ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED ALLEPAD PV ONE SOLAR PLANT AND ASSOCIATED INFRASTRUCTURE, UPINGTON, NORTHERN CAPE:

FAUNA & FLORA SPECIALIST EIA REPORT

savannah environmental

PRODUCED FOR SAVANNAH ENVIRONMENTAL

BY

3Foxes Biodiversity Solutions

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February 2019

EXECUTIVE SUMMARY

ILEnergy Development (Pty) Ltd are proposing the establishment of the 100MW Allepad PV One commercial photovoltaic solar energy facility on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington, in the Dawid Kruiper Local Municipality, of the ZF Mgcawu District, in the Northern Cape Province. The development is currently in the EIA Phase and 3Foxes Biodiversity Solutions has been appointed to provide a specialist terrestrial biodiversity impact assessment study of the development site as part of the EIA process.

Two site visits as well as a desktop review of the available ecological information for the area was conducted in order to identify and characterise the ecological features of the site. The vegetation of the site consists of Kalahari Karroid Shrubland in the east and Gordonia Duneveld in the west of the project site. The areas of Kalahari Karroid Shrubland in the east are associated with shallow calcrete soils and have numerous drainage lines as well as a few small pans present. This area is considered largely unsuitable for development. The Allepad PV One development site is however restricted to the low and medium sensitivity areas along the N10 and the affected area is considered suitable for the development. In terms of fauna, there are few species of conservation concern that are likely to be present or abundant at the site and the primary impact of the development on fauna would be some habitat loss for the more common resident species. As such, no high long-term post-mitigation impacts on fauna are expected to occur as a result of the development. Consequently, the impacts of the development on fauna and flora are considered acceptable and would be of low significance after mitigation.

Cumulative impacts in the area are a potential concern due to the proliferation of solar energy development in the wider Upington area. In terms of habitat loss, the affected vegetation and habitat types are widespread in the area and have not experienced significant levels of transformation to date. As a result, the loss of approximately 250ha of currently intact habitat likely to result from the development is not considered highly significant. Cumulative impacts associated with the development of the PV project and associated grid connection are therefore considered acceptable.

The development footprint of the Allepad PV One Solar facility is restricted to low and moderate sensitivity habitat typical of the Upington area. The affected area is considered suitable for development and there are no impacts associated with the Allepad PV One Solar facility that cannot be mitigated to a low level. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layout provided for the assessment, the Allepad PV One Solar facility can be supported from a terrestrial ecology point of view. The Allepad PV One Solar Grid Connection with associated infrastructure is likely to generate low impacts on fauna and flora after mitigation. No high impacts that cannot be avoided were observed and from a flora and

terrestrial fauna perspective, there are no reasons to oppose the development of the grid connection and associated infrastructure.

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COMPLIANCE WITH APPENDIX 6 OF THE 2014 EIA REGULATIONS, AS AMENDED

Requirements of Appendix 6 – GN R326 2014 EIA Regulations, 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;	6
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	7
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
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 3
g) an identification of any areas to be avoided, including buffers;	Section 3
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 3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 3
k) any mitigation measures for inclusion in the EMPr;	Section 7
l) any conditions for inclusion in the environmental authorisation;	Section 5
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7
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, 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 6
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See Main Report
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See Main Report
q) any other information requested by the competent authority.	
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

SHORT CV/SUMMARY OF EXPERTISE – SIMON TODD

Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.
Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.
Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.
Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.
Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Bloemsmond Solar 1 and Solar 2. Fauna and Flora EIA Process. Savannah Environmental 2015.
- Karoshoek CSP Development. Fauna and Flora EIA Process. Savannah Environmental 2016.
- Rooipunt 132kV Line, Upington. Fauna and Flora BA study. SiVest 2016.
- Dyason's Klip Solar PV Facility, Upington. Fauna and Flora EIA Process. Cape EAPrac 2015.
- RE Capital 11 Solar PV Facility, Upington. Fauna and Flora EIA Process. Cape EAPrac 2015.
- Joram Solar Plant, Upington. Fauna and Flora EIA Process. Cape EAPrac 2015.
- Adams PV Project – EIA process and follow-up vegetation survey. Aurora Power Solutions. 2016.

- Solis 2 CSP Facility, van Roois Vley, Upington. Flora EIA process. WSP. 2014.

SPECIALIST DECLARATION

I, ..Simon Todd....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

-
- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study 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: 

Name of Specialist: ____Simon Todd_____

Date: ____15 February 2019_____

1 INTRODUCTION

ILEnergy Development (Pty) Ltd are proposing the establishment of the 100MW Allepad PV One commercial photovoltaic solar energy facilities on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington, in the Dawid Kruiper Local Municipality, of the ZF Mgcawu District, in the Northern Cape Province. Savannah Environmental has been appointed to undertake the required application for environmental authorisation process for the above development. The development is currently in the EIA Phase and 3Foxes Biodiversity Solutions has been appointed to provide a specialist terrestrial biodiversity (fauna and flora) impact assessment study of the proposed development as part of the EIA process.

The purpose of the Allepad PV One Terrestrial Biodiversity Impact Assessment Report is to describe and detail the ecological features of the proposed PV project site, provide an assessment of the ecological sensitivity of the site, and identify the likely impacts associated with the development of the site as a solar PV facility. Two site visits as well as a desktop review of the available ecological information for the area were conducted in order to identify and characterise the ecological features of the site. This information is used to derive an ecological sensitivity map which has been used to inform the layout of the development. Impacts are assessed for the pre-construction, construction, operation, and decommissioning phases of the development. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the EMPr for the development. The full scope of study is detailed below.

SCOPE OF STUDY

The scope of the study includes the following activities

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project
- a description and evaluation of environmental issues and potential impacts (incl. using direct, indirect and cumulative impacts) that have been identified
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- an indication of the methodology used in determining the significance of potential environmental impacts
- an assessment of the significance of direct indirect and cumulative impacts in terms of the following criteria:
    - the nature of the impact, which shall include a description of what causes the

effect, what will be affected, and how it will be affected
    - the extent of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
    - the duration of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0-5 years), medium-term (5- 15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity), or permanent
    - the probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood) probable (distinct possibility), highly probable (most likely), or definite (impact will occur regardless of any preventable measures)
    - the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight, or have no effect
    - the significance which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high
    - the status which will be described as either positive, negative or neutral
    - the degree to which the impact can be reversed
    - the degree to which the impact may cause irreplaceable loss of resources
    - the degree to which the impact can be mitigated

- a description and comparative assessment of all alternatives
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Programme (EMPr)
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- a description of any assumptions uncertainties and gaps in knowledge
- an environmental impact statement which contains:
    - a summary of the key findings of the environmental impact assessment;
    - an assessment of the positive and negative implications of the proposed activity;
    - a comparative assessment of the positive and negative implications of identified alternatives.

General Considerations:

- Disclose any gaps in information or assumptions made.
- Identify recommendations for mitigatory measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Programme (EMP) for faunal related issues.

A description of the potential impacts of the development and recommended mitigation measures are to be provided, which will be separated into the following project phases:

- Pre-construction
- Construction
- Operational Phase
- Decommissioning

1.1 ASSESSMENT APPROACH & PHILOSOPHY

This assessment is conducted according to the 2014 EIA Regulations (Government Notice Regulation 326) in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005).This includes adherence to the following broad principles:

- That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

- Demonstrate how the proponent intends complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should:

    - In order of priority aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
    - Avoid degradation of the environment;
    - Avoid jeopardising ecosystem integrity;
    - Pursue the best practicable environmental option by means of integrated environmental management;

- Protect the environment as the people's common heritage;
- Control and minimise environmental damage; and
- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent to show how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by the NEMA.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:
The study will include data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, describing:

- The broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc.*)

Species level

- Red Data Book (RDB) species (giving location if possible using GPS)
- The viability of an estimated population size of the RDB species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, Low 0-40% confident)
- The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence)

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify species of special concern (SSC) and that are known to be:

- endemic to the region;
- that are considered to be of conservational concern;
- that are in commercial trade (CITES listed species); or
- are of cultural significance.

- Provide monitoring requirements as input into the Environmental Management Programme (EMP) for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified or described:

- The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

1.2 RELEVANT ASPECTS OF THE DEVELOPMENT

The project is proposed on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington. The area under investigation is approximately

3 889ha in extent and comprises a single agricultural property. The project site can be accessed directly via the N10 national road which borders the southern boundary of the site. (**Figure 1**). Photovoltaic (PV) technology is proposed for the generation of electricity. The solar energy facility will have a contracted capacity of up to 100MW, and will make use of either fixed-tilt, single-axis tracking, or dual-axis (double axis) tracking PV technology. The solar energy facility will comprise the following key infrastructure components:

- Arrays of PV panels with a generation capacity of up to 100MW.
- Mounting structures to support the PV panels.
- Combiner boxes, on-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and power transformers.
- A 132kV on-site substation up to 1ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line approximately 5.3km in length, between the on-site substation and Eskom grid connection point.
- Cabling between the project's components (to be laid underground where practical).
- Meteorological measurement station.
- Energy storage area of up to 2ha in extent.
- Access road and internal access road network.
- On-site buildings and structures, including a control building and office, ablutions and guard house.
- Perimeter security fencing, access gates and lighting.
- Temporary construction equipment camp up to 1ha in extent, including temporary site offices, parking and chemical ablution facilities.
- Temporary laydown area up to 1ha in extent, for the storage of materials during the construction and a concrete batching plant.

