# IMPACT ASSESSMENT FOR THE PROPOSED KOTULO TSATSI ENERGY PV1 DEVELOPMENT:

# FAUNA & FLORA SPECIALIST STUDY

**PRODUCED FOR SAVANNAH ENVIRONMENTAL**

**BY**

3Foxes Biodiversity Solutions

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***EXECUTIVE SUMMARY***

Kotulo Tsatsi Energy (Pty) Ltd, is proposing the construction of the Kotulo Tsatsi Energy PV1 photovoltaic (PV) solar energy facility on a site located between Kenhardt and Brandvlei in the Northern Cape Province. The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 200MW. Savannah Environmental has appointed 3Foxes Biodiversity Solutions to provide a specialist terrestrial biodiversity EIA study of the project site as part of the required EIA process.

A field assessment 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 project site. In terms of vegetation, the site is not considered highly sensitive as the affected vegetation type, Bushmanland Basin Shrubland, is widely distributed and the abundance of species of conservation concern within the affected area is low. Although the majority of the site consists of sparse, arid shrubland on shallow soils, considered to be of low sensitivity, there are also some medium and high sensitivity washes present. Although some development in the washes areas is considered acceptable, some caution should be exercised regarding vegetation clearing in these areas as wholesale clearing is likely to leave these areas vulnerable to erosion as these areas receive runoff from the adjacent slopes and the PV development is likely to significantly increase runoff.

Due to the homogenous nature of the habitat for fauna, faunal diversity in the area is low and faunal species of concern are not likely to be abundant at the site. As the surrounding habitat is very homogenous, the habitat loss resulting from the development would not result in significant local habitat loss for fauna or disrupt any broader scale movement corridors for fauna. Consequently, there are no highly significant impacts present at the site which cannot be mitigated to a low level and which would represent a red flag for the development.

The site falls outside of any CBAs, ESAs and NC-PAES focus areas with the result that impacts on CBAs and the ability to meet future conservation targets would be minimal. Although there are several other planned renewable energy developments in the area, cumulative impacts are still low and considered acceptable.

***Impact Statement***

There are no impacts associated with the Kotulo Tsatsi PV1 project that cannot be mitigated to an acceptable level and as such, the assessed layout is considered acceptable. With the application of relatively simple mitigation and avoidance measures, the impact of the Kotulo Tsatsi PV1 on the local environment can be reduced to an acceptable magnitude. The contribution of the Kotulo Tsatsi PV1 development to cumulative impact in the area would be low and is considered acceptable. Overall, there are no specific long-term impacts likely to be associated with the development of the Kotulo Tsatsi PV1 project that cannot be reduced to

a low significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

***CONTENTS***

***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-<br>a) details of-<br>i. the specialist who prepared the report; and<br>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 5 |
| l) any conditions for inclusion in the environmental authorisation; | Section 5 |
| m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 5 |
| n) a reasoned opinion-<br>i. whether the proposed activity, activities or portions thereof should be authorised;<br>(iA) regarding the acceptability of the proposed activity or activities and<br>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*


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Ecological Solutions for People & the Environment

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 on PV Facilities in the Northern Cape**

- Kathu Solar PV Facility. Fauna and Flora EIA Process. Cape EAPrac 2015.
- Mogobe Solar PV Facility. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- Logoko Solar PV Facility. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- RE Capital 10 Solar Power Plant, Postmasburg. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- Adams PV Project – EIA process and follow-up vegetation survey. Aurora Power Solutions. 2016.

***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: ____02 February 2021_____

# 1 INTRODUCTION

The Applicant, Kotulo Tsatsi Energy (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Kotulo Tsatsi Energy PV1) located on a site located approximately 70km south-west of the town of Kenhardt and 60km north east of Brandvlei in the Northern Cape Province. The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 200MW. The facility will be located within the farm Portion 3 of Farm Styns Vley 280. The PV facility is planned to be located adjacent to the authorised 100MW Kotulo Tsatsi PV2 facility, and within an area previously authorised for CSP project infrastructure. Savannah Environmental (Pty) Ltd has appointed 3Foxes Biodiversity Solutions to provide a specialist terrestrial biodiversity EIA study of the project site as part of the required authorisation process.

The purpose of the Kotulo Tsatsi Energy PV1 terrestrial biodiversity specialist study is to describe and detail the ecological features of the project site; provide an assessment of the ecological sensitivity of the project site; and identify the likely impacts that would be associated with the development of a solar energy facility on the project site. 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 project area. 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 development
- 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 the proposed 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 (EIS) which contains:
  - a summary of the key findings of the EIA;
  - an assessment of the positive and negative implications of the proposed development;
  - 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 EMPr 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:

- Preconstruction and Construction
- Operational Phase
- Decommissioning Phase

### *1.1 ASSESSMENT APPROACH & PHILOSOPHY*

This assessment is conducted according to the 2014 EIA Regulations (Government Notice Regulation 326, as amended) 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 the proposed development 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:

- A description of 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 EMPr 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 project 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 project 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 project site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the project 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 proposed development will be identified.
- The opportunities and constraints for proposed 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*

A development envelope of ~847 ha was defined through the Scoping evaluation of the site, and has now been assessed for the project which includes the PV infrastructure required to

generate 200MW of electricity. The infrastructure to be developed within the development envelope will be known as the development footprint and will have an extent of ~810ha. The infrastructure associated with the PV development includes:

- Solar PV array footprint comprising of:
  - PV modules and mounting structures
  - Inverters and transformers
  - Integrated Energy Storage System (IESS)
  - Cabling between the project components
- On-site facility substation to facilitate the connection between the solar PV facility and the Eskom electricity grid
- Battery Energy Storage System (BESS)
- Internal access roads
- Access roads, internal distribution roads and fencing around the development footprint area.
- Admin block comprising of:
  - Site offices and maintenance buildings, including workshop areas for maintenance and storage.
  - Assembly plant
  - Laydown areas and temporary man camp area
- Access roads, internal distribution roads and fencing around the development area.

# 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 2018 SANBI update) as well as the National List of Threatened Ecosystems (2018), 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 project site, but this is necessary to ensure a conservative approach as well as counter the fact that the project 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 (2021).

*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 Northern Cape Protected Areas Expansion Strategy (NC-PAES) as well as the National Protected Areas Expansion Strategy 2008 (NPAES).

*Fauna*

- Lists of mammals, reptiles and amphibians which are likely to occur at the project 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 Animal Demography Unit (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 project site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2021), 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 (2021).

### *2.2 SITE VISITS & FIELD ASSESSMENT*

An initial site visit took place on the 14th of August 2016 when the proposed development was still a CSP plant, and the follow-up field assessment to verify and sample the current footprint took place on the 12th of December 2021. During the site visits, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Specific features visible on the satellite imagery of the site were also marked for field inspection and were verified and assessed during the site visit. Walk-through-surveys were conducted within representative areas across the different habitat units identified and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such. The presence

of sensitive habitats such as stands of large trees, pans or rocky outcrops were noted in the field where present and recorded on a GPS. The site is homogenous and open, with the result that any features present are easily observable and it is highly unlikely that there are any species of significance or sensitive features present that were not observed during the site visits.

### *2.3 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 as well as personal knowledge of the project 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/No-Go** – 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.

### 2.4 SAMPLING LIMITATIONS AND ASSUMPTIONS

The current study included two sites visits with associated field assessment which took place across different seasons as well as a desktop study. This serves to significantly reduce the limitations and assumptions required for the study. During both sampling periods, conditions

at the site were fairly dry with a low abundance of forbs and annuals. The perennial species present were however in an adequate condition for identification. As a result, the species lists obtained for the site are considered representative and reliable for the perennial flora of the site but forbs and annual are poorly represented. However, since there are few forbs or annuals of conservation concern in the area, this is not considered to represent a significant limitation of the current study.

In terms of fauna, there are always some limitations present due to the relatively short duration of the site visits and the difficultly in confirming the presence of many species. However, the consultant is very familiar with the fauna of the area, having worked extensively in the area on various projects over the course of several years. In terms of the 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 project site. This is acknowledged as a limitation of the study; however, it is substantially reduced given the previous experience in the area. In order to further reduce this limitation, and ensure a conservative approach, the species lists derived for the project site from the literature were obtained from an area significantly larger than the project site and are likely to include a much wider array of species than actually occur at the project 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*

The vegetation in and around the site is illustrated below in Figure 3. The site lies entirely within the Bushmanland Basin Shrubland vegetation type. This is an extensive vegetation type that occupies over 34 000 km$^2$ of the Northern Cape and is among the most extensive vegetation types in South Africa. As a result of the arid nature of the area, very little of this vegetation type has been affected by intensive agriculture and it is classified as Least Threatened. There are few endemic and biogeographically important species present within this vegetation unit and only *Tridentea dwequensis* is listed by Mucina and Rutherford as biogeographically important while *Cromidon minimum*, *Ornithogalum bicornutum* and *O.ovatum* subsp *oliverorum* are listed as being endemic to the vegetation type. The characteristic species as described in Mucina & Rutherford (2006) for this vegetation type are not repeated here as the actual vegetation as observed on the site is described in the next section.

