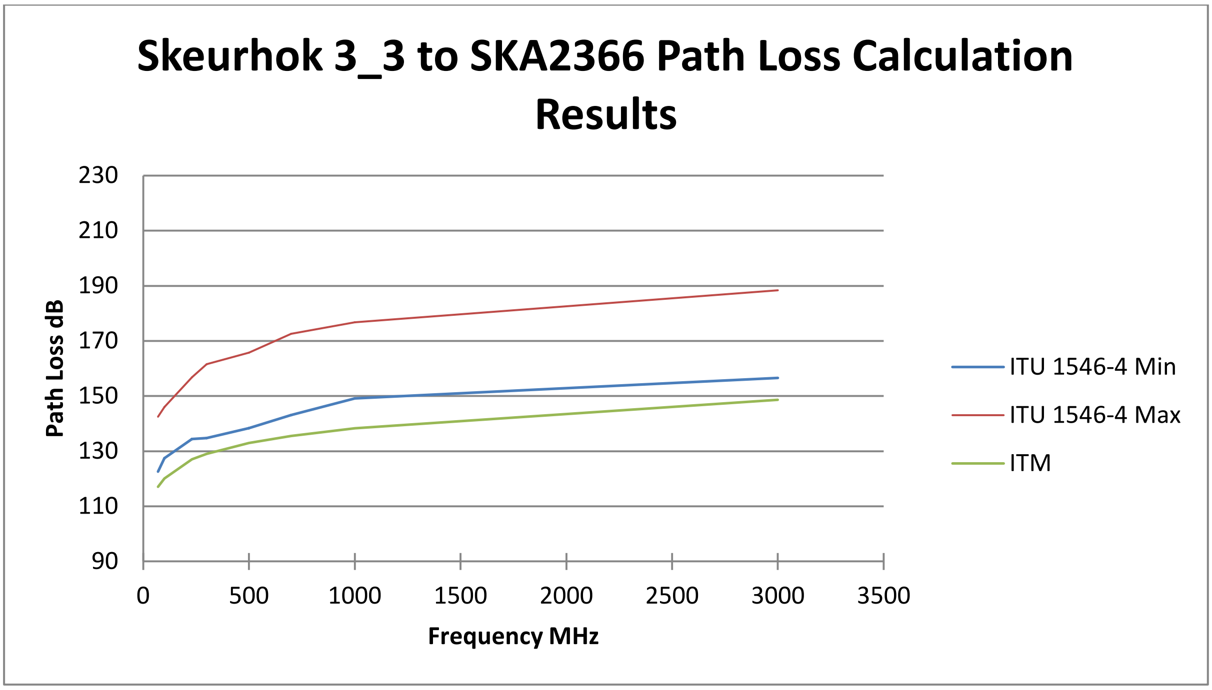
The path loss was calculated using the parameters as specified in Table 1 and transmit and receive heights of 3m and 10m, respectively.



Graph 1:Skeurhok 3_3 to M059 Path Loss Calculation Results



Graph 2: Skeurhok 3_2 to SKA006 Path Loss Calculation Results



Graph 3: Skeurhok 3_3 to SKA2366 Path Loss Calculation Results

Graph 1 to Graph 3 show the expected path loss as determined by the Irregular Terrain Model (Longley Rice model applicable for frequencies between 20MHz and 20GHz) and the minimum and maximum values of the ITU-R P.1546-4 Land Path propagation model statistical simulation based on the Monte-Carlo method. The ITU-R P.1546-4 Land Path propagation model does not apply site specific terrain data.

The reduction in power density of an electromagnetic wave as it propagates is a function of free-space loss (natural expansion of the wave front in free space i.e. distance between source and receiver), diffraction loss (part of the wave front is obstructed by an obstacle, in this case terrain such as a hill), vegetation and foliage (environment) and the propagation medium (dry/ moist air in this case) to name a few.

The distance of 16.21 km from Skeurhok 3_3 to SKA ID 2366 is the shortest with the lowest path loss result.

5. POTENTIAL IMPACT AND MITIGATION REQUIREMENTS

Measured data at Dreunberg is 15dB to 25dB less than the laboratory results shown in Appendix A and B.

1.1 IMPACT ON MEERKAT BASED ON THE SCATEC INVERTER DATA

Worst case impact on MeerKAT will be from the Skeurhok 3_3 waypoint to M059.

Skeurhok 3_3 to M059 @ 183.66km							
Frequency [MHz]	SCATEC Data P[dBW]	Saras [dBW/Hz]	Required path loss [dB]	Path Loss (Measured or calculated) [dB]	Number of inverter units in facility	Mitigation required for facility [dB]	Mitigation required per unit [dB]
70	*-79.80*	-253.94	123.35	165.10	120	-41.75	-20.96
100	*-79.80*	-256.61	126.02	168.30	120	-42.28	-21.49
230	*-79.80*	-262.86	132.27	178.60	120	-46.33	-25.54
300	*-79.80*	-264.85	134.26	182.70	120	-48.44	-27.65
500	*-79.80*	-268.68	138.09	191.40	120	-53.31	-32.52
700	*-79.80*	-271.21	140.62	195.50	120	-59.18	-38.39
1000	*-79.80*	-273.88	143.29	199.80	120	-70.41	-49.62
3000	*-90.26*	-279.09	128.84	213.70	120	-84.86	-64.07
6000	*-90.26*	-279.11	128.86	222.70	120	-93.84	-73.05

Table 2: MeerKAT impact and mitigation requirement

1.2 IMPACT ON SKA PHASE 1 BASED ON THE SCATEC INVERTER DATA

Worst case impact on SKA Phase 1 will be from the Skeurhok 3_2 waypoint to SKA 006.

Skeurhok 3_2 to SKA006 @ 138.80km							
Frequency [MHz]	SCATEC Data P[dBW]	Saras [dBW/Hz]	Required path loss [dB]	Path Loss (Measured or calculated) [dB]	Number of inverter units in facility	Mitigation required for facility [dB]	Mitigation required per unit [dB]
70	*-79.80*	-253.94	123.35	151.10	120	-27.75	-6.96
100	*-79.80*	-256.61	126.02	154.50	120	-28.48	-7.69
230	*-79.80*	-262.86	132.27	162.70	120	-30.43	-9.64
300	*-79.80*	-264.85	134.26	165.50	120	-31.24	-10.45
500	*-79.80*	-268.68	138.09	171.20	120	-33.11	-12.32
700	*-79.80*	-271.21	140.62	175.50	120	-40.08	-19.29
1000	*-79.80*	-273.88	143.29	180.70	120	-58.01	-37.22
3000	*-90.26*	-279.09	128.84	201.30	120	-72.46	-51.67
6000	*-90.26*	-279.11	128.86	216.10	120	-87.24	-66.45

Table 3: SKA Phase 1 impact and mitigation requirement

1.3 IMPACT ON SKA PHASE 2 BASED ON THE SCATEC INVERTER DATA

Worst case impact on SKA Phase 2 will be from the Skeurhok 3_3 waypoint to SKA 2366.

Skeurhok 3_3 to SKA2366 @ 16.21km							
Frequency [MHz]	SCATEC Data P[dBW]	Saras [dBW/Hz]	Required path loss [dB]	Path Loss (Measured or calculated) [dB]	Number of inverter units in facility	Mitigation required for facility [dB]	Mitigation required per unit [dB]
70	*-79.80*	-253.94	123.35	117.10	120	6.25	27.04
100	*-79.80*	-256.61	126.02	120.10	120	5.92	26.71
230	*-79.80*	-262.86	132.27	127.00	120	5.27	26.06
300	*-79.80*	-264.85	134.26	129.00	120	5.26	26.05
500	*-79.80*	-268.68	138.09	133.00	120	5.09	25.88
700	*-79.80*	-271.21	140.62	135.50	120	2.32	23.11
1000	*-79.80*	-273.88	143.29	138.30	120	-5.31	15.48
3000	*-90.26*	-279.09	128.84	148.60	120	-19.76	1.03
6000	*-90.26*	-279.11	128.86	157.20	120	-28.34	-7.55

Table 4: SKA Phase 2 impact and mitigation requirement

1.4 IMPACT ON MEERKAT BASED ON THE SCATEC TRACKER DATA

Worst case impact on MeerKAT will be from the Skeurhok 3_3 waypoint to M059.

Skeurhok 3_3 to M059 @ 183.66km							
Frequency [MHz]	SCATEC Data P[dBW]	Saras [dBW/Hz]	Required path loss [dB]	Path Loss (Measured or calculated) [dB]	Number of tracker units in facility	Mitigation required for facility [dB]	Mitigation required per unit [dB]
70	*-89.80*	-253.94	113.35	165.10	1093	-51.75	-21.37
100	*-89.80*	-256.61	116.02	168.30	1093	-52.28	-21.89
230	*-89.80*	-262.86	122.27	178.60	1093	-56.33	-25.95
300	*-89.80*	-264.85	124.26	182.70	1093	-58.44	-28.05
500	*-89.80*	-268.68	128.09	191.40	1093	-63.31	-32.92
700	*-89.80*	-271.21	130.62	195.50	1093	-69.18	-38.80
1000	*-89.80*	-273.88	133.29	199.80	1093	-80.41	-50.02
3000	*-100.26*	-279.09	118.84	213.70	1093	-94.86	-64.48
6000	*-100.26*	-279.11	118.86	222.70	1093	-103.84	-73.46

Table 5: MeerKAT impact and mitigation requirement

1.5 IMPACT ON SKA PHASE 1 BASED ON THE SCATEC TRACKER DATA

Worst case impact on SKA Phase 1 will be from the Skeurhok 3_2 waypoint to SKA 006.

Skeurhok 3_2 to SKA006 @ 138.80km							
Frequency [MHz]	**SCATEC Data P[dBW]**	**Saras [dBW/Hz]**	**Required path loss [dB]**	**Path Loss (Measured or calculated) [dB]**	**Number of tracker units in facility**	**Mitigation required for facility [dB]**	**Mitigation required per unit [dB]**
70	*-89.80*	-253.94	113.35	151.10	1093	-37.75	-7.37
100	*-89.80*	-256.61	116.02	154.50	1093	-38.48	-8.09
230	*-89.80*	-262.86	122.27	162.70	1093	-40.43	-10.05
300	*-89.80*	-264.85	124.26	165.50	1093	-41.24	-10.85
500	*-89.80*	-268.68	128.09	171.20	1093	-43.11	-12.72
700	*-89.80*	-271.21	130.62	175.50	1093	-50.08	-19.70
1000	*-89.80*	-273.88	133.29	180.70	1093	-68.01	-37.62
3000	*-100.26*	-279.09	118.84	201.30	1093	-82.46	-52.08
6000	*-100.26*	-279.11	118.86	216.10	1093	-97.24	-66.86

Table 6: SKA Phase 1 impact and mitigation requirement

1.6 IMPACT ON SKA PHASE 2 BASED ON THE SCATEC TRACKER DATA

Worst case impact on SKA Phase 2 will be from the Skeurhok 3_3 waypoint to SKA 2366.

Skeurhok 3_3 to SKA2366 @ 16.21km							
Frequency [MHz]	**SCATEC Data P[dBW]**	**Saras [dBW/Hz]**	**Required path loss [dB]**	**Path Loss (Measured or calculated) [dB]**	**Number of tracker units in facility**	**Mitigation required for facility [dB]**	**Mitigation required per unit [dB]**
70	*-89.80*	-253.94	113.35	117.10	1093	-3.75	26.63
100	*-89.80*	-256.61	116.02	120.10	1093	-4.08	26.31
230	*-89.80*	-262.86	122.27	127.00	1093	-4.73	25.65
300	*-89.80*	-264.85	124.26	129.00	1093	-4.74	25.65
500	*-89.80*	-268.68	128.09	133.00	1093	-4.91	25.48
700	*-89.80*	-271.21	130.62	135.50	1093	-7.68	22.70
1000	*-89.80*	-273.88	133.29	138.30	1093	-15.31	15.08
3000	*-100.26*	-279.09	118.84	148.60	1093	-29.76	0.62
6000	*-100.26*	-279.11	118.86	157.20	1093	-38.34	-7.96

Table 7: SKA Phase 2 impact and mitigation requirement

6. CUMULATIVE IMPACT OF ADJACENT PROJECTS

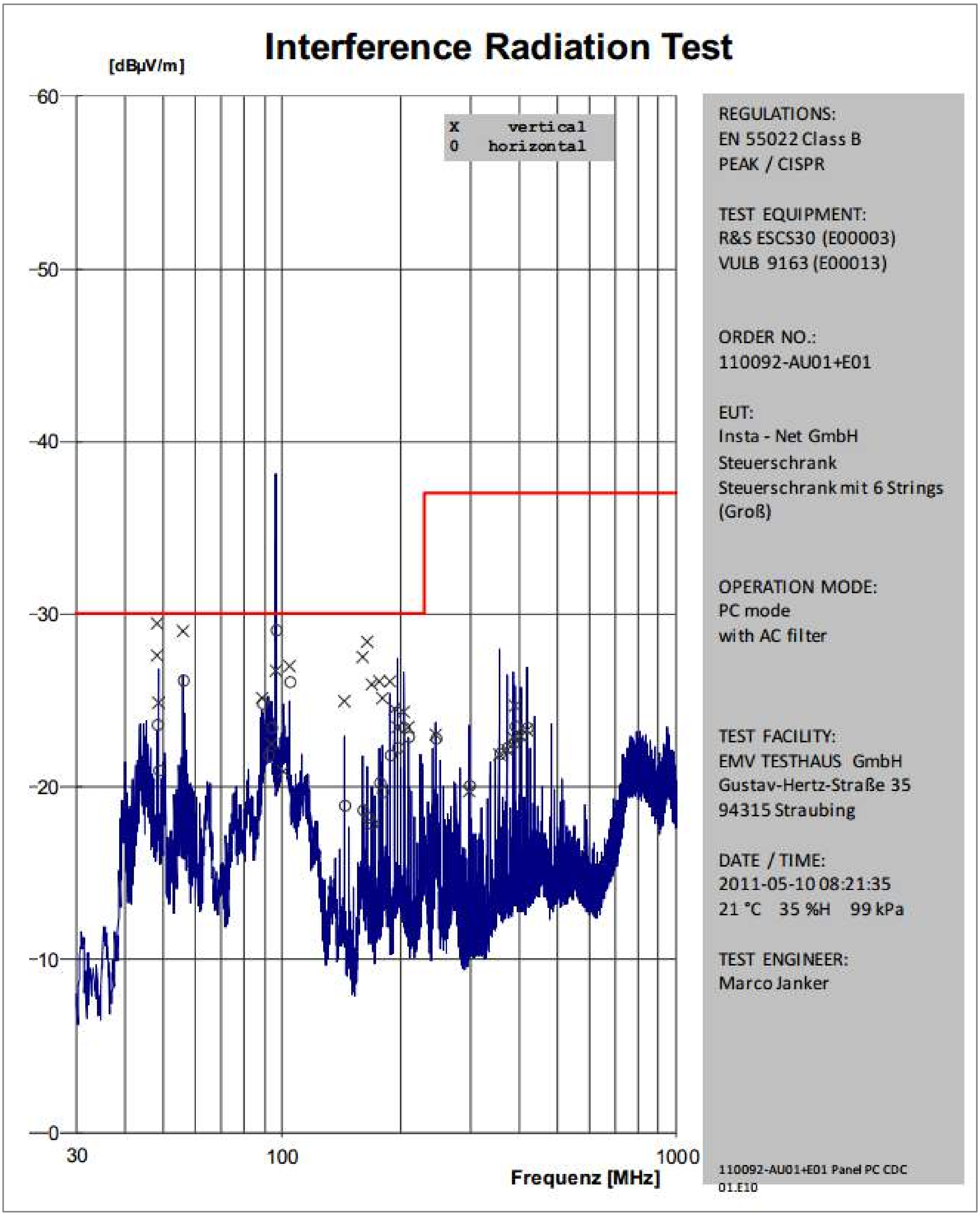
Assuming six nearby projects will continue and each project complies to the Radio Astronomy Protection Levels in Astronomy Advantage Areas, the additional mitigation required will be 8dB based on the calculations shown in 4.1.4.

7. CONCLUSION

Based on the current SKA location information, this impact analysis shows that without adequate mitigation a possible interference scenario between the Skeurhok Solar PV Energy Facility and the SKA installations may occur. This impact can be adequately mitigated through the implementation of standard mitigation techniques with standard off the shelf components. The mitigation required should include an allowance of 8dB for cumulative impact of adjacent sites totalling less than 35dB..

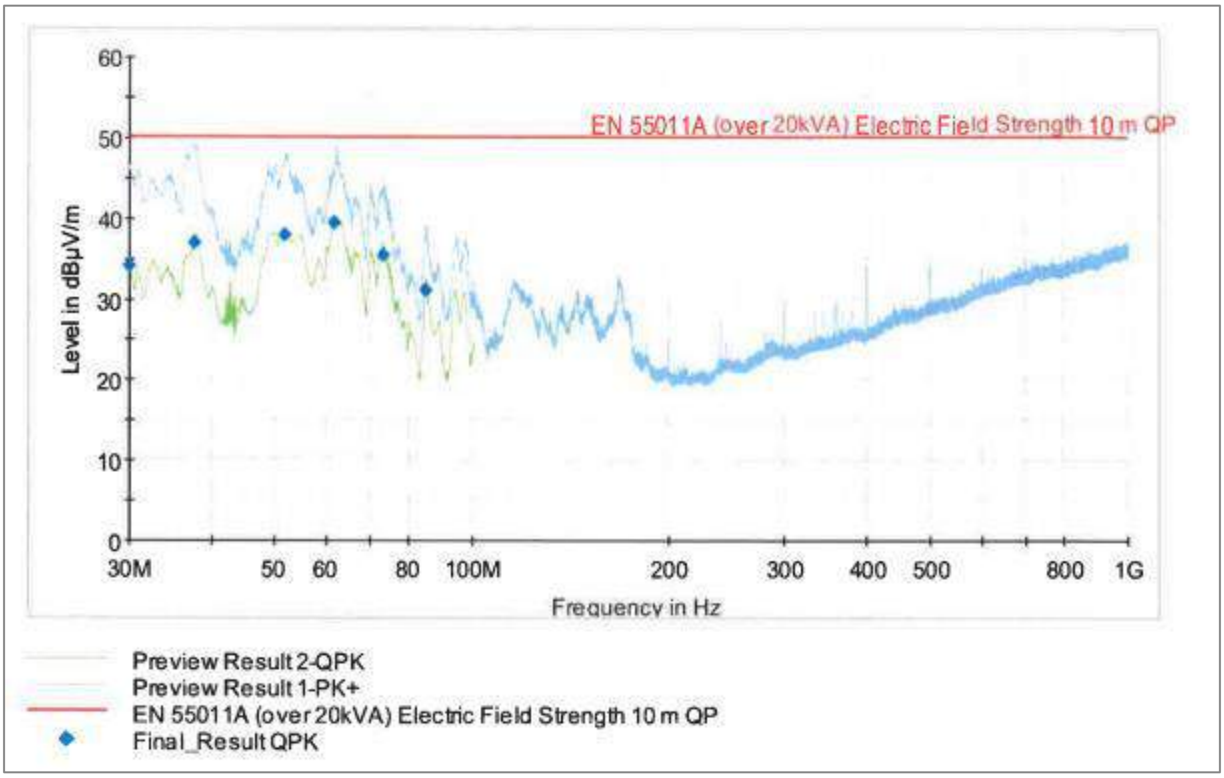
On-site measurement of the operational plant is proposed as a requirement. If such measurements find additional emission reductions to be necessary, measures such as additional shielding and EMC filters should, among others, be considered.

8. APPENDIX A: TRACKER AND DC COMBINER RESULTS

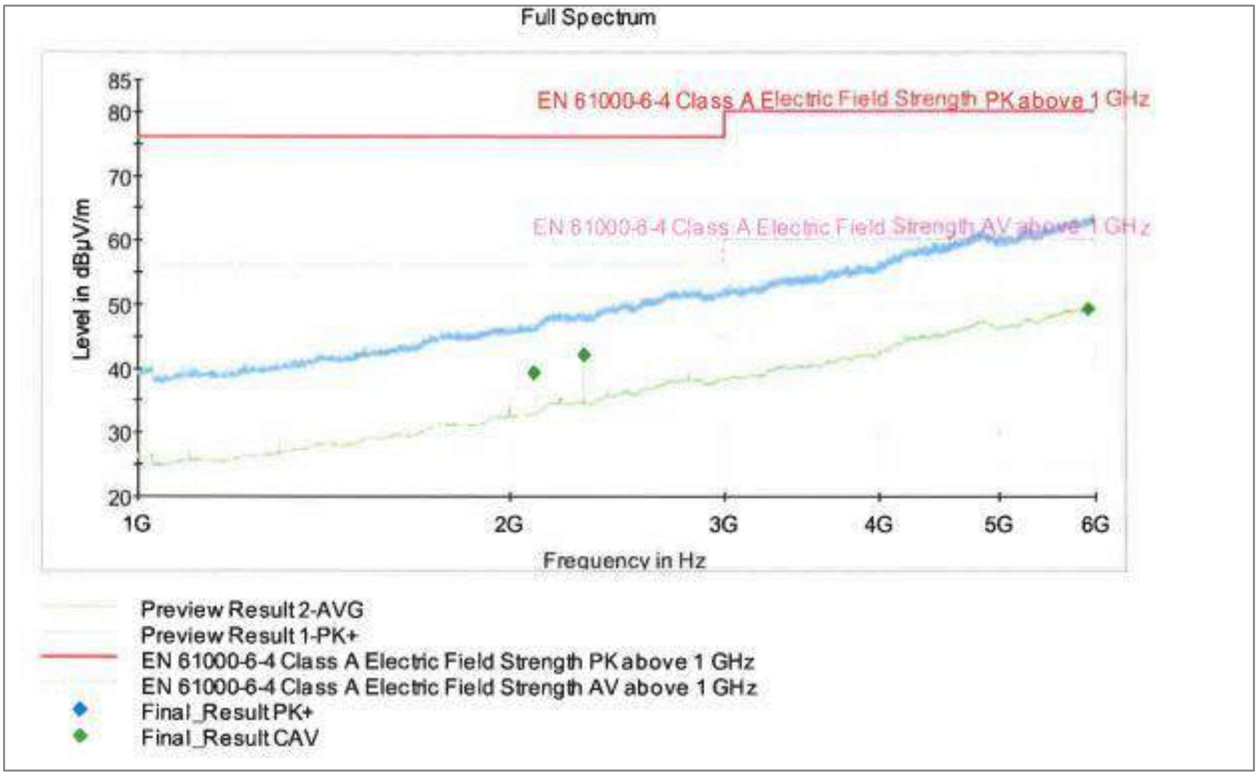


9. APPENDIX B: INVERTER TEST RESULT

9.1 RADIATED EMISSION <1GHZ



9.2 RADIATED EMISSIONS >1GHZ



10. APPENDIX C: SKEURHOK DESIGN SUMMARY

(Note: Kenhardt PV had to be renamed to Skeurhok to avoid name duplication)

401001212_Kenhardt PV1_South Africa_86,2 MWp

juwi

401001212 Kenhardt PV1 - South Africa

Design: Dung Vu Thi My

System: 1500 V

Modules: BYD 340P6D-36
253576x BYD 340P6D-36 = 86.215,84 kWp
Module dimensions: 1,961m length x 0,985m width
8744 strings with 29 modules each

Arrays (Tracker): Ideematec safeTrack Horizon
1093 Trackers consists of 4x2x20 & 2x2x18
Array Type: 2 row(s) with 29 modules each in Portrait mounting
1 array = electrical string(s) = 19,72 kWp
Tilt angle: +/- 45°, Azimuth: 0° East-West
Approx. array length: 28,845 m Array width: 3,942 m
Row spacing: 5 m or adjusted if necessary

DC Combiner Boxes
600x DC combiner boxes 16 inputs, 1 string per DCB input

Solar cables 4mm² 733 km

Connectors +/- 17488

Inverters: ABB PVS980-1909 kVA-J
Nominal AC Power: 1909kWAC

Inverter Station
1 inverter per station

Earthing:
All frame metal work to be bonded to earth with a minimum 16mm², corrosion protection of bonding points. Earthing Cable to be laid in the MV Cable trenches. All earthing shall meet the minimum requirements of SANS 10142-1 & SANS 10142-2

Comms:
The data communication network shall consist exclusively of fibre optic cabling

Rev.	Description	Date	Created	Page
R 1	Rough Configuration	09.02.2017	DUN	1/1

DRAFT EIA REPORT

Scoping and Environmental Impact Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (SKEERHOK PV 3) on Portion 0 of the farm Smutshoek 395, north-east of Kenhardt, Northern Cape Province

PART B:

ENVIRONMENTAL MANAGEMENT PROGRAMME

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

This Environmental Management Programme (EMPr) has been prepared as part of the requirements of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) and the 2014 amended Environmental Impact Assessment (EIA) Regulations promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R325 on 7 April 2017. This EMPr is being submitted to the National Department of Environmental Affairs (DEA) as part of the Application for Environmental Authorisation (EA) for the proposed construction of a 100 Megawatt (MW) Solar Energy Facility (SEF) and associated electrical infrastructure on Portion 0 of Smutshoek Farm 395, approximately 70 km south of Upington and 43 km north-east of Kenhardt within the !Kheis Local Municipality, Northern Cape Province (Figure 1). The proposed project is referred to as Skeerhok PV 3 and has been assigned the following DEA Reference Number: 14/12/16/3/3/2/1035. The Project Applicant for this proposed 100 MWac solar PV project is juwi Renewable Energies (PTY) Ltd (hereinafter referred to as juwi).