Electricity generated by the project will feed into Eskom's national electricity grid via a new 132kV power line which will connect the on-site substation to the upgraded 132kV double circuit power line running between the new Upington Main Transmission Substation (MTS) (currently under construction approximately 15km south of the project site), and the Gordonia Distribution Substation (located in Upington town). The point of connection is located approximately 5km east of the project site, and will make use of a loop-in and loop-out configuration, utilising a double circuit mono-pole construction. The proposed power line required for the project will be constructed within a 36m wide servitude due to building restrictions. A 300m wide power line corridor has been identified for investigation along the southern boundary of the site, running immediately north of, and parallel to, the N10 national road.

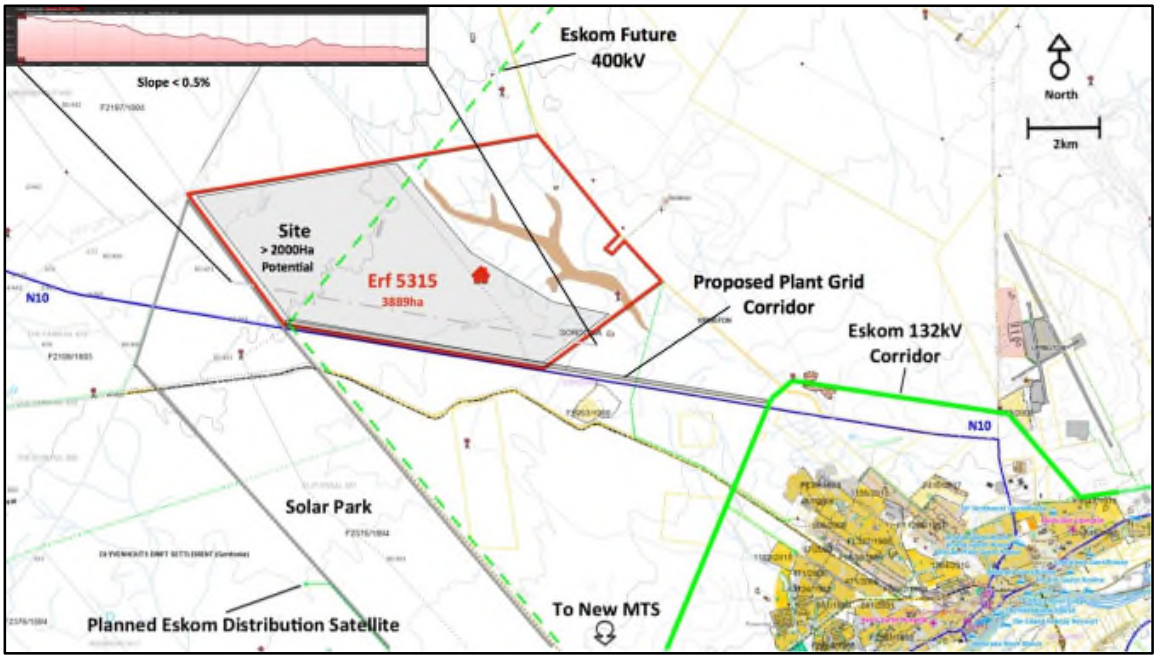

Figure 1. Locality map of the Allepad PV One study site, illustrating the property boundary in red and the proposed power line route to the Eskom substation at Upington in grey.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina & Rutherford 2006 and 2012 Powrie update) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Information on plant species recorded for the broad area around the site was extracted from the SANBI POSA database hosted by SANBI. The species list was derived from a considerably larger area than the study site, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself or the immediate area has not been well sampled in the past.
- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2018).

Ecosystem

- Critical Biodiversity Areas (CBAs) were extracted from the Northern Cape Critical Biodiversity Areas Map (Oosthuysen & Holness 2016).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (NFEPA) (Nel et al. 2011).
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and Animal Demography Unit (ADU) Virtual Museum spatial database (http://vmus.adu.org.za/).
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- Apart from the literature sources, additional information on fauna was extracted from the ADU web portal http://vmus.adu.org.za
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates et al. 2013) and amphibians on Minter et al. (2004) as well as the IUCN (2018).

2.2 Sensitivity Mapping & Assessment

An ecological sensitivity map of the site was produced by integrating the available ecological and biodiversity information available in the literature and various spatial databases with mapping based on the satellite imagery of the site as well as personal knowledge of the site. This includes delineating different habitat units identified on the satellite imagery and assigning likely sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These

areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

2.3 SAMPLING LIMITATIONS AND ASSUMPTIONS

The current study is based on two site visits, the first on the 7th and 8th of November 2018 and the second from 1-3 February 2019. Conditions during the initial site visit were reasonably good for the field assessment, there having been some rains in the preceding period. As a result, the vegetation was in a good condition with the vast majority of shrubs and grasses present in a condition that they could be identified. The second site visit was dry and vegetation had not greened up yet with the result that it was in a relatively poor condition. In both periods, forbs and annuals were scarce or absent and so the vegetation surveys conducted on the site are considered to provide a representative indication of the shrubs, grasses, trees and other perennial on site, but not of the more ephemeral component of the vegetation. However, as there are few species of conservation concern within these growth forms, this is not seen as a highly significant limitation associated with the study. In addition, the habitats and plant communities present at the site are clearly discernible, and it is these that are the primary driver of the sensitivity of the site, with the result that additional fieldwork at a different time of year would not be likely to change the assessed sensitivity of the site in any appreciable manner.

In terms of the fauna present at the site, several steps were taken to reduce the uncertainty associated with the assessment of the faunal communities present. Apart from the active searches that were conducted for reptiles and amphibians during the current study, additional species presence is inferred based on results obtained from the previous studies the consultant has conducted in the area. In addition, five camera traps were distributed across the site during the initial November 2018 field trip and retrieved during the February 2019 site visit. These provide an indication of both the distribution and abundance of the different moderate and larger fauna present on the site. As many fauna are difficult to observe in the field, their potential presence at the site must be evaluated based on the literature and available databases. Many remote areas have not been well-sampled in the past with the result that the species lists derived from the available spatial databases for

the area do not always adequately reflect the actual fauna present at the site. This is acknowledged as a limitation of the study however it is substantially reduced by the previous experience in the area. In order to further reduce this limitation, and ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site and are likely to include a much wider array of species than actually occur at the site. This is a cautious and conservative approach which takes the study limitations into account.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map (Mucina & Rutherford 2006), there are two vegetation types within the study area, Kalahari Karroid Shrubland in the east and Gordonia Duneveld in the west (Figure 5).

Both Kalahari Karroid Shrubland and Gordonia Duneveld are classified as Least Threatened and have been little impacted by transformation and more than 99% of their original extent is still intact. Kalahari Karroid Shrubland is considered Hardly Protected within formal conservation areas, while Gordonia Duneveld is Moderately Protected. No vegetation-type endemic species are listed for either Kalahari Karroid Shrubland or Gordonia Duneveld (Mucina & Rutherford 2006). The biogeographically important and endemic species known from these vegetation types tend to be widespread within the vegetation type itself and local-level impacts are not likely to be of significance for any of these vegetation types or species concerned. Gordonia Duneveld is widely distributed and is among the most extensive vegetation types in South Africa while Kalahari Karroid Shrubland is less extensive, but represents a transitional vegetation type between the northern Nama Karoo and Kalahari (Savannah) vegetation types.

Species observed within the areas of Kalahari Karroid Shrubland include shrubs such as *Leucosphaera bainesii*, *Hermannia spinosa*, *Monoechma genistifoilium*, *Salsola rabieana*, *Aptosimum albomarginatum*, *A.spinecens*, *Kleinia longiflora*, *Limeum argute-carinatum*, *Phyllanthus maderaspatensis*, *Zygophyllum dregeanum* and grasses such as *Stipagrostis anomala*, *S.ciliata*, *S.uniplumis*, *S.hochstetteriana* and *Schmidtia kalariensis*. The proportion of shrubs in this vegetation type is usually related to soil depth and texture, with the proportion of grass increasing as the soils become deeper or more sandy. Species of conservation concern that may be present include *Adenium oleifolium*, *Aloe claviflora* and *Hoodia gordonii*, although none of these species were observed at the site.

Figure 2. Typical Kalahari Karroid Shrubland observed at the site along the eastern margin of the Allepad PV 1 footprint area. The scattered trees include *Boscia foetida* and *Acacia erioloba*.