Other vegetation types which occur in the wider area include Bushmanland Arid Grassland which occurs on sandy pediments north and east of the site, Lower Gariep Broken Veld on the rocky hills of the area and Bushmanland Vloere which occupies the low-lying flat pan systems

of the area. Neither Bushmanland Arid Grassland or Lower Gariep Broken Veld occur in proximity to the site and would not be affected by the development. There is a small pan within the site that can be considered to represent the Bushmanland Vloere vegetation, but which has not been mapped under the VegMap or the 2018 NBA wetlands layer.

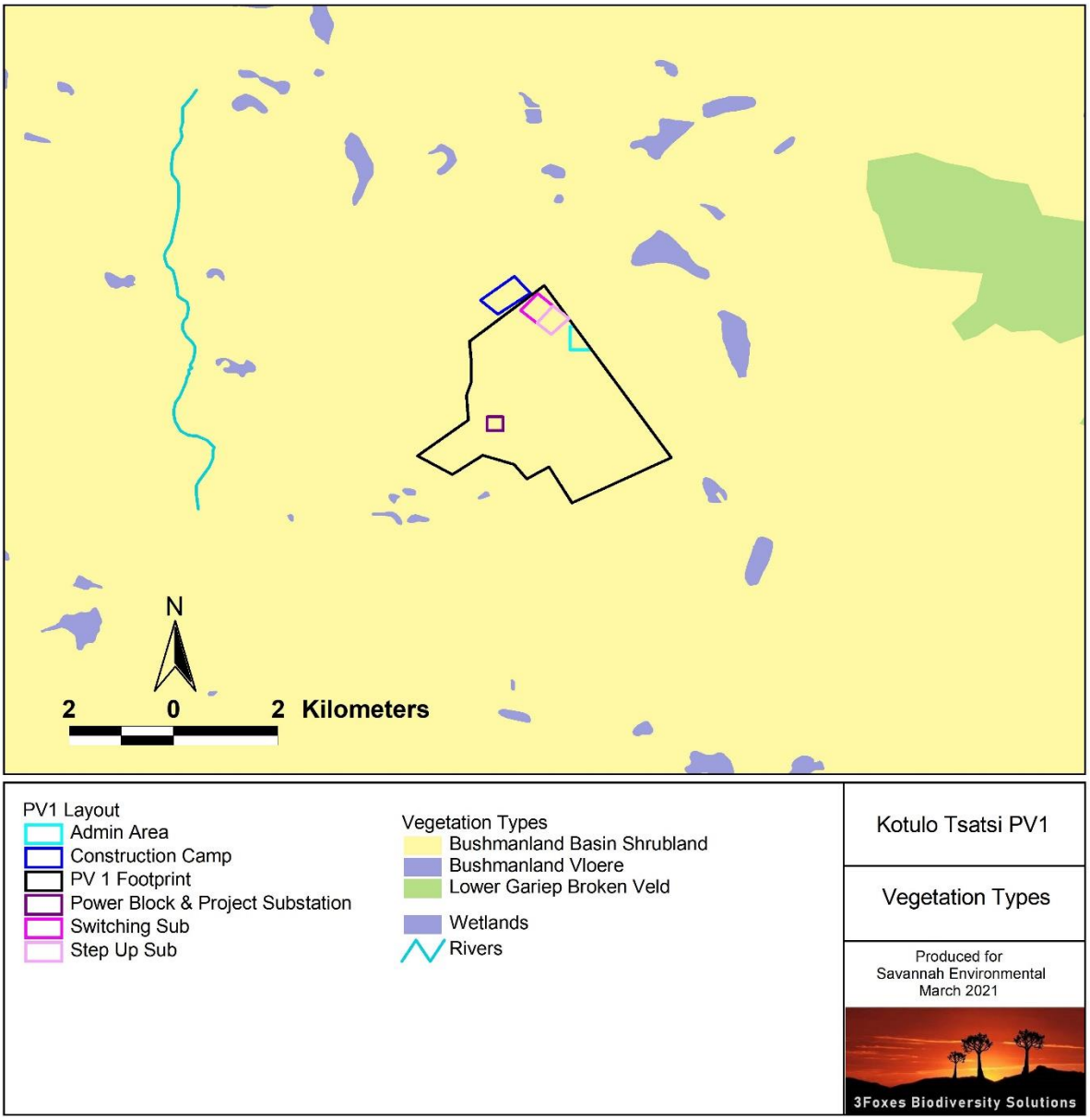


**Figure 1.** Broad-scale overview of the vegetation in and around the Kotulo Tsatsi PV1 site. The vegetation map is an extract of the 2018 update of the national vegetation map.

### *3.2 HABITATS & PLANT COMMUNITIES*

The plant communities and habitats of the affected area as observed at the site are described and illustrated below.

*Bushmanland Basin Shrubland*

At a broad level, the Bushmanland Basin Shrubland of the site is very homogenous and repetitive, with generally low diversity. There is however some variation observable at the site related largely to soil depth, with very sparse vegetation present on the areas of stony soils, usually associated with the slightly elevated hills of the site, while the lower-lying areas have deeper soils and are characterised by various shrub-dominated communities. These are described and illustrated below.

**Figure 2.** Large parts of the site consist of stony soils with low vegetation cover. Common species in these areas include low shrubs such as *Aizoon schellenbergii*, *Osteospermum armatum*, *Eriocephalus pauperrimus*, *Rosenia glandulosa*, *Pteronia leucoclada Pteronia glomerata*, *Pteronia sordida*, *Salsola tuberculata*, *Sarcocaulon patersonii* and *Hermannia spinosa*. Grasses emerge after rains and consist of species such as *Stipagrostis obtusa*, *Enneapogon scaber*, E.desvauxii and *Aristida adscensionis*.. These areas are considered low sensitivity and the only species of significance present are occasional individuals of the provincially protected species *Aloe claviflora* and *Hoodia gordonii* which occur at a low density.

**Figure 3.** The lower-lying parts of the site on deeper soils are often dominated by extensive *Rhigozum trichotomum* stands. Other common species include large shrubs such as are *Phaeoptilum spinosum* and *Lycium pumilum* with low shrubs such as *Osteospermum armatum*, *Eriocephalus pauperrimus*, *Rosenia glandulosa*, *Pteronia leucoclada Pteronia glomerata*, *Salsola tuberculata*, *Lycium pumilum* and *Zygophyllum chrysopteron*. Perennial grasses are common and dominant species include *Stipagrostis ciliata*, *Stipagrostis obtusa*, *Stipagrostis uniplumis*, *Fingerhuthia africana*, *Enneapogon scaber* and *Aristida adscensionis*. No species of conservation concern were observed in these areas and they are generally considered low to medium sensitivity.

*Washes and Drainage Features*

The low rainfall and low topography of the site means that the drainage features present are not well-developed. Typically, water drains from the low hills into the broad intervening low-lying areas and a well-defined drainage line is not present, but rather represents a broad area which receives runoff from the adjacent areas in which the vegetation is denser. These areas are typically dominated by *Rhigozum trichotomum* with occasional taller species such as *Parkinsonia africana*. There is also a small pan feature within the footprint with little vegetation present. These areas are generally considered medium sensitivity in the less-well developed areas and high sensitivity within the areas of dense vegetation or where a drainage line has developed. Although some development in these areas is considered acceptable, it

would be undesirable to clear all vegetation from these areas as this would likely encourage erosion.

**Figure 4.** Example of a well-developed wash within the site. The vegetation of these areas is dominated by large shrubs such as *Phaeoptilum spinosum*, *Lycium pumilum* and *Rhigozum trichotomum*, with an understorey of grasses including *Stipagrostis ciliata*, *S.obtusa* and *S.brevifolia* as well as low shrubs such as *Aptosimum spinescens*, *Salsola turberculata* and *Rosenia oppositifolia*.

**Figure 5.** View over the small pan which is about 4ha in extent and which lies near the southern boundary of the PV1 area, within the wash that characterises this area. This feature is considered to be high sensitivity and should preferably not be built on.

### *3.3 LISTED AND PROTECTED PLANT SPECIES*

According to the SANBI POSA database, 135 species have been recorded from the four quarter degree squares 2920 BC, BD, DA and DB. Although the area has naturally low species richness, this total is still quite low given that it covers four quarter degree squares and indicates that the area has probably not been well sampled. Only one listed species is known from the area, *Hoodia gordonii* which is classified as DDD (Data Deficient – Insufficient Information) and which was observed to occur as occasional scattered individuals across the broader study area, but was not observed within the current development footprint. Aside from the listed species, a number of protected species are present at the site, including *Aloe claviflora*. Overall, the abundance of plant species of conservation concern within the site is low and no significant impacts on such species can be expected.

