ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED STRAUSSHEIM CHARLIE SOLAR POWER PLANT AND ASSOCIATED GRID CONNECTION INFRASTRUCTURE, KENHARDT, NORTHERN CAPE:

FAUNA & FLORA SPECIALIST EIA REPORT

PRODUCED FOR CAPE EAPRAC

BY

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The content of this report has been prepared in terms of Regulation GNR 982 of 2014, as detailed below

Specialist Report Checklist

Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6	**Cross-reference in this report**
(a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	
(c) an indication of the scope of, and the purpose for which, the report was prepared;	
(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	
(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	
(g) an identification of any areas to be avoided, including buffers;	
(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;	
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
(p) any other information requested by the competent authority.	

DECLARATION OF CONSULTANTS' INDEPENDENCE

- I Simon Todd, as the appointed independent specialist hereby declare that I:
- act/ed as the independent specialist in this application;
- 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, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 12 of GN No. R. 982) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 48 of GN No. R. 982.

Note: The terms of reference must be attached.

Simon Todd Pr.Sci.Nat 400425/11.
September 2016

EXECUTIVE SUMMARY

AMDA is proposing the establishment of the Straussheim Charlie Solar Energy Facility of 75MW near Kenhardt in the Northern Cape. As part of the required EIA process, this Fauna and Flora EIA specialist report provides a characterisation of the ecological features of the site and assesses the likely impacts associated with the development of a 75MW PV plant at the site. A site visit and a desktop review of the available ecological information for the area were used to identify and characterize the ecological features of the site and develop an ecological sensitivity map for the site, which is depicted below.

The site is restricted to a single vegetation type, Bushmanland Arid Grassland. This is a very extensive vegetation type that has been little impacted by transformation and classified as Least Threatened. No features of high sensitivity were identified within the Straussheim Charlie site. The site consists of low shrubland of medium low sensitivity with few species or habitats of conservation present. Similarly, faunal diversity at the site is relatively low, largely as a result of the low diversity of habitats present. There are few listed species present and the development would not impact significantly on listed fauna. In addition, the site is not within a CBA or NPAES Focus area and impacts on broad-scale ecological processes are likely to be low. Although there are several other PV developments in the area, the overall concentration of development in the area is still low and cumulative impacts in the area are not likely to be significant for fauna or flora.

The major impact associated with the development of the Straussheim Charlie Power Plant, would be local habitat loss for fauna and flora. However the area is relatively homogenous and there are no reasons to expect that the current or cumulative impact of development at the site would significantly disrupt the landscape for fauna or other broad-scale ecological processes. Overall, there are no assessed impacts associated with the development of the Straussheim Charlie Power Plant that cannot be mitigated to a low level and most impacts are likely to be of moderate to low significance and of local extent only. As such, the site is considered a favourable site for the development of the PV plant and there are no ecological reasons that should prevent the development from proceeding.

1 INTRODUCTION

AMDA Charlie (Pty) Ltd is proposing the establishment of a PV and/or concentrated PV plant with fixed, single or double axis tracking technology. The proposed site is located near Kenhardt on Portion 1 of N'Rougas Zuid No 121, Kenhardt Registration Division, Northern Cape and would be approximately 240ha in extent with an output of 75MW. A scoping study for the development has already been produced and accepted by DEA.

The development is currently in the EIA phase and this fauna and flora specialist study details the ecological characteristics of the site and provides an assessment of the likely ecological impacts associated with the development of a 75MW solar facility and associated grid connection at the site. Impacts are assessed for the preconstruction, 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.

1.1 SCOPE OF STUDY

The specific terms of reference for the scoping study includes the following:

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of potential environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified;
- Direct, indirect and cumulative impacts of the identified issues are evaluated within the Scoping Report in terms of the following criteria:
    - the nature, which includes a description of what causes the effect, what will be affected and how it will be affected;
    - the extent, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issue/impacts;
- Identification of potentially significant impacts to be assessed within the EIA phase and the details of the methodology to be adopted in assessing these impacts. This should be detailed enough to include within the Plan of Study for EIA and include a description of the proposed method of assessing the potential environmental impacts associated with the project

1.2 ASSESSMENT APPROACH & PHILOSOPHY

The assessment will be conducted according to the EIA Regulations, published by the Department of Environmental Affairs (2014) as well as within the best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005).

This includes adherence to the following broad principles:

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

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

    - In order of priority aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
    - Avoid degradation of the environment;
    - Avoid jeopardising ecosystem integrity;
    - Pursue the best practicable environmental option by means of integrated environmental management;
    - Protect the environment as the people's common heritage;
    - Control and minimise environmental damage; and
    - Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

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

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

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

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify species of special concern (SSC) and that are known to be:
    - endemic to the region;
    - that are considered to be of conservational concern;
    - that are in commercial trade (CITES listed species);
    - or, are of cultural significance.
- Provide monitoring requirements as input into the Environmental Management Plan (EMP) for faunal related issues.

Other pattern issues

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

- The condition of the site in terms of current or previous land uses.

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

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

1.3 RELEVANT ASPECTS OF THE DEVELOPMENT

The proposed development site is located east of Kenhardt on Portion 1 of N'Rougas Zuid No 121, Kenhardt Registration Division, Northern Cape with a total farm area of 5233 ha.

The development will consist of the following:

- The proposed facility is planned and designed with a net generating capacity (AC) of 75MWp, with an installed capacity (DC) of +/-85MWp.
- The facility will occupy approximately 240 ha.

Infrastructure associated with the facility is likely to include:

» PV and/or concentrated PV with fixed, single or double axis tracking technology. The actual technology to be used will be decided at a later date.
» A single grid connection option to the Eskom Nieuwehoop MTS is included.
» Auxiliary buildings of approximately 2ha. The functions within these buildings include (but is not limited to) to ablution, workshops, storage areas and site offices. Fencing height shall be below 5m, but expected to be below 3m.
» Access roads are expected to be 6m in width, but less than 8m in width.
» Approximately 2-5ha of laydown area will be required, but will not exceed 5ha.

Figure 1. Satellite image of the Straussheim site, illustrating the proposed development footprint of the Straussheim Charlie PV Power Plant, with the grid connection in blue.

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 and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- No Critical Biodiversity Areas (CBA) mapping or systematic conservation planning has been conducted for the area with the result that no detailed conservation priority area information is available for the area.
- Information on plant and animal species recorded for the Quarter Degree Square (QDS) 2921 AA and AB was extracted from the SABIF/SIBIS database hosted by SANBI. This is a considerably larger area than the study area, but this is

necessary to ensure a conservative approach as well as counter the fact that the site itself or the immediate area has not been well sampled in the past.