The areas of Gordonia Duneveld consists of several different habitats. The most obvious of which are the dunes and the inter-dune areas. The dunes and areas of deep sand are dominated by species such as *Crotalaria orientalis*, *Stipagrostis amabilis*, *Centropodia glauca*, *Acacia haematoxylon* and various forbs. The interdune slacks are dominated by grasses or *Rhigozum trichotomum* depending on the substrate conditions as well as the history of land use. Other common species associated with the areas of Gordonia Duneveld include trees such as *Parkinsonia africana*, *Boscia foetida*, *Boscia albitrunca* and *Acacia erioloba*, shrubs such as *Phaeoptilum spinosum*, *Rhigozum trichotomum*, and *Lycium bosciifolium*, grasses such as *Stipagrostis ciliata*, *S.uniplumis*, *S.amabilis*, *Schmidtia kalahariensis*, and forbs such as *Senna italica*, *Tribulis pterophorus*, *Hermannia tomentosa* and *Requienia sphaerosperma*. Species of conservation concern associated with this habitat include the nationally protected trees *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca*.

Figure 3. Gordonia Duneveld within the Allepad study area, with *Acacia haematoxylon*, *Acacia erioloba* and *Boscia albitrunca* being typical, with a grass layer dominated by *Centropodia glauca* and various *Stipagrostis* species. These areas are considered unsuitable for development and not within the Allepad PV One footprint.

In terms of the current study site, the areas of Kalahari Karroid Shrubland in the east of the site are considered moderate sensitivity due to its higher species diversity, and the potential presence of several species of conservation concern. The flatter areas of Gordonia Duneveld dominated by *Rhigozum trichotomum* are considered relatively low sensitivity, while the more extensive area of contiguous dunes in the west of the site, are considered to be medium high sensitivity due to the vulnerability of this habitat to disturbance.

Figure 4. Typical vegetation within the Allepad PV One footprint area. These areas typically represent transitional areas between Gordonia Duneveld and Kalahari Karroid Shrubland. Typical and dominant species include *Rhigozum trichotomum*, *Phaeoptilum spinosum*, *Boscia foetida* subsp. *foetida*, *Stipagrostis ciliata*, *Monechma incanum* and *Aptosimum albomarginatum*. These areas are considered low sensitivity and considered suitable for development within the context of the site.

The current veld condition of the site can be considered to be fair and while there are some areas that have clearly suffered some degradation in the past, the vegetation cover and composition can be considered typical for the area. There are some localised areas of *Prosopis* invasion at the site, usually around watering points, but in general there are few alien species present across most of the site and it can be considered to be largely intact and in moderate condition.

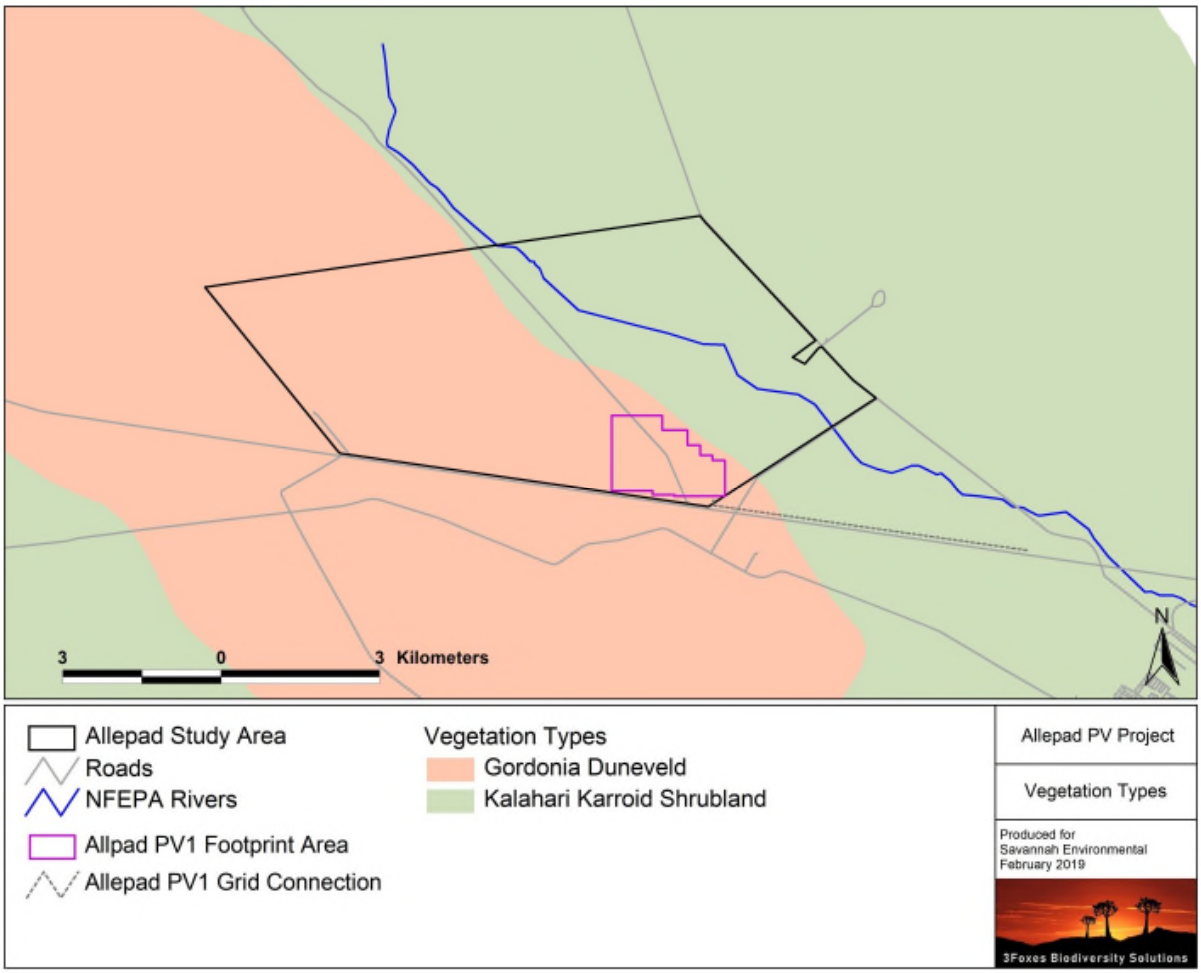

Figure 5. Broad-scale overview of the vegetation in and around the Allepad PV One project site. The vegetation map is an extract of the national vegetation map as produced by Mucina and Rutherford (2006/2012), and also includes drainage lines delineated by the NFEPA assessment (Nel et al. 2011).

3.2 Listed and Protected Plant Species

Three NFA-protected tree species occur at the site *Vachellia* (*Acacia) erioloba*, *Vachellia haematoxylon* and *Boscia albitrunca*. All three of these species are associated with the dune field areas of the site which are considered to be medium or high sensitivity. The provincially protected *Boscia foetida* subsp. *foetida* is also confirmed present at the site and is fairly widespread. Although it was not observed, it is possible that the provincially protected Devils' Claw *Harpagophytum procumbens* is present at the site, within the dune areas as this species is relatively common on Gordonia Duneveld in the Upington area. The development footprint of Allepad PV One generally avoids the areas where these species

occur, although there is a small area of dunes within the PV footprint where both *Boscia albitrunca* and *Vachellia haematoxylon* are present at a low density.

3.3 FAUNAL COMMUNITIES

Mammals

The site falls within the distribution range of 46 terrestrial mammals, indicating that the mammalian diversity at the site is of moderate potential. The variety of habitats present at the site is however fairly low and the overall mammalian diversity at the site is likely to be lower than the richness of the broader area. The lack of rocky hills or outcrops at the site would preclude a variety of species from the site. Mammal species that can be confirmed present at the site based on the results of the camera trapping of are known from adjacent sites in the immediate area include Black-backed Jackal, African Wildcat, Cape Fox, South African Ground Squirrel, Springhare, Steenbok, Duiker, Springbok, Gemsbok, Cape Porcupine, Yellow Mongoose, Slender Mongoose, Cape Hare and Aardvark.

Two listed terrestrial mammals may occur at the site, the Brown Hyaena *Hyaena brunnea* (Near Threatened) and Black-footed cat *Felis nigripes* (Vulnerable). While it is possible that both species occur at the site, it is least likely that the Brown Hyaena *Hyaena brunnea* is present as this species is often purposely or inadvertently persecuted within farming areas. As these two species have a wide national distribution, the development would not create a significant extent of habitat loss for these species.

Overall there do not appear to be any highly significant issues regarding mammals and the development of the site. In general, the major impact associated with the development of the site for mammals would be habitat loss and the disruption of the broad-scale connectivity of the landscape. However, given the intact nature of much of the surrounding landscape and the position of the site adjacent to the N10, this is likely to be of a low magnitude.