### *3.4 FAUNAL COMMUNITIES*

#### *3.4.1 Mammals*

The site is not likely to have a rich faunal community due to the low diversity of habitats within the site. This site falls within the known distribution range of 50 terrestrial mammals

but the actual number of species which occur at the site is likely to be considerably less. As there are no rocky hills or outcrops, species such as Klipspringer, Rock Hyrax, Dassie Rat, Western Rock Elephant Shrew and Smith's Red Rock Rabbit are not likely to occur at the site. Yellow Mongoose *Cynictis penicillata*, South African Ground Squirrel *Xerus inauris*, Steenbok *Raphicerus campestris* and Common Duiker *Sylvicapra grimmia* were observed on the site and there was evidence of Aardvark *Orycteropus afer*, Aardwolf *Proteles cristatus*, Cape Porcupine *Hystrix africaeaustralis*, Bat-Eared Fox *Otocyon megalotis* and Stiped Polecat *Ictonyx striatus*. Widespread predators such as Caracal *Caracal caracal*, Black-backed Jackal *Canis mesomelas* and Cape Fox *Vulpes chama* are also likely to be present at typically low density for an arid area. *Parotomys littledalei*, Littledale's Whistling Rat, is listed as Near Threatened and its habitat is typically associated with riverine habitat, particularly with *Lycium* bushes or *Psilocaulon absimile* plants, where there is some perennially green vegetation. As suitable habitat for this species does not occur at the site, it is not likely that this species is present on-site.

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 some habitat loss equivalent to the footprint of the development and potentially some local disruption of the broad-scale connectivity of the landscape.

### *3.4.2 Reptiles*

According to the SARCA database and the literature, 30 reptile species have been recorded from the broader area, which is a generally low reptile diversity. The SARCA list includes only two tortoises and eight snakes indicating that the reptile community is low in tortoises and snakes, but relatively rich in lizards, skinks and geckos. This composition reflects the lack of vegetation cover and structure in the landscape at the site and across Bushmanland in general, as the largely open ground and hot climate has favoured nocturnal and fast-moving species. Due to the lack of rocky outcrops at the site, Girdled Lizards (*Cordylus* spp) are not likely to be present, while species that prefer sandy, stony and open ground are likely to be dominant. The Namaqua Sand Lizard *Pedioplanis namaquensis* and Ground Agama *Agama aculeata* are the only species observed during the site visits. No listed species are known from the area but the two tent tortoise species known from the area are protected under provincial ordinance as well as Appendix II of Cites. Stohbach (2015) recorded *Psammophis* species (sand snake), Tent Tortoise, Variegated Skink and Southern Rock Agama at the site.

No specialised reptile habitats were observed within the development footprint and there were no areas of particular significance for reptiles present at the site. As a result, the habitat loss resulting from the PV plant, which in the long-term would be low, is not considered significant

in terms of generating an impact on reptiles. In addition, experience from existing PV plants indicates that some reptile species persist or are even favoured within operational PV plants.

### *3.4.3 Amphibians*

The site lies within or near the range of eight amphibian species, but given the aridity of the site, only those species which are relatively independent of water would be present. The Karoo Toad *Vandijkophrynus gariepensis* is the most likely species to be present on the site, but even this species is unlikely to be abundant and likely relies on anthropogenic water sources. The drainage wash areas are too small and temporal to represent breeding sites for amphibians. The greatest threat to amphibians associated with the development is probably chemical and fuel/oil spills related to the operation of heavy vehicles during construction, rather than the presence of the development in the long-term. Provided that suitable precautions are followed to avoid impacts on amphibians and their habitats during the construction phase, it is not likely that the development of the PV plant would have a significant long-term impact on amphibians that may be present.

## *3.5 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 6. The development area lies entirely outside of any CBAs or ESAs and as such would have minimal impact on these features. In terms of conservation planning, the site does not fall within a national or Northern Cape Protected Area Expansion Strategy Focus Area (NC-PAES) and as such is not currently considered important for meeting conservation targets, either at the national level or within the province. This is not surprising given the paucity of significant biodiversity features within the site. Thus, the development would not have an impact on CBAs or Ecological Support Areas and as such this impact is not further assessed.

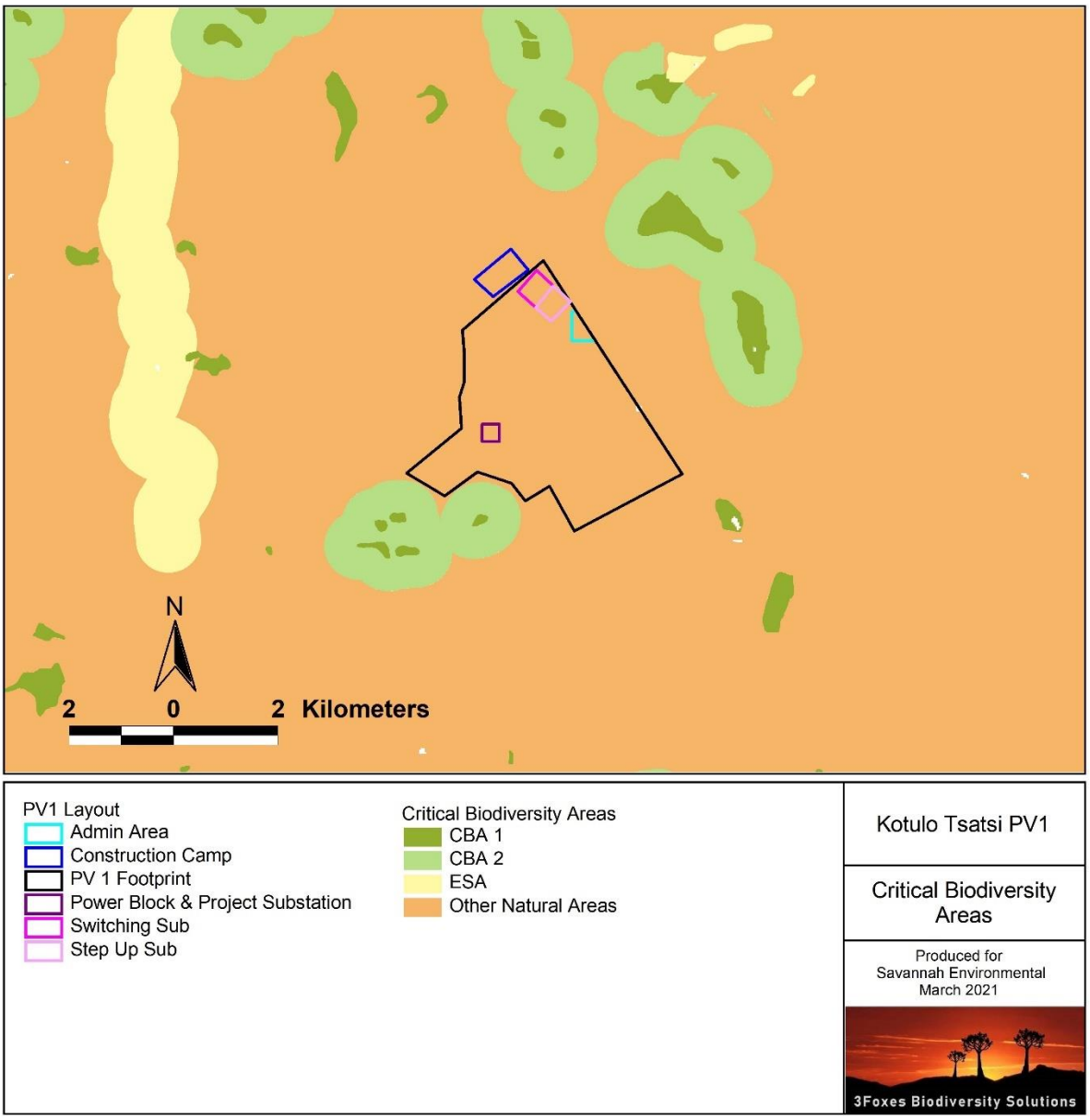


**Figure 6.** Extract of the Northern Cape Critical Biodiversity Areas map for the study area, showing that the site does not impact any CBAs or ESAs.

### *3.6 CURRENT BASELINE & CUMULATIVE IMPACT*

A map of the current proposed and developed renewable energy projects in the broad vicinity of the Kotulo Tsatsi PV1 project site is illustrated below in Figure 7. There are two nodes of development in the area, the first being around the Aries substation northeast of the current site, where there is an existing 10MW plant which occupies about 16 ha and an additional ~500ha of approved PV facilities.