This EMPr is being made available to Interested and Affected Parties (I&APs), stakeholders and Organs of State, as part of the EIA Report, for a 30-day review period. Comments received from stakeholders during this aforementioned review period will be incorporated into the EMPr, where applicable. Following the incorporation of comments from I&APs, stakeholders and Organs of State, this EMPr is intended as a "living" document and should continue to be updated regularly, as needed.

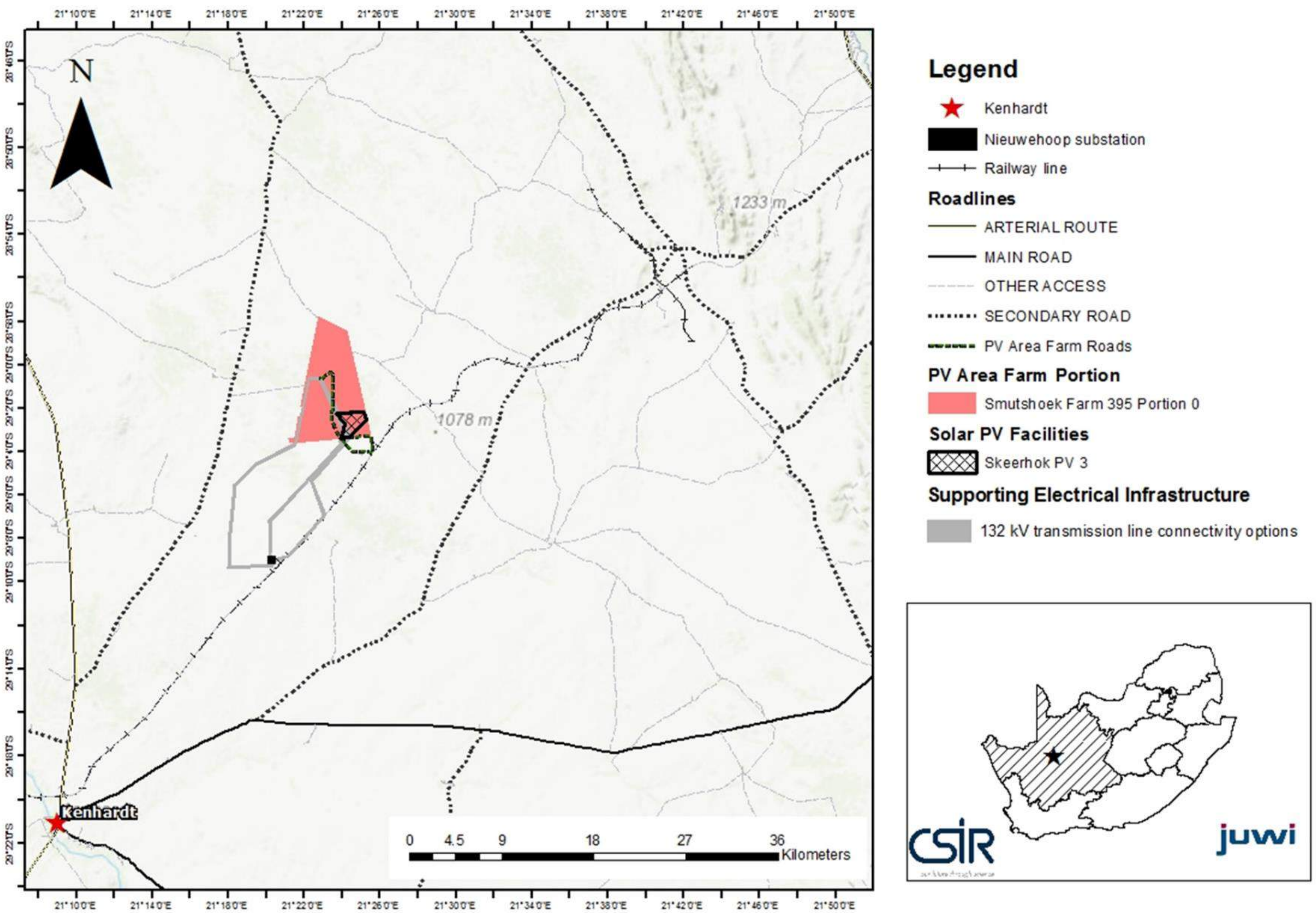


Figure 1: Locality map for the proposed Skeerhok Solar Photovoltaic 3 Facility near Kenhardt in the Northern Cape.

1.1 PROJECT DESCRIPTION

The proposed project will make use of PV solar technology to generate electricity from the sun's energy. The project is being developed with a maximum possible installed capacity 100 MWac of electricity. Once commercial operation date is achieved, the proposed facility will generate electricity for a minimum period of 20 years. The property on which the SEF is to be constructed will be leased by the project owner from the property owners for the life span of the project. It is proposed that juwi will implement the Self-Build Option for the additional electrical infrastructure to be constructed (which will be assessed separately as part of a Basic Assessment (BA) Process). Following the construction phase, the proposed transmission line will either be transferred into the ownership of Eskom.

The SEF will consist of the following components:

- ***Solar Field:***
  - ≤250 ha of photovoltaic (PV) modules mounted on free field single-axis trackers or fixed tilt PV solar module mounting structures comprised of galvanised steel and aluminium; and
  - below ground electrical cables connecting the PV arrays to the inverter stations, O&M building and collector substation; and
  - Ring main units; and
  - Inverters and mini-subs.

- ***Collector substation:***
  - ≤1 ha 22/33 kV to 132 kV collector substation to receive, convert and step up electricity from the PV facility to the 132 kV grid suitable supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32 m telecommunications tower (lattice or monopole type) will be established in the substation area;

- ***O&M area:***
  - Operations and Maintenance (O&M) buildings;
  - ≤1 ha hectare O&M laydown area (near / adjacent substation);
  - ≤0.01 ha solar measuring station;
  - Parking, reception area, offices, guest accommodations and ablution facilities for operational staff, security and visitors;
  - Workshops, storage areas for materials and spare parts;
  - Water storage tanks or lined ponds (~160 kl/day during first 3 months; ~90 kl/day for 21 months during rest of construction period; ~20 kl/day during operation);
  - Septic tanks and sewer lines to service ablution facilities; and
  - Central Waste collection and storage area.

- ***Battery Storage System:***
  - 100 MWh Battery Storage Facility with a maximum height of 8m and associated operational, safety and control infrastructure.

- ***Access road:***
  - ≤ 15 km long, ≤8 m wide gravel access road running from the Transnet Service Road to the site

- ***Service roads:***
  - ≤10 km of ≤ 6m wide gravel internal service roads within the plant boundary;

- ***Other infrastructure:***
  - Perimeter fencing and internal security fencing and gates as required.
  - Access control gate and guard house on access road;
  - ≤3.5 km length of water supply pipeline connecting existing boreholes to storage, alternatively water will be supplied by the local municipality.
  - Stormwater drainage

- ***Construction site office area (used during construction and rehabilitated thereafter):***
  - ≤1 ha site office area;
  - ≤ 10 ha laydown area; and
  - ≤1 ha concrete batching plant

The Skeerhok PV 3 project will connect to the Eskom Nieuwehoop Substation located on Portion 3 of Gemsbok Bult Farm 120 via a 132 kV overhead transmission line (the development of the 132 kV line will be considered under a separate BA process).

The proposed project can be divided into the following three main phases:

- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

Activities will be undertaken during each phase which may cause an environmental impact. These activities have therefore been considered by the appointed specialists, and considered during the EIA and management and mitigation measures required to address all the impacts included within this EMPr.

The main activities that will form part of the construction phase are:

- Transportation of personnel to and from the site, construction material and equipment to the site;
- Construction of the site camp and laydown areas, as well as dedicated access routes from the laydown areas to the working areas;
- Vegetation clearing in the areas required for building infrastructure and brush cutting in the solar field area where the panels will be installed;
- Excavations for infrastructure and associated infrastructure;
- Establishment of a laydown area for equipment;
- Construction of internal access roads, where required;
- Stockpiling of soil and cleared vegetation; and
- Construction of the solar field (consisting of the solar arrays and buildings) and additional infrastructure.

The main activities that will form part of the operational phase are:

- Generation of 100 MWac of electricity to add to the national grid; and
- Maintenance of the solar facility, including washing of panels.

The projected operations are expected to provide several services and added economic spin offs. The solar facility is expected to be operational for a minimum period of 20 years.

Should it be decided not to extend the operational lifespan of the project beyond 20 years, the project will be decommissioned. The main aim of decommissioning is to return the land to its original, pre-construction condition. Decommissioning involves removing the solar panels and associated infrastructures, and covering the concrete footings with soil to a depth sufficient for the re-growth of natural vegetation. Any supporting infrastructure no longer in use will be removed from the site and either disposed of at a registered disposal facility or recycled if possible.

1.2 ENVIRONMENTAL SENSITIVITY AND PROJECT LAYOUT

The total area of Portion 0 of Smutshoek Farm 395, where the proposed SEF will be constructed, is approximately 4,500 hectares (ha). The assessed area includes approximately 400 ha of land but the proposed SEF will cover an approximate area of 300 ha, accounting for 7 % of the total area of the farm. The larger 400 ha buildable area was considered and assessed by the specialists in order to ensure that any development constraints or environmental sensitivities can be avoided in the final siting and location of the proposed facility. Based on the findings of the specialist studies, an environmental sensitivity map was compiled (Figure 2). This map shows the sensitivities on site (terrestrial, aquatic, and sensitive heritage features) within the larger 400 ha site that was assessed.

The key environmental sensitivities identified on site and shown in Figure 2 are:

- One significant set of archaeological sites was discovered but it was located at least 350 m outside of the study area and 600 m from the proposed development footprint area, to their west. It is represented as LSA (Later Stone Age) pan & koppie (Figure 2). It consists of an endorheic pan surrounded by artefact scatters and a low rocky hill with another site on top of it;
- A single likely grave was found within the development footprint, consisting of a number of rocks that have been deliberately placed side by side on the ground.
-

No other sites were deemed of ecological significance by the specialists. Based on this map, the preferred location for the 300 ha Skeerhok PV 3 facility, also known as the Development Envelope, avoids the sensitive features that were identified by the specialists within the original 400 ha assessed, with the exception of the likely grave that falls within the Development Envelope. The Development Envelope is considered to be a “box” in which the proposed project components discussed within this chapter can be constructed at whichever location (within the boundaries of the assessed Development Envelope) without requiring an additional assessment or change in impact significance. Any changes to the layout are therefore considered to be non-substantive. This is further discussed in Chapter 7 of this EIA Report.

Based on the boundaries of the Development Envelope, the environmental sensitivities identified on site and the site layout determined for this project are shown in Figure 2.

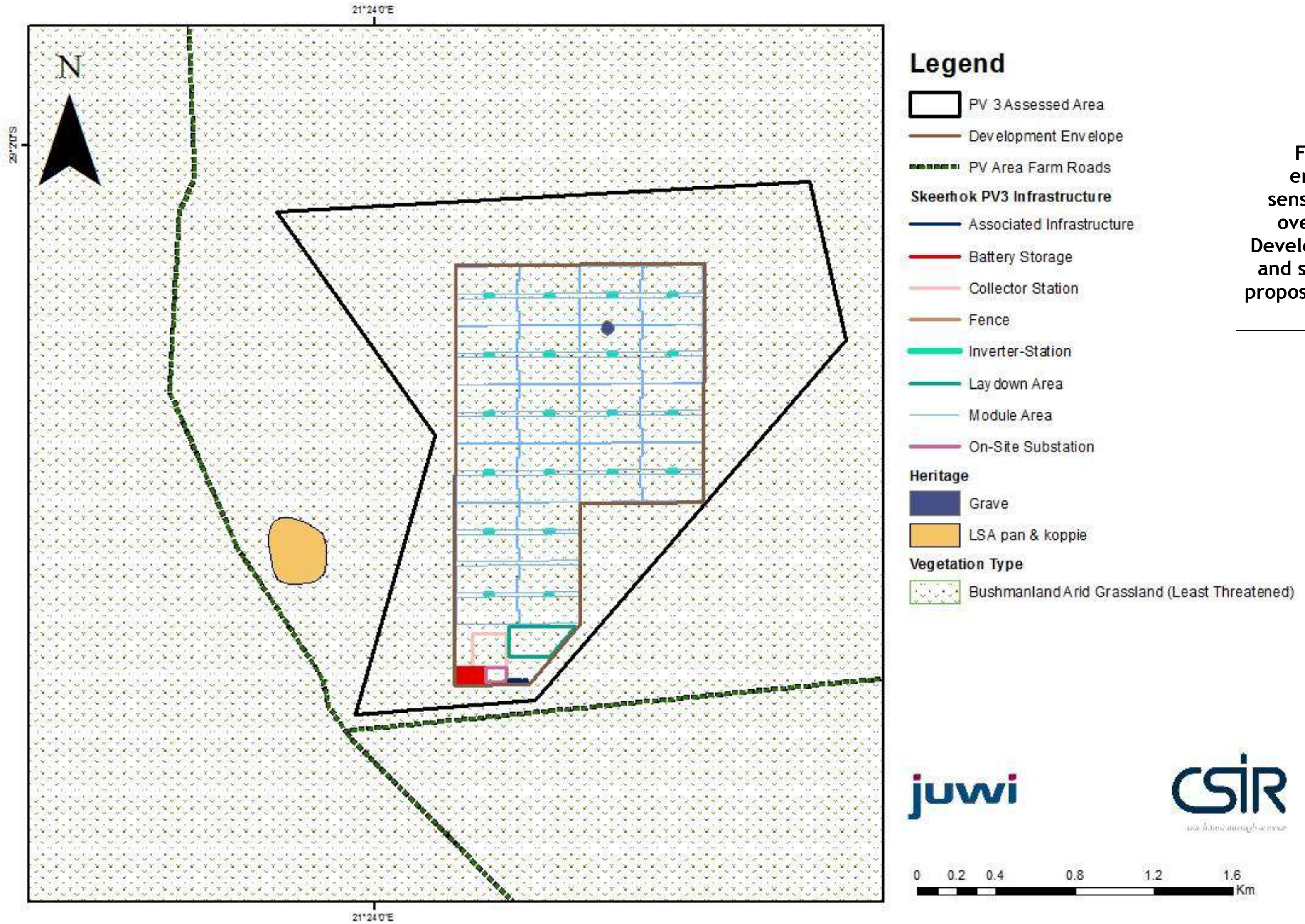


Figure 2: The environmental sensitivities on site overlain with the Development Envelope and site layout of the proposed Skeerhok PV 3 facility

1.3 AUTHORS OF THE EMPr

This EMPr has been compiled by the Environmental Assessment Practitioner (EAP) and the various specialists on the team (as indicated in Table 1). The details and expertise of the EAP and the specialists are provided in Appendix A of the EIA Report. The expertise of the EAP who compiled the report is provided below:

Kelly Stroebel holds a Bachelor of Science with Honours in Environmental Science from Rhodes University in Grahamstown and is currently pursuing a Masters at the University of Stellenbosch. Her undergraduate degree was a Bachelor of Science with majors in Environmental Science and Zoology. Kelly has been the Project Manager of several EIA's in South Africa and several Basic Assessments for the Special Needs and Skills Development Programme. She has assisted in the SIP projects including the National Wind & Solar Strategic Environmental Assessment (SEA) and Electricity Grid Infrastructure SEA as SEAs which were commissioned by the National Department of Environmental Affairs.

Table 1: The EIA Team

NAME	ORGANISATION	ROLE/ SPECIALIST STUDY UNDERTAKEN
Environmental Assessment Practitioners		
Kelly Stroebel	CSIR	Project Manager (*Cand. Sci. Nat.)*
Surina Laurie	CSIR	Project Leader (*Pr. Sci. Nat.)*
Babalwa Mqokeli	CSIR	Project Officer (*Cand. Sci. Nat.*)
Paul Lochner	CSIR	Technical Advisor and Quality Assurance (EAPSA) Certified
Specialists		
Simon Bundy	Sustainable Development Projects cc	Ecological Impact Assessment (including Terrestrial Ecology, Aquatic Ecology and Avifauna)
Jon Smallie	Wildskies Ecological Services	Avifauna Impact Assessment
Dr. Jayson Orton	ASHA Consulting (Pty) Ltd	Heritage Impact Assessment (Archaeology and Cultural Landscape)
Dr. John Almond	Natura Viva cc	Desktop Palaeontological Impact Assessment
Luanita Snyman-Van der Walt	CSIR	Visual Impact Assessment

An Electromagnetic Interference and Radio Frequency Interference Survey Technical Study was commissioned by juwi to determine the impact of the proposed project on the Square Kilometre Array (SKA). This report is not a standard specialist study in terms of Appendix 6 of the EIA Regulations, as it is a detailed, technical report which provides a cumulative topographical analysis of the proposed PV projects in the Astronomy Geographic Advantage Area and was undertaken to determine appropriate mitigation and management measures to reduce the risk of a detrimental impact on the SKA project.

1.4 IMPACTS IDENTIFIED DURING THE EIA PROCESS

Based on the specialist studies, the following main direct potential impacts, as indicated in Table 2, have been identified and appropriate management and mitigation measures included within the EMPr (where required) as per the recommendations made in the specialist studies to ensure the potential impacts are suitably addressed and managed during all phases of the project.

It should be noted that other impacts for which specialist studies were not undertaken but where mitigation or management actions may be required, are also included in the EMPr.

Table 2: Key Impacts identified during the EIA process

KEY IMPACT	IMPACTS IDENTIFIED
Terrestrial Ecology, Aquatic Ecology and Avifauna	**Construction Phase:** ▪ Alteration of habitat structure and composition. ▪ The ousting (and recruitment) of fauna through anthropogenic activities, disturbance of refugia and general change in habitat. ▪ Alteration of surface drainage patterns due to construction activities leading to change in plant communities and general habitat structure. ▪ Changes in subsurface water resources. ▪ Alteration of the availability of water to plants within the site due to the introduction of water to site by import, which may lead to changes in habitat form and structure around areas that receive such import. ▪ Alteration of surface water quality that lead to change in water chemistry. ▪ Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points. ▪ Increased Electrical Light Pollution (ELP), leading to changes in nocturnal behavioural patterns of fauna. ▪ Exclusion or entrapment of (in particular) large fauna, on account of the fencing of the site. ▪ Invasion of exotic weeds. **Operational Phase:** ▪ Continued alteration of habitat structure and composition on account of continuing low level anthropogenic impacts, such as "shading of vegetation" from PV arrays ▪ Ousting (and recruitment) of various fauna on account of long term changes in the surrounding habitat. ▪ Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the PV facility. ▪ Changes in the geomorphological state of drainage lines on account of long term climatic changes and the concomitant change in the nature of the catchment on account of the land use change. ▪ Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long term activities on site, but are likely to be negligible. ▪ Invasion of exotic weeds as a consequence of regular and continued disturbance within the site. ▪ Impact on faunal behaviour, leading to the exclusion of certain species and possible mortalities, due to the fencing of the site, possibly electric fencing. **Decommissioning Phase:** ▪ A reversion to the present seral stage, where continued grazing by livestock and herbivory

KEY IMPACT	IMPACTS IDENTIFIED
	by game will arise. ▪ A reversion of present faunal population states within the study area. ▪ Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment. ▪ Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures.
Visual	**Construction Phase:** ▪ Potential visual intrusion of construction activities on existing views of sensitive visual receptors. **Operational Phase:** ▪ Potential landscape impact of a large solar energy facility on a rural agricultural landscape. ▪ Potential visual intrusion of the proposed solar energy facility on the views of sensitive visual receptors. ▪ Potential impact of night lighting of a large solar energy facility on the nightscape of the region. **Decommissioning Phase:** ▪ Potential visual intrusion of decommissioning activities on views of sensitive visual receptors.
Heritage (Archaeology and Cultural Landscape)	**Construction Phase:** ▪ Destruction of archaeological resources. ▪ Destruction of graves. ▪ Impacts to the natural and cultural landscape. **Operational Phase:** ▪ Impacts to the natural and cultural landscape **Decommissioning Phase:** ▪ Impacts to the natural and cultural landscape
Palaeontology	**Construction Phase:** ▪ Loss of palaeontological heritage resources through disturbance, damage or destruction of fossils and fossil sites (including associated geological contextual data) through surface clearance and excavation activities during the construction phase.
Geohydrology	**Construction Phase:** ▪ Potential impact on the groundwater as a result of the construction of storage yards and temporary labour accommodation; ▪ Potential impact of increased storm water outflows; and ▪ Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages. **Operational Phase:** ▪ Potential impact of increased storm water outflows; and ▪ Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages. **Decommissioning Phase:** ▪ Potential impact on groundwater quality as a result of accidental oil spillages and fuel leakages.
Soils and Agricultural Potential	**Construction Phase:** ▪ Degradation of veld vegetation beyond the direct footprint of the proposed PV facility due to constructional disturbance and potential trampling by vehicles.

KEY IMPACT	IMPACTS IDENTIFIED
Note: A Soils and Agricultural Potential Impact Statement was compiled by the CSIR. It is not a specialist study in terms of Appendix 6 of the EIA Regulations; however it provides a general description of the potential impacts on soils and agriculture. This Statement has been subject to a peer review process by an external reviewer.	▪ Loss of topsoil due to poor topsoil management. ▪ Loss of agricultural land use. ▪ Soil erosion due to alteration of the land surface characteristics. ▪ Additional land use income generation. **Operational Phase:** ▪ Loss of agricultural land use. ▪ Soil erosion due to alteration of the land surface characteristics. ▪ Additional land use income generation. **Decommissioning Phase:** ▪ Degradation of veld vegetation beyond the direct footprint of the proposed PV facility due to constructional disturbance and potential trampling by vehicles. ▪ Loss of topsoil due to poor topsoil management. ▪ Loss of agricultural land use. ▪ Soil erosion due to alteration of the land surface characteristics. ▪ Additional land use income generation.
Socio-Economic *Note: A Social Impact Statement was compiled by the CSIR. It is not a specialist study in terms of Appendix 6 of the EIA Regulations; however it provides a general description of the potential socio-economic impacts. This Statement has been subject to a peer review process by an external reviewer.*	**Construction Phase:** ▪ Influx of jobseekers. ▪ Increases in social deviance and increases in incidence of HIV/AIDS infections. ▪ Expectations regarding employment. ▪ Local spending. ▪ Local employment. ▪ Human development resulting from the proposed Economic Development Plan. **Operational Phase:** ▪ Influx of jobseekers. ▪ Increases in social deviance and increases in incidence of HIV/AIDS infections. ▪ Expectations regarding employment. ▪ Local spending. ▪ Local employment. ▪ Human development resulting from the proposed Economic Development Plan. **Decommissioning Phase:** ▪ Job losses at the end of the project life-cycle.
Traffic *Note: A Traffic Impact Statement was compiled by the CSIR. It is not a specialist study in terms of Appendix 6 of the EIA Regulations; however it provides a general description of the potential traffic impacts. This Statement has been subject to a peer review process by an external reviewer.*	**Construction, Operational and Decommissioning Phases** ▪ Increase in traffic generation. ▪ Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads. ▪ Impact on air quality due to noise and release of air pollutants from vehicles and construction equipment. ▪ Decrease in quality of surface condition of the roads.

2 APPROACH TO PREPARING THE EMPr

2.1 COMPLIANCE WITH RELEVANT LEGISLATION

In terms of legal requirements, a crucial objective of the EMPr is to satisfy the requirements of Section 24N of the NEMA, as amended, and Appendix 4 of the amended NEMA EIA Regulations published in Government Notice No. R 326 of 7 April 2017. These regulations prescribe the content of the EMPr and specify the type of supporting information that must accompany the submission of the report to the authorities. An overview of where the requirements are addressed in this EMPr is presented in Tables 3 and 4.

Table 3: Compliance with Section 24N of NEMA

Requirements of Section 24N of NEMA	Where it is included in this EMPr
2) The environmental management programme must contain- a) information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of- (i) planning and design; (ii) pre-construction and construction activities; (iii) the operation or undertaking of the activity in question; (iv) the rehabilitation of the environment; and (v) (v) closure, if applicable;	Section 1.3 and the columns detailing the impact description, mitigation and management objectives, and mitigation and management actions in Sections 4 to 12 of this EMPr.
b) details of- (i) the person who prepared the environmental management programme; and (ii) the expertise of that person to prepare an environmental management programme;	Section 1.2 and Appendix A of the EIA Report
c) a detailed description of the aspects of the activity that are covered by the environmental management programme;	Section 1 and Section 1.1
d) information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);	Columns in Section 4 to 12 of the EMPr regarding the monitoring responsibility, including the requirements for monitoring and reporting on compliance and the responsible parties noted in Section 3.
e) information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance;	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency and responsibility in Sections 4 to 12 of this EMPr.
f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable	Sections 4 to 12 of this EMPr, as applicable to the post-construction, rehabilitation phase and the decommissioning phase.