- The IUCN conservation status (Table 1) 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 (2014).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases).
- 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 reptiles were extracted from the SARCA web portal, hosted by the ADU, http://vmus.adu.org.za
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 2014.2 (See Figure 2) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

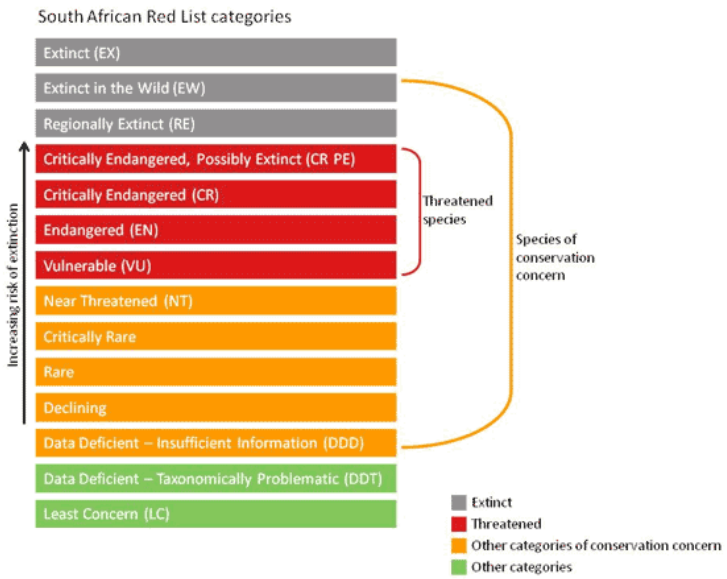

Figure 2. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

2.2 SENSITIVITY MAPPING & ASSESSMENT

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

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide

important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories.

2.3 SAMPLING LIMITATIONS AND ASSUMPTIONS

The current study is based on a desktop analysis, as well as a site visit. As such, the results provided and the description of features present and the sensitivity map are validated by field data. It was however fairly dry at the time of the site visit and while the perennials present could be identified, the abundance of annuals was fairly low and the species list obtained for the site is considered representative of perennials but short on annuals and geophytes. However, as the abundance of species of conservation concern in the area is low, this is not seen as a significant limitation for the study. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 VEGETATION PATTERNS

According to the national vegetation map (Mucina & Rutherford 2006), the site falls entirely within a single vegetation type, Bushmanland Arid Grassland. Bushmanland Arid Grassland is the second most extensive vegetation type in South Africa and occupies an area of 45 478 km^2 and extends from around Aggeneys in the west to Prieska in the east. It is associated largely with red-yellow apedal (without structure), freely drained soils, with a high base status and mostly less than 300 mm deep. Due the arid nature of the unit which receives between 70 and 200 mm annual rainfall, it has not been significantly impacted by intensive agriculture and more than 99% of the original extent of the vegetation type is still intact and its' conservation status is classified as Least Threatened. Mucina & Rutherford (2006) list 6 endemic species for the vegetation type which is relatively few given the extensive nature of the vegetation type.

Although the site is classified as Bushmanland Arid Grassland, it is not typical of this unit due to the stony soils and exposed calcrete and is more akin to Bushmanland Basin Shrubland, which is a similarly extensive and low sensitivity vegetation type. The site consists of stony plains with occasional areas on deeper soils in lower-lying areas and run-on sites. Despite being classified as Bushmanland Arid Grassland, the site is largely dominated by woody shrubs, which is typical on stony soils of the area. Typical species include *Zygophyllum lichtensteinianum*, *Lycium cinereum*, *Hermannia spinosa*, *Pteronia sordid*a, *Pteronia inflexa*, *Osteospermum armatum* and *Aristida adscensionis*. On deeper soils *Phaeoptilum spinosum*, *Lycium horridum*, *Pentzia incana*, *Ruschia spinosa*, *Aptosimum marlothii*, *Rosenia humilis*, *Pegolettia retrofracta*, *Stipgrostis obtusa*, *Enneapogon desvauxii*, *Stipagrostis ciliata* and *Eragrostis lehmanianna* are common.

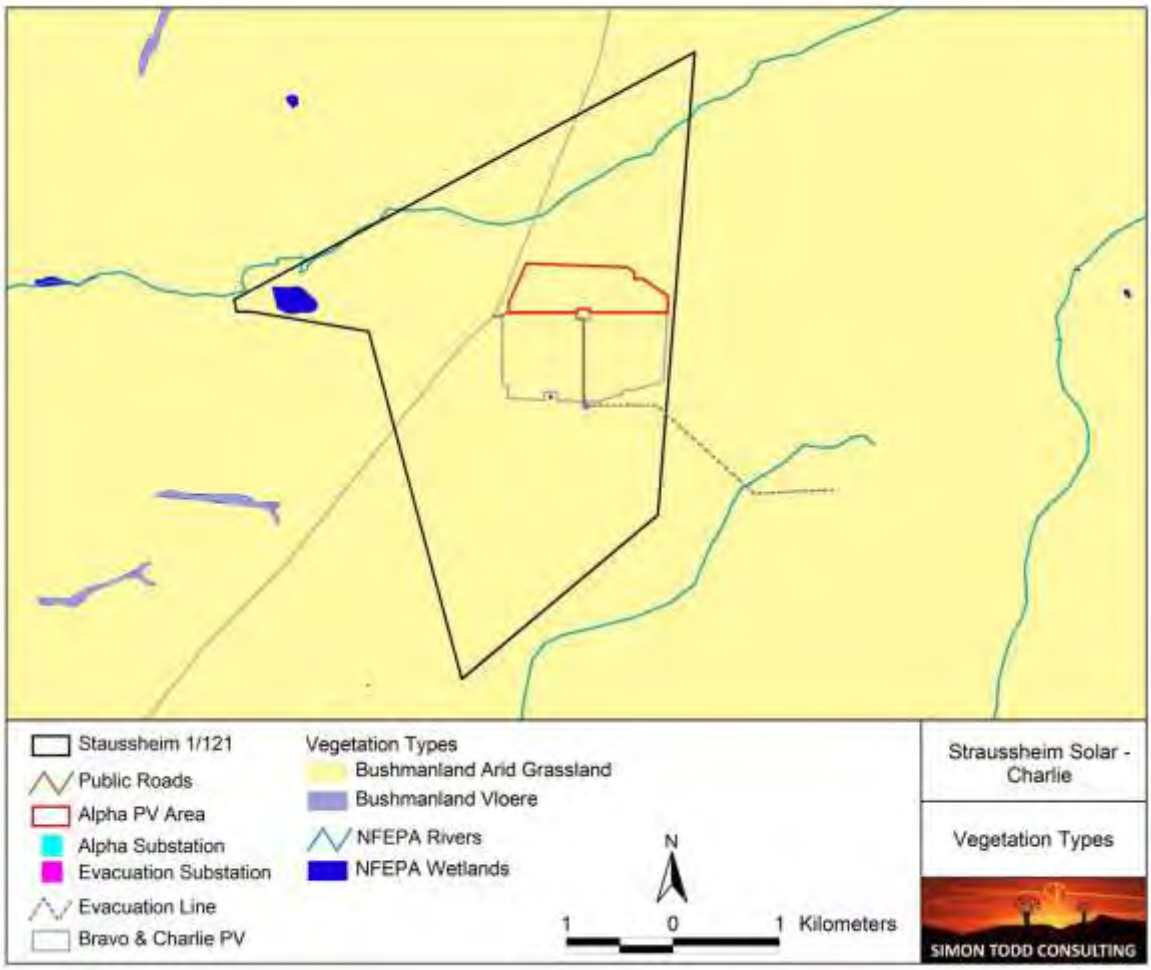

Figure 3. Broad-scale overview of the vegetation in and around the Straussheim Charlie site. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011).

Figure 4. Typical open plains habitat of the Straussheim Charlie site, showing the general lack of features at the site and broadly homogenous nature of the vegetation. Despite being classified as Bushmanland Arid Grassland, the majority of the site is on shallow soils dominated by shrubs typical of Bushmanland Basin Shrubland.