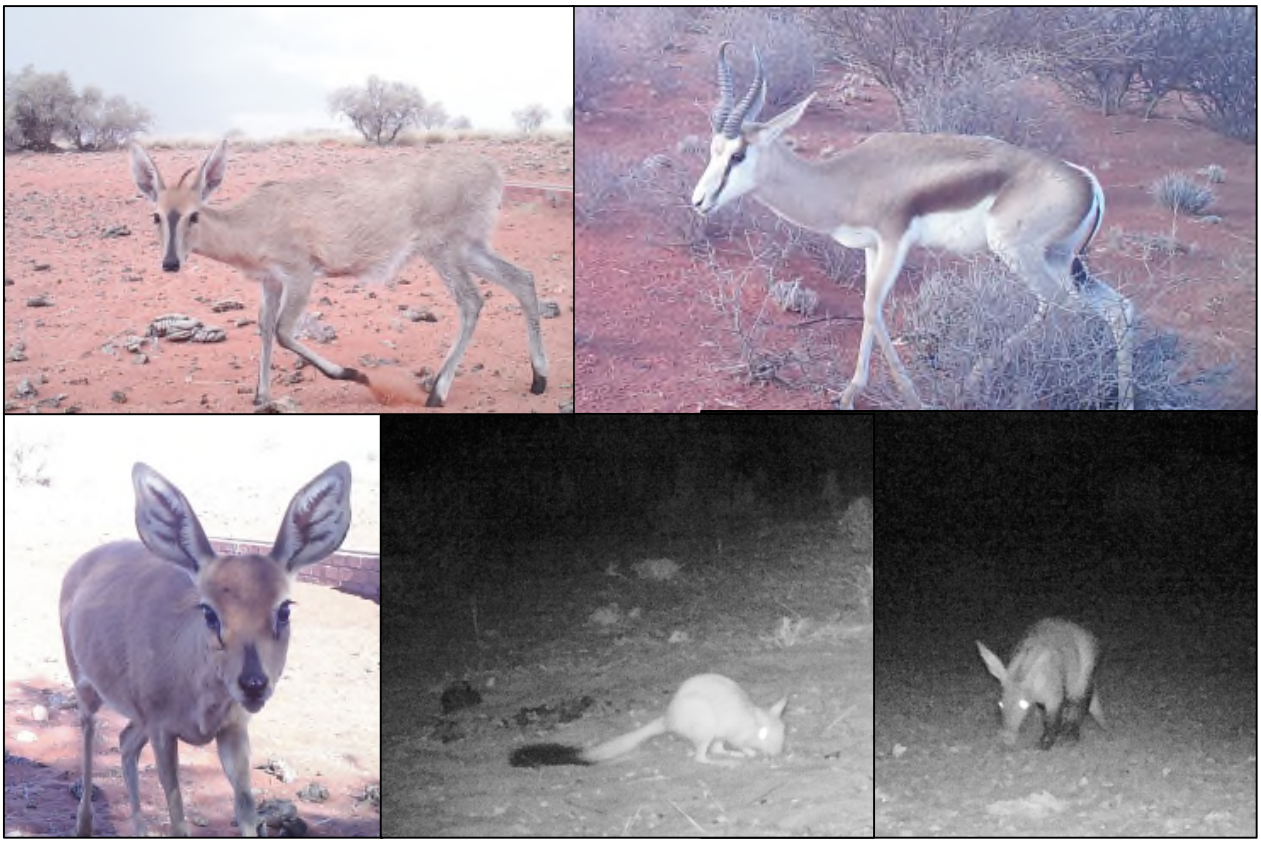

Figure 6. The most common mammal species confirmed present at the site includes Duiker, Steenbok, Springbok, Springhare and Aardvark. Less common species also observed include Meerkat, Scrub Hare, Yellow Mongoose, Polecat and Gemsbok.

Reptiles

According to the SARCA database, 39 reptile species are known from the area suggesting that the reptile diversity within the site is likely to be moderate to low. As there are no significant rocky outcrops at the site, only species associated with sandy substrates or trees are likely to be present. Species observed at the site or in the vicinity include the Namaqua Mountain Gecko *Pachydactylus montanus*, Ground Agama *Agama aculeata aculeata*, Spotted Sand Lizard *Pedioplanis lineoocellata* and Spotted Desert Lizard *Meroles suborbitalis*. No reptile species of conservation concern are known from the area and there do not appear to be any broad habitats at the site which would be of high significance for reptiles. As with mammals, the development is likely to result in local habitat loss for reptiles but as there are no listed or range-restricted reptiles that are likely to occur at the site the impacts are not likely to be of broader significance.

Figure 7. The Western Three-striped Skink *Trachylepis occidentalis* is a common reptile at the Allepad Site and is widespread within the wider Karoo and Bushmanland area.

Amphibians

The site lies within the distribution range of 10 amphibian species. The only listed species which may occur at the site is the Giant Bullfrog *Pyxicephalus adspersus* which is listed as Near Threatened. No suitable breeding sites were observed in or near the development footprint and it is not likely that this species is present or would be affected by the development. As there are no natural perennial water sources at the site, it is likely that amphibian abundance is generally low and restricted largely to those species which are relatively independent of water such as the Karoo Toad *Vandijkophrynus gariepensis*. Overall, given the low likely abundance of amphibians at the site, impacts on amphibians are likely to be local in extent and of low significance.

3.4 Critical Biodiversity Areas & Broad-Scale Processes

An extract of the Northern Cape Critical Biodiversity Areas map for the study area is depicted below in Figure 8. The majority of the site lies within an area classified as "Other natural areas" and is not classified as a CBA or ESA. The drainage line which traverses the site to the east of the development footprint is however classified as an ESA but would not be impacted by the development of the PV plant or the power line. There are no CBAs in close proximity to the site, indicating that the development does not pose a threat to any CBAs or other areas considered to be of significance from a broad-scale conservation planning perspective.

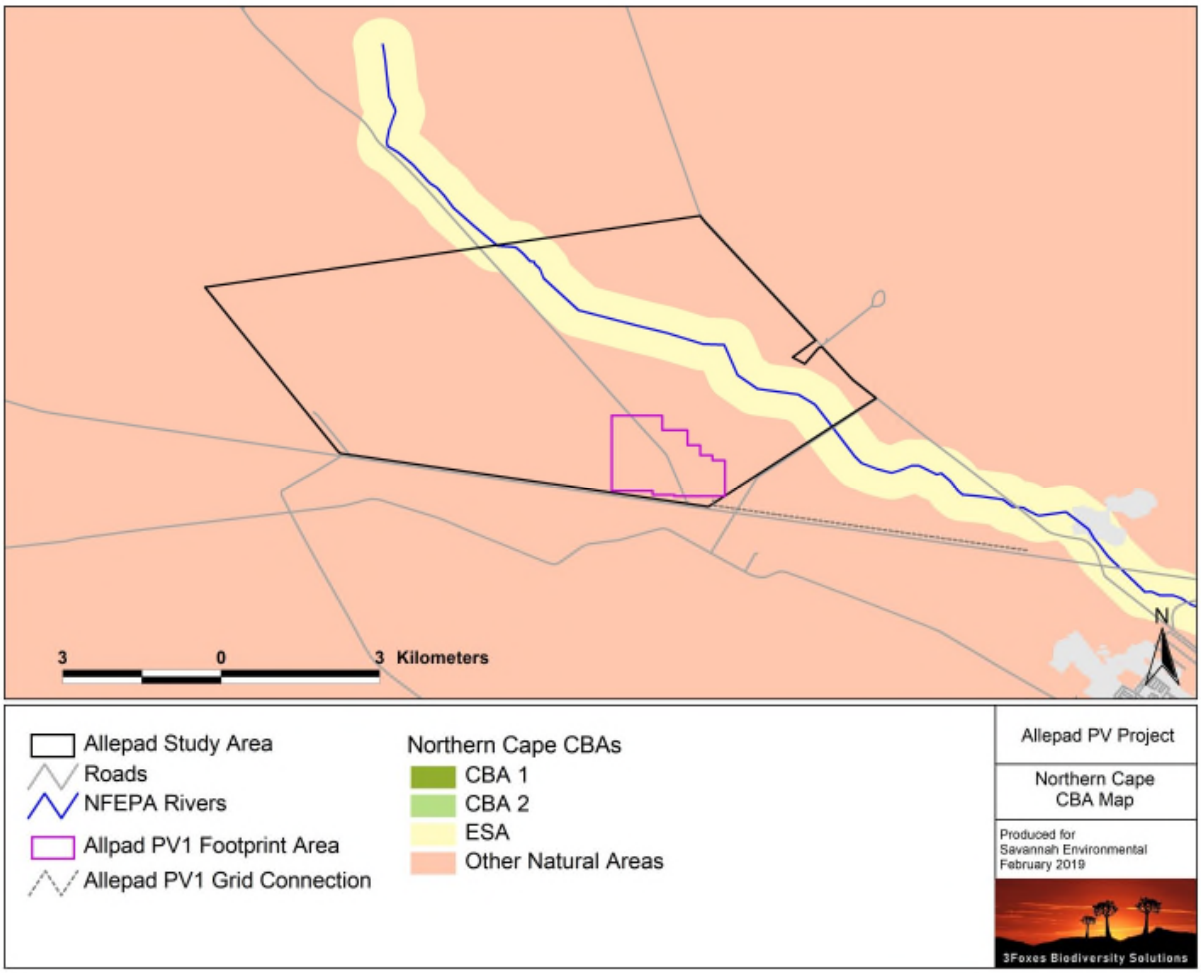

Figure 8. Extract of the Northern Cape Critical Biodiversity Areas map for the study area, showing that there are no CBAs in close proximity to the site.