Requirements of Section 24N of NEMA	Where it is included in this EMPr
development; and	
g) a description of the manner in which it intends to- (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) remedy the cause of pollution or degradation and migration of pollutants; and (iii) comply with any prescribed environmental management standards or practices.	The columns detailing the mitigation and management objectives, mitigation and management actions, and the monitoring methodology, frequency and responsibility in Sections 4 to 12 of this EMPr.
3) The environmental management programme must, where appropriate- a) set out time periods within which the measures contemplated in the environmental management programme must be implemented; b) contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation which may occur inside and outside the boundaries of the operations in question; and c) develop an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency and responsibility in Sections 4 to 12 of this EMPr. Section 11 of this EMPr includes an Environmental Awareness Plan.
5) The Minister, the Minister responsible for mineral resources or an MEC may call for additional information and may direct that the environmental management programme in question must be adjusted in such a way as the Minister, the Minister responsible for mineral resources or the MEC may require.	Not applicable at this stage.
6) The Minister, the Minister responsible for mineral resources or an MEC may at any time after he or she has approved an application for an environmental authorisation approve an amended environmental management programme.	Not applicable at this stage.
7) The holder and any person issued with an environmental authorisation- a) must at all times give effect to the general objectives of integrated environmental management laid down in section 23; b) must consider, investigate, assess and communicate the impact of his or her prospecting or mining on the environment; c) must manage all environmental impacts (i) in accordance with his or her approved environmental management programme, where appropriate; and (ii) as an integral part of the prospecting or mining, exploration or production operation, unless the Minister responsible for mineral resources directs otherwise; d) must monitor and audit compliance with the requirements of the environmental management programme;	Throughout the EMPr

Requirements of Section 24N of NEMA	Where it is included in this EMPr
e) must, as far as is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and f) is responsible for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation as a result of his or her operations to which such right, permit or environmental authorisation relates.	
8) Notwithstanding the Companies Act, 2008 (Act No. 71 of 2008), or the Close Corporations Act, 1984 (Act No. 69 of 1984), the directors of a company or members of a close corporation are jointly and severally liable for any negative impact on the environment, whether advertently or inadvertently caused by the company or close corporation which they represent, including damage, degradation or pollution.	Section 3 details the responsibility of the Project Applicant.

Table 4: Appendix 4 of the amended EIA Regulations

Requirements of Appendix 4 of the 2014 amended NEMA EIA Regulations GN R 326	Where it is included in this EMPr?
1. (1) An EMPr must comply with section 24N of the Act and include: (a) details of: (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.2 and Appendix A of the EIA Report
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 1 and Section 1.1
(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Figure 2 and Appendix A of this EMPr.
(d) a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including: (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post (v) closure; and (vi) where relevant, operation activities;	Section 1.4 and the columns detailing the impact description, mitigation and management objectives, and mitigation and management actions in Sections 4 to 12 of this EMPr.
(f) a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraphs (d) will be achieved, and must, where applicable, include actions to: (i) avoid, modify, remedy, control or stop any action, activity or	The columns detailing the mitigation and management actions in Sections 4 to 12 of this EMPr.

Requirements of Appendix 4 of the 2014 amended NEMA EIA Regulations GN R 326	Where it is included in this EMPr?
process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	
(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	The columns detailing the monitoring methodology in Sections 4 to 12 of this EMPr.
(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	The columns detailing the monitoring frequency in Sections 4 to 12 of this EMPr.
(i) an indication of the persons who will be responsible for the implementation of the impact management actions;	The columns detailing the monitoring responsibility in Sections 4 to 12 of this EMPr.
(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	The columns detailing the mitigation and management actions, and the monitoring methodology and frequency in Sections 4 to 12 of this EMPr.
(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency and responsibility in Sections 4 to 12 of this EMPr.
(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 4 to 12 of the EMPr, including the requirements for monitoring and reporting on compliance and the responsible parties noted in Section 3.
(m) an environmental awareness plan describing the manner in which: (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 11 of this EMPr.
(n) any specific information that may be required by the competent authority.	Section 2.2 and the management objectives and management actions in Sections 4 to 11.

2.2 COMPLIANCE WITH DEA REQUIREMENTS

The Final Scoping Report was submitted to the DEA on the 3rd of November 2017, in accordance with Regulation 21 (1) of the amended 2014 NEMA EIA Regulations, for decision-making in terms of Regulation 22 of the amended 2014 NEMA EIA Regulations. The DEA accepted the Final Scoping Report and Plan of Study for EIA on 30 November 2017, which marked the end of the Scoping Phase. The acceptance letter is included in Appendix G of the EIA Report.

The requirements listed in the acceptance letter from the DEA (dated 30 November 2017), stipulated certain plans that must be included in the EMPr. The EMPr is therefore structured in such a way to comply with the requirements of the DEA and to ensure that the mitigation and management measures that have been identified during the EIA Process are included in the respective plans. The requirements listed within the acceptance letter are detailed in Table 5.

It is important to note that other project specific aspects (such as the findings and recommendations of the specialist studies), in addition to those covered by the plans required by the DEA, have been included in Section 12 of the EMPr.

Table 5: DEA Requirement for the EMPr

DEA Requirements	Relevant Section in the EMPr
i. All recommendations and mitigation measures recorded in the EIA Report and the specialist studies conducted.	Recommended mitigation measures and monitoring actions as noted in the EIA Report and specialist studies have been included in this EMPr, where relevant.
ii. The final site layout map	Refer to Appendix A of this EMPr for the site layout map. Refer to Section 1.1 of this EMPr for a description of the approach followed to determine the site layout.
iii. Measures as dictated by the final site layout map and micro-siting.	Refer to Appendix A of this EMPr for the site layout map. Refer to Section 1.1 of this EMPr for a description of the approach followed to determine the site layout.
iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA Process.	Refer to Appendix B of this EMPr for an environmental sensitivity map. Refer to Section 1.1 of this EMPr for a description of the approach followed to identify the environmental sensitivities.
v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Refer to Appendix A of this EMPr for a combined environmental sensitivity and layout map. Refer to Section 1.1 of this EMPr for a description of the approach followed to identify the environmental sensitivities and to determine the site layout.
vi. An alien invasive management plan to be implemented during the construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Refer to Section 4 of this EMPr.
vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	Refer to Section 5 of this EMPr. It should be noted that faunal protection and habitat rehabilitation has also been included in this section.
viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	Refer to Section 5 of this EMPr. It should be noted that faunal protection and habitat rehabilitation has also been included in this section.
ix. An open space management plan to be implemented during	Refer to Section 6 of this EMPr.

DEA Requirements	Relevant Section in the EMPr
the construction and operation of the facility.	
x. A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimise impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	Refer to Section 7 of this EMPr.
xi. A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment.	Refer to Section 7 of this EMPr.
xii. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Refer to Section 8 of this EMPr.
xiii. A fire management plan to be implemented during the construction and operation of the facility.	Refer to Section 11 of this EMPr. It should be noted that this has been combined with an Environmental Awareness Plan.
xiv. An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Refer to Section 9 of this EMPr.
xv. 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	Refer to Section 10 of this EMPr.
xvi. Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments have been included throughout the EMPr, such as Sections 8, 9 and 10.

2.3 CONTENTS OF THE EMPr

Where applicable, each section of the EMPr is divided into the following four phases of the project cycle:

- Design Phase;
- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

The EMPr includes the findings and recommendations of the EIA Process and specialists studies. However, the EMPr is considered a “living” document and must be updated with additional information or actions during the design, construction, operational and decommissioning phases if applicable.

The EMPr follows an approach of identifying an over-arching goal and objectives, accompanied by management actions that are aimed at achieving these objectives. The management actions are presented in a table format in order to show the links between the goal and associated objectives, actions, responsibilities, and monitoring requirements and targets.

The management plans for the design, construction, operational and decommissioning phases consist of the following components:

- **Impact:** The potential positive or negative impact of the development that needs to be enhanced, mitigated or eliminated.
- **Objectives:** The objectives necessary in order to meet the goal; these take into account the findings of the specialist studies.
- **Mitigation/Management Actions**: The actions needed to achieve the objectives of enhancing, mitigating or eliminating impacts; taking into consideration factors such as responsibility, methods, frequency, resources required and prioritisation.
- **Monitoring**: The key monitoring actions required to check whether the objectives are being achieved, taking into consideration methodology, frequency and responsibility.

2.4 GOAL FOR ENVIRONMENTAL MANAGEMENT

The overall goal for environmental management for the proposed Skeerhok PV 3 project is to construct and operate the project in a manner that:

- Minimises the ecological footprint of the project on the local environment;
- Minimises impacts on fauna, flora and freshwater ecosystems;
- Facilitates harmonious co-existence between the project and other land uses in the area; and
- Contributes to the environmental baseline and understanding of environmental impacts of solar energy facility in a South African context.

3 ROLES AND RESPONSIBILITIES

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

- Project Owner;
- Environmental Control Officer;
- Construction Manager (Lead Contractor); and
- Facility Manager.

Note: The specific titles for these functions will vary from project to project. The intent of this section is to give a generic outline of what these roles typically require. It is expected that this will be appropriately defined at a later stage.

3.1 PROJECT OWNER

The Project Developer (i.e. juwi Renewable Energies) is the current 'owner' of the project and, as such, is responsible for ensuring that the conditions of the EA issued in terms of NEMA (should the project receive such authorisation) are fully adhered to, as well as ensuring that any other necessary permits or licences are obtained and complied with. It is expected that the project owner at the point of construction will appoint the Environmental Control Officer and the Lead Contractor, and possibly an Environmental Manager (or Health, Safety and Environmental Manager).

3.2 ENVIRONMENTAL CONTROL OFFICER

An independent Environmental Control Officer (ECO) must be appointed to ensure that the provisions of the EMPr as well as the conditions of the EA (should such authorization be granted by DEA) are complied with at all times. The ECO must also monitor compliance of the proposed project with environmental legislation and recommendations of the EMPr, as well as oversee the implementation of the EMPr during the phases of the project, monitor environmental impacts, undertake record-keeping.

The ECO will be responsible for updating the EMPr as and when necessary, and compiling a monitoring checklist based on the EMPr. The roles and responsibilities of the ECO should include the following:

- The ECO must undertake periodic environmental audits during the relevant phases of the proposed project in order to monitor and record environmental impacts and non-conformances, and to monitor site activities to ensure adherence to the specifications contained in the EMPr, using a monitoring checklist. The timeframes for environmental audits will be indicated in the EA (should such authorisation be granted by the DEA).
- Environmental compliance/audit reports must be compiled and submitted by the ECO to the Competent Authority (i.e. DEA and/or Provincial Department of Environment and Nature Conservation) on a regular basis (i.e. at intervals as indicated in the EA (should such authorisation be granted by the DEA)).
- The ECO must maintain a diary of site visits and audits, a copy of the Environmental Authorisation (should such authorisation be granted by the DEA) and relevant permits for reference purposes, a non-conformance register, a public complaint register, and a copy of previous environmental audits undertaken.
- Prior to the commencement of construction, the ECO must meet on site with the Contractor to confirm the construction procedure and designated construction areas and work activity zones.
- Reporting of any non-conformances within 48 hours of identification of such non-conformance to the relevant agents.
- Conducting an environmental inspection on completion of the construction period and 'signing off' the construction process with the Contractor.
- Ensure that records are kept of all monitoring activities and results.
- Conducting an environmental inspection on completion of decommissioning and 'signing off' the site rehabilitation process.

The Lead Contractor and sub-contractors may have their own Environmental Officers, or designate Environmental Officer functions to certain personnel.

3.3 CONSTRUCTION MANAGER

The Construction Manager will be responsible for the following:

- Ensure that all appointed contractors and sub-contractors are aware of the EMPr and their respective responsibilities;
- Prior to the commencement of construction, the Lead Contractor must meet on site with the ECO in order to confirm the construction procedure and designated construction areas and work activity zones.
- Ensure that each sub-contractor employs an Environmental Officer (or employs a designated suitably qualified individual to fulfil the role of an Environmental Officer) to monitor and report on the daily activities on-site during the construction period;
- Implementation of the overall construction programme, project delivery and quality control for the construction for the solar project;
- Overseeing compliance with the Health, Safety and Environmental Responsibilities specific to the project management related to project construction;
- Promoting total job safety and environmental awareness by employees, contractors and sub-contractors and stress to all employees and contractors and sub-contractors the importance that the project proponent attaches to safety and the environment;
- Ensuring that safe, environmentally acceptable working methods and practices are implemented and that sufficient plant and equipment is made available properly operated and maintained, to facilitate proper access and enable any operational to be carried out safely;
- Ensuring that all appointed contractors and sub-contractors repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in the EMPr, to the satisfaction of the Project Owner’s ECO;
- Implement the Traffic Management Plan (Section 7), Transportation Plan (Section 7) and Storm Water Management Plan (Section 8).

3.4 FACILITY MANAGER

The Facility Manager will be responsible for the following:

- Operation of the 100 MWac Solar PV facility;
- Required maintenance of the facility; and
- Overall compliance with the EMPr and EA (should such authorisation be granted by the DEA).

4 ALIEN INVASIVE VEGETATION MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. DESIGN PHASE					
4.1. Impacts due to establishment of alien invasive plants.	Ensure the appropriate removal of alien invasive vegetation from the proposed project area and prevent the establishment and spread of alien invasive plants due to the project activities.	4.1.1. Compile an alien and invasive species control and monitoring plan as required in the Alien and Invasive Species Regulations under the National Environmental Management Biodiversity Act (Act 10 of 2004). 4.1.2. Ensure compliance with relevant Environmental Specifications for the control and removal of alien invasive plant species. 4.1.3. Compile and finalise an alien weed eradication programme.	▪ Ensure that this is done and taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports. ▪ Appoint a suitable specialist/ Contractor or contact the relevant authorities to seek guidance on the removal of the planted alien invasive species. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the design phase. ▪ Once-off during the design phase with possible follow up tasks during the construction phase. ▪ Once-off during the design phase.	▪ Project Owner ▪ Project Owner and ECO ▪ ECO
B. CONSTRUCTION PHASE					
4.2. Impacts due to the establishment of and increased spread of alien invasive plants.	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	4.2.1. Appoint a suitable specialist or contractor to undertake a sweep and survey of the final development footprint site, with an alien invasive eradication team to remove exotic vegetation prior to the commencement of construction. 4.2.2. Establish an ongoing monitoring programme for the construction phase to detect and	▪ Appoint a suitable vegetation contractor to inspect the site and remove any exotic weeds prior to the commencement of construction. ECO to ensure that this is taken into consideration and implemented. ▪ Prepare monitoring programme	▪ Prior to the commencement of construction. ▪ Once-off	▪ Project Owner, ECO and Specialist Contractor ▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) and National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM: BA)).	which will monitor the presence of alien invasive species on the site. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.		
		4.2.3. Ensure proper management of soil stockpiles. Do not import soil stockpiles from areas with alien plants to ensure proper management of stockpiles.	▪ Monitor the presence of alien invasive plants during the construction phase via visual inspections and take action to remove and control these species.	▪ On-going	▪ ECO and Contractor
		4.2.4. Undertake rehabilitation of disturbed areas as soon as possible after construction. Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas.	▪ Rehabilitate disturbed areas and monitor the presence of alien invasive species on site.	▪ On-going	▪ ECO and Contractor
		4.2.5. Keep clearance and disturbance of indigenous vegetation to a minimum.	▪ Monitor and manage vegetation clearing by undertaking visual inspections to ensure minimal disturbance and to restrict activities to within demarcated areas.	▪ On-going	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring: Methodology	Monitoring: Frequency	Monitoring: Responsibility
		4.2.6. Ensure that the footprint required for the proposed project activities (such as temporary stockpiling, earthworks, storage areas, site establishment etc.) is kept at a minimum.	▪ Verify that the proposed project area is determined and outlined prior to the commencement of the construction phase by undertaking visual inspections.	▪ Once-off prior to construction and as required during the construction process.	▪ ECO and Contractor
		4.2.7. Ensure that alien invasive vegetation found on site, within the proposed project footprint, is immediately controlled and removed promptly, in a scheduled manner throughout the construction phase. The removal of alien vegetation on site during the construction phase should use registered control methods and take into consideration the Alien and Invasive Species Regulations published in terms of Section 97(1) of the NEM: BA, if applicable.	▪ Monitor the presence of alien invasive plants during the construction phase via visual inspections and take action to remove and control these species. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. Any alien invasive should be cleared from site.	▪ On-going	▪ ECO and Contractor
		4.2.8. The removed alien invasive vegetation should be immediately disposed at a suitable waste disposal facility and should not be kept on site for prolonged periods of time, as this will enhance the spread of these species.	▪ Monitor the removal of the alien vegetation found on site via visual inspections.	▪ As necessary during the construction phase.	▪ ECO
		4.2.9. All construction machinery and plant equipment delivered to site for use during the construction phase should be cleaned in order to limit the introduction of alien	▪ Clean machinery and equipment prior to the construction phase. ▪ ECO to conduct visual inspections to verify that machinery and	▪ Prior to the commencement of construction. ▪ As necessary	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		species.	equipment are cleaned, and report any non-compliance.	during the construction phase.	
C. OPERATIONAL PHASE					
4.3. Impacts due to establishment of alien invasive plants. Exotic weed invasion may result in the ousting of natural vegetation and alteration of ecological processes on site, with incremental impacts on the adjacent veld types.	Reduce the establishment and spread of alien invasive plants. To remove exotic weeds as and when they may arise and thereby prevent alteration of local and adjacent habitat forms.	4.3.1. Continue with on-going monitoring programme to detect and quantify any alien species that may become established and identify the highly invasive species during the operation phase.	▪ Annual audit of project area and immediate surroundings. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.	▪ Annual	▪ Operations and Maintenance Contractor
		4.3.2. Immediately control any alien plants that become established using registered control methods. Use of herbicides and manual removal of alien vegetation on site where this may arise to be undertaken as advised by a specialist. Regular address and redress of weeds identified on site by a suitable contractor. The clearance of exotic weed to be undertaken bi-annually at a minimum and on a needs basis at an intermittent level.	▪ Monitor the use of herbicide sprays and manual removal of alien vegetation by undertaking visual inspections and reporting any non-compliance. ▪ Maintain register of weed spraying activities and ensure that herbicide use is recorded.	▪ Bi-annually	▪ Project Owner and Environmental Manager/ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
D. DECOMMISSIONING PHASE					
4.4. Exotic weed invasion of the decommissioned site resulting in ecological change.	To prevent the excessive growth and propagation of exotic weeds on disturbed lands that formed a portion of the PV facility.	4.4.1. All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level.	▪ Once off	▪ Lead Contractor with advice from specialist
		4.4.2. Exotic weed control measures to be instituted through weed control programme. Regular redress of exotic weed through the use of herbicide and manual removal.	▪ Compile weed eradication programme for a period of 12 months after the decommissioning exercise. ▪ Appoint contractor to undertake the weed eradication programme.	▪ Weed eradication exercise to be undertaken every 6 months for a period of 12 months following decommissioning. ▪ Prior to the commencement of the decommissioning phase.	▪ Project Owner ▪ Project Owner

5 PLANT RESCUE AND PROTECTION PLAN INCLUDING RE-VEGETATION AND HABITAT REHABILITATION PLAN (INCLUDING FAUNA AND AVIFAUNA)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. DESIGN PHASE					
5.1. The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat, with impacts on terrestrial and aquatic ecology as a result of the final site layout and routes of the access roads.	Avoidance of unnecessary disturbance to the site and surrounds, and to establish buffers where required.	5.1.1. Avoidance of northern drainage features during the design and layout of the proposed PV facility. Ensure that sensitive habitat and features (as defined in the Ecological Impact Assessment, Appendix I of the EIA Report) are considered in the design. 5.1.2. Incorporate minor drainage lines into design and avoid unnecessary disturbance, where applicable. Refer Appendix B and C of this EMPr. 5.1.3. Consider the most applicable access road to site (i.e. the unnamed farm road or the Transnet Service Road (subject to the discussions between the Applicant and Transnet Freight Rail). 5.1.4. Appoint a specialist or suitable contractor to identify any plant species on site that may require "rescue" as well as any exotic weeds/vegetation that require removal. Appoint a specialist team flush game from the construction area. 5.1.5. Consideration of the siting and layout of the temporary construction site and worker camp to avoid all sensitive areas as identified	▪ Review the site plan with the ECO and possibly an ecologist (if required). ▪ Appoint a specialist to oversee the final development footprint area and undertake search and rescue, game sweep and alien removal. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off, prior to the commencement of construction. ▪ Appoint specialist once-off, prior to the commencement of construction. ▪ Once-off during the planning and design phase.	▪ Project Developer and ECO ▪ Project Owner ▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		in the relevant specialist studies included in the EIA Report.			
5.2. Destruction of indigenous vegetation without relevant licences or permits.	Ensure compliance with relevant Provincial and National legislation in respect of habitat and vegetation forms.	5.2.1. Ensure the necessary permits or licences are identified and applied for as applicable for the removal of protected, indigenous vegetation. 5.2.2. Await response and provision of permit (as required) from the relevant Authorities prior to the removal of the indigenous species (if required). Once these permits are obtained, search and rescue must be undertaken for the indigenous species.	▪ Review the findings of the Ecological Impact Assessment and consider legislative requirements in respect of loss of indigenous vegetation etc. ▪ Appoint a suitable Search and Rescue Specialist/Contractor to undertake Search and Rescue. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off, prior to the commencement of construction ▪ Once-off, prior to the commencement of construction ▪ Once-off during the planning and design phase.	▪ Project Owner and ECO ▪ Project Owner , Specialist/ Contractor and ECO ▪ Project Owner
5.3. Loss of Species of Special Concern (SSC) and protected species and their habitats.	Minimise fragmentation and loss of SSC and protected species and their habitats through the careful siting and layout planning for the project.	5.3.1. Avoid the removal of listed SSC and protected species as far as possible.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the planning and design phase	▪ Project Owner
		5.3.2. A buffer zone of 32 m must be implemented from the edge of the drainage features on site (as shown in Appendix B and C of this EMPr), in which no development or activities should take place.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the planning and design phase	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
5.4. Impact on avian behaviour and avian species as a result of collision with infrastructure of the proposed PV facility.	Reduce impact on avifauna.	5.4.1. The PV panels should spend as little time as possible time in a vertical position since this presents a greater collision hazard. 5.4.2. The more sensitive habitat areas of the site should be avoided. A buffer area has been identified around all farm dams (of 100m) within which no PV panels or other above ground infrastructure should be built.	▪ Ensure that this is taken into consideration during the planning and design phase. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing	▪ Once-off ▪ Once during the design and planning phase	▪ Project Owner and Contractor ▪ Project Owner and Contractor
B. CONSTRUCTION PHASE					
5.5. Excessive loss of natural vegetation in and outside the development footprint area and veld degradation.	Minimise loss of natural vegetation. Prevent impacts on natural vegetation in sensitive habitats and SSC.	5.5.1. Sensitive habitats and areas outside of the project development area should be clearly demarcated as no go areas during the construction phase to avoid accidental impacts.	▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. ▪ ECO must monitor activities and record and report non-compliance. Fines should be issued for non-compliance and the payment of fines should be specified in the contract of the construction workers and in the contract of the ECO. ▪ Strict control and proper education of staff to prevent misconduct. If ECO is absent, there should be a designated ECO present to deal with any urgent issues.	▪ Daily	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		5.5.2. Ensure that the footprint required for the proposed project activities is kept at a minimum.	▪ Verify that the proposed project area is determined and outlined prior to the commencement of the construction phase by undertaking visual inspections.	▪ Once-off prior to construction and as required during the construction process.	▪ ECO
		5.5.3. The proposed project footprint must be demarcated to reduce unnecessary disturbance beyond the proposed project area.	▪ Carry out visual inspections to ensure strict control over the behaviour of staff in order to restrict activities to within demarcated areas.	▪ Weekly	▪ ECO
		5.5.4. The Contractors and construction personnel must be made aware that indigenous vegetation must not be removed or damaged.	▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor/ ECO ▪ ECO
		5.5.5. Ensure that the temporary site camp is established at least 32 m away from the banks of the drainage features.	▪ Monitor the placement of the site camp via visual inspections, and record and report any non-compliance.	▪ Once-off prior to construction and as required during the construction phase.	▪ ECO
		5.5.6. Unnecessary impacts on surrounding natural vegetation must be avoided during construction. All construction vehicles should remain on properly and clearly demarcated roads.	▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. ▪ Include periodical site inspection in environmental performance	▪ Daily	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			reporting that specifically records occurrence of off-road vehicle tracks in specific areas.		
		5.5.7. Undertake rehabilitation of disturbed areas as soon as possible after construction. Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site during the pre-construction phase.	▪ Undertake audits following the construction phase and report any non-compliance.	▪ Monthly	▪ ECO and Contractor
		5.5.8. The collection, hunting or harvesting of any plants, fuel wood or animals at the site during construction should be strictly forbidden and the staff must be educated to prevent this from happening.	▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Daily ▪ Once-off training and ensure that all new staff are inducted. ▪ As needed	▪ ECO and Contractor ▪ Contractor/ ECO ▪ ECO
		5.5.9. Fires should only be allowed within fire-safe demarcated areas. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on site for the duration of the construction phase.	▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas. ▪ Ensure fire safety requirements are well understood and respected by	▪ Daily	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			workers (by providing basic fire safety training).		
		5.5.10. Existing access roads/servitudes must be used and should be located along the boundaries of existing disturbed areas, if possible.	▪ Compile plan pre-construction.	▪ Prior to construction commencing.	▪ Project Developer and ECO
5.6. Impact on indigenous vegetation, and on SSC and their habitats.	To reduce negative impacts on and loss of indigenous vegetation and protected trees. Minimise impacts on SSC and protected trees.	5.6.1. Appoint a specialist to undertake a second review and site visit of the final layout of the development footprint, in order to identify any plant species on site that may require “rescue” as well as any exotic weeds/vegetation that require removal.	▪ Appoint an Ecologist to oversee the final development footprint area through a reconnaissance survey.	▪ Prior to the commencement of construction.	▪ Project Owner, Specialist and ECO
		5.6.2. Identification of roadways and areas where extensive vegetation loss will result is required. Upon consideration, the avoidance of unnecessary clearance of vegetation on site should be undertaken through minor deviations to the design. 5.6.3. Ensure that the footprint required for the proposed project activities is kept at a minimum.	▪ Review how larger vegetation will be dealt with by contractors. ▪ Vegetation should be subject to redress when given a height that aligns with the lower limit of the PV array or when adjudged to affect construction.	▪ Ongoing	▪ ECO and Project Owner
		5.6.4. A plant rescue operation must be initiated to confirm that no other species are located within the development site.	▪ ECO must undertake a final walkthrough of the site prior to commencement of construction to ensure no SCC will be impacted on	▪ Once-off	▪ ECO and Contractor
		5.6.5. Clearing of vegetation should be kept to a minimum, keeping the width and length of	▪ Monitor activities and record and report non-compliance.	▪ Daily	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		the earthworks to a minimum.			
		5.6.6. Avoid the removal of listed SSC or protected species as far as possible. Should any of the listed/protected species need to be removed, the requisite permits must be obtained prior to the removal of the species.	▪ Monitor activities and record and report non-compliance.	▪ Daily	▪ ECO and Contractor
5.7. Disturbance of terrestrial fauna and flora on site due to construction workers and activities.	To advise construction staff of the requirements in respect of management of flora and fauna on site during the construction phase.	5.7.1. Conduct an Environmental Awareness Training and induction for all construction staff and personnel.	▪ Carry out Environmental Awareness Training with a discussion on the management of terrestrial fauna and flora on site. ▪ Conduct audits of the signed attendance registers.	▪ Prior to construction and as required by the ECO. Ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ ECO
5.8. Impact on fauna as a result of construction activities.	To identify any faunal mortalities and record the details (such as the reason, spatial extent etc.) in order to avoid repetition of fatality.	5.8.1. Establish a recording method in order to monitor the construction activities, including species presence within site, mortalities and sightings.	▪ Establish database of species, sightings etc. ▪ Construction personnel should advise on the findings and presence of fauna on site.	▪ Daily to monthly	▪ ECO
	To remove species that may be found present in the construction footprint and laydown area.	5.8.2. Appoint a specialist to conduct an inspection of the final project area and sweep or inspect the site for any fauna, once the fencing is complete (i.e. the established site should be flushed to ensure any large wildlife is not contained within the fenced area). Appoint a	▪ Team to flush game as required. ▪ ECO to monitor flushing process and record any incidents or non-compliance.	▪ Once off prior to commencement and thereafter if required.	▪ ECO and Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		small team to flush game during the early evening. Game should be flushed by driving a team through the gated facility towards the exit.			
		5.8.3. The Contractor or Contractors Environmental Officer should monitor trenches at the start and end of each working day to check if any small animals are trapped.	▪ Monitor activities and record and report non-compliance.	▪ Daily and record as required during construction.	▪ ECO and Contractor
		5.8.4. No animals (including snakes) shall be killed on site. An expert or a suitable specialist should be appointed to remove and relocate any poisonous snakes during the construction phase.	▪ Monitor activities and record and report non-compliance. ▪ Ensure that the ECO receive the appropriate snake handling training.	▪ As required during construction.	▪ ECO and Contractor
5.9. Impacts on avifauna due to the construction of the solar facility.	Reduce impact on avifauna.	5.9.1. An extensive post construction monitoring programme is recommended for this site in order to document any impacts and provide the basis for an adaptive management approach to any impacts. 5.9.2. A site specific avifaunal walk through should be conducted by a qualified ornithologist as part of the site specific EMP just prior to construction, so as to ensure that no sensitive bird species have started breeding on or near site.	▪ Compile and implement a monitoring plan, and record any findings. ▪ If any such sites are found case specific mitigation measures will need to be designed.	▪ Daily to monthly record keeping. ▪ Once-off prior to construction	▪ Project Owner and ECO ▪ ECO
5.10. Faunal and avifaunal road	Minimise loss of fauna as a	5.10.1. The construction personnel and staff should be made aware of the presence of fauna	▪ Carry out Environmental Awareness	▪ Once-off training and ensure that	▪ ECO and