Figure 5. Example of a run-on area at the Straussheim site, with taller more dense vegetation than the surrounding plains. Typical species include *Salsola tunberculata*, *Phaeoptilum spinosum*, *Lycium pumilum*, *Aristida congesta*, *Stipagrostis obtusa* and *S.ciliata*. There are however no areas which would be considered to be drainage lines within the Straussheim Charlie site.

3.2 LISTED AND PROTECTED PLANT SPECIES

According to the SIBIS database, only thee red data-listed plant species are known from the area, *Hoodia officinalis* subsp. *officinalis* (NT), *Aloe dichotoma* (VU) and *Haworthia venosa* subsp. *venosa* (VU). Of these *Aloe dichotoma* can be confirmed present at low density and could be impacted by the development. The total number of individuals at the site is however low and although no trees were observed within the development footprint, it is possible that some young seedlings are present within the development area. However, this is unlikely as there are no adult plants in the immediate vicinity of the Strausheim Charlie site. There are also a variety of provincially protected species which may be present at the site which would potentially be impacted by the development such as *Boscia foetida* subsp. f*oetida*. However the density and abundance of such species at the site is low and significant impact on any protected species is not unlikely.

3.3 CRITICAL BIODIVERSITY AREAS

No fine-scale conservation planning has been conducted for the region and as a result, no Critical Biodiversity Areas have been defined for the study area. In terms of other broad-scale planning studies, the site does not fall within a National Protected Areas Expansion Strategy Focus Area (NPAES), indicating that the area has not been identified as an area of exceptional biodiversity or of significance for the long-term maintenance of broad-scale ecological processes and climate change buffering within the region.

3.4 CUMULATIVE IMPACT& BROAD-SCALE ECOLOGICAL PROCESSES

As there are a number of other renewable energy developments in the wider area, it is important to consider the potential for cumulative impact. A map of all the DEA-registered renewable energy developments in the area is depicted in Figure 6 below and illustrates that there is currently not a lot of the renewable energy development in the area. As a result, the potential for cumulative impact in the area is still relatively low and a significant impact on broad-scale ecological processes is not likely. Apart from the current development, there are two other PV development applications on Straussheim (Straussheim Alpha & Bravo), as well as several facilities on the adjacent property (Gemsbok Solar PV 1-6, Boven Solar PV1-4) as well as three Scatec facilities which have been refused by DEA but are under appeal. The total extent of habitat loss resulting from all of these developments would be approximately 2000ha. However, not all of these developments are likely to actually be developed and the total extent of habitat loss that is likely to occur would be less. Regardless, even taking the loss of 2000ha as a worst-case scenario, this would not generate a significant extent of habitat loss within the Bushmanland Arid Grassland vegetation type. As the area is fairly homogenous and important areas for faunal movement are outside of the current study area, it is not likely that there would be

significant cumulative impacts on faunal movement or other broad-scale ecological processes.

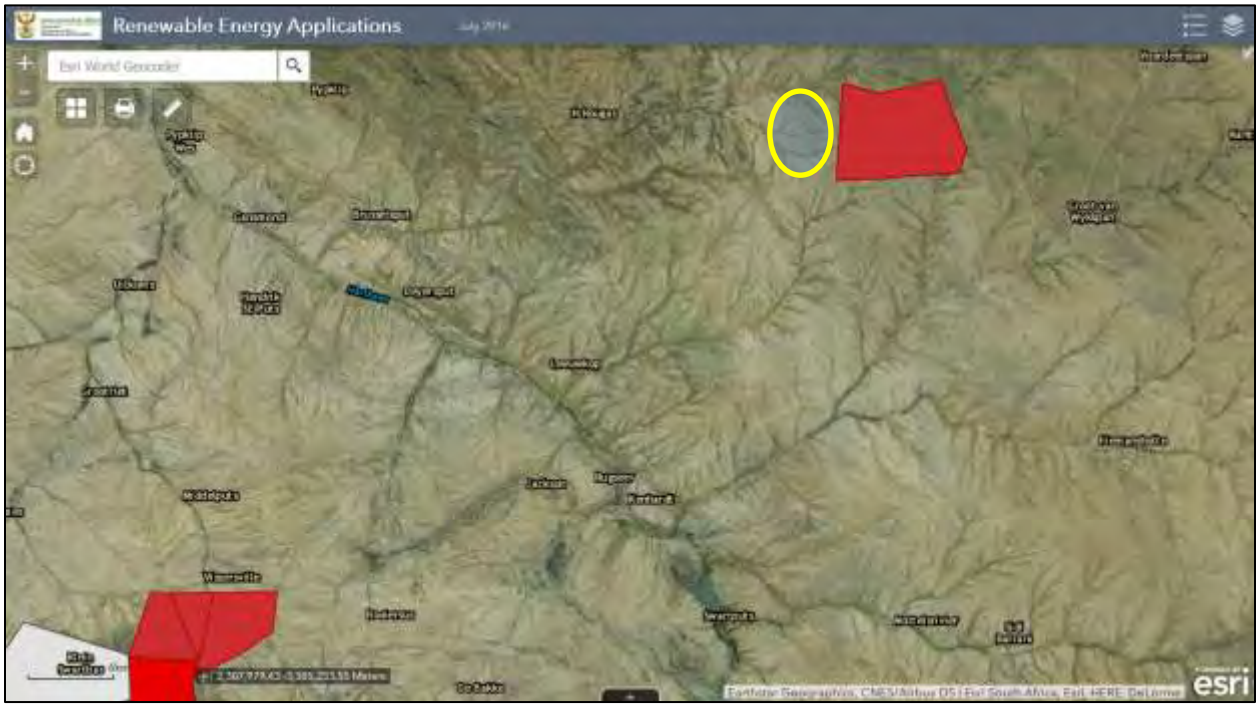

Figure 6. Map of DEA-registered renewable energy projects around the Straussheim site indicated by the yellow circle, showing other renewable energy developments in the area around Kenhardt.

3.5 FAUNAL COMMUNITIES

Mammals

According to the MammalMap database approximately 31 terrestrial mammals are known from the area. Listed species which may occur in the area include the Black-footed cat *Felis nigripes* (VU) Brown Hyaena *Hyaena brunnea* (NT) and Littledale's Whistling Rat *Parotomys littledalei* (NT). All of these species have a wide distribution in South Africa and the loss of about 240 ha of habitat would not result in significant habitat loss for these species.

The diversity of habitats at the site is low and consists largely of open low shrubland on shallow stony soils, with no rocky outcrops or large drainage lines. As a result, the species present would be those that are associated with open plains and includes species such as Cape Porcupine *Hystrix africaeaustralis*, Steenbok *Raphicerus campestris*, Springbok *Antidorcas marsupialis*, Aardvark *Orycteropus afer*, Cape Hare *Lepus capensis*, South African Ground Squirrel *Xerus inauris*, Black-backed Jackal *Canis mesomelas*, Bat-eared Fox *Otocyon megalotis* and African Wild Cat *Felis silvestris*.

Impacts on mammals are likely to be restricted largely to disturbance during the construction phase and habitat loss during the operational phase. Given the largely intact nature of the broader area, cumulative impacts are likely to be relatively low and overall impacts on fauna would be low and local in nature.