In the immediate vicinity of the current site, the current project would replace the existing approved CSP plant and as such the CSP plant would fall away. In addition to the Kotulo Tsatsi PV1 facility, there are two additional PV facilities that are planned for the site. The Kotulo Tsatsi PV1 footprint would be approximately 810 ha, while it can be assumed that the other two facilities would have a similar footprint, giving rise to an estimated 2430 ha of PV plants at the current site. While this sounds like an extensive area, in context of the receiving environment, this is a small proportion of the landscape within 50km of the site (7854 km²). While the PV developments would generate some local impact were all three to go ahead, a significant broader impact is not likely for a number of reasons. Firstly, the affected vegetation type, Bushmanland Basin Shrubland is one of the most extensive vegetation types in South Africa; is still more than 99% intact and has consistently low levels of species turnover, with the result that it is very homogenous with few habitats of concern present. Secondly, the broader area, within a 50km radius of the site is still overwhelmingly intact with little other existing transformation. As the wider area is still largely free from development, the capacity of the area to support development is still considered generally quite high and given the broad-scale that most ecological processes in this area operate over, the current levels of habitat fragmentation are still considered low and not a threat to ecological processes in the area. The contribution of the current project at 810ha is considered relatively low and would result in a low additional contribution to cumulative impact in the area and as such is considered acceptable.

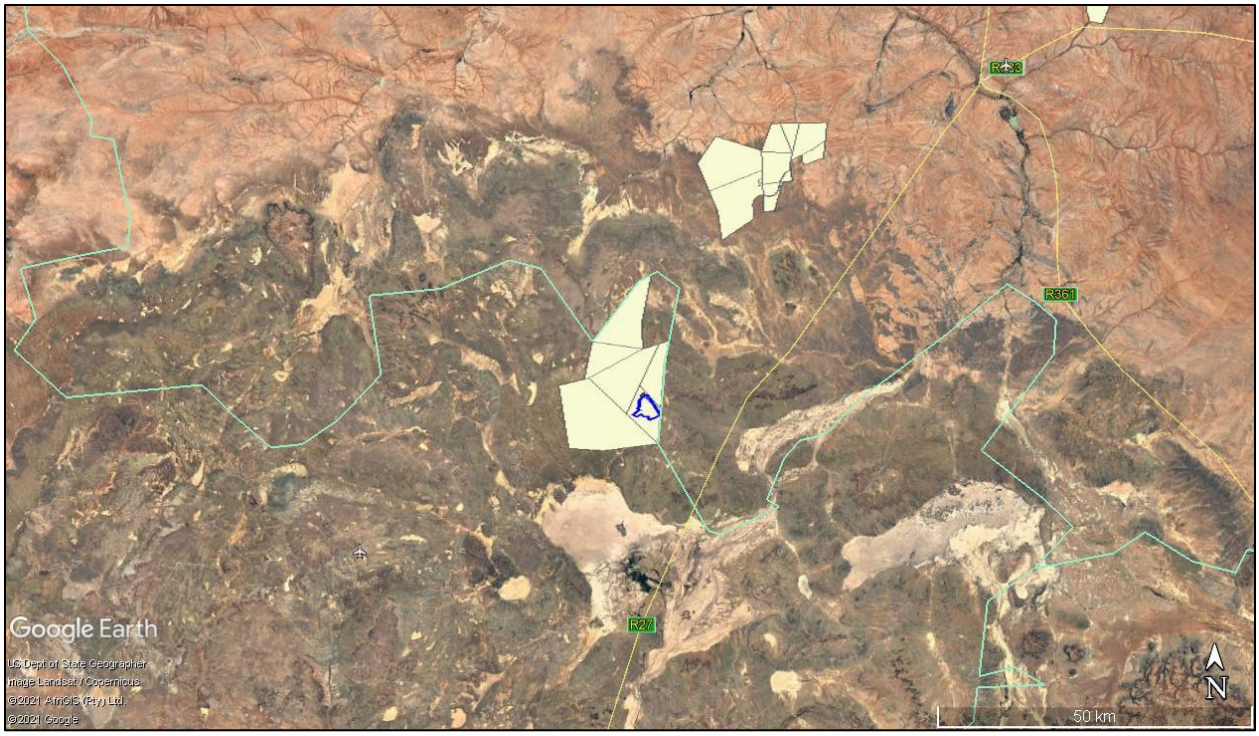


**Figure 7**. Map of renewable energy development facilities as well as current applications for the wider study area. It is important to note that the map indicates the affected properties and not the extent of the facilities themselves.

### *3.7 SITE SENSITIVITY ASSESSMENT*

The sensitivity map for the development area associated with Kotulo Tsatsi PV1 is illustrated below in Figure 8. Although most of the development footprint is within low sensitivity areas, there are also some medium sensitivity minor washes and high sensitivity large washes present within the development footprint. Although the high sensitivity areas are not considered no-go areas, development in these areas, should be subject to certain constraints regarding the clearing of vegetation. The high sensitivity areas represent broad flat-bottomed sandy washes dominated by *Rhigozum trichotomum*. These areas receive runoff from the surrounding landscape and this is likely to increase following the construction of the PV plant as the panels themselves would generate a lot of run off, making these areas vulnerable to erosion. Clearing and disturbance in these areas would potentially increase the erosion potential of the site. In order to allow for some protection against erosion, it is recommended that if these larger wash areas cannot be avoided, that the vegetation is not clipped below 50cm in height. Provided that impact on the major wash areas can be minimised as suggested above, then the development is considered acceptable.

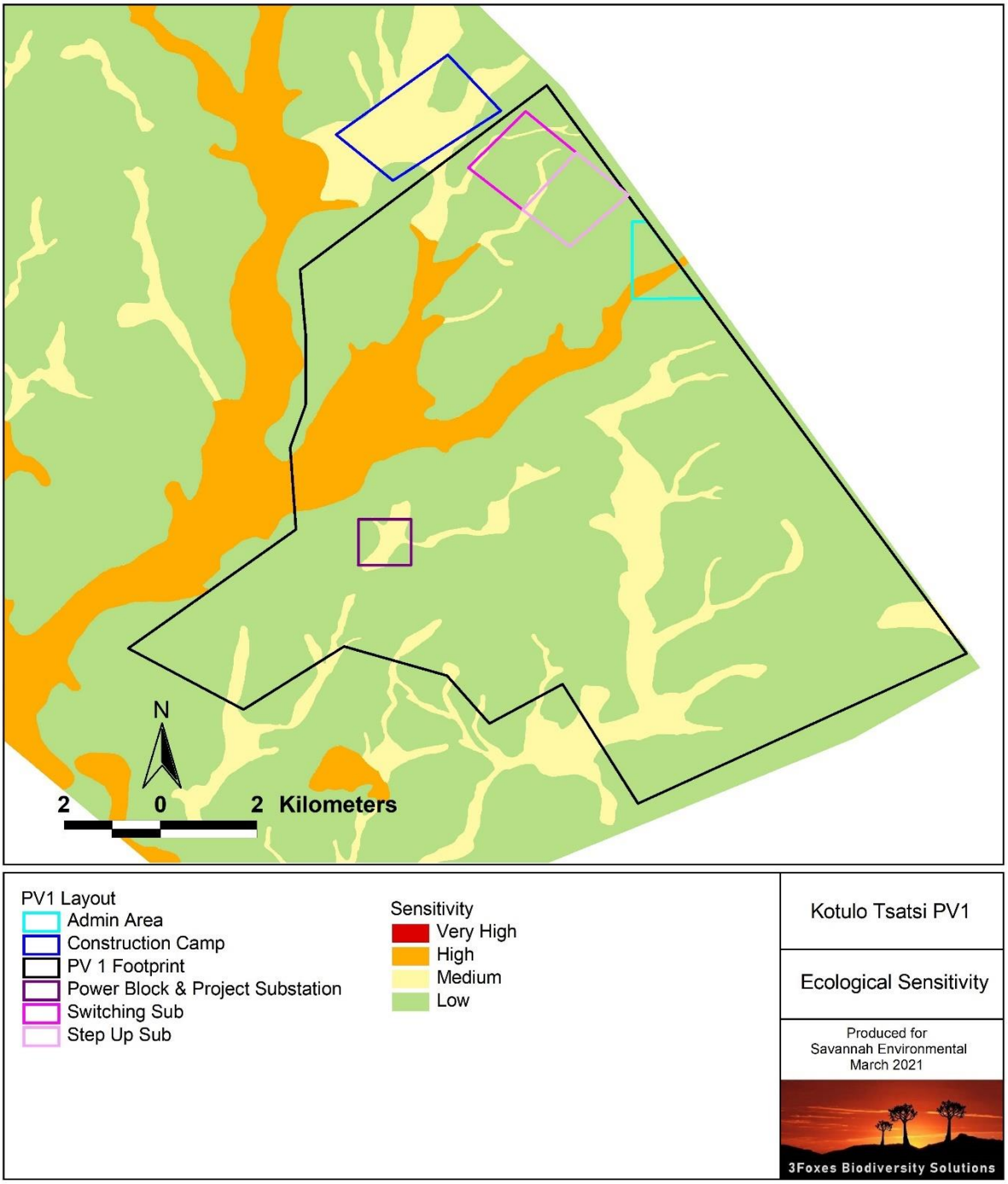


**Figure 8.** Sensitivity map for the Kotulo Tsatsi PV1 development area and immediate surroundings.

# 4 IDENTIFICATION & NATURE OF IMPACTS

In this section, the potential impacts and associated risk factors that may be generated by the proposed development are identified. In order to ensure that the impacts identified are broadly applicable and inclusive, all the likely or potential impacts that may be associated with the proposed development are listed. The relevance and applicability of each potential impact to the current situation are then examined in more detail in the next section.