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
mortality as a result of increased vehicles travelling to and within the site.	result of road mortalities.	within the proposed project area. The construction personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings.	Training. ▪ Conduct audits of the signed attendance registers.	all new staff are inducted. ▪ Monthly	Contractor ▪ ECO
		5.10.2. To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the site camp must be kept clean on a daily basis.	▪ Monitor the activities via visual inspections, and record and report any non-compliance.	▪ Daily	▪ ECO and Contractor
5.11. Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in ecological change within the site.	To reduce incidental mortality and injury of fauna within the construction area.	5.11.1. Ensure that the live electrical fence wire is not placed at ground level. 5.11.2. Conduct inspections of the fence line to address any animals that may be affected by the fence. 5.11.3. A site specific avifaunal walk through should be conducted by a qualified ornithologist as part of the site specific EMP just prior to construction, so as to ensure that no sensitive bird species have started breeding on or near site. If any such sites are found case specific mitigation measures will need to be designed.	▪ Construct fence to ensure the live fence is not placed at ground level? ▪ Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence. ▪ Conduct a site specific avifaunal walk through.	▪ Daily to monthly record keeping. A register of all faunal sightings indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established.	▪ Project Owner and Contractor ▪ ECO ▪ Ornithologist

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
				▪ Once-off prior to construction.	
5.12. Increased ELP, leading to changes in nocturnal behavioural patterns amongst fauna.	The avoidance of electrical light pollution through prudent positioning of external lighting.	5.12.1. Placement of lighting, particularly security lighting, to avoid excessive influence on surrounding areas. Placement of lighting to be judiciously considered at time of implementation.	▪ Review lighting plans and identify important habitat zones to be avoided.	▪ Prior to the installation of lighting.	▪ Project Owner, Contractor and ECO
C. OPERATIONAL PHASE					
5.13. Vegetation management on site - consideration of redress methods of growth and habitat form around site.	Manage vegetation throughout the site to avoid conflict with operations of the proposed PV facility. Excessive growth of vegetation on site may affect operations of the PV facility, while excessive clearance of vegetation on site has concomitant impacts on the land in question. Management of vegetation at an optimum level of growth and height is required.	5.13.1. Identify protocol for pruning of vegetation and clearance where required. 5.13.2. Identify level of pruning and vegetation management required.	▪ Identify means of pruning and clearance of vegetation. For example, brushcutter, grazing etc.	▪ Ongoing and as required.	▪ Environmental Manager/ECO
5.14. Loss of SSC and their habitats.	Control loss of natural vegetation during the operational phase. Prevent impacts on natural	5.14.1. Unnecessary impacts on surrounding natural vegetation must be avoided. All operational and maintenance vehicles to remain on the roads and no driving off road allowed. No unauthorized persons should be allowed onto the site.	▪ Strict control over the behaviour of operation workers, restricting activities to within demarcated areas for operation. Strict control and proper education of staff to prevent misconduct.	▪ Ongoing and as required	▪ Environmental Manager/ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
	vegetation in sensitive habitats and SSC.	5.14.2. The collection, hunting or harvesting of any plants, any protected trees, fuel wood or animals at the site should be strictly forbidden and the staff educated to prevent this from happening. 5.14.3. Educate personnel and staff members about the biodiversity importance of the area by means of environmental awareness programmes. 5.14.4. Staff must remain within the boundaries of the PV facility at all times. The undeveloped portions of the site must be treated as conservation areas.	▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers. ▪ Issue fines for non-conformance as appropriate and as specified in the worker's contracts. ▪ Ensure that the awareness raising programmes are implemented.	▪ Daily ▪ Once-off training and ensure all new staff are inducted. ▪ As required ▪ As required during the operational phase.	▪ Facility Manager and Environmental Manager/ECO ▪ Facility Manager ▪ Environmental Manager/ECO
		5.14.5. All hazardous materials should be stored in the appropriate manner to prevent impacts on vegetation. 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.	▪ Monitor the activities via visual inspections, and record and report any non-compliance.	▪ Daily	▪ Environmental Manager/ECO
		5.14.6. Fires should only be allowed within fire-safe demarcated areas. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on site for the duration of the operational phase.	▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas. ▪ Ensure fire safety requirements are well understood and respected by workers (by providing basic fire safety training).	▪ Daily	▪ Facility Manager and Environmental Manager/ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		5.14.7. A storm-water management plan must be implemented during the operational phase. Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	▪ Verify that the stormwater management plan is being implemented and signed off prior to the commencement of operations. ▪ Undertake regular inspections of the stormwater infrastructure (i.e. by implementing walk through inspections).	▪ Prior to commencement of operations. ▪ Weekly/Monthly	▪ Environmental Manager/ECO ▪ Facility Manager
		5.14.8. Undertake maintenance of rehabilitated areas in accordance with the rehabilitation and landscaping plan.	▪ Monitor topsoil removal and rehabilitation activities, and record and report non-compliance.	▪ Weekly or Monthly	▪ Facility Manager and Environmental Manager/ECO
		5.14.9. Continue with on-going monitoring programme to detect and quantify any alien species that may become established and identify the highly invasive species during the operation phase.	▪ Monitor the presence of alien invasive species on the development site.	▪ Reporting frequency depends on legal compliance framework	▪ Facility Manager and Environmental Manager/ECO
5.15. Impact and loss of fauna as a result of operational activities.	To reduce the loss of and impact on fauna.	5.15.1. Prior to the commencement of the operational phase, the plant manager and the landowner need to reach a decision in terms of the allowance of faunal activities or redress of faunal activities within site. 5.15.2. Identify points of excessive faunal activity and impact on operations. Undertake monitoring of faunal activities within the fenced area of the site and the immediate proximity of the site.	▪ Establish reporting procedure. ▪ Monitor the presence of fauna during the operational phase via visual inspections and site visits. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers. ▪ Issue fines for non-conformance as	▪ Daily ▪ Daily ▪ Once-off training and ensure all new staff are inducted. ▪ As required ▪ As required	▪ Facility Manager and Environmental Manager/ECO ▪ Facility Manager and Environmental Manager/ECO ▪ Facility Manager ▪ Environmental

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
	Reduce nesting of birds on the facility infrastructure during the operational phase.	5.15.3. Reduction in speed limits in and around site. 5.15.4. No hunting or trapping of animals. 5.15.5. The operational phase EMP must include provision for application to the provincial authority for permits for any necessary nest management.	appropriate and as specified in the worker's contracts. ▪ Nest relocation or removal should be done under permit from the provincial authority.		Manager/ECO ▪ Environmental Manager/ECO
5.16. Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in ecological change within the site.	To reduce the impact and loss of fauna from site as a result of their exclusion from the area.	5.16.1. Avoidance of damage to infrastructure by faunal activity as well as impact on fauna as a result of the site infrastructure. 5.16.2. Identify impact of burrowing and other faunal activities on the fence line and operations activities. 5.16.3. Undertake the management of faunal intrusion through the fence, including possible mortalities. 5.16.4. Provide critter paths through the fence line to allow species access to site. 5.16.5. Ensure that the live electrical fence wire is not placed at ground level. 5.16.6. Conduct inspections of the fence line to address any animals that may be affected by the fence. 5.16.7. Promote and support faunal presence and activities within the proposed PV facility.	▪ Identify where fauna may be affecting operations of site (burrows etc.) Consider redress if necessary. ▪ Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence. ▪ Monitor the activities via visual inspections, and record and report any non-compliance.	▪ Daily to monthly record keeping. ▪ A register of all faunal sitings indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established. ▪ Daily	▪ Environmental Manager/ECO and Project Owner ▪ Environmental Manager/ECO and Project Owner ▪ Environmental Manager/ECO and Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
5.17. Impact of ELP around the site.	The avoidance of electrical light pollution through prudent positioning of external lighting.	5.17.1. Placement of lighting, particularly security lighting to avoid excessive influence on surrounding areas.	▪ Review lighting plans and identify important habitat zones to be avoided.	▪ Prior to the installation of lighting.	▪ Project Owner and Environmental Manager/ECO
5.18. Faunal and avifaunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	5.18.1. The operational personnel and staff should be made aware of the presence of fauna within the proposed project area. The operational personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings.	▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Facility Manager ▪ Environmental Manager/ECO
		5.18.2. To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the offices must be kept clean on a daily basis.	▪ Monitor the activities via visual inspections, and record and report any non-compliance.	▪ Daily	▪ ECO and Contractor
5.19. Impact on avifauna as a result of electrocution.	The reduction in the impact that electrical structures will have on avifauna within the area.	5.19.1. Mitigation is complex at electrical structures since there are many ways in which birds could get electrocuted as the hardware is complex and provides many different potential perches for birds. It is therefore recommended that mitigation be applied reactively once the facility is operational, only if a significant problem is detected.	▪ Monitoring of this infrastructure for bird fatalities should be built into the operational environmental management plan for the facility.	▪ As needed	▪ ECO and contractor
D. DECOMMISSIONING PHASE					

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
5.20. Rehabilitation of flora on site.	Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.	5.20.1. All damaged areas shall be rehabilitated upon completion of the contract. 5.20.2. All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction. 5.20.3. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas.	▪ Conduct a final external audit to confirm that area is rehabilitated to an acceptable level.	▪ Once off	▪ Project Owner with feedback and input from an appropriate specialist. with advice from specialist

6 OPEN SPACE MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. DESIGN PHASE					
6.1. Loss of vegetation and habitat fragmentation.	Keeping the area cleared of vegetation to a minimum.	6.1.1. Clearing of vegetation should be kept to a minimum and take into consideration the sensitivities on site shown in Appendices A and B of this EMPr.	▪ Ensure that solar panel/array design and layout is uniform and well-adapted to the surrounding environment and that no unnecessary areas are cleared of vegetation.	▪ Once-off during design	▪ Project Owner
6.2. Impacts due to establishment of alien invasive plants.	Ensure the appropriate removal of alien invasive vegetation from the proposed project area and prevent the establishment and spread of alien invasive plants due to the project activities.	6.2.1. Ensure compliance with relevant Environmental Specifications for the control and removal of alien invasive plant species. 6.2.2. Appoint a specialist or contact relevant authorities to seek guidance on the removal of the alien vegetation on site. 6.2.3. Compile and finalise an alien weed eradication programme.	▪ Appoint a suitable specialist/ Contractor or contact the relevant authorities to seek guidance on the removal of the planted alien invasive species. ▪ Appoint a suitable specialist to compile an alien invasive vegetation eradication plan. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the design phase. ▪ Once-off during the design phase. ▪ Once-off during the design phase.	▪ Project Owner ▪ Project Owner ▪ ECO
6.3. Permanent barriers to animal movement and habitat fragmentation.	The reduction in the impact that barrier will have on animal movement within the area.	6.3.1. Provide critter paths through the fence line to allow species access to site.	▪ Ensure that this is taken into consideration during the planning and design phase.	▪ Once-off during the planning and design phase	▪ Project Owner
		6.3.2. All remaining areas that are not impacted upon by the proposed development footprint should remain unfenced to allow for movement corridors between the	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the planning and design phase	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		remainder of the farm.			
B. CONSTRUCTION PHASE					
6.4. Permanent barriers to animal movement and habitat fragmentation.	The reduction in the impact that barrier will have on animal movement within the area.	6.4.1. Fencing should allow for the passage of small and medium sized mammals and all forms of mesh fencing should be avoided.	▪ This should be monitored by the ECO to determine whether this is effective.	▪ Daily	▪ ECO and Contractor
6.5. Loss of vegetation and habitat fragmentation.	Keeping the area cleared of vegetation to a minimum.	6.5.1. Clearing of vegetation should be kept to a minimum, keeping the width and length of the earthworks to a minimum.	▪ Monitor activities and record and report non-compliance.	▪ Daily	▪ ECO and Contractor
C. OPERATIONAL PHASE					
6.6. Increased risk of alien plant invasion.	Ensure that the site is kept free from alien invasive species.	6.6.1. Continuously monitor the site and remove alien invasive species that are found.	▪ Monitor the presence of alien invasive species on the development site.	▪ Reporting frequency depends on legal compliance framework	▪ Facility Manager and Environmental Manager/ECO
6.7. Increased animal road mortality.	Minimise loss of fauna as a result of road mortalities.	6.7.1. Create awareness during staff induction programmes. Staff must be made aware of the general speed limits as well as the potential animals that may cross and how to react in these situations.	▪ Conduct staff awareness training programmes.	▪ Once-off training and ensure all new staff are inducted.	▪ Facility Manager and Environmental Manager
		6.7.2. The relevant requirements and methodology for post construction bird monitoring in terms of the applicable and most recent Best practice Guideline at the time, e.g. "Birds and Solar Energy, Best	▪ Ensure that the relevant requirements for the post-construction bird monitoring in terms of the applicable Birds and Solar Energy Best Practice Guidelines are adhered to.	▪ As prescribed in the relevant Guidelines	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		Practice Guidelines" must be adhered to.			
		6.7.3. Any avian mortality or injury at the facility should be duly recorded and reported.	▪ Record any bird fatalities and undertake the necessary reporting to relevant authority.	▪ When required	▪ Project Owner
D. DECOMMISSIONING PHASE					
6.8. No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area.	To manage impacts on the surrounding environment during the operational phase.	6.8.1. Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level	▪ Once off	▪ Project Owner
		6.8.2. Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of native species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape.	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level	▪ Once off	▪ Project Owner
		6.8.3. Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape.	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level	▪ Once off	▪ Project Owner

7 TRAFFIC MANAGEMENT PLAN INCLUDING TRANSPORTATION PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. DESIGN PHASE					
7.1. Increased traffic generation.	Manage impact that additional traffic generation will have on road network.	7.1.1. If abnormal loads need to be transported by road to the site, a permit needs to be obtained from the Provincial Government Northern Cape (PGNC) Department of Public Works, Roads and Transport.	▪ Ensure that the permits are applied for and obtained prior to commencement. ▪ Verify that this has been undertaken by reviewing approved permits.	▪ Once-off during the design phase ▪ Once-off during the design phase.	▪ Contractor ▪ ECO
		7.1.2. If the Transnet Service Road will be used as the designated access road to site, discussions must be held with Transnet Freight Rail prior to commencement to confirm requirements and details of the agreement.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the design phase.	▪ Project Owner and ECO
		7.1.3. Ensure that the requirements for use of the Transnet Service Road are addressed and considered in the design, as and where applicable.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the design phase.	▪ Project Owner and ECO
		7.1.4. If the Transnet Service Road will be used as the designated access road, the registration details of all vehicles that will make use of the road during the construction and operational phases must be provided to Transnet Freight Rail, in	▪ Ensure that the permits are applied for and obtained prior to commencement. ▪ Verify that this has been undertaken by reviewing approved permits.	▪ Once-off during the design phase ▪ Once-off during the design phase.	▪ Contractor ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		order to obtain official permits.			
		7.1.5. Provide a Transport Traffic Plan to SANRAL (if required).	▪ Ensure that the plan is compiled and submitted prior to commencement. ▪ Verify that this has been undertaken by reviewing approved plans.	▪ Once-off during the design phase ▪ Once-off during the design phase.	▪ Contractor ▪ ECO
7.2. Accelerated degradation of road structure due to construction and operational traffic.	Limit the deterioration of the road condition due to construction and operational traffic.	7.2.1. A Road Maintenance Plan should be developed for the section of the Transnet Service Road that will be used. The plan should address the requirements of Transnet Freight Rail, including but not limited to, grading, dust suppressant mechanisms, drainage, signage, and speed limits.	▪ Ensure that the plan is compiled and submitted prior to commencement. ▪ Verify that this has been undertaken by reviewing approved plans.	▪ Once-off during the design phase ▪ Once-off during the design phase.	▪ Contractor ▪ ECO
B. CONSTRUCTION PHASE					
7.3. Increased traffic generation during the construction phase resulting in a reduction of road based level of service	Reduce the amount of road based traffic during the construction phase.	7.3.1. Well maintained vehicles should be used together with well-trained drivers during the construction phase. Vehicle maintenance and driver competency should be monitored. Proof of driver competency as well as the vehicle checks should be verified and undertaken to ensure that vehicles are roadworthy and hence, do not pose a safety risk. The Contractors must ensure that construction vehicles are roadworthy,	▪ Carry out random checks of driver licences and conduct random visual inspections of construction vehicles for roadworthiness.	▪ Random visual inspection of vehicles weekly.	▪ Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		properly serviced and maintained, and respect the vehicle safety standards implemented by the Project Owner.			
		7.3.2. During the construction phase, suitable parking areas should be designated for trucks and vehicles.	▪ Monitor the placement of the designated parking area for trucks and vehicles via visual inspections and record and report any non-compliance.	▪ Once-off prior to construction and as required during the construction phase.	▪ Project Owner and ECO
		7.3.3. The use of public transport (buses and/or minibus taxis) to convey construction personnel to the site should be encouraged If possible.	▪ Contractor may record arrival and departure times as well as number of workers using minibuses.	▪ Once a month on a randomly selected day.	▪ Contractor
		7.3.4. It is recommended that vehicles are not overloaded during the construction phase in order to reduce impacts on the road structures, particularly the access roads leading to the site. Random visual inspection of vehicles should be undertaken in order to monitor for overloading. The inspections should also verify if the trucks are covered with appropriate material (such as tarpaulin) if and where possible.	▪ Perform visual inspection of vehicles during the construction phase.	▪ Random visual inspection of vehicles weekly.	▪ Contractor
7.4. Increased level of road accidents (involving pedestrians, animals, other motorists on	Minimise the impact of the construction activities on the local traffic and avoid accidents with pedestrians, animals and	7.4.1. Well maintained vehicles should be used together with well-trained drivers during the construction phase. Vehicle maintenance and driver competency should be monitored. Proof of driver	▪ Carry out random checks of driver licences and conduct random visual inspections of construction vehicles for roadworthiness.	▪ Random visual inspection of vehicles weekly.	▪ Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
the surrounding tarred/ gravel road network) due to increased traffic during construction.	other drivers on the surrounding tarred/ gravel roads. Reduce number of road accidents due to increased traffic during construction.	competency as well as the vehicle checks should be verified and undertaken to ensure that vehicles are roadworthy and hence, do not pose a safety risk. The Contractors must ensure that construction vehicles are roadworthy, properly serviced and maintained, and respect the vehicle safety standards implemented by the Project Owner.			
		7.4.2. Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences should be installed, if needed, to direct animals to safe road crossings.	▪ Appropriate monitoring should be undertaken and fences installed, if needed to direct animals to safe road crossings.	▪ Weekly	▪ Contractor and ECO
		7.4.3. Adhere to all speed limits applicable to all roads used. All heavy load vehicles should maintain a speed limit of 40 km/hour in the proposed section of the Transnet Service Road.	▪ Ensure that speed limits are adhered to. ▪ Carry out random visual inspections to verify speed limits and general awareness of vehicle drivers.	▪ Daily ▪ Random during the construction phase.	▪ Contractor and ECO ▪ ECO
		7.4.4. Implement clear and visible signage and signals indicating movement of vehicles at the intersection with the Transnet Service Road to ensure safe entry and exit.	▪ Implement clear signalisation. ▪ Carry out random inspections to verify whether proper construction signage is being implemented.	▪ On-going ▪ Random during the construction phase	▪ Contractor and ECO ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
7.5. Accelerated degradation of road structure due to construction traffic.	Limit the deterioration of the road condition due to construction traffic.	7.5.1. Construction activities will have a higher impact than the normal road activity and therefore the main access roads to site should be inspected on a weekly basis for structural damage.	▪ Ensure that the main access road to site maintains current condition through photographic surveys and monitoring.	▪ Weekly	▪ Contractor and ECO
		7.5.2. Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles.	▪ Ensure dust management measures are in place to adequately decrease the generation of dust.	▪ On-going	▪ Contractor and ECO
		7.5.3. It is recommended that vehicles are not overloaded during the construction phase in order to reduce impacts on the road structures, particularly the access roads leading to the site. Random visual inspection of vehicles should be undertaken in order to monitor for overloading. The inspections should also verify if the trucks are covered with appropriate material (such as tarpaulin) if and where possible.	▪ Perform visual inspection of vehicles during the construction phase.	▪ Random visual inspection of vehicles weekly.	▪ Contractor
		7.5.4. Make provision for the repairing of subgrade deterioration (i.e. pot holes, dust holes) that could possibly result due to loading of heavy construction vehicles on the Transnet Service Road.	▪ Make provision for repairs required to road	▪ Agree to with Transnet	▪ Contractor and ECO
7.6. Impact on air quality due to dust generation, noise and	Limit the release of noise, pollutants and dust	7.6.1. Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service	▪ Ensure dust management measures are in place to adequately decrease the	▪ On-going	▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
exhaust emissions from construction vehicles and equipment.	emissions	Road, exposed areas and stockpiles.	generation of dust.		
		7.6.2. Construction vehicles must have their lights on at all times. Lights to be properly set to not blind train drivers who may then miss important signal, e.g stop signal (Signal Passed At Danger (SPAD).	▪ Ensure lights are on and properly set.	▪ On-going	▪ Contractor and ECO
		7.6.3. Postpone or reduce dust-generating activities during periods with strong wind. Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased.	▪ Ensure dust management measures are in place to decrease the dust generated	▪ On-going	▪ Contractor and ECO
		7.6.4. Avoid using old and unmaintained construction equipment (which generate high sound levels) and ensure equipment is well maintained.	▪ Manage the air pollutants form construction vehicles through checking the condition of vehicles	▪ On-going	▪ Contractor and ECO
7.7. Soil contamination from leakage from battery (during transport and on-site construction).	Avoid soil contamination during transportation and construction of batteries on site.	7.7.1. The transport vehicle should be identified with symbols: the vehicle, must be correctly identified, following international conventions, symbols and colours, identifying the fact that corrosive and hazardous products are being transported.	▪ Check that trucks transporting batteries to site are appropriately identified with the required symbols.	▪ On-going	▪ Contractor and ECO
		7.7.2. PPE should be provided for the transport team and they should be trained in the use of the equipment, in case of any accident.	▪ Provide PPE to transport team.	▪ On-going	▪ Contractor and ECO
		7.7.3. Drivers and personnel on site dealing with	▪ Ensure that drivers and personnel	▪ Monthly	▪ Contractor and