Reptiles

The site lies in or near the distribution range of approximately 40 reptile species but given the low habitat diversity at the site, the actual reptile diversity present is likely to be significantly lower. Species either observed or likely to be present confirmed at the site include the Namaqua Sand Lizard *Pedioplanis namaquensis*, Ground Agama *Agama aculeata* and Cape Skink *Mabuya capensis*. No species which may occur in the area are listed as endangered, but the Bushmanland Tent Tortoise is protected under provincial ordinance and is also listed under Appendix II of Cites which regulates trade in these species.

In terms of the likely impact of the development on reptiles, habitat loss is likely to be of local significance only, due to the relatively low footprint of the development and the relatively low reptile diversity of the site. Furthermore, some species would be able to use the vegetation under the panels and some species would take advantage of the buildings and structures present. Some transient disturbance of reptiles during construction is likely due to disturbance and vegetation clearing. Overall, as there are few range-restricted or listed reptile species at the site, impacts on reptiles from the development is likely to be local in nature and not of broader significance.

Amphibians

Although the site lies within or near the range of nine amphibian species, several of these require more or less permanent water and would not occur at the site. In practice, probably only toad species which are able to tolerate extended dry periods such as the Karoo Toad *Vandijkophrynus gariepensis* occur at the site. There is no breeding habitat for frogs at the site and any frogs at the site would be likely to breed at man-made features present in the wider area. Given the low likely abundance of frogs at the site, impacts on frogs are likely to be low.

3.6 Site Sensitivity Assessment

The sensitivity map for the proposed development area of the Straussheim Charlie PV plant site is illustrated below in Figure 7. There are no highly sensitive features identified within the site that would be affected by the development. The site is homogenous and there are no rocky hills or large drainage systems of higher sensitivity status. In terms of listed or protected species, no individuals were observed within the footprint and it is not likely that there are many such species present and overall impacts on such species would be low.

There are no areas of specific importance identified for terrestrial fauna within the study area as it is generally homogenous and similar to the surrounding plains. Given the above findings, the site is therefore considered relatively favourable within the local and regional context for the development of a PV facility. Furthermore, although there are some other developments planned nearby, the affected vegetation types remain largely intact and there are no reasons to expect that the development would significantly impact broad scale ecological processes as there is little to suggest that the affected area would be of particular importance for fauna movement or migration.

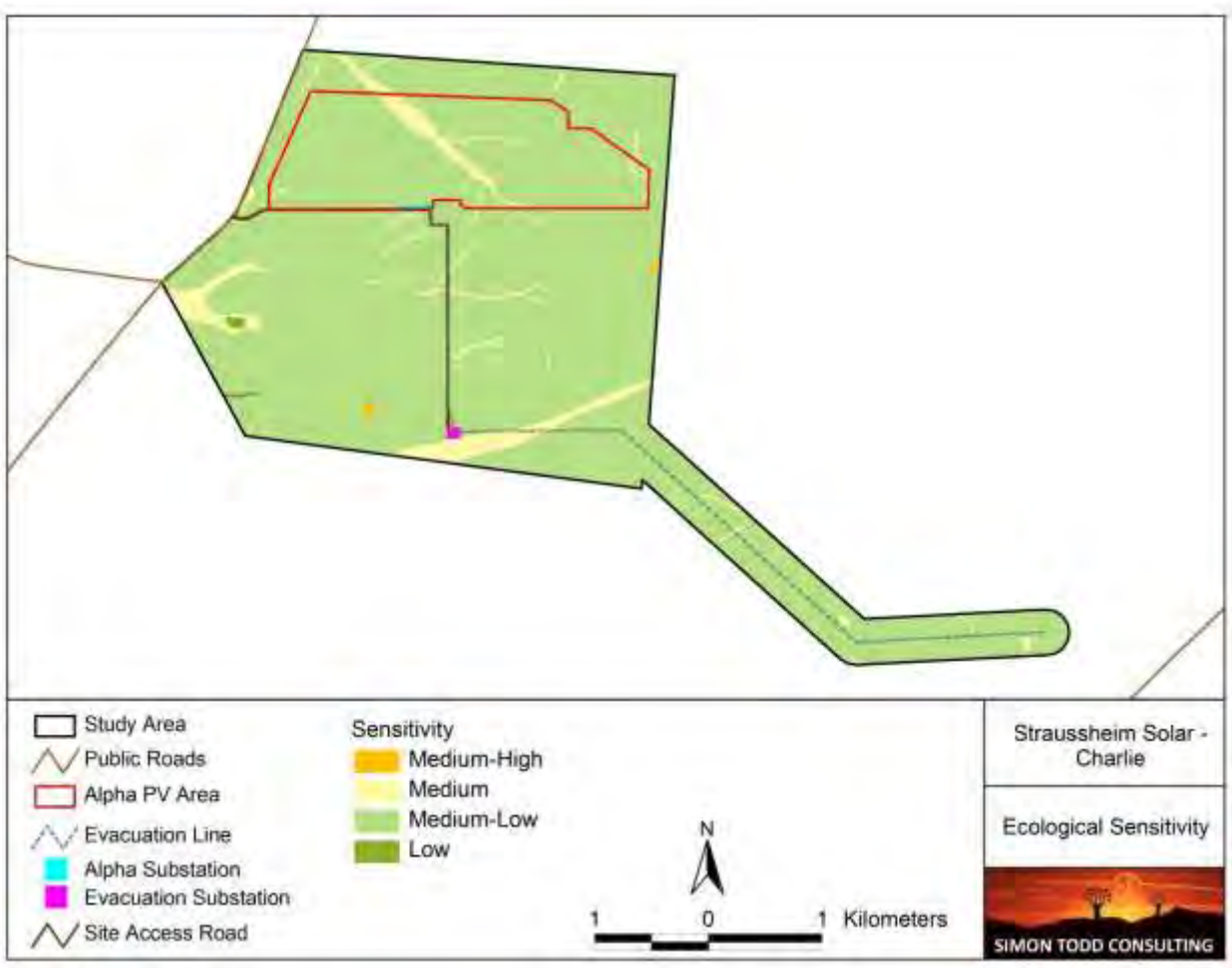

Figure 7. Ecological sensitivity map of the Straussheim Charlie PV Plant, showing that the majority of the site consists of the natural vegetation of low sensitivity.

4 IMPACT ASSESSMENT

4.1 IDENTIFICATION & NATURE OF IMPACTS

In this section, the potential impacts and associated risk factors that may be generated by the 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 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.

4.2 IDENTIFICATION OF POTENTIAL IMPACTS AND DAMAGING ACTIVITIES

Potential ecological impacts resulting from the development of the Straussheim Charlie PV Facility 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:

Preconstruction Phase

- Human presence and uncontrolled access to the site may result in negative impacts on fauna and flora through poaching of fauna and uncontrolled collection of plants for traditional medicine or other purpose.
- Site clearing and exploration activities for site establishment would have a negative impact on biodiversity if this was not conducted in a sensitive manner.

Construction Phase

- Vegetation clearing for the PV arrays, access roads, site fencing etc could impact listed plant species as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.
- Increased erosion risk would occur due to the loss of plant cover and soil disturbance created during the construction phase. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems.
- Presence and operation of construction machinery on site. This will create a physical impact as well as generate noise, pollution and other forms of disturbance at the site.
- Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

Operational Phase

- The operation of the facility will generate noise and disturbance which may deter some fauna and avifauna from the area.