## *4.1 IDENTIFICATION OF POTENTIAL IMPACTS AND DAMAGING ACTIVITIES*

Potential ecological impacts resulting from the proposed development of the Kotulo Tsatsi PV1 development and associated infrastructure would stem from a variety of different activities and risk factors associated with the preconstruction, construction and operational phases of the project including the following:

*Impacts on vegetation and protected plant species*

Vegetation clearing during construction will lead to the loss of currently intact habitat within the proposed development footprint and is an inevitable consequence of the proposed development. As this impact is certain to occur it will be 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.

*Increased Erosion Risk*

The disturbance created during construction would leave the site vulnerable to wind and water erosion. Soil disturbance associated with the development will render the impacted areas vulnerable to erosion and measures to limit erosion will need to be implemented. This impact is likely to manifest during construction and would persist into the operation phase and should therefore be assessed for both phases.

*Alien Plant Invasion*

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some woody aliens such as *Prosopis* are already present in the area and additional alien plant invasion following construction is likely. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion. This impact would manifest during the operation phase, although some of the required measures to reduce this impact are required during construction.

*Cumulative Impact broad-scale ecological processes*

Transformation of intact habitat 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. Due to the presence of a number of other renewable energy developments in the area, this is a potential cumulative impact of the development that is assessed.

# 5 ASSESSMENT OF IMPACTS

The various identified potential impacts are assessed below for the different phases of the proposed development. It is important to note that this is contingent on the layout as provided and any changes to the layout or project description would potentially invalidate the assessment.

## *5.1 KOTULO TSATSI PV1*

The following is an assessment of the Kotulo Tsatsi PV1 development and associated infrastructure, for the planning and construction, operational and decommissioning phases of the proposed 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, there is likely to be some loss of individuals of protected plant species. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (1) | Local (1) |

| | | |
|---|---|---|
| **Duration** | Long-term (4) | Long-term (4) |
| **Magnitude** | Moderate (4) | Low (3) |
| **Probability** | Definite (5) | Definite (5) |
| **Significance** | Medium (45) | Medium (40) |
| **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 and any individuals of protected species 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 permit conditions.<br>• Search and rescue for identified species of concern before construction.<br>• Vegetation clearing to commence only after walk-through has been conducted and necessary permits obtained.<br>• Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, remaining within demarcated construction areas etc.<br>• Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas.<br>• Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.<br>• All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.<br>• 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. The affected vegetation type is however widespread and the contribution would be low. | |
| **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 (3) |
| **Probability** | Highly Probable (4) | Highly Probable (4) |
| **Significance** | Medium (32) | Low (24) |
| **Status** | Negative | Negative |
| **Reversibility** | Moderate | Moderate |
| **Irreplaceable loss of resources** | No | No |
| **Can impacts be mitigated?** | Although 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 readily 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.<br>• Any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer.<br>• All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.<br>• 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.<br>• If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench. | |
| **Cumulative Impacts** | During the construction phase the activity would contribute to cumulative fauna disturbance and disruption in the area, but as there are still extensive 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.<br>• 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 or HPS bulbs), which do not attract insects.<br>• 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.<br>• All vehicles accessing the site should adhere to a low speed limit (30km/h max for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises.<br>• 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 Phase Impact 2. Habitat Degradation due to Erosion***

| **Impact Nature:** Disturbance created during construction will leave the site and its immediate surroundings vulnerable to erosion for several years into the operational phase. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium-term (2) | Short-term (1) |
| **Magnitude** | Medium (4) | Low (3) |
| **Probability** | Likely (4) | Likely (3) |
| **Significance** | Low (28) | Low (15) |
| **Status** | Negative | Negative |
| **Reversibility** | Medium | 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. This should make provision for annual monitoring and rehabilitation.<br>• All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.<br>• There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs, grasses and trees from the local area. | |
| **Cumulative Impacts** | Erosion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised. | |
| **Residual Risks** | Some erosion is likely to occur even with the implementation of control measures, but would have a low impact if effectively managed. | |

### *Operational Phase Impact 3. Habitat Degradation due to Alien Plant Invasion*

| **Impact Nature:** Disturbance created during construction will leave the site and its immediate surroundings vulnerable to alien plant invasion for several years into the operational phase. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium-term (2) | Short-term (1) |
| **Magnitude** | Medium (4) | Low (2) |
| **Probability** | Likely (4) | Likely (3) |
| **Significance** | Low (28) | Low (12) |
| **Status** | Negative | Negative |
| **Reversibility** | Medium | 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** | • There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs, grasses and trees from the local area.<br>• Alien management at the site should take place according to the Alien Invasive Management Plan.<br>• Regular (annual) monitoring for alien plants during operation to ensure that no alien invasive problems have developed as result of the disturbance, as per an Alien Management Plan for the project.<br>• 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** | 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 alien plant invasion is likely to occur even with the implementation of control measures, but would have a low impact if effectively managed. | |

#### *5.1.3 Decommissioning Phase*

### *Decommissioning Phase Impact 1. Habitat Degradation due to Erosion*

| **Impact Nature:** Disturbance created during decommissioning will leave the site vulnerable to erosion for several years. | | |
|---|---|---|
| | **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. This should make provision for monitoring of the site for at least 5 years after decommissioning.<br>• All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.<br>• There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs, grasses and trees from the local area. | |
| **Cumulative Impacts** | Erosion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised. | |
| **Residual Risks** | Some erosion is likely to occur even with the implementation of control measures, but would have a low impact if effectively managed. | |

***Decommissioning Phase Impact 2. Habitat Degradation due to Alien Plant Invasion***

| **Impact Nature:** Disturbance created during decommissioning will leave the site vulnerable to plant invasion for several years. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Long-term (4) | Long-term (3) |
| **Magnitude** | Medium (4) | Low (2) |
| **Probability** | Likely (4) | Likely (3) |
| **Significance** | Medium (36) | Low (18) |
| **Status** | Negative | Negative |
| **Reversibility** | Moderate | 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** | • There should be rehabilitation and revegetation of all cleared areas remaining after decommissioning with indigenous perennial shrubs, grasses and trees from the local area.<br>• Alien management at the site should take place according to the Alien Invasive Management Plan. This should make provision for alien monitoring and management for at least 5 years after decommissioning.<br>• Regular (annual) monitoring for alien plant during operation to ensure that no erosion problems have developed as result of the disturbance, as per the Decommissioning Plan for the project.<br>• 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** | 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 alien plant invasion is likely to occur even with the implementation of control measures, but would have a low impact if effectively managed. |

### *Decommissioning Phase Impact 3. Direct Faunal Impacts Due to Decommissioning Activities*

**Impact Nature**: Due to disturbance, noise and the operation of heavy machinery, faunal disturbance due to decommissioning will extend beyond the footprint and impact adjacent areas to some degree. This will however be transient and restricted to the period while machinery is operational. In the long term, decommissioning should restore the ecological functioning and at least some habitat value to the affected areas.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Short-term (2) | Short-term (2) |
| **Magnitude** | Low (4) | Low (3) |
| **Probability** | Highly Probable (4) | Probable (3) |
| **Significance** | Low (28) | Low (18) |
| **Status** | Negative | Negative |
| **Reversibility** | Moderate | Moderate |
| **Irreplaceable loss of resources** | No | No |
| **Can impacts be mitigated?** | Although the noise and disturbance generated at the site during decommissioning is largely unavoidable, this will be transient and | |

| | |
|---|---|
| | ultimately the habitat should be restored to something useable by the local fauna. |
| **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.<br>• Any fauna threatened by the decommissioning activities should be removed to safety by an appropriately qualified environmental officer.<br>• All vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.<br>• All hazardous materials should be stored in the appropriate manner to prevent contamination of the site and ultimately removed from the site as part of decommissioning. 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.<br>• The site should be rehabilitated with locally occurring species to restore ecosystem structure and function. |
| **Cumulative Impacts** | During the decommissioning, the associated disturbance would contribute to cumulative fauna disturbance and disruption in the area, but this would be transient and not of long-term impact. |
| **Residual Risks** | Although some components of disturbance cannot be avoided, the site itself would have low faunal abundance at decommissioning and no significant residual impacts are likely. |

#### *5.1.4 Cumulative Impacts*

The following are the cumulative impacts that are assessed as being a likely consequence of the development of the Kotulo Tsatsi PV1 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 mining, agriculture and other activities in the area.