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		the battery storage's hazardous wastes should always be trained in emergency procedures, including explosions, fire, spilling, etc. and how to contact emergency response teams. Besides this, they should be aware of the specific kind of hazardous material is being transported and how to deal with it	are trained in handling the battery.		ECO
C. OPERATIONAL PHASE					
7.8. Increased level of road accidents (involving pedestrians, animals, other motorists on the surrounding tarred/ gravel road network) due to increased traffic during the operational phase.	Minimise the impact of the operational activities on the local traffic and avoid accidents with pedestrians, animals and other drivers on the surrounding tarred/ gravel roads. Reduce number of road accidents due to increased traffic during the operational phase.	7.8.1. Well maintained vehicles should be used together with well-trained drivers during the operational phase, as required. Vehicle maintenance and driver competency should be monitored. Proof of driver competency as well as the vehicle checks should be verified and undertaken to ensure that vehicles are roadworthy and hence, do not pose a safety risk. Vehicles must be roadworthy, properly serviced and maintained.	▪ Carry out random checks of driver licences and conduct random visual inspections of vehicles for roadworthiness.	▪ Random visual inspection of vehicles weekly.	▪ Facility Manager
		7.8.2. Adhere to all speed limits applicable to all roads used. All heavy load vehicles should maintain a speed limit of 40 km/hour in the proposed section of the Transnet Service Road.	▪ Ensure that speed limits are adhered to. ▪ Carry out random visual inspections to verify speed limits and general awareness of vehicle drivers.	▪ Daily ▪ Random during the operational phase.	▪ Facility Manager ▪ Facility Manager
		7.8.3. Implement clear and visible signage and signals indicating movement of vehicles at the intersection with the Transnet Service	▪ Implement clear signalisation. ▪ Carry out random inspections to	▪ Ongoing ▪ Random during	▪ Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		Road to ensure safe entry and exit.	verify whether proper construction signage is being implemented.	the operational phase.	▪ Facility Manager
		7.8.4. The use of public transport (buses and/or minibus taxis) or carpooling to convey operational personnel to the site should be encouraged.	▪ Monitor the requirements	▪ On-going	▪ Facility Manager
		7.8.5. Adhere to requirements made within Transport Traffic Plan.	▪ Monitor the requirements as set out in the Plan as ensure that it is adhered to	▪ On-going	▪ Facility Manager
		7.8.6. Limit access to the site to personnel.	▪ Maintain a register of visitors and staff that enter site and restrict access to personnel.	▪ On-going	▪ Facility Manager
7.9. Accelerated degradation of road structure due to operational traffic.	Limit the deterioration of the road condition due to operational phase traffic.	7.9.1. The main access roads to site should be inspected on a weekly basis for structural damage.	▪ Ensure that the main access road to site maintains current condition through photographic surveys and monitoring.	▪ Weekly	▪ Facility Manager
		7.9.2. Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles.	▪ Ensure dust management measures are in place to adequately decrease the generation of dust.	▪ On-going	▪ Facility Manager
		7.9.3. It is recommended that vehicles are not overloaded during the operational phase (where applicable) in order to reduce impacts on the road structures, particularly the access roads leading to the site. Random visual inspection of	▪ Perform visual inspection of vehicles during the construction phase.	▪ Random visual inspection of vehicles weekly.	▪ Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		vehicles should be undertaken in order to monitor for overloading (where applicable).			
		7.9.4. Make provision for the repairing of subgrade deterioration (i.e. pot holes, dust holes) that could possibly result due to overloading of vehicles (where applicable) on the Transnet Service Road.	▪ Make provision for repairs required to road.	▪ Agree to with Transnet	▪ Project Owner
		7.9.5. Implement requirements of the Road Maintenance Plan.	▪ Adhere to requirements of the Road Maintenance Plan.	▪ On-going	▪ Facility Manager
D. DECOMMISSIONING PHASE					
7.10. Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

8 STORM WATER MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. DESIGN PHASE					
1. Impact of the project if a detailed storm water management plan is not correctly prepared and implemented.	To limit the effect of uncontrolled storm water run-off from developed areas onto natural areas.	1.1. Prepare a detailed stormwater management plan outlining appropriate treatment measures to address runoff from disturbed portions of the site, such that they do not: ▪ result in concentrated flows into natural watercourses i.e. provision should be made for temporary or permanent measures that allow for attenuation, control of velocities and capturing of sediment upstream of natural water courses; ▪ result in any necessity for concrete or other lining of natural water courses to protect them from concentrated flows of the development; ▪ divert flows out of their natural flow pathways, thus depriving downstream watercourses of water.	▪ Check compliance with specified conditions. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during design followed by regular control. ▪ During the design phase.	▪ Contractor ▪ ECO
B. CONSTRUCTION PHASE					
2. Diversion and impedance surface	Prevent interference with natural run-off patterns,	2.1. The appointed Contractor should compile a Method Statement for Stormwater	▪ Compile a Method Statement for Stormwater Management during	▪ Prior to the construction phase.	▪ Contractor ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
water flows – Changes to the hydrological regime and increased potential for erosion. Diversion and increased velocity of surface water flows – reduction in permeable surfaces.	diverting flows and increasing the velocity of surface water flows.	Management during the construction phase.	the construction phase. ▪ Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	▪ Once-off prior to the commencement of the construction phase.	
		2.2. Stormwater and any run-off generated by the hard surfaces should be discharged into retention swales or areas with rock rip-rap (or similar). These could be used to enhance the sense of place, if they are planted with indigenous vegetation.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		2.3. Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (gabions and Reno mattresses or similar) and the re-vegetation of any disturbed riverbanks.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		2.4. Place energy dissipation structures in a manner that allows the management of flows prior to being discharged into the natural environment, thus not only preventing erosion, but supporting the maintenance of natural base flows within these systems i.e. hydrological regime (water quantity and quality) is maintained.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		2.5. Reinforce soil slopes to minimise erosion during rehabilitation (as needed, and once construction in a specific area has been	▪ Monitor activities and record and report non-compliance.	▪ As needed during the construction	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring: Methodology	Monitoring: Frequency	Monitoring: Responsibility
		completed).		phase.	
		2.6. Any irrigation of the development area for landscaping or dust control purposes should be controlled, such that it does not result in any measurable increase in moisture being passed into natural drainage lines.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		2.7. Drainage along the sides of the roads should be designed so that it does not result in concentrated flows into watercourses.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		2.8. Perform periodic inspections and maintenance of soil erosion measures and stormwater control structures.	▪ Monitor activities and record and report non-compliance.	▪ As needed during the construction phase.	▪ ECO
3. Pollution of the surrounding environment as a result of the contamination of stormwater. Contamination could result from the spillage of chemicals, oils, fuels, sewage, solid waste, litter etc.	To prevent contaminated stormwater from entering into and adversely impacting on freshwater ecosystems and reducing the water quality. To reduce sedimentation of nearby water systems. To apply best practice principles in managing risks to storm water pollution.	3.1. The appointed Contractor should compile a Method Statement for Stormwater Management during the construction phase.	▪ Compile a Method Statement for Stormwater Management during the construction phase. ▪ Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	▪ Prior to the construction phase. ▪ Once-off prior to the commencement of the construction phase.	▪ Contractor ▪ ECO
		3.2. Provide secure storage for fuel, oil, chemicals and other waste materials to prevent contamination of stormwater runoff. Fuels and chemicals (i.e. any hazardous materials and dangerous goods) used during the construction phase must be	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents. Monitor if spillages have taken	▪ Weekly	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		stored safely on site and in bunded areas. Fuel and chemical storage containers must be inspected to ensure that any leaks are detected early.	place and if they are removed correctly.		
		3.3. All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation. No stockpiling should take place within a watercourse. 3.4. Stockpiles must be located away from river channels i.e. greater than 32 m.	▪ Monitor the excavations and stockpiling process throughout the construction phase via visual site inspections. Record non-compliance and incidents.	▪ Daily	▪ ECO
		3.5. Littering and contamination of water resources during construction must be prevented by effective construction camp management.	▪ Monitor via site audits and record non-compliance and incidents (i.e. by implementing walk through inspections).	▪ Weekly	▪ Contractor and ECO
		3.6. Emergency plans must be in place to deal with potential spillages (especially those leading to any watercourses).	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		3.7. Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (gabions and Reno mattresses or similar) and the re-vegetation of any disturbed riverbanks.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		3.8. Ensure that the temporary site camp and ablution facilities are established at least 32	▪ Monitor the placement of the site camp via visual inspections, and	▪ Once-off prior to construction and as	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		m away from the banks of drainage lines.	record and report any non-compliance.	required during the construction phase.	
		3.9. Ensure that there is no ad-hoc crossing of channels by vehicles during the construction phase. Access routes across the site should be strictly demarcated and selected with a view to minimise impacts on drainage lines.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		3.10. Ensure that no waste materials or sediments are left in the surrounding drainage lines (as a result of the construction).	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		3.11. Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	▪ Monitor via site audits and record non-compliance and incidents (i.e. by implementing walk through inspections).	▪ Weekly	▪ Contractor and ECO
C. OPERATIONAL PHASE					
4. Stormwater discharge into the surrounding environment during operations.	To minimise the contamination of stormwater by uncontrolled release of contaminated or grey water. To protect soil resources and prevent soil erosion.	4.1. An operational phase Stormwater Management Plan should be designed and implemented, with a view to prevent the passage of concentrated flows from hardened surfaces and onto natural areas.	▪ Compile a Stormwater Management Plan for the operational phase. ▪ Inspect and verify if a Stormwater Management Plan has been compiled prior to the commencement of the operational phase.	▪ Continuously during operational phase. ▪ Once-off prior to the commencement of the operational phase.	▪ Project Owner
		4.2. All release points into the natural environment must have appropriate energy	▪ Monitor activities and record and	▪ On-going	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		dissipaters to minimise scouring/erosion.	report non-compliance. ▪ Monitor the placement of energy dissipaters via visual inspections, and record and report any non-compliance.		
		4.3. Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	▪ Undertake regular inspections of the stormwater infrastructure (i.e. by implementing walk through inspections).	▪ Weekly/Monthly	▪ ECO and O&M team
D. DECOMMISSIONING PHASE					
5. The proposed solar facility would be expected to run for a minimum period of 20 years, after which it would either be decommissioned, alternatively upgraded or an application submitted to obtain a new license. Should the plant be decommissioned, the solar field would be rehabilitated to its original (pre-development) state. In the (unlikely) event that none of the mitigation measures outlined for the construction and operational phases of the proposed project had been implemented, the period of time for recovery to take place would be extended. In the event that decommissioning occurs, and assuming implementation of mitigation measures, the hydrological regime should fully recover over time to present day conditions.					

9 EROSION MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. CONSTRUCTION PHASE					
9.1. Increased wind erosion and resultant deposition of dust.	Prevent wind erosion and resultant deposition of dust on surrounding indigenous vegetation.	9.1.1. Sand, stone and cement should be stored in demarcated areas, and covered or sealed to prevent wind erosion and resultant deposition of dust on the surrounding indigenous vegetation.	▪ Undertake regular inspections of the via site audits to verify that sand, stone and cement are stored and handled as instructed.	▪ Daily	▪ ECO and Contractor
		9.1.2. During construction, efforts should be made to retain as much natural vegetation as possible on the site, to reduce disturbed areas and maintain plant cover, thus reducing erosion risks.	▪ Monitor activities via site inspections and record and report non-compliance.	▪ Daily	▪ ECO and Contractor
		9.1.3. All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation.	▪ Monitor the stockpiling process throughout the construction phase via visual site inspections. Record non-compliance and incidents.	▪ Daily	▪ ECO
9.2. Excessive loss of natural vegetation within the development footprint area.	Prevent loss of natural vegetation through erosion.	9.2.1. Vegetation clearing during construction must be restricted to the footprint of the proposed project components and planned infrastructure only. It should be phased to ensure that the minimum area of soil is exposed to potential erosion at any one time.	▪ Monitor vegetation clearing throughout the construction phase via visual site inspections. Record non-compliance and incidents. ▪ Undertake regular monitoring for erosion to ensure is reduced and	▪ Daily ▪ Daily	▪ ECO and Contractor ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			rectified as soon as possible.		
		9.2.2. Stockpile the shallow topsoil layer separately from the subsoil layers (especially if the excavation exceeds 0.5 m). Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas.	▪ Rehabilitate disturbed areas and monitor the presence of alien invasive species on site.	▪ Daily (stockpiling) and once-off for the reinstatement of the top soil layer	▪ ECO and Contractor
		9.2.3. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	▪ Re-seed with seeds of indigenous grass species.	▪ Once off	▪ ECO with advice from specialist (if required)
		9.2.4. Topsoil stockpiles not used in three months after stripping must be seeded to prevent dust and erosion.	▪ Regular monitoring for erosion to ensure that no erosion problems are occurring at the site. All erosion problems observed should be rectified as soon as possible.	▪ Weekly initially and thereafter monthly	▪ ECO and Contractor
9.3. Erosion of surface soils, rilling and gulleys due to water erosion.	Measures to be implemented that address or avoid the loss of surface soils and exacerbates gulley formation.	9.3.1. Identify cause of erosion and possible means of redress (i.e. implement erosion control measures, where applicable), such as the use of geofabric, stone gabions and re-vegetation or similar measures. 9.3.2. Erosion control measures should seek to	▪ Monitor the erosion on site during construction, as well as the implementation and effectiveness of erosion control on site (such as the use of geofabric, stone gabions and re-vegetation or similar measures).	▪ Ongoing and as required during erosion events.	▪ ECO and Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		reduce surface flow velocity and allow for settlement on site of silt laden surface waters. Washaways, excessive loss of soils and gulleys can be considered to be indicative of excessive erosion.			
B. OPERATIONAL PHASE					
9.4. Excessive loss of natural vegetation in the development footprint area and resulting impacts on SSC, faunal habitat and habitat fragmentation.	Prevent loss of natural vegetation and minimise habitat fragmentation and the loss of connectivity as a result of erosion.	9.4.1. To prevent erosion, indigenous grasses that seed themselves below the solar arrays should (where possible) be left to form a ground cover and kept short.	▪ ECO to advise on seed to be used.	▪ Prior to re-vegetation.	▪ Project Owner
		9.4.2. The use of silt fences, sand bags or other suitable methods must be implemented in areas that are susceptible to erosion. Other erosion control measures that can be implemented are as follows: 1) Brush packing with cleared vegetation, 2) Planting of vegetation, 3) Hydro seeding/hand sowing. All erosion control mechanisms need to be regularly maintained.	▪ Monitor efficiency of erosion control measures.	▪ Weekly or monthly	▪ Project Owner
		9.4.3. Conduct regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. Ensure that all erosion problems are rectified as soon as possible.	▪ Undertake regular monitoring for erosion to ensure is reduced and rectified as soon as possible.	▪ Monthly	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
9.5. Increased water erosion as a result of run-off water from hardened surfaces.	Manage run-off water to prevent down slope water erosion.	9.5.1. Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	▪ Include periodic site inspections in environmental performance reporting that inspects the effectiveness and integrity of the run-off control system and specifically records occurrence or non-occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Monthly	▪ Project Owner
C. DECOMMISSIONING PHASE					
9.6. No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas. Monitoring: Final external audit of area to confirm that area is rehabilitated to an acceptable level (once off event to be conducted by ECO).					

10 HAZARDOUS SUBSTANCES LEAKAGE OR SPILLAGE MONITORING SYSTEM

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. CONSTRUCTION PHASE					
10.1. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of concrete and cement.	To control concrete and cement batching activities in order to reduce spillages and resulting contamination of soil, groundwater and the vegetation and/or fauna.	10.1.1. If any concrete mixing takes placed on site, this must be carried out in a clearly marked, designated area at the site camp on an impermeable surface (such as on boards or plastic sheeting and/or within a bunded area with an impermeable surface).	▪ Monitor the handling and storage of sand, stone and cement as instructed.	▪ Daily	▪ Project Owner, Contractor and ECO
		10.1.2. Bagged cement must be stored in an appropriate facility and at least 10 m away from any water courses, gullies and drains.	▪ Monitor the handling and storage of sand, stone and cement as instructed.	▪ Daily	▪ Project Owner, Contractor and ECO
		10.1.3. A washout facility must be provided for washing of concrete associated equipment. Water used for washing must be restricted.	▪ Monitor the handling and storage of sand, stone and cement as instructed.	▪ Daily	▪ Project Owner, Contractor and ECO
		10.1.4. Hardened concrete from the washout facility or concrete mixer can either be reused or disposed of at an appropriate licensed disposal facility. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Monitor the handling and storage of sand, stone and cement as instructed. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Daily ▪ Monthly	▪ Project Owner, Contractor and ECO ▪ ECO
		10.1.5. Empty cement bags must be secured with adequate binding material if these will be temporarily stored on site. Empty cement bags	▪ Monitor the handling and storage of sand, stone and cement as instructed.	▪ Daily	▪ Project Owner, Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		must be collected from the construction area at the end of every day. Sand and aggregates containing cement must be kept damp to prevent the generation of dust.			
		10.1.6. Any excess sand, stone and cement must be removed from site at the completion of the construction period and disposed at a licensed waste disposal facility. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Monitor the handling and storage of sand, stone and cement as instructed. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Daily ▪ Monthly	▪ Project Owner, Contractor and ECO ▪ ECO
10.2. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils.	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	10.2.1. Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel, hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the site camp. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel).	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	▪ Weekly	▪ Contractor and ECO
		10.2.2. Monitor and inspect construction equipment and vehicles to ensure that no fuel spillage takes place. Ensure that drip trays are provided for construction equipment and vehicles as required.	▪ Monitor the construction equipment and vehicles and monitor the occurrence of spills and the management process thereof.	▪ Daily ▪ During spill events	▪ Contractor and ECO ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			▪ Record all spills and lessons learnt.		
		10.2.3. Contractor to compile a Method Statement for refuelling activities under normal and emergency situations. If on-site servicing and refuelling is required in emergency situations, a designated area must be created at the construction site camp for this purpose. Drip trays or similar impervious materials must be used during these procedures.	▪ Verify if a Method Statement is compiled by reviewing approved and signed off reports. ▪ Monitor the refuelling/ servicing process and record the occurrence of any spillages.	▪ Once-off prior to commenceme nt of construction. ▪ During emergency refuelling and servicing activities.	▪ ECO ▪ ECO
		10.2.4. Spilled fuel, oil or grease must be retrieved and contaminated soil removed, cleaned and replaced.	▪ Monitor the handling and storage of fuels and oils via site audits and monitor if spillages have taken place and if so, are removed correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Daily (or during spills)	▪ Contractor and ECO
		10.2.5. Contaminated soil to be collected by the Contractor (under observation of the ECO) and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and	▪ Daily (or during spills)	▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			incidents.		
		10.2.6. A Spill Response Method Statement must be compiled by the Contractor for the construction phase in order to manage potential spill events.	▪ Compile a Spill Response Method Statement. ▪ Audit signed and approved Spill Response Method Statement.	▪ Once-off (and thereafter updated as required during the construction phase). ▪ Once-off (and thereafter as required during the construction phase).	▪ Contractor and Project Owner ▪ ECO
		10.2.7. The Contractor must ensure that adequate spill containment and clean-up equipment are provided on site for use during spill events.	▪ Monitor via site audits and record incidents and non-compliance.	▪ Daily/Weekly	▪ ECO and Contractor
		10.2.8. Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	▪ Ensure that a well-maintained portable bioremediation kit is available on site and that construction personnel and contractors are aware of its location and instructions	▪ Daily	▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		10.2.9. In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e. GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Environmental Affairs of the significant contamination.	▪ Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e. GN 331) in order to determine if the soil is significantly contaminated or not. ▪ If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.	▪ During spill events	▪ Project Owner
		10.2.10. The Contractor must record and document all significant spill events.	▪ Monitor documentation and records of significant spill events via audits and record non-compliance and incidents.	▪ During spill events	▪ ECO
10.3. Soil contamination from leakage from battery (during transport and	Avoid soil contamination during transport and construction of battery	10.3.1. Batteries must be transported inside containers.	▪ Check that this is undertaken.	▪ During transport of batteries	▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
on-site construction).	storage facility.	10.3.2. Containers must be well packed to the transport vehicle.	▪ Check that this is undertaken.	▪ During transport of batteries	▪ Contractor and ECO
		10.3.3. A minimum set of equipment necessary to combat any simple spillage or leakage problems should be provided and the transport team trained on how to use it.	▪ Ensure that transport team know how to manage spills.	▪ During transport of batteries	▪ Contractor and ECO
		10.3.4. The construction of the facility should adhere to the appropriate international standards and South African National Standards (SANS) requirements and should be located on an impermeable barrier/layer (e.g. concrete surface with acid lining).	▪ Ensure that the facility adheres to the relevant SANS and international requirements.	▪ Ongoing	▪ Contractor and ECO
		10.3.5. Secondary containment may need to be constructed and must have a capacity of at least 110% of the largest storage tank's capacity. The secondary containment should include the following: ▪ The off-loading point must be located in the bunded area to ensure that any potential spill during the off-loading of the electrolyte solutions is contained; ▪ Divert rainwater away from the bunded area to avoid rainwater mixing with electrolyte spillage potentially present within the secondary containment; ▪ Ensure that the containment area is	▪ Provide secondary containment according to the specifications.	▪ On-going	▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		sloped to a sump; and ▪ All drains should be covered.			
		10.3.6. Although highly unlikely, any spill/leakage from the battery storage facility must be attended to immediately and be handled in an environmental friendly manner (i.e. no discharge into the ground or any surface water body) and must be disposed of at an appropriate licenced hazardous waste disposal facility.	▪ Immediately attend to any spillage.	▪ On-going	▪ Contractor and ECO
B. OPERATIONAL PHASE					
10.4. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	10.4.1. Monitor and inspect maintenance equipment and vehicles to ensure that no fuel spillage takes place.	▪ Implement specifications for maintenance equipment use as specified by the maintenance Contractor.	▪ Monthly	▪ Project Owner
		10.4.2. Spilled fuel, oil or grease is retrieved during operations where possible and contaminated soil removed, cleaned and replaced.	▪ Monitor the handling and storage of fuels and oils via site audits and monitor if spillages have taken place and if so, are removed correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ During spills	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		10.4.3. Contaminated soil to be collected by the Contractor and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ During spills	▪ Project Owner
		10.4.4. A Spill Response Plan must be compiled for the operational phase in order to manage potential spill events.	▪ Compile a Spill Response Plan. ▪ Audit signed and approved Spill Response Method Statement.	▪ Once-off (and thereafter updated as required). ▪ Once-off (and thereafter as required).	▪ Project Owner ▪ Facility Manager
		10.4.5. Ensure that adequate spill containment and clean-up equipment are provided on site for use during spill events. Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	▪ Ensure that a well-maintained portable bioremediation kit is available on site and that operational personnel are aware of its location and instructions.	▪ Weekly	▪ Facility Manager
		10.4.6. In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address	▪ Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e. GN 331) in order to determine if the	▪ During spill events	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e. GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Environmental Affairs of the significant contamination. 331).	soil is significantly contaminated or not. ▪ If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.		
		10.4.7. Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel, hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the PV facility. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel).	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	▪ Weekly	▪ Facility Manager
10.5. Impacts due to management of solid and liquid wastes disposed of on the site during operational phase.	Prevent environmental impacts as a result of the operational phase such as pollution.	10.5.1. All operation waste to be removed from the site by an appointed service provider.	▪ Waste removal and disposal to be monitored throughout operation.	▪ Monthly	▪ Facility Manager
		10.5.2. All liquid waste or spills (used oil, paints, lubricating compounds and grease from vehicles passing through the entrance facility) to be packaged and disposed appropriately at a	▪ Monitor the correct removal of liquid waste or spills. Monitor waste disposal slips and waybills	▪ During spills	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		registered landfill site.	via site audits and record non-compliance and incidents.		
		10.5.3. Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided in order to avoid spillages.	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	▪ Weekly	▪ Facility Manager
C. DECOMMISSIONING PHASE					
10.6. No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area.					