- The areas inside the facility will require management and if this is not done appropriately, it could impact adjacent intact areas through impacts such as erosion, alien plant invasion and contamination from pollutants, herbicides or pesticides.

Cumulative Impacts

- The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets.
- Transformation of intact habitat 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.

4.3 IDENTIFICATION OF IMPACTS TO BE ASSESSED

The development will result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure such as roads, PV areas, operations buildings etc. The following impacts are identified as those most likely to be associated with the development and which are assessed for the different phases of the project as appropriate.

Impacts on vegetation and protected plant species

There are a number of listed and protected species present in the area and it is possible that some of these would be impacted by the development. Vegetation clearing during construction will lead to the loss of currently intact habitat within the development footprint and is an inevitable consequence of the development. As this impact is certain to occur it is assessed for the construction phase as this is when clearing will take place.

Soil erosion and associated degradation of ecosystems

The large amount of disturbance created during construction would potentially leave the site vulnerable to soil erosion. The site is gently sloping and disturbance leading to the loss of plant cover over large parts of the site will certainly increase the risk of wind and water erosion at the site. In addition, the panels will generate a lot more runoff than the natural vegetation would and as a result the amount of runoff the site experiences would be likely to increase. Soil erosion is therefore considered a likely impact and is assessed for the construction phase.

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 is therefore assessed for the construction phase and operational phase.

Alien Plant Invasion

The disturbance created during construction is highly likely to encourage the invasion of the disturbed areas by alien species. Although there are not a lot of alien species present within the undisturbed parts of the site, there were some aliens present in disturbed areas such as around watering points. This includes woody invaders such as *Prosopis glandulosa*. Such species will rapidly increase in abundance and expand into the disturbed areas if given the opportunity. This impact is deemed highly likely to occur and is assessed as a likely impact associated with the development.

Reduced ability to meet conservation obligations & targets

The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the country's ability to meet its conservation targets. The receiving vegetation types in the study area are classified as Least Threatened and are still more than 98% intact. As these are widespread vegetation types and there is no indication that there are any rare or restricted habitats within the development footprint, this is not considered to be a high risk associated with the current development when considered at the scale of the vegetation type. In addition, there are no habitats within the development footprint that are not widely available in the area. Consequently, this is not considered to be an impact of significance and is not assessed.

Impact on 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 large amount of development in the area, this is a likely cumulative impact of the development that is assessed.

4.4 ASSESSMENT METHODOLOGY

Direct, indirect and cumulative impacts of the issues identified above, are assessed according to the following standard methodology:

- The **nature** which shall include a description of what causes the effect what will be affected and how it will be affected.

- The **extent** wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):

- The **duration** wherein it will be indicated whether:

    - the lifetime of the impact will be of a very short duration (0- 1 years).
    - the lifetime of the impact will be of a short duration (2-5 years).
    - medium-term (5-15 years).
    - long term (> 15 years); or
    - permanent

- The **magnitude** quantified as small and will have no effect on the environment, minor and will not result in an impact on processes, low and will cause a slight impact on processes, moderate and will result in processes continuing but in a modified way, high (processes are altered to the extent that they temporarily cease) and very high and results in complete destruction of patterns and permanent cessation of processes.

- The **probability** of occurrence, which shall describe the (likelihood of the impact actually occurring. Probability will be estimated as very improbable (probably will not happen), improbable (some possibility, but of low likelihood), probable (distinct possibility), highly probable (most likely) and definite (impact will occur regardless of any prevention measures).

The **significance** which shall be determined through a synthesis of the characteristics described above and will be assessed as follows:

- **No significance**: the impacts do not influence the proposed development and/or environment in any way.
- **Low significance**: the impacts will have a minor influence on the proposed development and/or environment. These impacts require some attention to modification of the project design where possible, or alternative mitigation.
- **Moderate significance**: the impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures.
- **High significance**: the impacts will have a major influence on the proposed development and/or environment and will result in the "no-go" option on the development or portions of the development regardless of any mitigation measures that could be implemented. This level of significance must be well motivated.

and;
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.

5 ASSESSMENT OF IMPACTS

The following assessed impacts are those for the solar facility itself, for the planning and construction and operational phases of the development.

5.1 STRAUSSHEIM CHARLIE PV PLANT

Planning & Construction Phase

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	With Mitigation	
Impacts on vegetation and listed or protected plant species resulting from construction activities	Local	Long-Term	High	Definite	Low	Medium Negative	Medium-Low Negative	High

Mitigation/Management Actions

- Preconstruction walk-through of the facility in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions.
- Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.
- All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.
- Temporary lay-down 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 if they do not fall within the development footprint of the plant infrastructure.

Direct Faunal Impacts During Construction	Local	Short- Term	Medium	High	High	Medium Negative	Low Negative	High

Mitigation/Management Actions

- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.
- Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	With Mitigation	

- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- If trenches need to be dug for electrical cabling or other infrastructure, 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.

Soil Erosion Risk During Construction	Local	Medium-term	Medium	High	Low	Medium-Low Negative	Low Negative	High

Mitigation/Management Actions

- Dust suppression and erosion management should be an integrated component of the construction approach.
- Disturbance near to drainage lines should be avoided and any drainage areas near to access roads and construction activities should demarcated as no-go areas.
- Regular monitoring for erosion problems along the access roads and other cleared areas.
- Erosion problems should be rectified on a regular basis.
- Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.
- A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

Operational Phase

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	With Mitigation	
Alien Plant Invasion Risk During Operation	Local	Long-term	Medium-High	High	Low	Medium Negative	Low Negative	High

Mitigation/Management Actions

- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- The recovery of the indigenous vegetation should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	**With Mitigation**	
cleared areas. • Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem on parts of the site and a long-term control plan will need to be implemented. • Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as these are also likely to be prone to invasion problems. • Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.								
Soil Erosion Risk During Operation	Local	Long-term	Medium	Medium	Low	Medium-Low Negative	Low Negative	High
Mitigation/Management Actions • All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All cleared areas should be revegetated with indigenous perennial grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.								
Faunal impacts during operation:	Low	Long-term	Medium	Moderate	High	Medium-Low Negative	Low-Negative	High
Mitigation/Management Actions • No unauthorized persons should be allowed onto the site. • Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. • The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. • If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. • If the facility is to be fenced, then the electrified strands should be on the inside of the fence as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour by retreating into their shells and are killed by repeated shocks.								

Cumulative Impacts

The following are the cumulative impacts that are assessed as being a likely consequence of the development.

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	With Mitigation	
Impact on broad-scale ecological processes due to cumulative loss and fragmentation of habitat	Regional	Long-Term	Medium	Moderate	Low	Medium-Low Negative	Low Negative	Moderate-High

Mitigation/Management Actions

- Minimise the development footprint as far as possible and allow the retention of some natural vegetation between the rows of panels or trackers.
- The facility should be fenced off in a manner which allows fauna to pass by the facility as easily as possible. This implies not fencing-in large areas of intact vegetation into the facility and only the developed area should be fenced.