### *Cumulative Impact 1. Cumulative negative impact on broad-scale ecological processes*

| **Impact Nature**: Development of the Kotulo Tsatsi PV1 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 (1) |
| **Duration** | Long-term (4) | Long-term (4) |

| | | |
|---|---|---|
| **Magnitude** | Low (3) | Moderate (4) |
| **Probability** | Improbable (2) | Probable (3) |
| **Significance** | Low (16) | Low (27) |
| **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 the mitigation hierarchy is applied with a particular emphasis on reducing the development footprint, rehabilitating disturbed areas and minimising degradation around the site.<br>• 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 areas around the facility under the control of the developer. | |
| **Residual Risks** | The presence of the facility will represent an obstacle for some fauna which would contribute to fragmentation in the area. | |

# 6 CONCLUSION & RECOMMENDATIONS

In terms of vegetation, the site is not considered highly sensitive as the affected vegetation type, Bushmanland Basin Shrubland, is widely distributed and the abundance of species of conservation concern within the affected area is low. Although the majority of the site consists of sparse, arid shrubland on shallow soils, considered to be of low sensitivity, there are also some medium and high sensitivity washes present. Although some development in these areas is considered acceptable, some caution should be exercised regarding vegetation clearing in these areas as wholesale clearing is likely to leave these areas vulnerable to erosion as these areas receive runoff from the adjacent slopes and the PV development is likely to significantly increase runoff.

Due to the homogenous nature of the habitat for fauna, faunal diversity in the area is low and faunal species of concern are not likely to be abundant at the site. As the surrounding habitat is very homogenous, the habitat loss resulting from the development would not result in significant local habitat loss for fauna or disrupt any broader scale movement corridors for fauna. Consequently, there are no highly significant impacts present at the site which cannot be mitigated to a low level and which would represent a red flag for the development.

The site falls outside of any CBAs, ESAs and NC-PAES focus areas with the result that impacts on CBAs and the ability to meet future conservation targets would be minimal. Although there

are several other planned renewable energy developments in the area, cumulative impacts are still low and considered acceptable.

***Impact Statement***

There are no impacts associated with the Kotulo Tsatsi PV1 project that cannot be mitigated to an acceptable level and as such, the assessed layout is considered acceptable. With the application of relatively simple mitigation and avoidance measures, the impact of the Kotulo Tsatsi PV1 on the local environment can be reduced to an acceptable magnitude. The contribution of the Kotulo Tsatsi PV1 development to cumulative impact in the area would be low and is considered acceptable. Overall, there are no specific long-term impacts likely to be associated with the development of the Kotulo Tsatsi PV1 project that cannot be reduced to a low significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

# 7 Activities for Inclusion In 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 Kotulo Tsatsi PV1 PV 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 wind farm 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<br>» Clearing for infrastructure establishment.<br>» Access roads.<br>» Laydown areas.<br>» Construction Camps. | | |
| Mitigation: Target/Objective | » Low footprint and low impact on terrestrial environment.<br>» Low impact on protected plant species. | | |
| Mitigation: Action/control | | Responsibility | Timeframe |
| » Preconstruction walk-through of PV Plant and access road footprints to identify protected species and obtain information to inform a preconstruction Search and Rescue operation.<br>» 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.<br>» Affected individuals of selected (i.e. those that are of high conservation value or which have a high probability of surviving translocation) 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 a permit for their destruction would be required.<br>» Erosion control measures should be implemented in areas where slopes have been disturbed.<br>» Revegetation of cleared areas or monitoring to ensure that recovery is taking place.<br>» Alien plant clearing where necessary. | | Management/ECO | Construction & Operation |
| Performance Indicator | » Vegetation loss restricted to infrastructure footprint.<br>» Impact on protected plant species reduced to some degree through Search and Rescue.<br>» Permit obtained to destroy or translocate affected individuals of protected species. | | |

| | |
|---|---|
| Monitoring | ECO to monitor construction to ensure that:<br>» Vegetation is cleared only within essential areas.<br>» 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:<br>» Vegetation clearing.<br>» Human presence.<br>» 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.<br>» Presence of construction crews.<br>» Operation of heavy vehicles. | |
| Mitigation: Target/Objective | Low faunal impact during construction. | |
| Mitigation: Action/control | Responsibility | Timeframe |
| » Environmental induction for all construction staff.<br>» ECO to monitor and enforce ban on hunting, collecting etc. of all plants and animals or their products.<br>» 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.<br>» All vehicles to adhere to low speed limits (40km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust.<br>» 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 Indicator | » Low mortality of fauna due to construction machinery and activities.<br>» No poaching etc of fauna by construction personnel during construction.<br>» 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<br>» Movement of vehicles to and from the site.<br>» Presence of the PV infrastructure and site fencing. | |
| Potential Impact | » Alien plant invasion<br>» Erosion<br>» Pollution<br>» Faunal Impacts | |
| Activity/risk source | » Alien plant invasion in and around the road.<br>» Unregulated runoff from the access road.<br>» Human presence during road maintenance activities<br>» Pollution from maintenance vehicles due to oil or fuel leaks etc.<br>» 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.<br>» Low abundance of alien plants. | |
| Monitoring | » Annual monitoring with records of alien species presence and clearing actions.<br>» Annual monitoring with records of erosion problems and mitigation actions taken with photographs. | |

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# 9 Annex 1. List of Plant Species

List of plant species which are known to occur in the vicinity of the Kotulo Tsatsi PV1 site according to the SANBI SIBIS database. Species observed at the site are highlighted in bold. Listed and protected species that were observed at the site are highlighted in red.

| Family | Species | Family | Species |
|---|---|---|---|
| **Acanthaceae** | ***Acanthopsis disperma*** | Acanthaceae | *Acanthopsis hoffmannseggiana* |
| **Acanthaceae** | ***Barleria rigida*** | **Acanthaceae** | ***Blepharis mitrata*** |
| Acanthaceae | *Monechma divaricatum* | **Acanthaceae** | ***Monechma incanum*** |
| Acanthaceae | *Monechma spartioides* | Aizoaceae | *Aizoon canariense* |
| Aizoaceae | *Aizoon schellenbergii* | **Aizoaceae** | ***Galenia africana*** |
| Aizoaceae | *Galenia sarcophylla* | **Aizoaceae** | ***Tetragonia arbuscula*** |
| Aizoaceae | *Trianthema parvifolia var. parvifolia* | Amaranthaceae | *Amaranthus praetermissus* |
| Amaranthaceae | *Sericocoma avolans* | Amaranthaceae | *Sericocoma pungens* |
| Anacardiaceae | *Rhus lancea* | Anacardiaceae | *Searsia lancea* |
| **Apocynaceae** | *Fockea sinuata* | **Apocynaceae** | ***Gomphocarpus fruticosus subsp. fruticosus*** |
| **Apocynaceae** | ***Hoodia gordonii*** | Apocynaceae | *Sarcostemma viminale subsp. viminale* |
| **Asparagaceae** | ***Asparagus glaucus*** | **Asparagaceae** | ***Asparagus retrofractus*** |
| **Asphodelaceae** | ***Aloe claviflora*** | Asphodelaceae | *Aloe striata subsp. karasbergensis* |
| Asphodelaceae | ***Aloe variegata*** | Asteraceae | *Amellus strigosus subsp. pseudoscabridus* |
| Asteraceae | *Berkheya annectens* | **Asteraceae** | ***Berkheya pinnatifida subsp. pinnatifida*** |
| **Asteraceae** | ***Dicoma capensis*** | Asteraceae | *Dimorphotheca polyptera* |
| Asteraceae | *Eriocephalus microphyllus var. pubescens* | **Asteraceae** | ***Eriocephalus pauperrimus*** |
| Asteraceae | ***Eriocephalus spinescens*** | Asteraceae | ***Felicia clavipilosa subsp. clavipilosa*** |
| Asteraceae | *Felicia hyssopifolia* | Asteraceae | *Foveolina dichotoma* |
| Asteraceae | *Gazania krebsiana subsp. arctotoides* | Asteraceae | *Gazania lichtensteinii* |
| Asteraceae | *Helichrysum herniarioides* | **Asteraceae** | ***Kleinia longiflora*** |
| Asteraceae | *Laggera decurrens* | Asteraceae | *Myxopappus acutilobus* |
| **Asteraceae** | ***Osteospermum armatum*** | Asteraceae | *Osteospermum pinnatum var. pinnatum* |
| **Asteraceae** | ***Pegolettia retrofracta*** | Asteraceae | *Pentzia globosa* |
| Asteraceae | *Pentzia lanata* | Asteraceae | *Pentzia pinnatisecta* |
| Asteraceae | *Pentzia spinescens* | Asteraceae | *Pteronia inflexa* |
| **Asteraceae** | ***Pteronia leucoclada*** | **Asteraceae** | ***Pteronia mucronata*** |
| **Asteraceae** | ***Pteronia sordida*** | **Asteraceae** | ***Rosenia glandulosa*** |
| Asteraceae | *Rosenia humilis* | Asteraceae | *Senecio angustifolius* |
| Asteraceae | *Senecio niveus* | Asteraceae | *Senecio piptocoma* |
| Asteraceae | *Tripteris sinuata var. linearis* | Asteraceae | *Tripteris sinuata var. sinuata* |
| Asteraceae | *Ursinia nana subsp. nana* | **Asteraceae** | ***Geigeria filifolia*** |
| **Asteraceae** | ***Pentzia cf incana*** | **Bignoniaceae** | ***Rhigozum trichotomum*** |
| Brassicaceae | *Heliophila trifurca* | Brassicaceae | *Lepidium desertorum* |