11 ENVIRONMENTAL AWARENESS AND FIRE MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. DESIGN PHASE					
11.1. Potential impacts resulting from the lack of overall compliance with the conditions of the EA (issued by the DEA)	Ensure compliance with all environmental conditions of approval (issued by DEA as part of the EA).	11.1.1. Establish clear and transparent reporting of the activities undertaken with regard to all recommendations included in the EMPr.	▪ Audit report on compliance with actions and monitoring requirements.	▪ Based on EA conditions	▪ Project Owner and ECO
		11.1.2. Audit the implementation of the EMPr requirements.	▪ Audit report on compliance with actions and monitoring requirements.	▪ Weekly	▪ ECO
11.2. Risk of fire, explosion or release of toxic gas.	Reduce fire, explosion or release of toxic gas risk from battery storage facility.	11.2.1. The battery storage facility must be located outside (i.e. well-ventilated) and include vents (where necessary and applicable).	▪ Ensure compliance to this requirement.	▪ Once-off	▪ Project Owner
B. CONSTRUCTION PHASE					
11.3. Potential risk of fire due to construction activities or behaviour of staff on site during the construction phase.	Prevent fire on site resulting from workers smoking or starting fires (i.e. cooking, heating purposes).	11.3.1. Designate smoking areas, as well as areas for cooking, where the fire hazard could be regarded as insignificant.	▪ Ad-hoc checks to ensure workers are smoking or cooking in designated areas only.	▪ Daily	▪ ECO and Contractor
		11.3.2. Educate workers on the dangers of open and/or unattended fires.	▪ Ensure fire safety requirements are well understood and respected by construction personnel. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed	▪ Ongoing. ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ Contractor/ ECO ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			attendance registers.		
		11.3.3. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the construction phase.	▪ Ensure fire safety requirements are well understood and respected by construction personnel. Provide basic fire safety training.	▪ On-going	▪ ECO and Contractor
		11.3.4. Ensure that cooking takes place in a designated area shown on the site map. Ensure that no firewood or kindling may be gathered from the site or surrounds.	▪ Check compliance with specified conditions using a report card, and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors
		11.3.5. Fire-fighting equipment must be made available at various appropriate locations on the construction site.	▪ Ensure fire safety requirements are well understood and respected by workers. ▪ Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company.	▪ On-going ▪ Bi-annually	▪ ECO and Contractor ▪ Contractor
11.4. Inappropriate behaviour of civil contractors and sub-contractors during the construction phase	Prevent unnecessary impacts on the surrounding environment by ensuring that contractors are aware of the requirements of the EMPr. Ensure that contractors and sub-contractors do	11.4.1. Ensure that the EMPr and the EA (should it be granted by the DEA), are included in all tender documentation and contractors and sub-contractors contracts.	▪ Check compliance with specified conditions using a report card, and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors
		11.4.2. Contractors and sub-contractors must use the ablution facilities situated in a designated area within the site; and no bathing/washing should be permitted outside the designated area.	▪ Check compliance with specified conditions using a report card, and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors

<table>
<tr><th rowspan="2">Impact</th><th rowspan="2">Mitigation/Management Objectives</th><th rowspan="2">Mitigation/Management Actions</th><th colspan="3">Monitoring</th></tr>
<tr><th>Methodology</th><th>Frequency</th><th>Responsibility</th></tr>
<tr><td rowspan="4"></td><td rowspan="4">not induce impacts on the surrounding environment as a result of unplanned pollution on site.

Ensure that actions by on-site contractors and sub-contractors and workers are properly managed in order to minimise impacts to surrounding environment</td><td>11.4.3. All litter will be deposited in a clearly labelled, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.</td><td>▪ Check compliance with specified conditions using a report card, and allocate fines when necessary.</td><td>▪ On-going</td><td>▪ ECO and Contractors</td></tr>
<tr><td>11.4.4. No person other than a qualified specialist or personnel authorised by the Project Owner, will disturb or remove plants outside the demarcated construction area.</td><td>▪ Check compliance with specified conditions using a report card, and allocate fines when necessary.</td><td>▪ On-going</td><td>▪ ECO and Contractors</td></tr>
<tr><td>11.4.5. No person other than a qualified specialist or personnel authorised by the Project Owner, will disturb animals on the site.</td><td>▪ Check compliance with specified conditions using a report card, and allocate fines when necessary.</td><td>▪ On-going</td><td>▪ ECO and Contractors</td></tr>
<tr><td>11.4.6. Educate workers on site about suitable behaviour on site and initiate environmental awareness. Staff must be informed that no trapping, snaring or feeding of any animal will be allowed.</td><td>▪ Carry out Environmental Awareness Training.
▪ Conduct audits of the signed attendance registers.</td><td>▪ Once-off training and ensure that all new staff are inducted.
▪ Monthly</td><td>▪ Contractor/ ECO
▪ ECO</td></tr>
<tr><td>11.5. Inappropriate planning and of site camp establishment.</td><td>Ensure that environmental issues are taken into consideration in the planning for site establishment.</td><td>11.5.1. All construction activities, materials, equipment and personnel must be restricted to the actual construction area specified (as required to undertake the construction work). The construction area must be demarcated by the Contractor.</td><td>▪ Monitor compliance and record non-compliance and incidents.</td><td>▪ Before construction</td><td>▪ ECO</td></tr>
</table>

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		11.5.2. The Contractor should install and maintain Construction Site Information Boards in the position, quantity, design and dimensions specified by the Project Owner.	▪ Monitor compliance and record non-compliance and incidents.	▪ Before construction	▪ ECO
		11.5.3. General building materials should be stored in appropriate designated areas on site such that there will be no runoff from these areas towards sensitive systems. The site camp must be removed after construction.	▪ Monitor compliance and record non-compliance and incidents.	▪ Before construction	▪ ECO
11.6. Increased animal road mortality.	Reduction in animal mortality	11.6.1. The construction staff should be made aware of the presence of fauna and within the proposed project area. The construction personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings, and should be trained on how to react in these situations.	▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor/ ECO ▪ ECO
		11.6.2. To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the site camp must be kept clean on a daily basis.	▪ Monitor the activities via visual inspections, and record and report any non-compliance.	▪ Daily	▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		11.6.3. Establish a monitoring programme to record the number of faunal road mortalities and collisions. If it is established that the number of collisions and faunal fatalities increase within an area, particularly with regards to smaller species (reptiles), then measures such as exclusion fences within these areas only should be installed.	▪ Appropriate monitoring and recording should be undertaken. ▪ Exclusion fences should be installed, if needed to direct animals to safe road crossings.	▪ Weekly ▪ As required	▪ ECO ▪ ECO and Contractor
11.7. Increased energy consumption during the construction phase.	Reduce energy consumption where possible.	11.7.1. Encourage the use of energy saving equipment at the site camp site (such as low voltage lights and low pressure taps) and promote recycling. Construction personnel must be made aware of energy conservation practices as part of the Environmental Awareness Training programme.	▪ Contractor to monitor energy usage via audits. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Monthly ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor ▪ Contractor/ ECO ▪ ECO
11.8. Impact on the regional water balance as a result of increased water usage.	Reduce water usage during the construction phase.	11.8.1. Water conservation should be practiced as follows: ▪ Cleaning methods utilised for cleaning vehicles, floors, etc. should aim to minimise water use (e.g. sweep before wash-down). ▪ Ensure that regular audits of water systems are conducted to identify possible water leakages. 11.8.2. Avoid the use of potable water for dust suppression during the construction phase and consider the use of	▪ Monitor via site audits and record non-compliance and incidents.	▪ Monthly	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		alternative approved sources, where possible.			
		11.8.3. Make construction personnel aware of the importance of limiting water wastage, as well as reducing water use.	▪ Carry out Environmental Awareness Training with a discussion on water usage and conservation. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor/ ECO ▪ ECO
C. OPERATIONAL PHASE					
11.9. Potential risk of fire due to behaviour of staff on site during the operational phase	Ensure appropriate and efficient fire prevention during the operational phase.	11.9.1. Designate smoking areas as well as areas for cooking, where the fire hazard could be regarded as insignificant.	▪ Random inspections during a month to ensure workers are smoking or starting fires in designated areas only.	▪ Monthly	▪ Facility Manager
		11.9.2. Educate workers on the dangers of open and/or unattended fires.	▪ Ensure fire safety requirements are well understood and respected by operational personnel. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Ongoing ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Facility Manager ▪ Facility Manager ▪ Facility Manager
		11.9.3. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the operational phase.	▪ Ensure fire safety requirements are well understood and respected by operational personnel. Provide basic fire safety training.	▪ On-going	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		11.9.4. Ensure that adequate fire-fighting equipment is available and easily accessible on site.	▪ Ensure fire safety requirements are well understood and respected by workers. ▪ Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company.	▪ On-going ▪ Bi-annually	▪ Facility Manager ▪ Project Owner
11.10. Increased energy consumption during the operational phase.	Reduce energy consumption where possible.	11.10.1. Encourage the use of energy saving equipment at the PV facility (such as low voltage lights and low pressure taps) and promote recycling. Operational personnel must be made aware of energy conservation practices as part of the environmental awareness training programme.	▪ Monitor energy usage via site investigations. ▪ Conduct training for all operational personnel.	▪ Monthly ▪ As and when required and ensure that all new staff are inducted.	▪ Facility Manager ▪ Project Owner
11.11. Impact on the regional water balance as a result of increased water usage.	Reduce water usage during operations.	11.11.1. Water conservation to be practiced in line with Energy Saving Policies as follows: ▪ Cleaning methods utilised for cleaning vehicles, floors, the offices etc. should aim to minimise water use (e.g. sweep before wash-down). ▪ Where possible, encourage the re-use of water. ▪ Ensure that regular audits of water systems are conducted to identify possible water leakages. ▪ Consider installing water saving	▪ Record water usage during the operational phase, conduct audits and record non-compliance and incidents.	▪ Monthly	▪ Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		devices (e.g. dual flush toilets, automatic shut-off taps, etc.).			
		11.11.2. Carry out environmental awareness training with a discussion on water usage and conservation, and make operational personnel aware of the importance of limiting water wastage.	▪ Conduct training for all operational personnel.	▪ As and when required during operations and ensure that all new staff are inducted.	▪ Facility Manager
11.12. Non respect of waste management practices	Minimise the production of general waste. Ensure compliance with relevant waste management legislation. Minimise pollution of the environment.	11.12.1. Control and implement waste management plans. Ensure that relevant legislative requirements are respected. 11.12.2. Determine specific areas on site for temporary management of waste.	▪ Control of waste management practices throughout operation phase.	▪ Monthly	▪ Facility Manager
		11.12.3. Promote waste reduction, re-use, and recycling opportunities on site during the operation phase. 11.12.4. Ensure an adequate and sustainable use of resources.	▪ Monitor waste generation and collection throughout operation.	▪ Monthly	▪ Facility Manager
11.13. Excessive generation of waste water on site during the operation phase	Maintain reasonable levels of waste water generation	11.13.1. Waste water must be collected and disposed of at a suitable licenced disposal facility. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Waste water generation to be monitored throughout the operational phase. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Quarterly	▪ Facility Manager
11.14. Risk of fire, explosion or release of toxic gas.	Reduce fire, explosion or release of toxic gas risk from battery storage	11.14.1. Should electrolyte solutions be stored on site, these should be stored away from incompatible materials such as all peroxides, such as hydrogen peroxide;	▪ Adhere to Materials and Safety Data Sheet (MSDS)s of the electrolytes.	▪ On-going	▪ Operations and Maintenance

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
	facility.	chemicals that react with acid to generate a gaseous product, such as carbonate and bicarbonates, sulfites and bisulfites; strong reducing agents, such as alkaline metals (Li, Na, K) and alkaline earth metals (Be Mg Ca, Sr, Ba); reactive metals such as aluminum and zinc, all hydrides (such as $LiAlH4$, $NaBH4$), and some carbides (such as $CaC2$).			Contractor
D. DECOMMISSIONING PHASE					
11.15. Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

12 SPECIFIC PROJECT RELATED ENVIRONMENTAL IMPACTS

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. DESIGN PHASE					
A.1. VISUAL IMPACTS					
12.1. Potential visual intrusion of construction activities on existing views of sensitive visual receptors.	Reduce visual intrusion of construction activities project wide.	12.1.1. Ensure plans are in place to minimise fire hazards and dust generation. 12.1.2. Ensure plans are in place to rehabilitate temporary cleared areas as soon as possible.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ During design cycle and before construction commences.	▪ Project Owner ▪ ECO
		12.1.3. Clearance of the area for the solar field should be phased in such a way that the exposed area is always at a minimum.	▪ Ensure that this is taken into consideration prior to the commencement of construction by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the design phase.	▪ Project Owner
	Reduce visual intrusion of the solar energy facility.	12.1.4. A maintenance plan for buildings and structures should be in place. 12.1.5. Colours of buildings and structures should blend in with the landscape background where this is technically feasible and where it will not negatively affect the functionality of the structures. 12.1.6. Materials, coatings and paints should be chosen based on minimal reflectivity, where possible. 12.1.7. Grouped structures should be painted in the same colour where this will not affect the	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ During design cycle and before construction commences.	▪ Project Owner and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		functionality of the structures, to reduce visual complexity and contrast. 12.1.8. Appropriate coloured materials should be used for structures to blend in with the backdrop of the project. 12.1.9. Appropriate colours for smooth surfaces often need to be two to three shades darker than the background colour to compensate for shadows that darken most textured natural surfaces.			
12.2. Potential impact of night lighting of the Solar PV Facility on the nightscape of the region.	Reduce the impact of night lighting of structures and buildings associated with the solar energy facility on the surrounding nightscape and visual receptors.	12.2.1. A lighting plan for the proposed Solar PV plant that documents the design, layout and technology used for lighting purposes should be prepared, indicating how nightscape impacts will be minimised and that also demonstrates that project lighting is effectively shielded from surrounding and adjacent properties must be prepared with the design plans of the plant. The plan should minimize light spill onto neighbouring properties and glare which can affect visual receptors in the surrounding landscape. 12.2.2. The lighting plan should also minimize contribution to light pollution (night glow) of the regional nightscape. 12.2.3. The lighting plan should include a process for promptly addressing and mitigating complaints about potential lighting impacts. 12.2.4. Lighting of the facility should not exceed, in number of lights and brightness, the minimum	▪ A lighting specialist should be contracted to design the lighting plan for the project. The plan should provide for temporary lighting during the construction and decommissioning phases of all components of the project. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ During design cycle and before construction commences. ▪ Once-off during the design phase.	▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		required for safety and security. 12.2.5. Uplighting and glare (bright light) should be minimised using appropriate screening. 12.2.6. Low-pressure sodium light sources should be used to reduce light pollution. 12.2.7. Light fixtures should not spill light beyond the project boundary. 12.2.8. Install timer switches or motion detectors (within safety requirements) to be used to control lighting in areas that are not occupied continuously.			
A.2. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.3. Impacts to archaeology and graves.	Achieve a layout that minimizes the potential later impacts to archaeological resources and/or graves.	12.3.1. Ensure that project layout avoids as many known archaeological resources as possible, in particular the LSA pan and koppie identified in close proximity to the proposed development footprint. 12.3.2. The likely grave site located in the proposed Development Envelope will require testing.	▪ Take cognizance of the archaeological sites reported in the HIA when designing facility layout. ▪ Appoint a professional archaeologist to carry out a pre-construction walk down survey. ▪ The appointed archaeologist will need to test the site to see if human remains are present. If human remains are found, then the grave should be closed up and, if it still cannot be avoided by the development, SAHRA should be consulted on the proper course of action to follow.	▪ Once-off (at least 6 months in advance of construction) ▪ Once-off (at least 6 months in advance of construction) ▪ Once-off (at least 6 months in advance of construction)	▪ Project Owner and ECO ▪ Project Owner and ECO ▪ Archaeologist

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			If no human remains are found then a simple record of the feature should be made and a testing report submitted to SAHRA for approval.		
12.4. Impacts to the natural and cultural landscape.	Reduce the degree of visual contrast in the landscape.	12.4.1. Plan to use an earth-coloured paint on the built elements of the facility.	▪ Include earth-coloured paint in the design specifications for the facility.	▪ Once-off	▪ Project Owner
A.3. SOCIAL IMPACTS					
12.5. In-migration of potential job seekers into the Kenhardt area.	Proactively manage the in-migration of potential employment seekers and in so doing mitigate impacts on existing social structures.	12.5.1. Develop and implement a Workforce Recruitment Plan. 12.5.2. Reserve employment, where practical, for local residents. 12.5.3. Clearly define and agree upon the Project Affected People (PAP). 12.5.4. Develop a database of PAP and their relevant skills and experience. 12.5.5. Develop and implement a Stakeholder Engagement Plan.	▪ Mitigation measures (12.5.1); (12.5.4) and (12.5.5) requires the drafting of a document which would in each instance serve as the method through which the mitigation actions are monitored. ▪ Mitigation measures (12.5.2) and (12.5.3) requires clear statements regarding for whom work would be reserved (i.e. mitigation measure (12.5.2)) and who the PAP is (i.e. mitigation measure (12.5.3)).	▪ Once-off during the design phase.	▪ Project Owner
12.6. Economic Development Plan.	Draft an Economic Development Plan to align local investment with bona fide local needs.	12.6.1. The Economic Development Plan should adhere to all requirements of the relevant RFP at that time of implementation.	▪ The drafting of the EDP would serve as the method through which the mitigation action is monitored.	▪ Once-off during the design phase.	▪ Project Owner

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<tr><th rowspan="2">Impact</th><th rowspan="2">Mitigation/Management Objectives</th><th rowspan="2">Mitigation/Management Actions</th><th colspan="3">Monitoring</th></tr>
<tr><th>Methodology</th><th>Frequency</th><th>Responsibility</th></tr>
<tr><td colspan="6">A.4. ELECTROMAGNETIC AND RADIO FREQUENCY INTERFERENCE</td></tr>
<tr><td>12.7. Impact on the nearest and surrounding Square Kilometer Array (SKA) telescopes and the overall SKA project.</td><td>To reduce the impact of the proposed PV project on the SKA.

The mitigation required should include an allowance of 8dB for cumulative impact of adjacent sites totaling less than 35dB.</td><td>12.7.1. On-site measurement of the operational plant is proposed as a requirement. If such measurements find additional emission reductions to be necessary, measures such as additional shielding and EMC filters should, among others, be considered.
12.7.2. The inverter units, transformers, communication and control units for an array of panels should all be housed in a single shielded environment. For shielding of such an environment it must be ensured that:
▪ Radio Frequency Interference (RFI) gasketting is placed on all the seams and doors.
▪ RFI Honeycomb filtering should be placed on all ventilation openings.
12.7.3. It is important to ensure that the cables are laid directly in the soil or properly grounded cable trays (not plastic sleeves).
12.7.4. The use of bare copper directly in the soil for earthing is recommended to shunt Common Mode (CM) interference currents to ground.
12.7.5. In the case of a tracking PV plant design, care will need to be taken to shield the noise associated with the relays, contactors and hydraulic pumps/motors of the tracking units.
12.7.6. Data communications to and from the plants</td><td>▪ Ensure that the requirements and mitigation practices are incorporated into the design of the proposed PV plant during the planning and design phase by reviewing signed minutes of meetings or signed reports.</td><td>▪ Once-off during the design phase.</td><td>▪ Project Owner</td></tr>
</table>

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		should be via fibre optic.			
A.5. IMPACT ON SURFACE WATER RESOURCES					
12.8. Impact on surface water resources.	To reduce the impact of the proposed PV project on the surrounding drainage lines.	12.8.1. Ensure that the Department of Water and Sanitation are consulted with to confirm the need and requirements of a Water Use Licence, as noted in the Ecological Impact Assessment.	▪ Ensure that the requirements of the Department of Water and Sanitation are considered during the planning and design phase. ▪ Ensure that the Water Use Licence is submitted and approved prior to the commencement of construction, based on the requirements of the Department of Water and Sanitation.	▪ Once-off during the design phase.	▪ Project Owner
B. CONSTRUCTION PHASE					
B.1. ECOLOGICAL IMPACTS (TERRESTRIAL, AQUATIC)					
12.9. Changes in edaphics (soils) on account of excavation and import of soils, resulting in changes in soil state, compaction, and alteration of plant communities and fossorial species in and around these	Avoidance of undue disturbance to soils.	12.9.1. Ripping of compact soils to be considered according to site specifics and impact.	▪ If deemed applicable, monitor the manual or machine driven ripping of compact soils.	▪ Intermittent and upon identification of excess compaction or option of ripping is considered necessary (i.e. when and where extensive compaction arises).	▪ Contractor and Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
points etc.					
12.10. Abstraction from sub surface aquifers may have a significant impact on plant water relations.	To reduce excessive abstraction of sub surface waters and impacts on groundwater.	12.10.1. Identify yield and water quality levels in borehole prior to establishment (that is if borehole water will be used). 12.10.2. Identify limitations on rate and level of abstraction. 12.10.3. Identify alternative water sources (such as municipal supply).	▪ Ensure borehole is registered with imposed limits on abstraction. ▪ Undertake blow test on boreholes (if required). ▪ Undertake water quality analysis. ▪ Install flow meter during construction period and beyond (if borehole water will be used). ▪ Ensure that Municipal or alternate Supply is arranged prior to the commencement of the construction phase.	▪ Prior to construction	▪ Project Owner
12.11. Alteration of surface water quality leading to changes in water chemistry.	To manage construction activities that may impact on surface and subsurface water quality.	12.11.1. Avoidance of significant earthworks with concomitant risk of increasing silt mobility. 12.11.2. Conduct judicious excavation and clearance. 12.11.3. Undertake stabilisation of disturbed soils. 12.11.4. Implement the use of surface flow attenuators or energy dissipaters (if required). 12.11.5. Management of potential liquid material that may be classified as hazardous. 12.11.6. Management of hazardous waste. 12.11.7. Avoid significant sculpting of land and maintenance of the general topography of site.	▪ Undertake site and visual inspections and reporting any non-compliance. ▪ Containment of hazardous waste and hazardous materials.	▪ Ongoing	▪ Contractors, Project Owner and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
12.12. Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure.	Limit alteration of surface drainage, leading to changes in plant communities and general habitat structure, patters due to construction activities.	12.12.1. Avoidance of major drainage features during construction. The proposed project footprint must be demarcated to reduce unnecessary disturbance beyond the proposed project area. Demarcate as no-go areas. 12.12.2. Undertaking and completion of earthworks and road construction outside of the high rainfall period (if possible). 12.12.3. Avoidance of significant sculpting of land and maintenance of the general topography of the site. 12.12.4. Maintenance of a high level of housekeeping on site during the construction phase. 12.12.5. Inspection of drainage features immediately outside of the footprint of the proposed PV facility and undertake removal of solid waste and litter on a regular basis.	▪ Carry out visual inspections to ensure strict control over the behaviour of staff in order to restrict activities to within demarcated areas. ▪ Monitor the construction period to verify if this is being undertaken (where possible). ▪ Carry out visual inspections to ensure minimal impact on soils and erosion. ▪ Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. ▪ Monitor the condition of drainage features immediately outside of the footprint of the PV plant and the condition of the construction area throughout the construction phase via visual site inspections. Record non-compliance and incidents.	▪ Ongoing ▪ Ongoing ▪ Ongoing ▪ Ongoing ▪ Ongoing	▪ ECO ▪ Contractor, Project Owner and ECO ▪ Contractor, Project Owner and ECO ▪ ECO ▪ Contractor, Project Owner and ECO
B.2. VISUAL IMPACTS					
12.13. Potential visual intrusion of construction activities on	Prevent unnecessary visual clutter and focusing attention of surrounding visual receptors on the	12.13.1. Preparation of the solar field area (i.e. clearance of vegetation, grading, contouring and compacting) and solar field construction should be phased in a way that makes	▪ Ensure that this is taken into consideration prior to the commencement of construction.	▪ Once-off during the construction phase. ▪ Weekly	▪ Project Owner and Contractor ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
existing views of sensitive visual receptors.	proposed development.	practical sense in order to minimise the area of soil exposed and the shortest duration of exposure.	▪ Conduct site inspections to monitor the phasing of construction to verify unnecessary soil disturbance and clearing and report any non-compliance.		
		12.13.2. Parking areas should be demarcated and strictly controlled so that vehicles are limited to specific areas only.	▪ Carry out visual inspections to ensure the construction area and parking area is demarcated clearly, and record and report any non-compliance. ▪ Carry out visual inspections to ensure strict control over the parking of construction vehicles and access routes in order to restrict activities to within demarcated areas.	▪ Weekly ▪ Weekly	▪ ECO ▪ ECO
		12.13.3. Night time construction should be avoided where possible.	▪ Construction operation times to be monitored and managed (as well as included in the tender contract).	▪ Weekly	▪ ECO
		12.13.4. Night lighting of the construction sites should be minimised within requirements of safety and efficiency.	▪ Complaints about night lights should be investigated and documented in a register.	▪ As complaints arise	▪ Contractor and ECO
	Reduce the visual impact of construction activities project wide	12.13.5. Maintain good housekeeping on site to avoid litter and minimize waste. 12.13.6. Monitor construction sites for strict adherence to demarcated boundaries.	▪ Carry out site visits and inspections of the construction sites and ensure good housekeeping is maintained. Record and report any non-	▪ Daily ▪ Daily ▪ Daily and as	▪ Construction Manager and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		12.13.7. Monitor adherence to lighting plan. 12.13.8. Monitor adherence to rehabilitation plan. 12.13.9. Monitor adherence to erosion control plan. 12.13.10. Monitor adherence to dust and fire control plans.	compliance. ▪ Carry out site visits and record and report any non-compliance. ▪ Complaints about night lights should be investigated and documented in a register. Investigate any complaints about night lights and document it in a register. ▪ Visit sites requiring rehabilitation. ▪ Carry out site visits and record and report any non-compliance. ▪ Carry out site visits and record and report any non-compliance.	complaints arise. ▪ Daily ▪ Daily ▪ Daily	
B.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.14. Construction vehicles and activities could result in damage to or destruction of archaeological sites and/or graves.	Minimise the chances of significant archaeological sites and/or graves being disturbed.	12.14.1. Ensure that all heritage resources requiring mitigation are mitigated (such as cordoning off and protecting the EAS-MSA-LSA pan) prior to the start of construction. 12.14.2. Ensure that no activity takes place outside of the authorized construction footprint.	▪ Carry out visual inspections to ensure strict control over the behaviour of construction staff in order to restrict activities to within demarcated areas.	▪ Weekly ▪ Once-off (at least 6 months in advance of construction)	▪ ECO ▪ Archaeologist
		12.14.3. The Contractor and ECO must be informed of the possibility of any heritage material (i.e. ensure that all personnel are aware of the potential of encountering graves and what to do if this occurs (i.e. to report any suspicious	▪ Carry out Environmental Awareness Training to ensure that the Contractors are informed of the possible type of heritage features that may be	▪ Once-off training and ensure that all new staff are inducted.	▪ Contractor/ ECO ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		stone features prior to disturbance)). 12.14.4. Alternatively commission an archaeologist to examine the final development footprint at least six months prior to the commencement of construction.	encountered during the construction phase. ▪ Conduct audits of the signed attendance registers. ▪ Appoint a professional archaeologist to examine the construction footprint. ▪ Conduct an audit to verify that the necessary permits are obtained by the archaeologist, if required.	▪ Monthly ▪ Once-off six months prior to construction. ▪ As required/ necessary during the construction phase.	
		12.14.5. If archaeological sites and potential graves cannot be avoided, the buffers as stipulated in the HIA should be implemented during the construction phase.	▪ Carry out visual inspections to ensure strict control over the behaviour of construction staff in order to restrict activities to within demarcated areas and outside of the buffer area.	▪ Weekly	▪ ECO
		12.14.6. The likely grave site located in the proposed Development Envelope will require testing. 12.14.7. If any of the graves or potential graves found on site cannot be avoided then an archaeologist should be contracted to conduct a test excavation to determine the status of the feature. If it is determined to be a grave, then exhumation would need to occur (if necessary) with the permission of SAHRA (and in accordance with any requirements that	▪ Appoint an archaeologist to test the site to see if human remains are present. If human remains are found, then the grave should be closed up and, if it still cannot be avoided by the development, SAHRA should be consulted on the proper course of action to follow. If no human remains are found then a simple record of the feature should be made and a	▪ As potential graves are encountered	▪ Project Owner and Archaeologist