5.2 OVERHEAD POWER LINE

Planning & Construction Phase

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	With Mitigation	
Impacts on vegetation and listed or protected plant species resulting from construction activities	Local	Long-Term	Moderate-Low	High	Low	Medium-Low Negative	Low Negative	High

Mitigation/Management Actions

- Preconstruction walk-through of the power line route in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions.
- No large woody species should be cleared from the power line servitude. It may be necessary to remove some individuals from the directly beneath the power line due to safety concerns, however, within the servitude the presence of large woody species does not increase the fire risk and there are valid reasons to remove such trees. If these are too tall and cause safety problems, they can be cut to a lower height rather than removed and as growth rate in arid areas is slow. It would take

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	With Mitigation	
many years before such trees would need to be trimmed again. Such trees can be trimmed to 1m height if necessary. • Preconstruction environmental induction for all construction staff to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. • Vegetation clearing along the power line corridor should only be conducted where necessary and should not be cleared using herbicides or with a bulldozer. Vegetation can be cleared manually with bush cutters to 0.5m height where necessary. • Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity.								
Direct Faunal Impacts During Construction	Local	Short- Term	Medium	High	High	Medium Negative	Low Negative	High
Mitigation/Management Actions • All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition. • Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer. • All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • If holes need to be dug for pylons, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Holes should only be dug when they are required and should be used and filled shortly thereafter.								

Operational Phase

Nature of impact	Spatial Extent	Duration	Intensity	Probability	Reversibility	Significance and Status		Confidence level
						Without Mitigation	With Mitigation	
Ecosystem degradation along the power line route due to erosion and alien plant invasion.	Local	Long-term	Medium	High	Low	Medium-Low Negative	Low Negative	High
Mitigation/Management Actions • Regular erosion and alien plant management along the power line servitude.								

- Herbicides should only be used on alien species and should not be broadcast or sprayed and should only be used on cut-stump type applications where it is applied by hand to specific plants.
- During operation and maintenance of the power line servitudes, alien species especially large woody species such as *Prosopis glandulosa* should be cleared from the power line servitudes.

6 CONCLUSION & RECOMMENDATIONS

No features of very high sensitivity have been identified within the Straussheim Charlie Power Plant site. The majority of the site consists of low shrubland of medium-low sensitivity with few species or habitats of conservation present. Similarly, faunal diversity at the site is relatively low, largely as a result of the low diversity of habitats present and there are few listed species present and the development would not impact significantly on listed fauna. In addition, the site is not within a CBA or NPAES Focus area and impacts on broad-scale ecological processes are likely to be low, even though there are 3 facilities planned at the site as well as a number of other approved and planned facilities in the Kenhardt area.

The major impact associated with the development of the Straussheim Charlie Power Plant, would be local habitat loss for fauna and flora. However the area is relatively homogenous and there are no reasons to expect that the current or cumulative impact of development at the site would significantly disrupt the landscape for fauna or other broad-scale ecological processes. Overall, there are no assessed impacts associated with the development of the Straussheim Charlie Power Plant that cannot be mitigated to a low level and most impacts are likely to be of moderate to low significance and of local extent only. As such, the site is considered a favourable site for the development of the PV plant and there are no ecological reasons that should prevent the development from proceeding.

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8 LIST OF PLANT SPECIES

List of plant species known from the area around the Straussheim site and observed at the site.

Family	Species	Threat status	Observed
ACANTHACEAE	*Acanthopsis disperma Nees*	LC	1
ACANTHACEAE	*Acanthopsis hoffmannseggiana (Nees) C.B.Clarke*	LC	
ACANTHACEAE	*Barleria lichtensteiniana Nees*	LC	1
ACANTHACEAE	*Monechma distichotrichum (Lindau) P.G.Mey.*	LC	
ACANTHACEAE	*Monechma divaricatum (Nees) C.B.Clarke*	LC	
ACANTHACEAE	*Monechma incanum (Nees) C.B.Clarke*	LC	1
AIZOACEAE	*Aizoon schellenbergii Adamson*	LC	1
AIZOACEAE	*Galenia sarcophylla Fenzl*	LC	1
AIZOACEAE	*Plinthus karooicus I.Verd.*	LC	1
AIZOACEAE	*Tetragonia arbuscula Fenzl*	LC	1
AMARANTHACEAE	*Amaranthus dinteri Schinz subsp. dinteri var. a*	LC	
AMARYLLIDACEAE	*Nerine laticoma (Ker Gawl.) T.Durand & Schinz*	LC	
APOCYNACEAE	*Gomphocarpus filiformis (E.Mey.) D.Dietr.*	LC	
APOCYNACEAE	*Hoodia officinalis (N.E.Br.) Plowes subsp. officinalis*	NT	
APOCYNACEAE	*Larryleachia marlothii (N.E.Br.) Plowes*	LC	
APOCYNACEAE	*Microloma incanum Decne.*	LC	
ASPARAGACEAE	*Asparagus suaveolens Burch.*	LC	1
ASPHODELACEAE	*Aloe dichotoma Masson*	VU	1
ASPHODELACEAE	*Aloe karasbergensis Pillans*	LC	
ASPHODELACEAE	*Bulbine abyssinica A.Rich.*	LC	
ASPHODELACEAE	*Haworthia venosa (Lam.) Haw. subsp. venosa*	VU	
ASTERACEAE	*Amellus epaleaceus O.Hoffm.*	LC	
ASTERACEAE	*Amellus tridactylus DC. subsp. arenarius (S.Moore) Rommel*	LC	1
ASTERACEAE	*Chrysocoma ciliata L.*	LC	1
ASTERACEAE	*Dimorphotheca polyptera DC.*	LC	
ASTERACEAE	*Dimorphotheca sinuata DC.*	LC	
ASTERACEAE	*Eriocephalus ambiguus (DC.) M.A.N.Müll.*	LC	1
ASTERACEAE	*Felicia muricata (Thunb.) Nees subsp. muricata*	LC	
ASTERACEAE	*Foveolina dichotoma (DC.) Källersjö*	LC	
ASTERACEAE	*Gazania lichtensteinii Less.*	LC	1
ASTERACEAE	*Geigeria filifolia Mattf.*	LC	1
ASTERACEAE	*Geigeria ornativa O.Hoffm. subsp. ornativa*	LC	1
ASTERACEAE	*Geigeria pectidea (DC.) Harv.*	LC	
ASTERACEAE	*Geigeria vigintisquamea O.Hoffm.*	LC	
ASTERACEAE	*Hirpicium echinus Less.*	LC	
ASTERACEAE	*Ifloga molluginoides (DC.) Hilliard*	LC	
ASTERACEAE	*Lasiopogon glomerulatus (Harv.) Hilliard*	LC	
ASTERACEAE	*Nidorella resedifolia DC. subsp. resedifolia*	LC	
ASTERACEAE	*Osteospermum armatum Norl.*	LC	1
ASTERACEAE	*Osteospermum pinnatum (Thunb.) Norl. var. breve Norl.*	LC	