| | |
|---|---|
| **Capparaceae** | ***Cadaba aphylla*** |
| Chenopodiaceae | *Chenopodium glaucum* |
| Chenopodiaceae | *Chenopodium schraderianum* |
| Chenopodiaceae | *Salsola namibica* |
| Colchicaceae | *Ornithoglossum viride* |
| Cucurbitaceae | *Citrullus lanatus* |
| Ebenaceae | *Diospyros pallens* |
| Euphorbiaceae | *Euphorbia inaequilatera var. inaequilatera* |
| Euphorbiaceae | *Euphorbia spinea* |
| **Fabaceae** | ***Cullen tomentosum*** |
| Fabaceae | *Hoffmannseggia lactea* |
| Fabaceae | *Indigofera alternans var. alternans* |
| Fabaceae | *Lotononis platycarpa* |
| Fabaceae | *Melolobium microphyllum* |
| Fabaceae | *Xerocladia viridiramis* |
| Geraniaceae | *Monsonia luederitziana* |
| **Geraniaceae** | ***Pelargonium minimum*** |
| Geraniaceae | *Sarcocaulon salmoniflorum* |
| Gisekiaceae | *Gisekia pharnacioides var. pharnacioides* |
| Hyacinthaceae | *Ornithogalum unifolium var. unifolium* |
| **Iridaceae** | ***Moraea speciosa*** |
| Lophiocarpaceae | *Lophiocarpus polystachyus* |
| Malvaceae | *Althaea ludwigii* |
| **Malvaceae** | ***Hermannia spinosa*** |
| Malvaceae | *Malva aegyptia* |
| Malvaceae | *Malva parviflora* |
| **Mesembryanthemaceae** | ***Drosanthemum cymiferum*** |
| **Mesembryanthemaceae** | ***Mesembryanthemum articulatum*** |
| Mesembryanthemaceae | *Mesembryanthemum geniculiflorum* |
| Mesembryanthemaceae | *Mesembryanthemum nodiflorum* |
| Mesembryanthemaceae | *Mesembryanthemum tetragonum* |
| Mesembryanthemaceae | *Ruschia kenhardtensis* |
| Mesembryanthemaceae | *Ruschia vulvaria* |
| **Molluginaceae** | ***Limeum aethiopicum subsp. aethiopicum var. aethiopicum*** |
| Molluginaceae | *Limeum rhombifolium* |
| Nyctaginaceae | *Boerhavia repens subsp. repens* |
| Oxalidaceae | *Oxalis lawsonii* |
| Papaveraceae | *Argemone mexicana forma mexicana* |
| Plumbaginaceae | *Dyerophytum africanum* |
| **Poaceae** | ***Aristida congesta subsp. barbicollis*** |
| Poaceae | *Chloris virgata* |
| Chenopodiaceae | *Bassia salsoloides* |
| Chenopodiaceae | *Chenopodium murale var. murale* |
| Chenopodiaceae | *Salsola aellenii* |
| **Chenopodiaceae** | ***Salsola tuberculata*** |
| Convolvulaceae | *Convolvulus sagittatus* |
| Cucurbitaceae | *Cucumis africanus* |
| Euphorbiaceae | *Euphorbia fusca* |
| Euphorbiaceae | *Euphorbia rudis* |
| Fabaceae | *Acacia karroo* |
| Fabaceae | *Cyamopsis serrata* |
| **Fabaceae** | ***Indigastrum argyraeum*** |
| Fabaceae | *Lotononis marlothii* |
| Fabaceae | *Medicago laciniata var. laciniata* |
| **Fabaceae** | ***Parkinsonia africana*** |
| **Fabaceae** | ***Prosopis glandulosa*** |
| Fabaceae | *Sutherlandia frutescens* |
| **Geraniaceae** | ***Monsonia umbellata*** |
| Geraniaceae | *Sarcocaulon patersonii* |
| Gisekiaceae | *Gisekia africana var. africana* |
| Hyacinthaceae | *Dipcadi gracillimum* |
| Hyacinthaceae | *Ledebouria cf ovatifolia* |
| Lamiaceae | *Salvia verbenaca* |
| **Loranthaceae** | ***Septulina glauca*** |
| Malvaceae | *Hermannia abrotanoides* |
| Malvaceae | *Hermannia vestita* |
| **Malvaceae** | ***Radyera urens*** |
| **Mesembryanthemaceae** | ***Brownanthus ciliatus subsp. ciliatus*** |
| **Mesembryanthemaceae** | ***Drosanthemum sp.*** |
| Mesembryanthemaceae | *Mesembryanthemum crystallinum* |
| Mesembryanthemaceae | *Mesembryanthemum nitidum* |
| **Mesembryanthemaceae** | ***Mesembryanthemum stenandrum*** |
| **Mesembryanthemaceae** | ***Ruschia ferox*** |
| **Mesembryanthemaceae** | ***Ruschia spinosa*** |
| Molluginaceae | *Limeum aethiopicum var. lanceolatum* |
| **Molluginaceae** | ***Limeum africanum subsp. africanum*** |
| Molluginaceae | *Mollugo cerviana var. cerviana* |
| **Nyctaginaceae** | ***Phaeoptilum spinosum*** |
| Oxalidaceae | *Oxalis cf beneprotecta* |
| Pedalaceae | *Sesamum capense* |
| Poaceae | *Aristida adscensionis* |
| **Poaceae** | ***Cenchrus ciliaris*** |
| Poaceae | *Dichanthium annulatum var. papillosum* |

| | |
|---|---|
| **Poaceae** | ***Enneapogon cenchroides*** |
| **Poaceae** | ***Enneapogon scaber*** |
| Poaceae | *Eragrostis bicolor* |
| Poaceae | *Eragrostis nindensis* |
| Poaceae | *Eragrostis procumbens* |
| Poaceae | *Panicum lanipes* |
| **Poaceae** | ***Schmidtia kalahariensis*** |
| Poaceae | *Stipagrostis anomala* |
| Poaceae | *Stipagrostis ciliata var. capensis* |
| Poaceae | *Stipagrostis namaquensis* |
| **Poaceae** | ***Stipagrostis uniplumis var. neesii*** |
| **Poaceae** | ***Sporobolus ioclados*** |
| Polygonaceae | *Persicaria decipiens* |
| Rubiaceae | *Kohautia cynanchica* |
| Scrophulariaceae | *Aptosimum elongatum* |
| Scrophulariaceae | *Aptosimum procumbens* |
| Scrophulariaceae | *Diascia engleri* |
| **Scrophulariaceae** | ***Peliostomum leucorrhizum*** |
| **Solanaceae** | ***Lycium cinereum*** |
| Solanaceae | *Solanum capense* |
| Urticaceae | *Forsskaolea candida* |
| **Verbenaceae** | ***Chascanum pumilum*** |
| Zygophyllaceae | *Tribulus pterophorus* |
| Zygophyllaceae | *Tribulus zeyheri subsp. zeyheri* |
| **Zygophyllaceae** | ***Zygophyllum dregeanum*** |
| Zygophyllaceae | *Zygophyllum simplex* |
| **Poaceae** | ***Enneapogon desvauxii*** |
| Poaceae | *Eragrostis annulata* |
| **Poaceae** | ***Eragrostis biflora*** |
| **Poaceae** | ***Eragrostis porosa*** |
| **Poaceae** | ***Fingerhuthia africana*** |
| Poaceae | *Schismus barbatus* |
| Poaceae | *Setaria verticillata* |
| **Poaceae** | ***Stipagrostis brevifolia*** |
| Poaceae | *Stipagrostis fastigiata* |
| **Poaceae** | ***Stipagrostis obtusa*** |
| **Poaceae** | ***Tragus berteronianus*** |
| Polygalaceae | *Polygala seminuda* |
| Rhamnaceae | *Ziziphus mucronata subsp. mucronata* |
| Santalaceae | *Thesium lineatum* |
| Scrophulariaceae | *Aptosimum lineare var. lineare* |
| **Scrophulariaceae** | ***Aptosimum spinescens*** |
| Scrophulariaceae | *Jamesbrittenia argentea* |
| Scrophulariaceae | *Selago pinguicula* |
| **Solanaceae** | ***Lycium oxycarpum*** |
| Solanaceae | *Solanum namaquense* |
| Verbenaceae | *Chascanum garipense* |
| Zygophyllaceae | *Tribulus cristatus* |
| **Zygophyllaceae** | ***Tribulus terrestris*** |
| **Zygophyllaceae** | ***Zygophyllum chrysopteron*** |
| Zygophyllaceae | *Zygophyllum lichtensteinianum* |