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		SAHRA might impose at the time).	testing report submitted to SAHRA for approval. ▪ Conduct an audit to verify that the necessary permits are obtained by the archaeologist for the test excavation, if required.		
		12.14.8. If any concentrations of archaeological material, graves or stone features are uncovered during the proposed construction, work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution. Sufficient time should be allowed to remove/collect such material.	▪ Monitor excavations and construction activities for archaeological materials via visual inspections and report the finds accordingly. ▪ Contact the heritage authorities and the identified archaeologist if any heritage features are uncovered.	▪ Daily or during excavations. ▪ As required/ necessary during the construction phase.	▪ Contractor and ECO ▪ Project Owner
12.15. Alteration of the landscape from rural to industrial in nature.	Reduce visual contrast of the development in the landscape.	12.15.1. Minimise surface footprint and the amount of white structures visible.	▪ Monitor the paint colour via visual inspections and report non-compliance.	▪ Once-off, at an appropriate time during construction period.	▪ ECO
B.4. PALAEONTOLOGICAL HERITAGE IMPACTS					
12.16. Loss of legally-protected palaeontological heritage resources at or beneath	Reporting, conservation, recording and judicious sampling of scientifically important fossil material exposed during the	12.16.1. Reporting chance fossil finds to SAHRA for possible professional mitigation.	▪ Monitoring of all substantial excavations into sedimentary bedrocks for fossil material (e.g. vertebrate bones & teeth, fossilized wood, shells)	▪ Throughout the construction phase ▪ Throughout the construction phase	▪ ECO ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
ground surface within development footprint (fossils, fossil sites and contextual geological data).	construction phase of development (The paleontological sensitivity of the site is reported as Very Low in the Palaeontological Study).		▪ Safeguarding of chance fossil finds, preferably in situ.		
		12.16.2. Recording and sampling of fossil material and associated geological data (only necessary for chance fossil finds made during the proposed development).	▪ Application by a qualified palaeontologist for fossil collection permit from SAHRA. ▪ Palaeontologist to undertake field study of fossil finds in situ on site. Photography and sampling of important finds. ▪ Curation of fossils collected in an approved repository (museum/ university collection).	▪ Following alert of chance fossil finds on site (It is important to note that there is no need for on-site palaeontological monitoring unless new fossil finds are made during development).	▪ Qualified palaeontologist appointed and commissioned by the Project Owner. ▪ Qualified palaeontologist appointed and commissioned by the Project Owner ▪ Qualified palaeontologist appointed and commissioned by the Project Owner
B.5. SOILS AND AGRICULTURAL POTENTIAL IMPACTS					
12.17. Degradation of veld vegetation beyond the direct footprint of the proposed PV facility due to constructional disturbance and	To conserve the surrounding natural veld vegetation.	12.17.1. Minimize footprint of disturbance during the construction phase and ensure that construction work is undertaken within the demarcated area only. 12.17.2. Confine vehicle access on roads only. 12.17.3. Control dust generation during construction activities by implementing standard	▪ Monitor the construction activities via site audits to ensure that they are undertaken within the demarcated construction area, and record non-compliance and incidents. ▪ Include periodic site inspection in environmental performance	▪ Daily ▪ Monthly during the construction phase ▪ Monthly and during complaints/incidents	▪ Contractor and ECO ▪ ECO ▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
potential trampling by vehicles.		construction site dust control measures (dampening with water) where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem.	reporting that specifically records occurrence or not of off-road vehicle tracks surrounding the site. Monitor via site audits and record non-compliance and incidents. ▪ Monitor dust suppression mechanisms via visual inspections and record non-compliances. Maintain an incidents/ complaints register. The date, time, nature of complaint, name of complainant and corrective actions must be logged for all complaints. Complaints must be investigated and, if appropriate, acted upon.		
12.18. Loss of topsoil due to poor topsoil management.	Ensure effective topsoil covering to conserve soil fertility on all disturbed areas, after they have been rehabilitated.	12.18.1. Strip and stockpile topsoil from all areas where soil (below surface) will be disturbed. 12.18.2. After cessation of disturbance, re-spread topsoil over the surface. 12.18.3. Dispose of any sub-surface spoils from excavations where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.	▪ Establish an effective record keeping system for each area where soil is disturbed for construction purposes. These records should be included in environmental performance reports, and should include all the records below: ○ Record the GPS coordinates of each area. ○ Record the date of topsoil stripping. ○ Record the GPS coordinates of where the topsoil is stockpiled.	▪ As needed, dependent on the specifics of construction activities.	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			○ Record the date of cessation of construction activities at the particular site. ○ Photograph the area on cessation of construction activities. ○ Record date and depth of re-spreading of topsoil. ○ Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.		
12.19. Soil erosion due to alteration of the land surface characteristics.	To reduce erosion on site and downstream of the site as a result of run-off from the site, or due to wind erosion.	12.19.1. Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	▪ Include periodic site inspection in environmental performance reporting that inspects the effectiveness and integrity of the run-off control system and specifically records the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Monthly during the construction phase.	▪ ECO
B.6. SOCIAL IMPACTS					
12.20. Influx of job seekers into the Kenhardt area.	Control influx of job seekers into the Kenhardt area with the aim of protecting local	12.20.1. Implement the Workforce Recruitment Plan. 12.20.2. Ensure employment is reserved, where practical, for local residents.	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with	▪ Three times during the estimated 14 month construction period (i.e. at 3	▪ Construction Manager and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
	social structures.	12.20.3. Actively use the database of PAP and their relevant skills and experience to guide local employment. 12.20.4. Implement the Stakeholder Engagement Plan.	current recruitment practices, as well as cross-referencing employed personnel with PAP database; ▪ Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	months, 6 months, and 9 months).	
12.21. Outsiders move into the Kenhardt area.	Limit incidences of social deviance in the Kenhardt area.	12.21.1. Implement the Workforce Recruitment Plan. 12.21.2. Ensure employment is reserved, where practical, for local residents. 12.21.3. Actively use the database of PAP and their relevant skills and experience to guide local employment. 12.21.4. Implement the Stakeholder Engagement Plan	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database; ▪ Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	▪ Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	▪ Construction Manager and ECO
12.22. Expectations created regarding possible employment.	Prevent frustration resulting from miscommunication of employment opportunities and project-related benefits in the local community.	12.22.1. Implement the Stakeholder Engagement Plan	▪ Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	▪ Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	▪ Construction Manager and ECO
12.23. Local	Ensure the generation of	12.23.1. Procure goods and services, where practical,	▪ Verify purchase of local goods	▪ Three times during	▪ Construction

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
spending.	socio-economic benefits as a result of the multiplier effect.	within the study area 12.23.2. Obtain regularly required goods and services from as large a selection of local service providers as possible	and services through proof of purchase.	the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	Manager and ECO
12.24. Local employment.	Ensure optimum employment creation while taking cognizance of the local levels of experience and education.	12.24.1. Implement the Workforce Recruitment Plan	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database.	▪ Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	▪ Construction Manager and ECO
12.25. Economic Development Plan.	Ensure contribution to local employment, local spending and human capacity development is being made.	12.25.1. Implement the Economic Development Plan	▪ Verify that the Economic development Plan is being implemented.	▪ Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	▪ Construction Manager and ECO
B.7. GEOHYDROLOGY IMPACTS					
12.26. Potential impact on groundwater as a result of the construction of storage yards and temporary labour accommodation	To prevent unnecessary infiltration of polluted surface water	12.26.1. Waste water from labour accommodation site camps or yards must be collected in a designated container and disposed of at a suitable disposal point off site (i.e. a licenced waste disposal facility). A suitable waste contractor must be appointed to collect waste from site on a regular basis for correct disposal. Proof of disposal (waybills or waste	▪ Monitor the placement of structures, storage yards, accommodation camps and infrastructure during the construction phase to ensure existing wind pumps / boreholes are not damaged.	▪ Once off prior to the commencement of construction. ▪ Weekly ▪ Four times per annum for the construction period,	▪ Project Owner ▪ Project Owner and ECO ▪ Project Owner and ECO ▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
camps (i.e. wastewater from construction activities disposed of on the site leading to environmental impacts (e.g. groundwater pollution)).		disposal slips) must be retained and kept on file for auditing purposes. 12.26.2. Other non-hazardous solid waste (e.g. refuse) to be disposed of at a licensed landfill. A suitable waste contractor must be appointed to collect waste from site on a regular basis for correct disposal. Proof of disposal (waybills or waste disposal slips) must be retained and kept on file for auditing purposes. 12.26.3. Avoid using old or damaged construction equipment and vehicles and ensure that they are well maintained and regularly serviced in order to ensure no leakages. 12.26.4. Any engines that stand in one place must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and construction vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the construction site camp for refuelling activities and drip trays or similar impervious materials must be used during these procedures. Vehicle and washing areas must also be on paved surfaces and the by-products correctly managed.	▪ Waste removal and disposal to be monitored. Monitor via site audits and record non-compliance and incidents. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents. ▪ Construction vehicles need to be monitored throughout the construction phase. Monitor via site audits and record non-compliance and incidents. ▪ Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report non-compliance.	i.e. at 3 months, 6 months, 9 months and 12 months. ▪ Weekly	and ECO
12.27. Potential impact on groundwater as a result of stormwater	To prevent unnecessary infiltration of polluted storm water	12.27.1. Ensure the storm water runoff is not contaminated. All reasonable measures must be taken to prevent the contamination of storm water outflows.	▪ Monitor the quality of the storm water ▪ ECO to verify that measures are in place to reduce the contamination of storm water	▪ If possible do this during or shortly after a storm event, at the start of the rain season.	▪ Project Owner and ECO. ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
outflows.			and to monitor the quality of storm water by undertaking site visits and visual inspections.	▪ Weekly	
12.28. Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.	To reduce the potential of groundwater pollution.	12.28.1. Avoid using old or damaged construction equipment and vehicles and ensure that they are well maintained and regularly serviced in order to ensure no leakages. 12.28.2. Any engines that stand in one place for an excessive length of time, must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and construction vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the construction site camp for refuelling activities and drip trays or similar impervious materials must be used during these procedures. If liquid product is being transported it must be ensured this does not spill during transit. 12.28.3. If spillages occur during refuelling, they should be contained and removed as rapidly as possible, with correct disposal of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes. During the operational phase, the same principles should be adhered to. Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.	▪ Construction vehicles need to be monitored throughout the construction phase. Monitor via site audits and record non-compliance and incidents. ▪ Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report non-compliance. ▪ Monitor the refuelling/ servicing process and record the occurrence of any spillages.	▪ Four times per annum for the construction period, i.e. at 3 months, 6 months, 9 months and 12 months. ▪ Weekly ▪ Weekly	▪ Project Owner and ECO ▪ Project Owner and ECO ▪ Project Owner and ECO

<table>
<tr><th rowspan="2">Impact</th><th rowspan="2">Mitigation/Management Objectives</th><th rowspan="2">Mitigation/Management Actions</th><th colspan="3">Monitoring</th></tr>
<tr><th>Methodology</th><th>Frequency</th><th>Responsibility</th></tr>
<tr><td colspan="6">B.8. WASTE MANAGEMENT</td></tr>
<tr><td rowspan="2">12.29. Pollution of the surrounding environment (including drainage lines) as a result of the handling, temporary stockpiling and disposal of general waste.</td><td rowspan="2">Reduce environmental impacts such as soil, surface water and groundwater contamination as a result of incorrect storage, handling and disposal of general waste.

Minimise the production of waste.

Prevent environmental problems (e.g. pollution / change in soil pH) due to solid and liquid wastes disposed of on the site.

Ensure compliance with waste management legislation.</td><td>12.29.1. General waste (i.e. construction waste, building rubble, discarded concrete, bricks, tiles, wood, glass, window panes, air conditioners, plastic, metal, excavated material, packaging material, paper and domestic waste etc.) generated during the construction phase should be stockpiled temporarily (i.e. once-off) on site in a designated area within suitable waste collection bins and skips (or similar). Waste collection bins and skips should be covered with suitable material, where appropriate.</td><td>▪ Monitor the strategic placement of the temporary, designated waste stockpiling area at the site camp via visual inspections, and record and report any non-compliance.
▪ Monitor the temporary storage and handling of general waste on site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area).</td><td>▪ Once-off prior to the commencement of the construction phase and as required as the construction phase process evolves.
▪ Daily</td><td>▪ ECO and Contractor
▪ ECO</td></tr>
<tr><td>12.29.2. Should the on-site stockpiling of general waste exceed 100 m^3 and a period of 90 days, then the National Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) must be adhered to.</td><td>▪ Record the amount of general waste that is temporarily stockpiled at the designated area on site, as well as the duration and record non-compliance and incidents.
▪ Monitor the duration and amounts of general waste that is temporarily stockpiled at the designated area on site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area).
▪ Audit compliance with the Norms</td><td>▪ Daily
▪ Weekly
▪ Monthly</td><td>▪ Contractor
▪ ECO
▪ Project Owner</td></tr>
</table>

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) if the storage amounts are exceeded (i.e. only if required).		
		12.29.3. Ensure that the designated stockpiling area for general waste (i.e. skips and waste collection bins) is inspected on a daily basis to verify its condition and integrity, particularly after rainfall events.	▪ Monitor the temporary, designated waste stockpiling area at the site camp, as well as the handling of general waste on site via site audits and record non-compliance and incidents.	▪ Daily	▪ ECO
		12.29.4. Ensure that general waste generated during the construction phase is removed from the site on a regular basis, and safely disposed of at an appropriate, licensed waste disposal facility by an approved waste management Contractor. Waste disposal slips or waybills should be kept on file as proof of disposal. As a general principle, waste manifests must be obtained to prove legal disposal of waste.	▪ Ensure that a suitable Waste Management Contractor is appointed to remove and dispose the general waste at an appropriate, licensed waste disposal facility. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Once-off prior to the construction phase. ▪ Weekly	▪ Project Owner / Contractor ▪ ECO
		12.29.5. Ensure that the construction site is kept clean at all times and that construction personnel are made aware of correct waste disposal methods. Littering must be prevented through effective site camp management.	▪ Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed	▪ Daily ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ ECO and Contractor ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			attendance registers.		
		12.29.6. Sufficient general waste disposal bins must also be provided for use by construction personnel throughout the site. These bins must be emptied on a regular basis.	▪ Monitor general waste generation by construction staff and collection via audits throughout the construction phase.	▪ Daily or Weekly	▪ ECO and Contractor.
		12.29.7. Ensure that all general waste emanating from the construction phase is removed from site prior to the commencement of the rehabilitation and operational phases.	▪ Undertake a final inspection at the end of the construction phase in order to verify and ensure that all general waste is removed from site and correctly disposed, prior to the commencement of the rehabilitation and operational phases.	▪ At the end of the construction phase.	▪ ECO and Contractor.
		12.29.8. Promote waste reduction, re-use, and recycling opportunities on site during the construction phase.	▪ Monitor waste generation and collection throughout construction. ▪ Investigate if any, complaints have been expressed by the surrounding community regarding waste handling.	▪ Weekly or bi-weekly	▪ ECO and Contractor
		12.29.9. Ensure an adequate and sustainable use of resources.	▪ Monitor waste generation and collection throughout construction.	▪ Weekly or bi-weekly	▪ ECO and Contractor
		12.29.10. Control and implement waste management plans provided by contractors. Ensure that relevant legislative requirements	▪ Control of waste management practices throughout construction phase	▪ Weekly or bi-weekly	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		are respected.			
12.30. Pollution of the surrounding environment as a result of the handling, temporary stockpiling and disposal of hazardous waste.	Reduce environmental impacts such as soil, surface water and groundwater contamination as a result of incorrect storage, handling and disposal of hazardous waste.	12.30.1. Hazardous waste (i.e. empty tins, oils, fuel spillages, spilled materials and chemicals etc.) generated during the construction phase should be stockpiled temporarily (i.e. once-off) on site in a designated area in suitable waste collection bins and leak-proof storage skips (or similar). Waste collection bins and skips should be covered with suitable material, where appropriate. Hazardous waste must be stored separately from all other general waste. The designated stockpiling area must be labelled correctly.	▪ Monitor the strategic placement of the temporary, designated waste stockpiling area at the site camp via visual inspections, and record and report any non-compliance. ▪ Monitor the temporary storage and handling of hazardous waste on site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area).	▪ Once-off prior to the commencement of the construction phase and as required as the construction process evolves. ▪ Daily	▪ ECO and Contractor ▪ ECO
		12.30.2. Should the on-site stockpiling of hazardous waste exceed 80 m^3, then the National Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) must be adhered to.	▪ Record the amount of hazardous waste that is temporarily stockpiled at the designated area on site, as well as the duration and record non-compliance and incidents. ▪ Monitor the duration and amounts of hazardous waste that is temporarily stockpiled at the designated area on site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area). ▪ Audit compliance with the Norms	▪ Daily ▪ Weekly ▪ Monthly	▪ Contractor ▪ ECO ▪ Project Owner

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) if the storage amounts are exceeded (i.e. only if required).		
		12.30.3. Ensure that the designated stockpiling area for hazardous waste (i.e. leak proof skips and waste collection bins) is inspected on a daily basis to verify its condition and integrity, particularly after rainfall events.	▪ Monitor the temporary, designated waste stockpiling area at the site camp, as well as the handling of hazardous waste on site via site audits and record non-compliance and incidents.	▪ Daily	▪ ECO
		12.30.4. Ensure that all hazardous waste is removed from the site on a regular basis, and safely disposed at an appropriate, licensed hazardous waste disposal facility by an approved waste management Contractor.	▪ Ensure that a suitable Waste Management Contractor is appointed to remove and dispose the hazardous waste at an appropriate, licensed hazardous waste disposal facility. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Once-off prior to the construction phase. ▪ Weekly	▪ Contractor ▪ ECO
		12.30.5. Ensure that the construction site is kept clean at all times and that construction personnel are made aware of correct waste disposal methods. Littering must be prevented through effective site camp management.	▪ Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed	▪ Daily ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ ECO and Contractor ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			attendance registers.		
		12.30.6. Ensure that all hazardous waste emanating from the construction phase is removed from site prior to the commencement of the rehabilitation and operational phases.	▪ Undertake a final inspection at the end of the construction phase in order to verify and ensure that all general waste is removed from site and correctly disposed, prior to the commencement of the rehabilitation and operational phases.	▪ At the end of the construction phase.	▪ ECO and Contractor.
		12.30.7. All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means.	▪ Waste removal and disposal to be monitored throughout construction	▪ Weekly or bi-weekly	▪ ECO and Contractor
		12.30.8. Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages.	▪ Waste removal and disposal to be monitored throughout construction	▪ Weekly or bi-weekly	▪ ECO and Contractor
		12.30.9. Waste water from construction and painting activities must be collected in a designated container and disposed of at a suitable disposal point off site.	▪ Waste removal and disposal to be monitored throughout construction	▪ Weekly or bi-weekly	▪ ECO and Contractor
		12.30.10. Control and implement waste management plans provided by contractors. Ensure that relevant legislative requirements are respected.	▪ Control of waste management practices throughout construction phase.	▪ Weekly or bi-weekly	▪ ECO and Contractor
C. OPERATIONAL PHASE					

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
C.1. ECOLOGICAL IMPACTS (TERRESTRIAL, AQUATIC)					
12.31. Erosion control measures. The impact of wind and water erosion results in loss of surface soils and degradation of land.	To mitigate and manage the site to prevent any soil loss arising from wind and water.	12.31.1. Where appropriate and within the general drainage of the site, attenuators (or similar) should serve to reduce flow energy, while the maintenance of general vegetation cover to avoid excessive aeolian impacts should be implemented.	▪ Monitor the erosion on site during operations, as well as the implementation and effectiveness of erosion control on site (such as the use of gabions and geofabric materials or similar) at appropriate points.	▪ Ongoing and as required	▪ Project Owner and Environmental Manager/ECO
12.32. Alteration of the state of subsurface water resources due to excessive abstraction of groundwater for the cleaning of the PV panels, as well as for operational use.	To reduce excessive abstraction of sub surface waters and impacts on groundwater.	12.32.1. Identify alternative water sources, such as municipal supply. 12.32.2. Preferential use of recycled water sources for operational phase requirements (instead of groundwater). 12.32.3. Ensure the prudent use of surface water resources. 12.32.4. Adopt “dry” cleaning methods, such as dusting and sweeping the site before washing down. 12.32.5. Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol. 12.32.6. Low level and ongoing cleaning of PV panels over time to reduce demand on aquifers.	▪ Ensure that Municipal Supply or alternate supply is arranged prior to the commencement of the operational phase. ▪ Monitor via site audits and record non-compliance and incidents.	▪ During the operational phase.	▪ Project Owner and ECO
C.2. VISUAL IMPACTS					

<table>
<tr><th rowspan="2">Impact</th><th rowspan="2">Mitigation/Management Objectives</th><th rowspan="2">Mitigation/Management Actions</th><th colspan="3">Monitoring</th></tr>
<tr><th>Methodology</th><th>Frequency</th><th>Responsibility</th></tr>
<tr><td rowspan="2">12.33. Potential visual intrusion of the proposed Solar Energy Facility on the views of sensitive visual receptors.</td><td rowspan="2">Reduce visual intrusion of the solar energy facility on the views of sensitive visual receptors as well as its impact on the surrounding landscape</td><td>12.33.1. Monitor effectiveness of the rehabilitation plan for temporarily cleared areas and erosion scarring.
12.33.2. Monitor building and façade maintenance. Painted features should be maintained and repainted when colour fades or paint flakes.</td><td>▪ Carry out visual inspections during site audits to verify the effectiveness of the rehabilitation, and record and report any non-compliance.
▪ Carry out an inspection of solar energy facility to ensure that it is being maintained in a good condition.</td><td>▪ Monthly
▪ Annually</td><td>▪ Project Owner and Environmental Manager/ECO
▪ Project Owner and Environmental Manager/ECO</td></tr>
<tr><td>12.33.3. Maintain re-vegetated surfaces until a self-sustaining stand of vegetation is established and visually adapted to the undisturbed surrounding vegetation. No new disturbance should be created during operations without approval from the Environmental Manager.
12.33.4. Restoration of disturbed land should commence as soon after disturbance as possible.
12.33.5. Road maintenance activities should avoid damaging or disturbing vegetation.
12.33.6. Dust and noxious weed control should be part of maintenance activities.</td><td>▪ Carry out visual inspections during site audits to verify the effectiveness of the rehabilitation and the progress of rehabilitation, and record and report any non-compliance.
▪ Ensure that all vegetation removal outside of the project footprint is approved by the Environmental Manager.
▪ Monitor the road maintenance process to ensure limited damage to vegetation. Record and report any non-compliance.
▪ Monitor the presence of alien vegetation on site.
▪ Monitor dust suppression mechanisms and record non-compliances. Maintain an incidents/ complaints register, in</td><td>▪ Weekly during the rehabilitation phase
▪ Throughout the operational phase
▪ During road maintenance activities.
▪ Throughout the operational phase
▪ During complaints/ incidents</td><td>▪ Environmental Manager/ECO
▪ Environmental Manager/ECO
▪ Environmental Manager/ECO
▪ Environmental Manager/ECO
▪ Environmental Manager/ECO</td></tr>
</table>