ASTERACEAE	*Osteospermum pinnatum (Thunb.) Norl. var. pinnatum*	LC	
ASTERACEAE	*Osteospermum spinescens Thunb.*	LC	
ASTERACEAE	*Pegolettia retrofracta (Thunb.) Kies*	LC	1
ASTERACEAE	*Pteronia acuminata DC.*	LC	
ASTERACEAE	*Senecio burchellii DC.*	LC	
ASTERACEAE	*Senecio niveus (Thunb.) Willd.*	LC	
ASTERACEAE	*Senecio sisymbriifolius DC.*	LC	
ASTERACEAE	*Tripteris microcarpa Harv. subsp. microcarpa*	LC	
ASTERACEAE	*Tripteris sinuata DC. var. sinuata*	LC	1
ASTERACEAE	*Ursinia nana DC. subsp. nana*	LC	
BORAGINACEAE	*Heliotropium ciliatum Kaplan*	LC	
BORAGINACEAE	*Heliotropium supinum L.*	Alien	
BORAGINACEAE	*Trichodesma africanum (L.) Lehm.*	LC	
BRASSICACEAE	*Heliophila deserticola Schltr. var. deserticola*	LC	
BRASSICACEAE	*Lepidium schinzii Thell.*	LC	
CAPPARACEAE	*Boscia albitrunca (Burch.) Gilg & Gilg-Ben.*	LC	
CAPPARACEAE	*Boscia foetida Schinz subsp. foetida*	LC	1
CAPPARACEAE	*Cadaba aphylla (Thunb.) Wild*	LC	1
CAPPARACEAE	*Cleome angustifolia Forssk. subsp. diandra (Burch.) Kers*	LC	
CAPPARACEAE	*Cleome foliosa Hook.f. var. lutea (Sond.) Codd & Kers*	LC	
CAPPARACEAE	*Cleome oxyphylla Burch. var. oxyphylla*	LC	
CHENOPODIACEAE	*Salsola barbata Aellen*	LC	
CHENOPODIACEAE	*Salsola tuberculata (Moq.) Fenzl*	LC	1
COLCHICACEAE	*Colchicum melanthoides (Willd.) J.C.Manning & Vinn. subsp. melanthoides*	LC	
CUCURBITACEAE	*Cucumis myriocarpus Naudin subsp. leptodermis (Schweick.) C.Jeffrey & P.Halliday*	LC	
CUCURBITACEAE	*Cucumis myriocarpus Naudin subsp. myriocarpus*	LC	1
EBENACEAE	*Diospyros lycioides Desf. subsp. lycioides*	LC	
FABACEAE	*Acacia karroo Hayne*	LC	
FABACEAE	*Indigofera alternans DC. var. alternans*	LC	
FABACEAE	*Lessertia annularis Burch.*	LC	1
FABACEAE	*Lotononis falcata (E.Mey.) Benth.*	LC	
FABACEAE	*Lotononis rabenaviana Dinter & Harms*	LC	
FABACEAE	*Melolobium exudans Harv.*	LC	
FABACEAE	*Parkinsonia africana Sond.*	LC	
FABACEAE	*Prosopis glandulosa Torr. var. glandulosa*	Alien	
FABACEAE	*Prosopis glandulosa Torr. var. torreyana (Benson) M.C.Johnst.*	Alien	
FABACEAE	*Prosopis velutina Wooton*	Alien	
FABACEAE	*Tephrosia dregeana E.Mey. var. dregeana*	LC	
GERANIACEAE	*Monsonia luederitziana Focke & Schinz*	LC	
GERANIACEAE	*Monsonia umbellata Harv.*	LC	
GERANIACEAE	*Sarcocaulon crassicaule Rehm*	LC	1
GISEKIACEAE	*Gisekia pharnacioides L. var. pharnacioides*	LC	1
HYACINTHACEAE	*Dipcadi brevifolium (Thunb.) Fourc.*	LC	

IRIDACEAE	*Ferraria ferrariola (Jacq.) Willd.*	LC	
IRIDACEAE	*Lapeirousia plicata (Jacq.) Diels subsp. plicata*	LC	
IRIDACEAE	*Moraea serpentina Baker*	LC	
IRIDACEAE	*Moraea venenata Dinter*	LC	
MALVACEAE	*Abutilon pycnodon Hochr.*	LC	
MALVACEAE	*Hermannia abrotanoides Schrad.*	LC	1
MALVACEAE	*Hermannia bicolor Engl. & Dinter*	LC	
MALVACEAE	*Hermannia gariepina Eckl. & Zeyh.*	LC	
MALVACEAE	*Hermannia minutiflora Engl.*	LC	
MALVACEAE	*Hermannia spinosa E.Mey. ex Harv.*	LC	1
MALVACEAE	*Hermannia tomentosa (Turcz.) Schinz ex Engl.*	LC	
MALVACEAE	*Hibiscus elliottiae Harv.*	LC	
MELIANTHACEAE	*Melianthus comosus Vahl*	LC	
MESEMBRYANTHEMACEAE	*Aptenia geniculiflora (L.) Bittrich ex Gerbaulet*	LC	
MESEMBRYANTHEMACEAE	*Aridaria noctiflora (L.) Schwantes subsp. straminea (Haw.) Gerbaulet*	LC	
MESEMBRYANTHEMACEAE	*Brownanthus vaginatus (Lam.) Chess. & M.Pignal*	LC	
MESEMBRYANTHEMACEAE	*Lithops julii (Dinter & Schwantes) N.E.Br. subsp. fulleri (N.E.Br.) B.Fearn*	LC	
MESEMBRYANTHEMACEAE	*Mesembryanthemum crystallinum L.*	LC	1
MESEMBRYANTHEMACEAE	*Mesembryanthemum nodiflorum L.*	LC	
MESEMBRYANTHEMACEAE	*Prenia tetragona (Thunb.) Gerbaulet*	LC	
MESEMBRYANTHEMACEAE	*Psilocaulon articulatum (Thunb.) N.E.Br.*	LC	1
MESEMBRYANTHEMACEAE	*Psilocaulon coriarium (Burch. ex N.E.Br.) N.E.Br.*	LC	1
MOLLUGINACEAE	*Hypertelis salsoloides (Burch.) Adamson var. salsoloides*	LC	
NEURADACEAE	*Grielum humifusum Thunb. var. humifusum*	LC	1
NEURADACEAE	*Grielum humifusum Thunb. var. parviflorum Harv.*	LC	
NYCTAGINACEAE	*Phaeoptilum spinosum Radlk.*	LC	1
POACEAE	*Aristida congesta Roem. & Schult. subsp. congesta*	LC	1
POACEAE	*Brachiaria glomerata (Hack.) A.Camus*	LC	
POACEAE	*Cenchrus ciliaris L.*	LC	
POACEAE	*Centropodia glauca (Nees) Cope*	LC	
POACEAE	*Dichanthium annulatum (Forssk.) Stapf var. papillosum (A.Rich.) de Wet & Harlan*	LC	
POACEAE	*Digitaria eriantha Steud.*	LC	
POACEAE	*Enneapogon cenchroides (Licht. ex Roem. & Schult.) C.E.Hubb.*	LC	
POACEAE	*Enneapogon desvauxii P.Beauv.*	LC	1
POACEAE	*Enneapogon scaber Lehm.*	LC	1
POACEAE	*Eragrostis annulata Rendle ex Scott-Elliot*	LC	
POACEAE	*Eragrostis brizantha Nees*	LC	
POACEAE	*Eragrostis curvula (Schrad.) Nees*	LC	
POACEAE	*Eragrostis echinochloidea Stapf*	LC	
POACEAE	*Eragrostis lehmanniana Nees var. chaunantha (Pilg.) De Winter*	LC	
POACEAE	*Eragrostis lehmanniana Nees var. lehmanniana*	LC	1
POACEAE	*Eragrostis macrochlamys Pilg. var. macrochlamys*	LC	