3.5 Current Baseline & Cumulative Impact

There is a large amount of renewable energy development in the Upington area, concentrated along the N14 and south of the Orange River (Figure 9). The Allepad PV One project would potentially contribute approximately 250ha of additional habitat loss and fragmentation in the area. The significance of this impact is likely to be of a local nature only. The drainage system which characterises the eastern section of the broader Allepad project site is likely to be the most important feature of the area in terms of connectivity and faunal movement and would not be impacted by the development. At a broader scale, the site is also adjacent to the N10 and in relatively close proximity to Upington, with the result that the development would have a reduced impact on landscape connectivity as compared to more remote and less disturbed areas. There are no features within the development footprint that indicate that the affected area is likely to be of broader significance for fauna or flora in terms of landscape connectivity and ecological process. As

such, development of Allepad PV 1 is considered to be acceptable in terms of its contribution to cumulative impact.

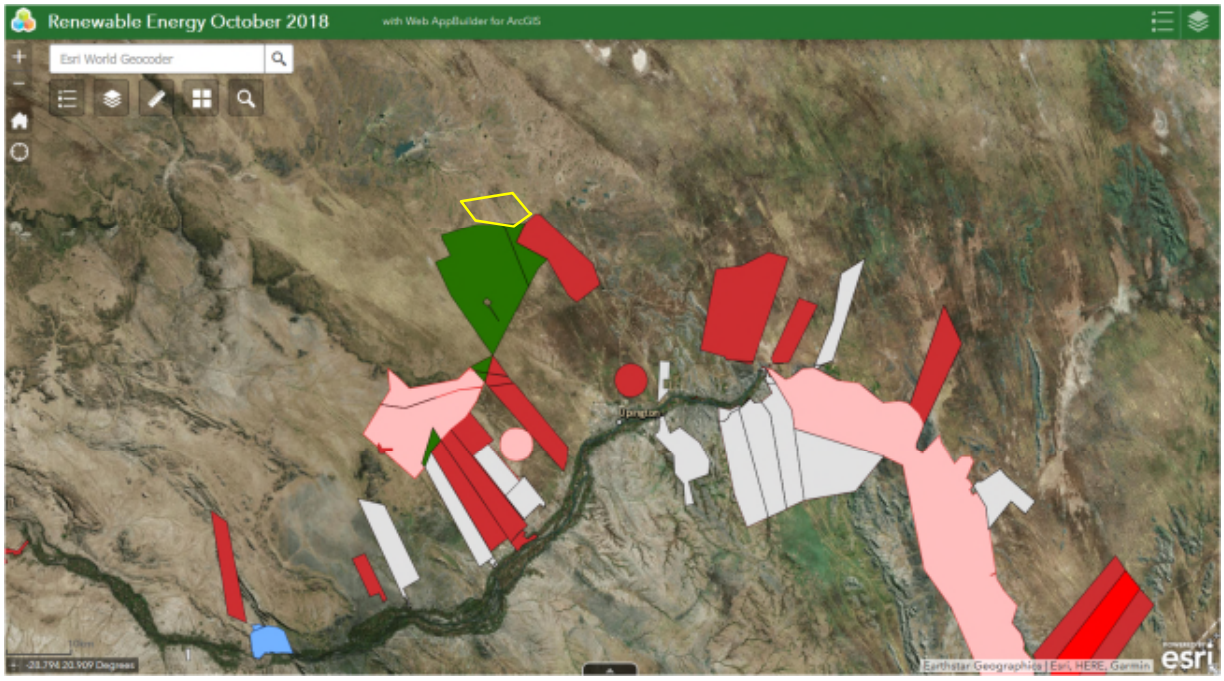

Figure 9. Map of DEA registered renewable energy applications as at October 2018, showing the Allepad PV One project site in yellow.

3.6 SITE SENSITIVITY ASSESSMENT

The sensitivity map for the wider Allepad study area is illustrated below in Figure 10. The eastern half of the site occurs on shallow calcrete soils and has numerous drainage lines as well as a few small pans present. Due to the presence of the drainage system and the difficulty involved in avoiding impact to this feature, this area is considered to be of high ecological sensitivity and largely unsuitable for development. The western half of the site consists of two broad areas. The dunes in the north west and central part of this area and then the shrubby plains of the south and central part of the site. The dunes are considered to be medium or high sensitivity and not suitable for development as the loose sands are very vulnerable to erosion. The remainder of the site consists of the typical undulating plains of the area with relatively shallow, sandy soils dominated by a variable mix of grasses and shrubs depending on context. These areas are considered to be low sensitivity and suitable for development (Figure 6). The Allepad PV One development area is restricted to the low sensitivity shrubby plains habitat and a relatively small section of medium sensitivity more sandy habitat towards the east. There are no highly sensitive features within the development footprint and no specific species that would be disproportionally affected by the development. As such, the location of the development is considered

acceptable within the context of the site and recommendations with regards to the avoidance of the more sensitive dunes and drainage line systems have been adhered to by the developer.

The power line corridor runs adjacent to the N10 national road until it reaches upgraded 132kV between the Upington Main Transmission Substation (MTS) and the Gordonia Distribution Substation. There are no major sensitive features along the route and the majority of the corridor is considered to be low sensitivity.

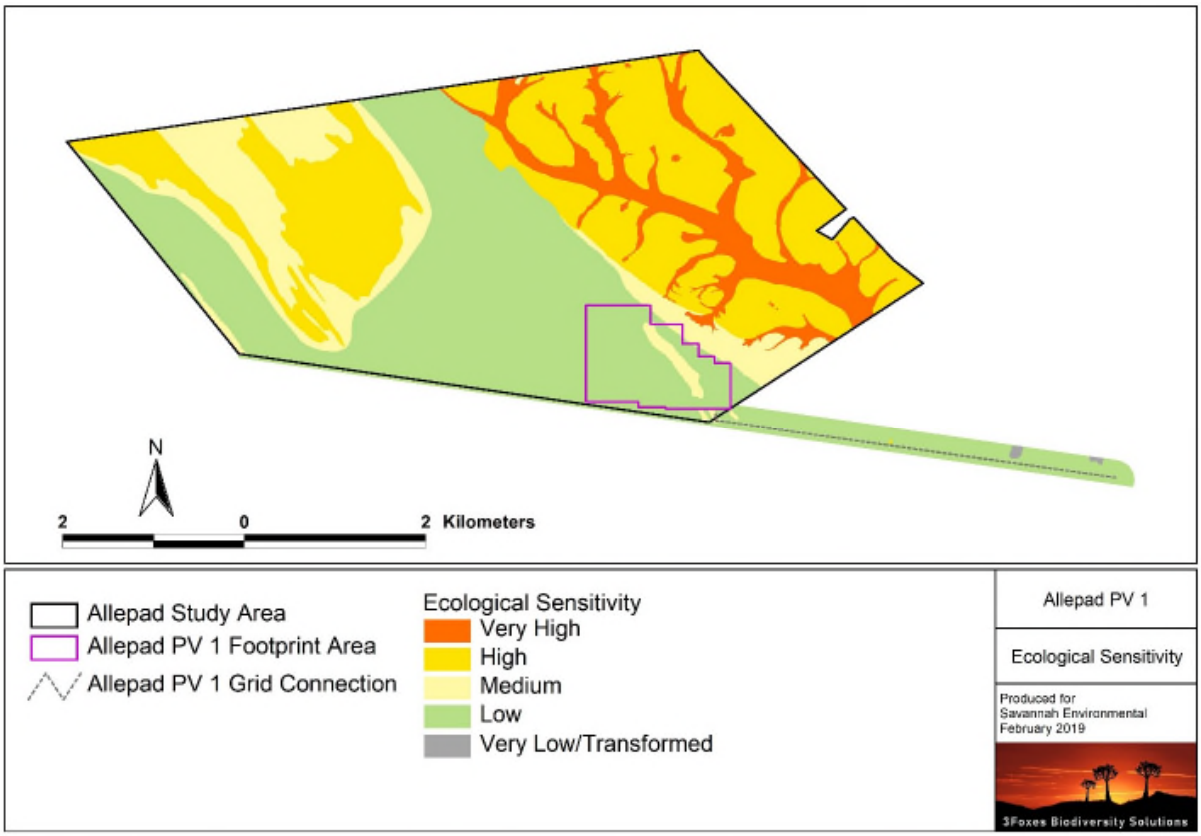

Figure 10. Sensitivity map for the Allepad site and the PV One project area. The development is restricted to low and medium sensitivity areas.

4 IDENTIFICATION & NATURE OF IMPACTS

In this section, the potential impacts and associated risk factors that may be generated by the development are identified and discussed before a preliminary Scoping-Level assessment is provided in the next section.