Impact	**Mitigation/Management Objectives**	**Mitigation/Management Actions**	**Monitoring**		
			Methodology	***Frequency***	***Responsibility***
			which any complaints from the public must be logged. The date, time, nature of complaint, name of complainant and corrective actions must be logged for all complaints. Complaints must be investigated and, if appropriate, acted upon.		
12.34. Potential impact of night lighting of the proposed Solar Energy Facility on the nightscape of the region.	Reduce the impact of night lighting of the proposed PV facility on the surrounding nightscape and sensitive visual receptors.	12.34.1. Monitor the effectiveness of the lighting plan to minimize light spill and glare.	▪ Visit surrounding neighbouring farmsteads and ensure that residents in the surrounding landscape are not affected by glaring lights from the plant. ▪ Complaints about night lights should be investigated and documented in a register. Investigate any complaints about night lights and document it in a register.	▪ Once off at the end of the construction phase or the start of the operational Phase. ▪ As complaints arise.	▪ Project Owner and Environmental Manager/ECO ▪ Project Owner and Environmental Manager/ECO
		12.34.2. Lights should be switched off when not in use whenever it is in line with safety and security.	▪ Carry out visual inspections during site audits to monitor lighting, and record and report any non-compliance.	▪ Weekly	▪ Project Owner and Environmental Manager
C.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.35. Maintenance vehicles and activities could	Minimise the chances of significant archaeological sites and/or graves being	12.35.1. Ensure that no activity takes place outside of the authorized operational footprint.	▪ Carry out visual inspections to ensure strict control over the behaviour of operational staff in	▪ Weekly	▪ Environmental Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
result in damage to or destruction of archaeological sites and/or graves.	disturbed.		order to restrict activities to within demarcated areas.		
C.4. SOILS AND AGRICULTURAL POTENTIAL IMPACTS					
12.36. Soil erosion due to alteration of the land surface characteristics	To reduce erosion on site and downstream of the site as a result of run-off from the site, or due to wind erosion.	12.36.1. Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	▪ Include periodic site inspection in environmental performance reporting that inspects the effectiveness and integrity of the run-off control system and specifically records the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Quarterly during the Operational Phase.	▪ Environmental Manager/ECO
C.5. SOCIAL IMPACTS					
12.37. Influx of job seekers into the Kenhardt area.	Control influx of job seekers into the Kenhardt area with the aim of protecting local social structures.	12.37.1. Implement the Workforce Recruitment Plan. 12.37.2. Ensure employment is reserved, where practical, for local residents. 12.37.3. Actively use the database of PAP and their relevant skills and experience to guide local employment. 12.37.4. Implement the Stakeholder Engagement Plan.	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database. ▪ Verify that Stakeholder Engagement Plan is being implemented with written proof	▪ Once a year during the operational phase.	▪ Environmental Manager/ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			of such engagement with the PAP.		
12.38. Outsiders moves into the Kenhardt area.	Limit incidences of in social deviance in the Kenhardt area.	12.38.1. Implement the Workforce Recruitment Plan. 12.38.2. Ensure employment is reserved, where practical, for local residents. 12.38.3. Actively use the database of PAP and their relevant skills and experience to guide local employment. 12.38.4. Implement the Stakeholder Engagement Plan.	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database; ▪ Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	▪ Once a year during the operational phase.	▪ Environmental Manager/ECO
12.39. Expectations created regarding possible employment.	Prevent frustration resulting from miscommunication of employment opportunities and project-related benefits in the local community.	12.39.1. Implement the Stakeholder Engagement Plan.	▪ Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	▪ Once a year during the operational phase.	▪ Environmental Manager/ECO
12.40. Local spending.	Ensure the generation of socio-economic benefits as a result of the multiplier effect.	12.40.1. Procure goods and services, where practical, within the study area. 12.40.2. Obtain regularly required goods and services from as large a selection of local service providers as possible.	▪ Verify purchase of local goods and services through proof of purchase.	▪ Once a year during the operational phase.	▪ Environmental Manager/ECO
12.41. Local employment.	Ensure optimum employment creation while taking cognizance of the	12.41.1. Implement the Workforce Recruitment Plan	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the	▪ Once a year during the operational phase.	▪ Environmental Manager/ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
	local levels of experience and education.		Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database.		
12.42. Economic Development Plan.	Ensure contribution to local employment, local spending and human capacity development is being made.	12.42.1. Implement the Economic Development Plan.	▪ Verify that the Economic development Plan is being implemented.	▪ Once a year during the operational phase.	▪ Environmental Manager/ Officer
C.6. GEOHYDROLOGY IMPACTS					
12.43. Potential impact on groundwater as a result of stormwater outflows.	To prevent unnecessary infiltration of polluted storm water	12.43.1. Ensure the storm water runoff is not contaminated. All reasonable measures must be taken to prevent the contamination of storm water outflows	▪ Monitor the quality of the storm water. Facility Manager to verify that measures are in place to reduce the contamination of storm water and to monitor the quality of storm water by undertaking site visits and visual inspections.	▪ If possible do this during or shortly after a storm event, at the start of the rain season.	▪ ECO
12.44. Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.	To reduce the potential of groundwater pollution.	12.44.1. Avoid using old or damaged equipment and vehicles and ensure that they are well maintained and regularly serviced in order to ensure no leakages. 12.44.2. Any engines that stand in one place for an excessive length of time, must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and vehicles and equipment should also be refueled on an impermeable surface. A designated area should be established at the	▪ Vehicles need to be monitored throughout the operational phase. Monitor via site audits and record non-compliance and incidents. ▪ Monitor the placement and designation of the area for refueling at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report	▪ Monthly during operations. ▪ Weekly ▪ Weekly	▪ ECO ▪ ECO ▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		PV facility for refueling activities and drip trays or similar impervious materials must be used during these procedures. If liquid product is being transported it must be ensured this does not spill during transit. 12.44.3. If spillages occur during refueling, they should be contained and removed as rapidly as possible, with correct disposal of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes. During the operational phase, the same principles should be adhered to. Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.	non-compliance. ▪ Monitor the refueling/ servicing process and record the occurrence of any spillages.		
C.7. WASTE MANAGEMENT					
12.45. Pollution of the surrounding environment as a result of the handling, temporary storage and disposal of solid waste (general and hazardous).	Reduce soil and groundwater contamination as a result of incorrect storage, handling and disposal of general and hazardous waste.	12.45.1. Sufficient waste collection bins and skips (or similar) should be provided at the PV facility. Waste collection bins and skips should be covered with suitable material and correctly labelled, and should be kept in a designated, demarcated area, where access control is monitored and managed.	▪ Monitor waste generation and collection throughout the operational phase.	▪ Weekly	▪ Facility Manager
		12.45.2. Segregation of hazardous waste from general waste to be in place. Waste separation is encouraged and therefore receptacles should be labelled to reflect the different waste types.	▪ On-site inspection of waste segregation. ▪ Control of waste management practices throughout operational phase.	▪ Weekly ▪ Weekly	▪ Facility Manager ▪ Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		12.45.3. General waste and hazardous waste should be removed from the site on a regular basis and disposed of at an appropriate, licensed waste disposal facility. Hazardous waste should be removed by an approved waste management Contractor. General solid waste could be removed from the site by municipal services. Waste disposal slips or waybills should be kept on file for auditing purposes as proof of disposal, as applicable	▪ Inspection of the waste storage area. ▪ Monitor via site audits and record non-compliance and incidents. Facility Manager to monitor and audit disposal slips.	▪ Daily ▪ Monthly	▪ Facility Manager
		12.45.4. Ensure that the PV facility is kept clean at all times and that operational personnel are made aware of correct waste disposal methods.	▪ Conduct training for all operational personnel. ▪ Monitor the state of PV facility via site audits and record non-compliance and incidents.	▪ Once-off during operations and ensure that all new staff are inducted. ▪ Daily	▪ Facility Manager
		12.45.5. No solid waste may be burned or buried on site.	▪ Monitor via site audits and record non-compliance and incidents.	▪ Daily	▪ Facility Manager
		12.45.6. Waste amounts shall be recorded on a monthly basis.	▪ Waste amounts to be documented.	▪ Monthly	▪ Facility Manager
		12.45.7. All operational waste (concrete, steel, rubbles etc.) to be removed from the site and waste hierarchy of prevention, as the preferred option, followed by reuse, recycling, and recovery must be implemented, where possible.	▪ Waste removal and disposal to be monitored	▪ Monthly	▪ Facility Manager
		12.45.8. Other non-hazardous solid waste (e.g. packaging material) to be disposed of at a	▪ Waste removal and disposal to be monitored	▪ Monthly	▪ Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		licensed landfill.			
		12.45.9. All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means.	▪ Waste removal and disposal to be monitored	▪ Monthly	▪ Facility Manager
		12.45.10. Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages.	▪ Waste removal and disposal to be monitored	▪ Monthly	▪ Facility Manager
		12.45.11. Waste water from operations and painting activities must be collected in a designated container and disposed of at a suitable disposal point off site.	▪ Waste removal and disposal to be monitored	▪ Monthly	▪ Facility Manager
D. DECOMMISSIONING PHASE					
D.1. ECOLOGICAL IMPACTS (TERRESTRIAL, AQUATIC AND AVIFAUNA)					
12.46. Exotic weed invasion of abandoned site resulting in ecological change	To prevent the excessive growth and propagation of exotic weeds on disturbed lands that formed portion of the PV facility	12.46.1. Exotic weed control measures to be instituted through weed control programme. 12.46.2. Regular redress of exotic weed through use of herbicide and manual removal.	▪ Compile weed eradication programme for period of 12 months post the decommissioning exercise. ▪ Appoint contractor to undertake weed eradication programme.	▪ Weed eradication exercise to be undertaken every 6 months for a period of 12 months following decommissioning	▪ Project Owner
D.2. VISUAL IMPACTS					
12.47. Potential visual intrusion of decommissioning activities on	Prevent unnecessary visual clutter and focusing attention of surrounding visual receptors on the	12.47.1. Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes.	▪ Conduct visual inspections to ensure that landscaping is following the rehabilitation plan.	▪ Weekly	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
existing views of sensitive visual receptors.	proposed development.	12.47.2. Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape.			
		12.47.3. Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of indigenous species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape.	▪ Site visits to ensure that stockpiled topsoil (or appropriate soil for vegetation when stockpiled topsoil is exhausted) is used.	▪ Weekly	▪ ECO
		12.47.4. Night lighting of decommissioning sites should be minimised within requirements of safety and efficiency.	▪ Complaints about night lights should be investigated and documented in a register.	▪ As complaints arise	▪ Contractor and ECO
		12.47.5. Working at night should be avoided where possible.	▪ Operation times for decommissioning activities to be monitored and managed (as well as included in the tender contract).	▪ Weekly	▪ ECO
	Reduce the visual impact of decommissioning activities project wide.	12.47.6. Maintain good housekeeping on site to avoid litter and minimize waste. 12.47.7. Monitor sites for strict adherence to demarcated boundaries. 12.47.8. Monitor adherence to lighting plan. 12.47.9. Monitor adherence to rehabilitation plan. 12.47.10. Monitor adherence to erosion control plan. 12.47.11. Monitor adherence to dust and fire control plans.	▪ Carry out site visits and inspections of the sites and ensure good housekeeping is maintained. Record and report any non-compliance. ▪ Carry out site visits and record and report any non-compliance. ▪ Complaints about night lights should be investigated and documented in a register. Investigate any complaints about	▪ Daily ▪ Daily ▪ Daily and as complaints arise. ▪ Daily ▪ Daily ▪ Daily	▪ Construction Manager and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			night lights and document it in a register. ▪ Visit sites requiring rehabilitation. ▪ Carry out site visits and record and report any non-compliance. ▪ Carry out site visits and record and report any non-compliance.		
D.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.48. Construction vehicles and activities could result in damage to or destruction of archaeological sites and/or graves.	Minimise the chances of significant archaeological sites and/or graves being disturbed.	12.48.1. Ensure that no activity takes place outside of the authorized construction footprint.	▪ Carry out visual inspections to ensure strict control over the behaviour of construction staff in order to restrict activities to within demarcated areas.	▪ Weekly	▪ ECO
12.49. Scarring of the landscape once infrastructure has been removed.	Ensure that the landscape within the development footprint has a similar appearance to that around it.	12.49.1. Ensure removal of all foundations, construction materials and foreign matter. 12.49.2. Ensure rehabilitation of the site in accordance with environmental guidelines.	▪ Follow the relevant environmental guidelines.	▪ Throughout the decommissioning phase.	▪ ECO
D.4. SOILS AND AGRICULTURAL POTENTIAL IMPACTS					
12.50. Degradation of veld vegetation beyond the direct footprint of the proposed PV	To conserve the surrounding natural veld vegetation.	12.50.1. Minimize footprint of disturbance during the decommissioning phase and ensure that work is undertaken within the demarcated area only.	▪ Monitor the decommissioning activities via site audits to ensure that they are undertaken within the demarcated decommissioning area, and record non-compliance	▪ Daily ▪ Monthly during the decommissioning phase	▪ Contractor and ECO ▪ ECO ▪ Contractor and

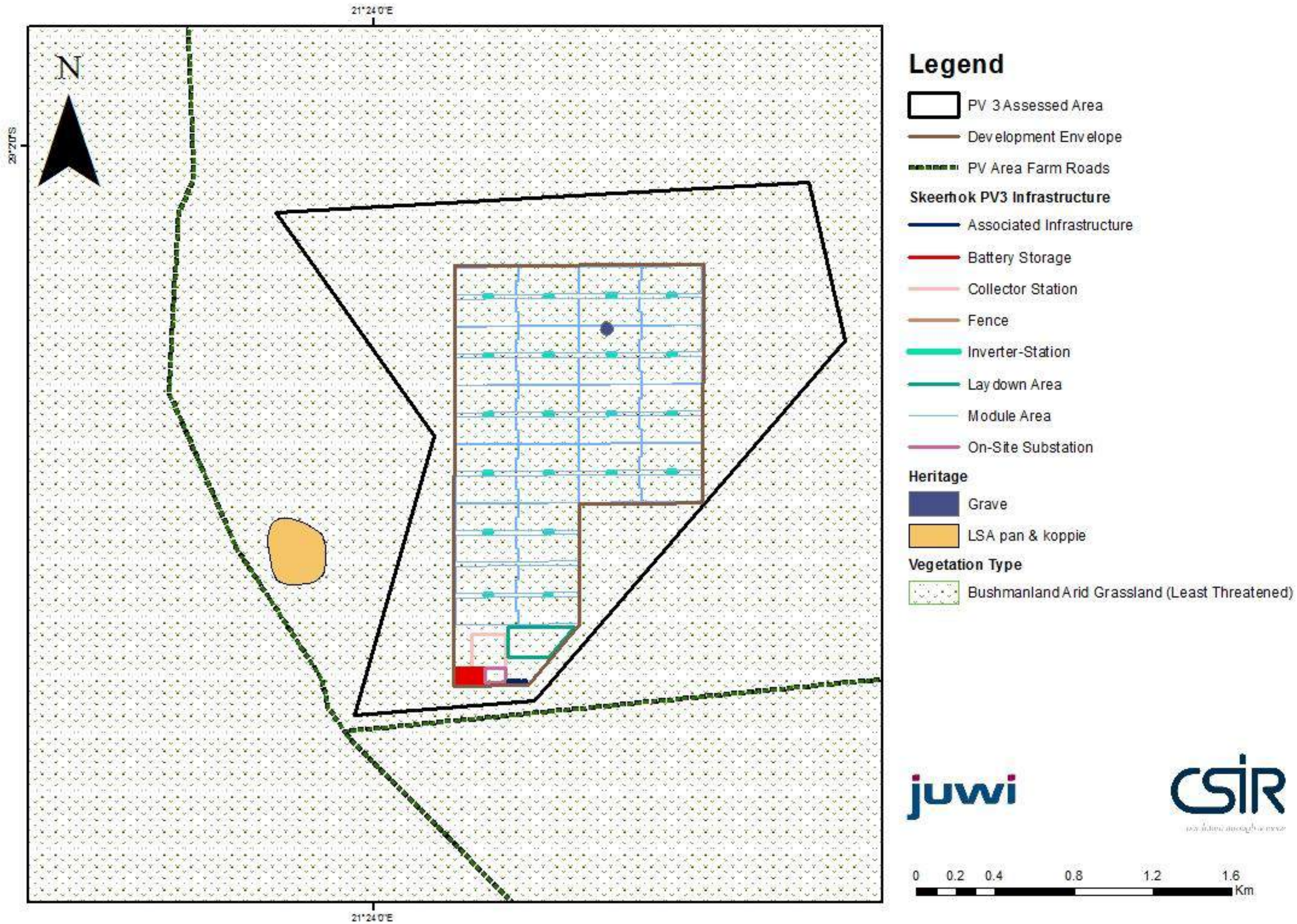
Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
facility due to decommissioning disturbance and potential trampling by vehicles.		12.50.2. Confine vehicle access on roads only 12.50.3. Control dust generation during decommissioning activities by implementing standard construction site dust control measures (dampening with water) where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem.	and incidents. ▪ Include periodic site inspection in environmental performance reporting that specifically records occurrence or not of off-road vehicle tracks surrounding the site. Monitor via site audits and record non-compliance and incidents. ▪ Monitor dust suppression mechanisms via visual inspections and record non-compliances. Maintain an incidents/ complaints register. The date, time, nature of complaint, name of complainant and corrective actions must be logged for all complaints. Complaints must be investigated and, if appropriate, acted upon.	▪ Monthly and during complaints/incidents	ECO
12.51. Loss of topsoil due to poor topsoil management.	Ensure effective topsoil covering to conserve soil fertility on all disturbed areas, after they have been rehabilitated.	12.51.1. Strip and stockpile topsoil from all areas where soil (below surface) will be disturbed. 12.51.2. After cessation of disturbance, re-spread topsoil over the surface. 12.51.3. Dispose of any sub-surface spoils from excavations where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.	▪ Establish an effective record keeping system for each area where soil is disturbed for decommissioning purposes. These records should be included in environmental performance reports, and should include all the records below: ○ Record the GPS coordinates of each area. ○ Record the date of topsoil	▪ As needed, dependent on the specifics of decommissioning activities.	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			stripping. ○ Record the GPS coordinates of where the topsoil is stockpiled. ○ Record the date of cessation of decommissioning activities at the particular site. ○ Photograph the area on cessation of decommissioning activities. ○ Record date and depth of re-spreading of topsoil. ○ Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.		
12.52. Soil erosion due to alteration of the land surface characteristics	To reduce erosion on site and downstream of the site as a result of run-off from the site, or due to wind erosion.	12.52.1. Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	▪ Include periodic site inspection in environmental performance reporting that inspects the effectiveness and integrity of the run-off control system and specifically records the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Monthly during the decommissioning phase.	▪ ECO
D.5. SOCIAL IMPACTS					

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
12.53. Decommissioning of the proposed development.	Minimise job losses.	12.53.1. The proponent should comply with relevant South African labour legislation when retrenching employees. 12.53.2. The proponent must implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning. 12.53.3. All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse.	▪ Verify that retrenchment practices are compliant with South African labour legislation ▪ Verify that the proponent implemented succession training of locally employed staff before the plant is decommissioned ▪ Verify that decommissioned infrastructure does not pose any significant risk to the environment or the people living in the environment.	▪ Once-off during the decommissioning phase (for mitigation measures (12.53.1) and (12.53.2) and once-off after decommissioning is completed (for mitigation measure (12.53.3)).	▪ Contractor and ECO
D.6. GEOHYDROLOGY IMPACTS					
12.54. Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.	To reduce the potential of groundwater pollution.	12.54.1. Avoid using old or damaged equipment and vehicles and ensure that they are well maintained and regularly serviced in order to ensure no leakages. 12.54.2. Any engines that stand in one place for an excessive length of time, must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the site camp for refuelling activities and drip trays or similar impervious materials must be used during these procedures. If liquid product is being transported it must be ensured this does not spill during transit.	▪ Vehicles need to be monitored throughout the decommissioning phase. Monitor via site audits and record non-compliance and incidents. ▪ Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report non-compliance. ▪ Monitor the refuelling/ servicing process and record the occurrence of any spillages.	▪ Four times per annum for the decommissioning period, i.e. at 3 months, 6 months, 9 months and 12 months. ▪ Weekly ▪ Weekly	▪ Contractor and ECO. ▪ Contractorand ECO ▪ Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		12.54.3. If spillages occur during refuelling, they should be contained and removed as rapidly as possible, with correct disposal of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes. During the operational phase, the same principles should be adhered to. Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.			
D.7. WASTE MANAGEMENT					
12.55. Generation of waste due to disassembly of the solar facility.	Avoid substantial negative impacts at the decommissioning phase due to insufficient planning.	12.55.1. Suitable receptacles must be provided for the temporary storage of various waste types such as scrap metal and concrete, until it is removed to the nearest licensed landfill.	▪ Audit the implementation of mitigation measures recommended for the decommissioning phase.	▪ During the decommissioning phase	▪ ECO
		12.55.2. Waste separation is encouraged and therefore receptacles should be labelled to reflect the different waste types.	▪ Audit the implementation of mitigation measures recommended for the decommissioning phase.	▪ During the decommissioning phase	▪ ECO

APPENDIX A – COMBINED LAYOUT AND ENVIRONMENTAL SENSTIVITY MAP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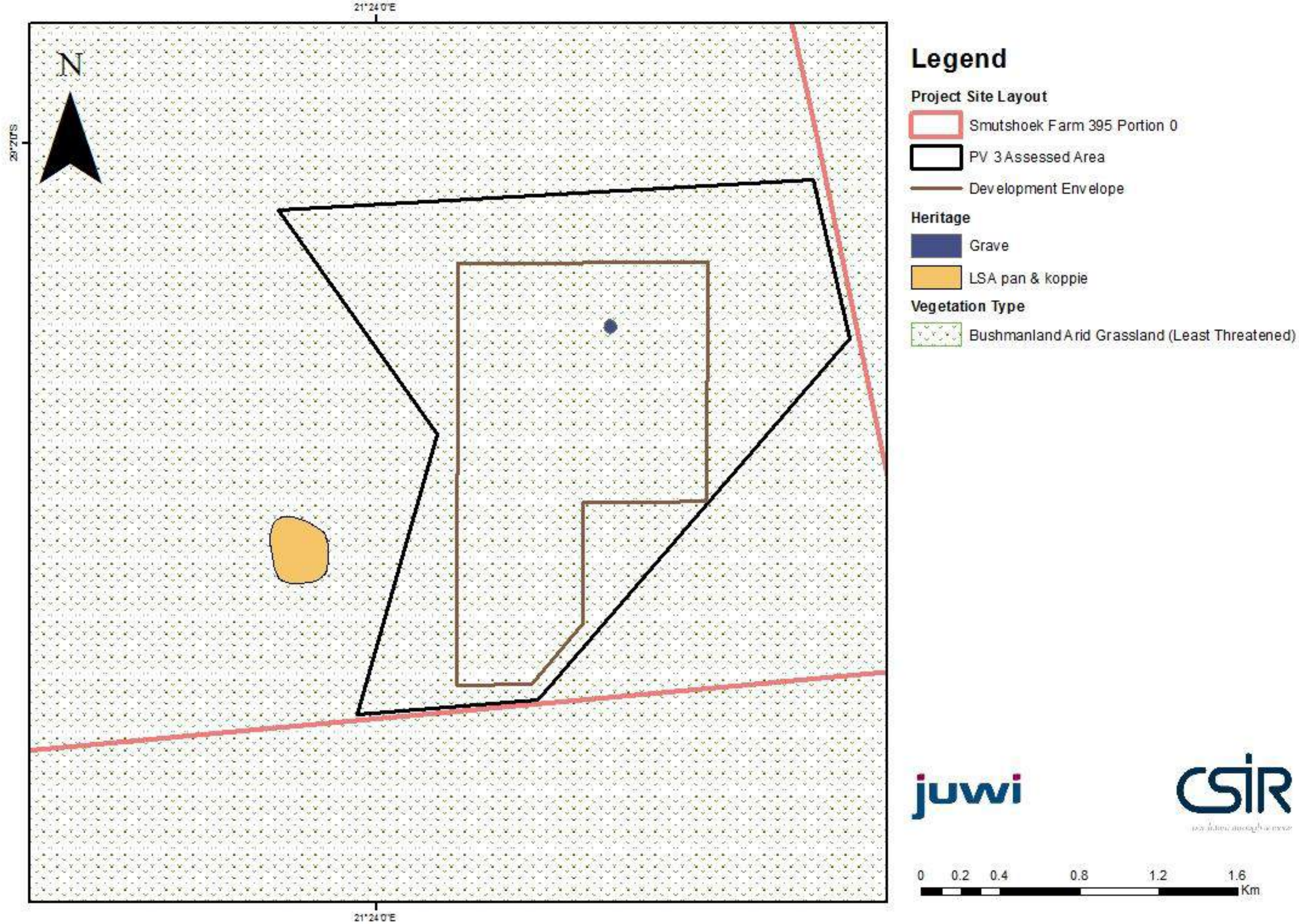
29°2'0"S
N
Legend
PV 3 Assessed Area
Development Envelope
PV Area Farm Roads
Skeerhok PV3 Infrastructure
Associated Infrastructure
Battery Storage
Collector Station
Fence
Inverter-Station
Lay down Area
Module Area
On-Site Substation
Heritage
Grave
LSA pan & koppie
Vegetation Type
Bushmanland Arid Grassland (Least Threatened)
juwi
CSIR
0 0.2 0.4 0.8 1.2 1.6
Km

APPENDIX B – ENVIRONMENTAL SENSITIVITY MAP


21°24'0"E
29°2'0"S
N
Legend
Project Site Layout
Smutshoek Farm 395 Portion 0
PV 3 Assessed Area
Development Envelope
Heritage
Grave
LSA pan & koppie
Vegetation Type
Bushmanland Arid Grassland (Least Threatened)
0 0.2 0.4 0.8 1.2 1.6
Km
21°24'0"E