# 10 Annex 2. List of Mammals

List of mammals which are known to occur and are likely to occur in the vicinity of the Kotulo Tsatsi PV1 site. Habitat notes and distribution records are based on Skinner & Chimimba (2005) and MammalMap (ADU).

| 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 ruprestris* | 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 | V.Low |
| **Lagomorpha (Hares and Rabbits):** | | | | |
| *Pronolagus rupestris* | Smith's Red Rock Rabbit | LC | Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines | V.Low |
| *Lepus capensis* | Cape Hare | LC | Dry, open regions, with palatable bush and grass | High |
| *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):** | | | | |
| *Cryptomys hottentotus* | African Mole Rat | LC | Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils | Low |
| *Hystrix africaeaustralis* | Cape Porcupine | LC | Catholic in habitat requirements. | Confirmed |
| *Petromus typicus* | Dassie Rat | LC | Mountainous regions and inselbergs, where they are confined to rocky outcrops and live in crevices or piles of boulders | V.Low |

| | | | | |
|---|---|---|---|---|
| *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. | V.Low |
| *Xerus inauris* | South African Ground Squirrel | LC | Open terrain with a sparse bush cover and a hard substrate | High |
| *Graphiurus ocularis* | Spectacled Dormouse | LC | Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices. | V.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 |
| *Mus minutoides* | Pygmy Mouse | LC | Wide habitat tolerance | High |
| *Micaelamys 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 | High |
| *Parotomys brantsii* | Brants's 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 | NT | Riverine associations or associated with Lycium bushes or *Psilocaulon absimile* | High |
| *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 |
| *Gerbilliscus leucogaster* | Bushveld Gerbil | DD | Bushlands and grasslands | Likely |
| *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 |
| *Gerbillurus vallinus* | Brush-tailed hairy-footed Gerbil | LC | Confined to areas with rainfall less than 150 mm | High |
| *Malacothrix typica* | Large-Eared African Desert Mouse | LC | Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm. | Medium |
| **Primates:** | | | | |
| *Papio ursinus* | Chacma Baboon | LC | Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges. | 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. | High |
| **Carnivora:** | | | | |
| *Proteles cristatus* | Aardwolf | LC | Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes | Confirmed |
| *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. | High |
| *Felis nigripes* | Black-footed cat | LC | 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 pulverulenta* | Cape Grey Mongoose | LC | Wide habitat tolerance | High |
| *Vulpes chama* | Cape Fox | LC | Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub | High |
| *Canis mesomelas* | Black-backed Jackal | LC | Wide habitat tolerance, more common in drier areas. | High |
| *Otocyon megalotis* | Bat-eared Fox | LC | Open country with mean annual rainfall of 100-600 mm | Confirmed |
| *Ictonyx striatus* | Striped Polecat | LC | Widely distributed throughout the sub-region | Confirmed |
| *Mellivora capensis* | Ratel/Honey Badger | LC | Catholic habitat requirements | Moderate |
| **Rumanantia (Antelope):** | | | | |
| *Sylvicapra grimmia* | Common Duiker | LC | Presence of bushes is essential | High |
| *Antidorcas marsupialis* | Springbok | LC | Arid regions and open grassland. | V.Low |
| *Raphicerus campestris* | Steenbok | LC | Inhabits open country, | Confirmed |
| *Oreotragus oreotragus* | Klipspringer | LC | Closely confined to rocky habitat. | V.Low |

# 11 Annex 3. List of Reptiles

List of reptiles which are likely to occur at the Kotulo Tsatsi PV1 site, based on records from the SARCA database. Red list status is from Bates et al. 2014.

| Family | Genus | Species | Subspecies | Common name | Red list category |
|---|---|---|---|---|---|
| *Agamidae* | *Agama* | *aculeata* | *aculeata* | Common Ground Agama | Not evaluated. |
| *Agamidae* | *Agama* | *anchietae* | | Anchieta's Agama | Least Concern |
| *Agamidae* | *Agama* | *atra* | | Southern Rock Agama | Least Concern |
| *Colubridae* | *Boaedon* | *fuliginosus* | | Brown House Snake | Least Concern |
| *Colubridae* | *Dipsina* | *multimaculata* | | Dwarf Beaked Snake | Least Concern |
| *Colubridae* | *Psammophis* | *notostictus* | | Karoo Sand Snake | Least Concern |
| *Colubridae* | *Telescopus* | *beetzii* | | Beetz's Tiger Snake | Least Concern |
| *Cordylidae* | *Karusasaurus* | *polyzonus* | | Karoo Girdled Lizard | Least Concern |
| *Elapidae* | *Aspidelaps* | *lubricus* | *lubricus* | Coral Shield Cobra | Not Listed |
| *Elapidae* | *Naja* | *nivea* | | Cape cobra | Least Concern |
| *Gekkonidae* | *Chondrodactylus* | *angulifer* | *angulifer* | Common Giant Ground Gecko | Least Concern |
| *Gekkonidae* | *Chondrodactylus* | *bibronii* | | Bibron's Gecko | Least Concern |
| *Gekkonidae* | *Pachydactylus* | *capensis* | | Cape Gecko | Least Concern |
| *Gekkonidae* | *Pachydactylus* | *latirostris* | | Quartz Gecko | Least Concern |
| *Gekkonidae* | *Pachydactylus* | *montanus* | | Namaqua Mountain Gecko | Least Concern |
| *Gekkonidae* | *Pachydactylus* | *purcelli* | | Purcell's Gecko | Least Concern |
| *Lacertidae* | *Meroles* | *suborbitalis* | | Spotted Desert Lizard | Least Concern |
| *Lacertidae* | *Pedioplanis* | *inornata* | | Plain Sand Lizard | Least Concern |
| *Lacertidae* | *Pedioplanis* | *laticeps* | | Karoo Sand Lizard | Least Concern |
| *Lacertidae* | *Pedioplanis* | *lineoocellata* | *pulchella* | Common Sand Lizard | Least Concern |
| *Lacertidae* | *Pedioplanis* | *namaquensis* | | Namaqua Sand Lizard | Least Concern |
| *Lamprophiidae* | *Psammophis* | *notostictus* | | Karoo Sand Snake | Least Concern |
| *Scincidae* | *Trachylepis* | *occidentalis* | | Western Three-striped Skink | Least Concern |
| *Scincidae* | *Trachylepis* | *sparsa* | | Karasburg Tree Skink | Least Concern |

| | | | | | |
|---|---|---|---|---|---|
| *Scincidae* | *Trachylepis* | *spilogaster* | | Kalahari Tree Skink | Least Concern |
| *Scincidae* | *Trachylepis* | *sulcata* | *sulcata* | Western Rock Skink | Least Concern |
| *Scincidae* | *Trachylepis* | *variegata* | | Variegated Skink | Least Concern |
| *Testudinidae* | *Psammobates* | *tentorius* | *tentorius* | Karoo Tent Tortoise | Not listed |
| *Testudinidae* | *Psammobates* | *tentorius* | *verroxii* | Verrox's Tent Tortoise | Not listed |
| *Typhlopidae* | *Rhinotyphlops* | *schinzi* | | Schinz's Beaked Blind Snake | Least Concern |

# 12 Annex 4. List of Amphibians

List of amphibians which are likely to occur in the vicinity of the Kotulo Tsatsi PV1 site based on records from the Frog Atlas of Southern Africa as well as distribution maps available in the literature. Habitat notes and distribution records are based on Du Preez and Carruthers (2009), while conservation status is from Minter et al. 2004.

| Scientific Name | Common Name | Status | Habitat | Distribution | Likelihood |
|---|---|---|---|---|---|
| *Vandijkophrynus gariepensis gariepensis* | Karoo Toad | Not Listed | Karoo Scrub | Widespread | High |
| *Poyntonophrynus vertebralis* | Southern Pygmy Toad | LC | Nama karroo shrubland, grassland and dry savanna. Breeds in temporary shallow pans, pools or depressions containing rainwater, and rock pools along rivers. | Endemic | High |
| *Pyxicephalus adspersus* | Giant Bullfrog | LC | Breed in shallow margins of rain-filled depressions. | Widespread | Low |
| *Xenopus laevis* | Common Platanna | LC | Any more or less permanent water | Widespread | V. Low |
| *Cacosternum boettgeri* | Common Caco | LC | Marshy areas, vleis and shallow pans | Widespread | Low |
| *Amietia fuscigula* | Cape River Frog | LC | Large still bodies of water or permanent streams and rivers. | Widespread | V. Low |
| *Tomopterna tandyi* | Tandy's Sand Frog | LC | Nama karoo grassland and savanna | Widespread | Medium |
| *Tomopterna cryptotis* | Tremolo Sand Frog | LC | Widespread in savanna and grassland | Widespread | Low |