4.1 IDENTIFICATION OF IMPACTS TO BE ASSESSED

In this section the potential impacts associated with the development are explored in context of the features and characteristics of the site and the likelihood that each impact would occur given the characteristics of the site and the extent and nature of the development.

Impacts on vegetation and protected plant species

Several protected species occur at the site which may be impacted by the development, most notably *Acacia erioloba*, A*cacia haematoxylon* and *Boscia albitrunca*. The density of these species within the PV One development footprint is however low. Vegetation clearing during construction will lead to the loss of currently intact habitat within the development footprint and is an inevitable consequence of the development. As this impact is certain to occur it is assessed for the construction phase as this is when the impact will occur, although the consequences will persist for a long time after construction.

Direct faunal impacts

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction as well as operation and this impact will therefore be assessed for the construction phase and operational phase.

Reduced ability to meet conservation obligations & targets

The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the country's ability to meet its conservation targets. Although the receiving vegetation types in the study area are classified as Least Threatened and are still more than 99% intact, Kalahari Karroid Shrubland is a relatively restricted vegetation type for an arid area and is therefore vulnerable to cumulative impact. This impact is therefore assessed in light of the current development as well as any other developments in the surrounding area which would also contribute to cumulative impacts.

Impact on broad-scale ecological processes

Transformation of intact habitat due to the project alone as well as on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. These impacts are assessed for the plant

alone as well as on a cumulative basis considering other existing or proposed developments in the wider area.

5 ASSESSMENT OF IMPACTS

The various identified impacts are assessed below for the different phases of the development.

5.1 ALLEPAD PV ONE DEVELOPMENT

The following is an assessment of Allepad PV One, for the planning and construction and operational phase of the development.

5.1.1 Planning & Construction Phase

Impact 1. Impacts on vegetation and listed or protected plant species resulting from construction activities

Impact Nature: Impacts on vegetation will occur due to disturbance and vegetation clearing associated with the construction of the facility. In addition, it is likely that some loss of individuals of protected trees will occur.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low to Moderate (5)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	Medium (50)	Medium (45)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated?	This impact cannot be well mitigated because the loss of vegetation is unavoidable and is a certain outcome of the development.	
Mitigation	• Pre-construction walk-through of the facility's final layout in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions. • Search and rescue for identified species of concern before construction.	

	• Vegetation clearing to commence only after walk-through has been conducted and necessary permits obtained. • Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc. • Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near the pans. • Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. • All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area. • Temporary laydown areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.
Cumulative Impacts	The development will contribute to cumulative impacts on habitat loss and transformation in the area.
Residual Risks	As the loss of currently intact vegetation is an unavoidable consequence of the development, the habitat loss associated with the development remains a moderate residual impact even after mitigation and avoidance of more sensitive areas.

Impact 2. Direct Faunal Impacts Due to Construction Activities

Impact Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. Due to noise and operation of heavy machinery, faunal disturbance will extend well beyond the footprint and extend into adjacent areas. This will however be transient and restricted to the construction phase.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low to Medium (5)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (32)	Low (28)
Status	Negative	Negative
Reversibility	Moderate	Moderate

Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Although the large amounts of noise and disturbance generated at the site during construction is largely unavoidable, impacts such as those resulting from the presence of construction personnel at the site can be easily mitigated.	
Mitigation	• All personnel should undergo environmental induction with regards to fauna and, in particular, awareness about not harming or collecting species such as snakes, tortoises and owls, which are often persecuted out of superstition. • Any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer. • All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • If trenches need to be dug for electrical cabling, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.	
Cumulative Impacts	During the construction phase the activity would contribute to cumulative fauna disturbance and disruption in the area, but there are still large tracts of intact habitat in the area, it is likely that displaced fauna will have space to move about the site to avoid areas of high activity.	
Residual Risks	It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.	

5.1.2 Operational Phase Impacts

Impact 1. Faunal Impacts due to Operation

Impact Nature: The operation and presence of the facility may lead to disturbance or persecution of fauna within or adjacent to the facility.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)

Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Low (21)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To a large extent, but some low-level residual impact due to noise and human disturbance during maintenance is likely.	
Mitigation	• Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. • If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. • If the facility is to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants.	
Cumulative Impacts	The development would contribute to cumulative disturbance for fauna, but the contribution would be low for most species and is not considered highly significant.	
Residual Risks	Disturbance from maintenance activities will occur at a low level with the result that disturbance would be largely restricted to the site.	

Operational Impact 2. Habitat Degradation due to Erosion and Alien Plant Invasion

Impact Nature: Disturbance created during construction will leave the site vulnerable to erosion and alien plant invasion for several years into the operational phase.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)

Magnitude	Medium (4)	Low (3)
Probability	Likely (4)	Likely (3)
Significance	Medium (36)	Low (21)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Moderate	Low
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	
Mitigation	• Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • The road should have runoff control features which redirects water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion during operation to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and revegetated of any remaining bare areas with indigenous perennial shrubs and succulents from the local area. • Alien management at the site should take place according to the Alien Invasive Management Plan. • Regular monitoring for alien plant during operation to ensure that no erosion problems have developed as result of the disturbance, as per the Alien Management Plan for the project. • Woody aliens should be controlled on at least an annual basis using the appropriate alien control techniques as determined by the species present.	
Cumulative Impacts	Erosion and alien plant invasion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised.	
Residual Risks	Some erosion and alien plant invasion is likely to occur even with the implementation of control measures, but would have a low impact.	

5.1.3 Cumulative Impacts

The following are the cumulative impacts that are assessed as being a likely consequence of the development of the Allepad Solar One PV Facility. This is assessed in context of the

extent of the current site, other developments in the area as well as general habitat loss and transformation resulting from agriculture and other activities in the area.

Cumulative Impact 1. Reduced ability to meet conservation obligations & targets due to cumulative habitat loss

Nature: The development of the Allepad PV 1 project will potentially contribute to cumulative habitat loss and other cumulative impacts in the wider Upington area.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	Low (18)	Medium (30)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated	To some degree, but the majority of the impact results from the presence of the facility which cannot be mitigated.	
Mitigation: • Ensure that sensitive habitats such as drainage features, pans and quartz patches are not within the development footprint. • Ensure that the fencing around each facility is friendly with fauna and avifauna. This includes not having any electrified strands within 30cm of the ground as well as implementing a design that prevents fauna and avifauna from becoming trapped between the inner and out layer of the fence as this has been demonstrated to be a common impact associated with existing PV plants. • Ensure that an alien management plan and erosion management plan compiled for each project are effectively implemented at the site.		

Cumulative Impact 2. Negative impact on broad-scale ecological processes.

Impact Nature: Development of the PV plant may impact on broad-scale ecological processes such as the ability of fauna to disperse.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (2)

Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	Low (16)	Medium (30)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated?	Only partly as a significant proportion of the impact results from the presence and operation of the facility which cannot be well mitigated.	
Mitigation	• Ensure that known faunal movement corridors such as drainage lines and ridge systems are not developed. • Ensure that the mitigation hierarchy is applied with a particular emphasis on reducing the development footprint, rehabilitating disturbed areas and minimising degradation around the site. • An open space management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent bushveld.	
Cumulative Impacts	The development would potentially contribute to habitat degradation and the loss of landscape connectivity and ecosystem function within the area, but this is likely to be relatively low as most species are likely to be able to avoid the facility as there are still relatively large intact corridors present in the area.	
Residual Risks	The presence of the facility will represent an obstacle for some fauna which would contribute to fragmentation in the area.	

5.2 ALLEPAD PV ONE GRID CONNECTION

The following is an assessment of Allepad PV One Grid Connection, for the planning and construction and operational phase of the development.

5.2.1 Planning & Construction Phase

Impact 1. Impacts on vegetation and listed or protected plant species resulting from power line construction activities

Impact Nature: Impacts on vegetation will occur due to disturbance and vegetation clearing associated with the construction of the power line and association infrastructure.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)

Duration	Long-term (3)	Long-term (3)
Magnitude	Low (3)	Low (2)
Probability	Definite (5)	Highly Likely (4)
Significance	Medium (35)	Low (24)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated?	This impact cannot be well mitigated because the loss of vegetation is unavoidable and is a certain outcome of the development.	
Mitigation	• Pre-construction walk-through of the power line's final layout in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions. • Search and rescue for identified species of concern before construction. • Vegetation clearing to commence only after walk-through has been conducted and necessary permits obtained. • Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc. • Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near the pans. • Vegetation clearing along the power line route should be kept to a minimum. • All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area. • Temporary laydown areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.	
Cumulative Impacts	The grid connection will contribute to cumulative impacts on habitat loss and transformation in the area, but the contribution would be very low.	
Residual Risks	The loss of currently intact vegetation is an unavoidable consequence of the development and cannot be entirely mitigated. The residual impact would however be low.	

Impact 2. Direct Faunal Impacts Due to Construction Activities

Impact Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. This will however be transient and restricted to the construction phase.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low to Medium (4)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (18)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Partly, although noise and disturbance cannot be well mitigated, impacts on fauna due to human presence such as poaching can be mitigated.	
Mitigation	• All personnel should undergo environmental induction with regards to fauna and, in particular, awareness about not harming or collecting species such as snakes, tortoises and owls, which are often persecuted out of superstition. • Any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer. • All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • If holes or trenches need to be dug for pylons or electrical cabling, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Holes should only be dug when they are required and should be used and filled shortly thereafter.	
Cumulative Impacts	During the construction phase the activity would contribute to cumulative fauna disturbance and disruption in the area, but this would be short lived and little long-term impact would be generated.	
Residual Risks	It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.	

5.2.2 Operational Phase Impacts

Impact 1. Faunal Impacts due to Operation

Impact Nature: The operation and maintenance of the grid connection may lead to disturbance or persecution of fauna in the vicinity of the development.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Low (24)	Low (14)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To a large extent, but some low-level residual impact due to noise and human disturbance during maintenance is likely.	
Mitigation	• Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. • If the substation must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. • If the substation perimeter is to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside.	
Cumulative Impacts	The development would contribute to cumulative disturbance for fauna, but the contribution would be very low and is not considered significant.	
Residual Risks	Disturbance from maintenance activities will occur at a low and infrequent level with the result that no long-term impacts are expected	

	to occur.

5.2.3 Cumulative Impacts

The following cumulative impact is assessed as being a likely consequence of the development of the Allepad Solar One PV Grid Connection.

Cumulative Impact 1. Cumulative impacts on fauna and flora from power line and other development sources in the wider Upington area.

Nature: The development of the Allepad PV One Grid Connection project will potentially contribute to cumulative habitat loss and other cumulative impacts in the wider Upington area.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (3)
Probability	Improbable (2)	Probable (3)
Significance	Low (14)	Low (21)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated	To some degree, but the majority of the impact results from the presence of the facility which cannot be mitigated.	
Mitigation: • Ensure that the mitigation hierarchy is followed with a particular emphasis on reducing the development footprint, rehabilitating disturbed areas and reversing degradation where it occurs. • Ensure that an alien management plan and erosion management plan is compiled for the project and is effectively implemented at the site.		

6 CONCLUSION & RECOMMENDATIONS

The vegetation of the wider Allepad PV One project site consists of Kalahari Karroid Shrubland in the east and Gordonia Duneveld in the west of the site. The areas of Kalahari

Karroid Shrubland in the east are associated with shallow calcrete soils with numerous drainage lines as well as a few small pans present. This area is considered largely unsuitable for development. The Allepad PV One development footprint is however restricted to the low and medium sensitivity areas along the N10 and the affected area is considered suitable for the development of the PV project. In terms of fauna, there are few species of conservation concern that are likely to be present or abundant at the site and the primary impact of the development on fauna would be some habitat loss for the more common resident species. As such, no high long-term post-mitigation impacts on fauna are expected to occur as a result of the development. Consequently, the impacts of the development on fauna and flora are considered acceptable and would be of low significance after mitigation.

Cumulative impacts in the area are a potential concern due to the proliferation of solar energy development in the wider Upington area. In terms of habitat loss, the affected vegetation and habitat types are widespread in the area and have not experienced significant levels of transformation to date. As a result, the loss of approximately 250ha of currently intact habitat likely to result from the development is not considered highly significant. Cumulative impacts associated with the development are therefore considered acceptable.

Impact Statement

The development footprint of the Allepad PV One Solar facility is restricted to low and moderate sensitivity habitat typical of the Upington area. The affected area is considered suitable for development and there are no impacts associated with the Allepad PV One Solar facility that cannot be mitigated to a low level. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layout provided for the assessment, the Allepad PV One Solar facility can be supported from a terrestrial ecology point of view. The Allepad PV One Solar Grid Connection with associated infrastructure is likely to generate low impacts on fauna and flora after mitigation. No high impacts that cannot be avoided were observed and from a flora and terrestrial fauna perspective, there are no reasons to oppose the development of the grid connection and associated infrastructure.

7 Activities for Inclusion the Draft EMPr

An Environmental Management Programme (EMPr) provides a link between the predicted impacts and mitigation measures recommended within the EIA and the implementation and operational activities of a project. As the construction and operation of the Allepad PV One plant may impact the environment, activities which pose a threat should be managed and mitigated so that unnecessary or preventable environmental impacts do not result. The primary objective of the EMPr is to detail actions required to address the impacts identified in the EIA during the establishment, operation and rehabilitation of the proposed infrastructure. The EMPr provides an elaboration of how to implement the mitigation measures documented in the EIA. As such the purpose of the EMPr can be outlined as follows:

- To outline mitigation measures and environmental specifications which are required to be implemented for the planning, establishment, rehabilitation and operation/maintenance phases of the project in order to minimise and manage the extent of environmental impacts.
- To ensure that the establishment and operation phases of the solar PV facility do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- To propose mechanisms for monitoring compliance, and preventing long-term or permanent environmental degradation.
- To facilitate appropriate and proactive response to unforeseen events or changes in project implementation that were not considered in the EIA process

Below are the ecologically-orientated measures that should be implemented as part of the EMPr for the development to reduce the significance or extent of the above impacts. The measures below do not exactly match with the impacts that have been identified, as certain mitigation measures, such as limiting the loss of vegetation may be effective at combating several different impacts, such as erosion, faunal impact etc.

Construction Phase Activities

Objective: Limit disturbance of vegetation and loss of protected flora during construction			
Potential Impact	Loss of plant cover leading to erosion as well as loss of faunal habitat and loss of specimens of protected plants.		
Activity/risk source	Vegetation clearing for the following » Clearing for infrastructure establishment. » Access roads. » Laydown areas. » Construction Camps.		
Mitigation: Target/Objective	» Low footprint and low impact on terrestrial environment. » Low impact on protected plant species.		
Mitigation: Action/control		Responsibility	Timeframe
» Preconstruction walk-through of road footprint. » Obtain relevant permits from the Department of Agriculture, Forestry and Fisheries (DAFF) and the Northern Cape Department of Environment and Nature Conservation (DENC) prior to any construction activities at the site. » Affected individuals of selected protected species which cannot be avoided should be translocated to a safe area on the site prior to construction. This does not include woody species which cannot be translocated and where these are protected by DAFF and permit for their destruction would be required. » Erosion control measures should be implemented in areas where slopes have been disturbed. » Revegetation of cleared areas or monitoring to ensure that recovery is taking place. » Alien plant clearing where necessary.		Management/ECO	Construction & Operation
Performance Indicator	» Vegetation loss restricted to infrastructure footprint. » Low impact on protected plant species. » Permit obtained to destroy or translocate affected individuals of protected species.		

Monitoring	ECO to monitor construction to ensure that: » Vegetation is cleared only within essential areas. » Erosion risk is maintained at an acceptable level through flow regulation structures where appropriate and the maintenance of plant cover wherever possible.

Objective: Limit direct and indirect terrestrial faunal impacts during construction		
Project component/s	Construction activities especially the following: » Vegetation clearing. » Human presence. » Operation of heavy machinery.	
Potential Impact	Disturbance of faunal communities due to construction as well as poaching and hunting risk from construction staff.	
Activity/risk source	» Habitat transformation during construction. » Presence of construction crews. » Operation of heavy vehicles.	
Mitigation: Target/Objective	Low faunal impact during construction.	
Mitigation: Action/control	Responsibility	Timeframe
» Environmental induction for all construction staff » ECO to monitor and enforce ban on hunting, collecting etc. of all plants and animals or their products. » Any fauna encountered during construction should be removed to safety by the ECO or other suitably qualified person, or allowed to passively vacate the area. » All vehicles to adhere to low speed limits (30km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust. » All night-lighting should use low-UV type lights (such as most LEDs), which do not attract insects. The lights should also be of types which are directed downward and do not result in large amounts of light pollution.	Management/ECO	Construction
Performance	» Low mortality of fauna due to construction machinery and activities.	

Indicator	» No poaching etc. of fauna by construction personnel during construction. » Removal to safety of fauna encountered during construction.
Monitoring	Monitoring for compliance during the construction phase. All incidents to be noted.

Operational Phase Activities

OBJECTIVE: Limit the ecological footprint of the PV Plant	
Project component/s	Presence and operation of the facility including » Movement of vehicles to and from the site. » Presence of the PV infrastructure and site fencing.
Potential Impact	» Alien plant invasion » Erosion » Pollution » Faunal Impacts
Activity/risk source	» Alien plant invasion in and around the road. » Unregulated runoff from the access road. » Human presence during road maintenance activities » Pollution from maintenance vehicles due to oil or fuel leaks etc. » Maintenance activities which may lead to negative impacts such as pollution, herbicide drift etc.
Mitigation: Target/Objective	Low ecological footprint of the PV Plant during operation.

Mitigation: Action/control	Responsibility	Timeframe
Vegetation control should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner.	Management/ Contractor	Operation
Annual monitoring for alien plant species - with follow up clearing as needed – or as per the frequency stated in the alien invasive management plan to be developed for the site.	Management/ Contractor	Operation
Annual site inspection for erosion or water flow regulation problems – with follow up remedial action where problems are identified.	Management/ Contractor	Operation

Performance Indicator	» No erosion problems at the site. » Low abundance of alien plants.
Monitoring	» Annual monitoring with records of alien species presence and clearing actions. » Annual monitoring with records of erosion problems and mitigation actions taken with photographs.

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9 Annex 1. List of Mammals

List of mammals which are likely to occur in the vicinity of the project site. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the IUCN Red Lists 2014.2 and South African Red Data Book for Mammals (Friedmann & Daly 2004).

Scientific Name	Common Name	Status	Habitat	Likelihood
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus rupestris	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	Low
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Confirmed
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Possible
Lagomorpha (Hares and Rabbits):				
Lepus capensis	Cape Hare	LC	Dry, open regions, with palatable bush and grass	Confirmed
Lepus saxatilis	Scrub Hare	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	High
Rodentia (Rodents):				
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed
Pedetes capensis	Springhare	LC	Occur widely on open sandy ground or sandy scrub, on overgrazed grassland, on the fringes of vleis and dry river beds.	Confirmed
Xerus inauris	South African Ground Squirrel	LC	Open terrain with a sparse bush cover and a hard substrate	Confirmed
Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	Low
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
Mastomys coucha	Southern Multimammate Mouse	LC	Wide habitat tolerance.	High
Thallomys paedulcus	Acacia Tree Rat	LC	Associated with stands of Acacia woodland	Low
Thallomys nigricauda	Black-tailed Tree Rat	LC	Associated with stands of Acacia woodland	Low

Aethomys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	Medium
Parotomys brantsii	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with *Lycium* bushes or *Psilocaulon absimile*	Low
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Gerbilliscus leucogaster	Bushveld Gerbil	LC	Predominantly associated with light sandy soils or sandy alluvium	Low
Gerbilliscus brantsii	Higheld Gerbil	LC	Sandy soils or sandy alluvium with some cover of grass, scrub or open woodland	High
Saccostomus campestris	Pouched Mouse	LC	Catholic habitat requirements, commoner in areas where there is a sandy substrate.	High
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Primates:				
Papio ursinus	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Low
Cercopithecus mitis	Vervet Monkey	LC	Most abundant in and near riparian vegetation of savannahs	Low
Eulipotyphla (Shrews):				
Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	Low
Erinaceomorpha (Hedgehog)				
Atelerix frontalis	South African Hedgehog	VU	Generally found in semi-arid and subtemperate environments with ample ground cover	Moderate
Carnivora:				
Proteles cristata	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	Confirmed
Hyaena brunnea	Brown Hyaena	NT	Nama and Succulent Karoo and the drier parts of the Grassland and Savanna Biomes	Low
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	Confirmed

Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Confirmed
Cynictis penicillata	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	Confirmed
Galerella sanguinea	Slender Mongoose	LC	Catholic habitat requirements but does not occur in the south.	Low
Herpestes pulverulentus	Cape Grey Mongoose	LC	Wide habitat tolerance	High
Atilax paludinosus	Marsh Mongoose	LC	Associated with well-watered terrain, living in close association with rivers, streams, marshes, etc.	Moderate
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	Confirmed
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	Confirmed
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	High
Aonyx capensis	African Clawless Otter	LC	Predominantly aquatic and do not occur far from permanent water	Low
Ictonyx striatus	Striped Polecat	LC	Widely distributed throughout the sub-region	Confirmed
Mellivora capensis	Ratel/Honey Badger	LC	Catholic habitat requirements	High
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LC	Presence of bushes is essential	Confirmed
Raphicerus campestris	Steenbok	LC	Inhabits open country,	Confirmed
Chiroptera (Bats)				
Pipistrellus capensis	Cape Serotine Bat	LC	Wide habitat tolerances, but often found near open water	High
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	In arid areas. often associated with water sources	High
Nycteris thebaica	Egyptian Slit-faced Bat	LC	Wide habitat tolerance	High
Rhinolophus denti	Dent's Horseshoe Bat	LC	Arid areas but require caves or rock crevices	High
Rhinolophus darlingi	Darling's Horsehoe Bat	LC	Savanna woodland species but requires caves	Low
Eidolon helvum	Straw-coloured fruit bat	LC	Occasional migratory visitors within southern Africa	Low

10 Annex 2. List of Reptiles

List of reptiles which are likely to occur at the vicinity of the project site, based on the SARCA database. Conservation status is from Bates et al. (2014).

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Agamidae	*Agama*	*aculeata*	*aculeata*	Common Ground Agama	Least Concern	3
Agamidae	*Agama*	*anchietae*		Anchieta's Agama	Least Concern	2
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern	6
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern	3
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern	2
Colubridae	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern	1
Colubridae	*Prosymna*	*frontalis*		Southwestern Shovel-snout	Least Concern	2
Colubridae	*Psammophis*	*trinasalis*		Fork-marked Sand Snake	Least Concern	2
Colubridae	*Telescopus*	*beetzii*		Beetz's Tiger Snake	Least Concern	2
Cordylidae	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern	11
Elapidae	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not listed	2
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern	1
Gekkonidae	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern	6
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern	6
Gekkonidae	*Chondrodactylus*	*turneri*		Turner's Gecko	Least Concern	5
Gekkonidae	*Lygodactylus*	*bradfieldi*		Bradfield's Dwarf Gecko	Least Concern	1
Gekkonidae	*Lygodactylus*	*capensis*	*capensis*	Common Dwarf Gecko	Least Concern	1
Gekkonidae	*Pachydactylus*	*latirostris*		Quartz Gecko	Least Concern	6
Gekkonidae	*Pachydactylus*	*punctatus*		Speckled Gecko	Least Concern	2
Gekkonidae	*Pachydactylus*	*purcelli*		Purcell's Gecko	Least Concern	6
Gekkonidae	*Ptenopus*	*garrulus*	*garrulus*	Common Barking Gecko	Least Concern	1
Gekkonidae	*Ptenopus*	*garrulus*	*maculatus*	Spotted Barking Gecko	Least Concern	1
Lacertidae	*Heliobolus*	*lugubris*		Bushveld Lizard	Least Concern	1
Lacertidae	*Meroles*	*suborbitalis*		Spotted Desert Lizard	Least Concern	3
Lacertidae	*Pedioplanis*	*inornata*		Plain Sand Lizard	Least Concern	3
Lacertidae	*Pedioplanis*	*namaquensis*		Namaqua Sand Lizard	Least Concern	3

Scincidae	*Acontias*	*kgalagadi*	*kgalagadi*	Striped Blind Legless Skink	Least Concern	1
Scincidae	*Acontias*	*lineatus*		Striped Dwarf Legless Skink	Least Concern	4
Scincidae	*Trachylepis*	*occidentalis*		Western Three-striped Skink	Least Concern	3
Scincidae	*Trachylepis*	*sparsa*		Karasburg Tree Skink	Least Concern	3
Scincidae	*Trachylepis*	*spilogaster*		Kalahari Tree Skink	Least Concern	1
Scincidae	*Trachylepis*	*striata*		Striped Skink	Least Concern	4
Scincidae	*Trachylepis*	*sulcata*	*sulcata*	Western Rock Skink	Least Concern	4
Scincidae	*Typhlosaurus*	*lineatus*		Striped Blind Legless Skink	Not listed	1
Testudinidae	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed	16
Typhlopidae	*Rhinotyphlops*	*schinzi*		Schinz's Beaked Blind Snake	Least Concern	2
Varanidae	*Varanus*	*albigularis*	*albigularis*	Rock Monitor	Least Concern	1
Varanidae	*Varanus*	*niloticus*		Water Monitor	Least Concern	4
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern	1

11 Annex 3. List of Amphibians

List of amphibians which are likely to occur in the vicinity of the project site. Habitat notes and distribution records are based on Du Preez and Carruthers (2009), while conservation status is from the IUCN Red Lists 2014 and Minter et al. (2004).

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Amietophrynus gutturalis	Guttural Toad	Not Threatened	Around open pools, dams, vleis and other semi-permanent or permenent water	Widespread	Low
Amietophrynus poweri	Western Olive Toad	Not Threatened	Around vleis and pans in thornveld savanna	Widespread	Low
Amietophrynus rangeri	Raucous Toad	Not Threatened	Rivers and stream in grassland and fynbos	Endemic	Low
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	High
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened	Breed in shallow margins of rain-filled depressions.	Widespread	Low
Xenopus laevis	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	High
Cacosternum boettgeri	Common Caco	Not Threatened	Marshy areas, vleis and shallow pans	Widespread	High
Amietia angolensis	Common River Frog	Not Threatened	Banks of slow-flowing streams or permanent bodies of water	Widespread	High
Tomopterna cryptotis	Tremelo Sand Frog	Not Threatened	Savanna and grassland	Widespread	High
Tomopterna tandyi	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanna	Widespread	High