POACEAE	*Eragrostis porosa Nees*	LC	
POACEAE	*Eragrostis rotifer Rendle*	LC	
POACEAE	*Eragrostis x pseud-obtusa De Winter*	Not Evaluated	
POACEAE	*Fingerhuthia africana Lehm.*	LC	1
POACEAE	*Oropetium capense Stapf*	LC	
POACEAE	*Panicum lanipes Mez*	LC	
POACEAE	*Schismus barbatus (Loefl. ex L.) Thell.*	LC	
POACEAE	*Schmidtia kalahariensis Stent*	LC	
POACEAE	*Schmidtia pappophoroides Steud.*	LC	
POACEAE	*Stipagrostis anomala De Winter*	LC	1
POACEAE	*Stipagrostis ciliata (Desf.) De Winter var. capensis (Trin. & Rupr.) De Winter*	LC	1
POACEAE	*Stipagrostis hochstetteriana (Beck ex Hack.) De Winter var. secalina (Henrard) De Winter*	LC	
POACEAE	*Stipagrostis obtusa (Delile) Nees*	LC	1
POACEAE	*Stipagrostis uniplumis (Licht.) De Winter var. uniplumis*	LC	1
POACEAE	*Tragus racemosus (L.) All.*	LC	
POACEAE	*Tricholaena capensis (Licht. ex Roem. & Schult.) Nees subsp. capensis*	LC	
POACEAE	*Triraphis ramosissima Hack.*	LC	
PORTULACACEAE	*Talinum tenuissimum Dinter*	LC	
RHAMNACEAE	*Ziziphus mucronata Willd. subsp. mucronata*	LC	
RUBIACEAE	*Kohautia caespitosa Schnizl. subsp. brachyloba (Sond.) D.Mantell*	LC	
RUBIACEAE	*Kohautia cynanchica DC.*	LC	
SALICACEAE	*Salix mucronata Thunb. subsp. mucronata*	LC	
SANTALACEAE	*Thesium lineatum L.f.*	LC	1
SCROPHULARIACEAE	*Cromidon minutum (Rolfe) Hilliard*	LC	
SCROPHULARIACEAE	*Diascia engleri Diels*	LC	
SCROPHULARIACEAE	*Hebenstretia integrifolia L.*	LC	
SCROPHULARIACEAE	*Manulea schaeferi Pilg.*	LC	
SCROPHULARIACEAE	*Selago divaricata L.f.*	LC	
SCROPHULARIACEAE	*Veronica anagallis-aquatica L.*	LC	
SCROPHULARIACEAE	*Zaluzianskya diandra Diels*	LC	
SOLANACEAE	*Lycium schizocalyx C.H.Wright*	LC	1
SOLANACEAE	*Solanum burchellii Dunal*	LC	
THYMELAEACEAE	*Gnidia polycephala (C.A.Mey.) Gilg*	LC	1
URTICACEAE	*Forsskaolea candida L.f.*	LC	
VERBENACEAE	*Chascanum garipense E.Mey.*	LC	1
ZYGOPHYLLACEAE	*Augea capensis Thunb.*	LC	1
ZYGOPHYLLACEAE	*Sisyndite spartea E.Mey. ex Sond.*	LC	1
ZYGOPHYLLACEAE	*Tribulus cristatus C.Presl*	LC	1
ZYGOPHYLLACEAE	*Tribulus pterophorus C.Presl*	LC	
ZYGOPHYLLACEAE	*Zygophyllum dregeanum Sond.*	LC	1
ZYGOPHYLLACEAE	*Zygophyllum simplex L.*	LC	1

9 ANNEX 1. LIST OF MAMMALS

List of mammals which are likely to occur in the vicinity of the Staussheim site. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the IUCN Red Lists 2014.2 and South African Red Data Book for Mammals. Confirmed species are those observed in the area, not necessarily from the site itself.

Scientific Name	Common Name	Status	Habitat	Likelihood
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus rupestris	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	High
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	Confirmed
Lagomorpha (Hares and Rabbits):				
Lepus capensis	Cape Hare	LC	Dry, open regions, with palatable bush and grass	Confirmed
Lepus saxatilis	Scrub Hare	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	High
Rodentia (Rodents):				
Cryptomys hottentotus	African Mole Rat	LC	Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils	Confirmed
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed
Pedetes capensis	Springhare	LC	Occur widely on open sandy ground or sandy scrub, on overgrazed grassland, on the fringes of vleis and dry river beds.	High
Xerus inauris	South African Ground Squirrel	LC	Open terrain with a sparse bush cover and a hard substrate	Confirmed
Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	High
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
Mastomys coucha	Southern Multimammate Mouse	LC	Wide habitat tolerance.	High
Aethomys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these	Confirmed

			preferentially	
Parotomys brantsii	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	High
Otomys unisulcatus	Bush Vlei Rat	LC	Shrub and fynbos associations in areas with rocky outcrops Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	Low
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Gerbilliscus leucogaster	Bushveld Gerbil	LC	Predominantly associated with light sandy soils or sandy alluvium	Low
Gerbilliscus brantsii	Higheld Gerbil	LC	Sandy soils or sandy alluvium with some cover of grass, scrub or open woodland	Low
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Primates:				
Papio ursinus	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High
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
Erinaceomorpha (Hedgehog)				
Atelerix frontalis	South African Hedgehog	LC	Generally found in semi-arid and subtemperate environments with ample ground cover	Low
Carnivora:				
Proteles cristata	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	Confirmed
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	High

Cynictis penicillata	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	Confirmed
Herpestes pulverulentus	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.	Confirmed
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	IUCN LC/SA RDB EN	Catholic habitat requirements	High
Rumanantia (Antelope):				
Oryx gazella	Gemsbok	LC	Open arid country	Confirmed
Sylvicapra grimmia	Common Duiker	LC	Presence of bushes is essential	High
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Confirmed
Raphicerus campestris	Steenbok	LC	Inhabits open country,	Confirmed

10 ANNEX 2. LIST OF REPTILES

List of reptiles which are likely to occur at the proposed Straussheim Charlie site, based on the SARCA database. Conservation status is from the SARCA 2014 Assessment.

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Agamidae	*Agama*	*aculeata*	*aculeata*	Common Ground Agama	Least Concern	4
Agamidae	*Agama*	*anchietae*		Anchieta's Agama	Least Concern	5
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern	3
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern	1
Colubridae	*Psammophis*	*namibensis*		Namib Sand Snake	Least Concern	1
Colubridae	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern	3
Colubridae	*Telescopus*	*beetzii*		Beetz's Tiger Snake	Least Concern	2
Cordylidae	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern	3
Gekkonidae	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern	5
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern	14
Gekkonidae	*Pachydactylus*	*capensis*		Cape Gecko	Least Concern	4
Gekkonidae	*Pachydactylus*	*latirostris*		Quartz Gecko	Least Concern	6
Gekkonidae	*Pachydactylus*	*rugosus*		Common Rough Gecko	Least Concern	5
Gekkonidae	*Ptenopus*	*garrulus*	*maculatus*	Spotted Barking Gecko	Least Concern	6
Lacertidae	*Heliobolus*	*lugubris*		Bushveld Lizard	Least Concern	1
Lacertidae	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern	1
Lacertidae	*Pedioplanis*	*inornata*		Plain Sand Lizard	Least Concern	3
Lacertidae	*Pedioplanis*	*lineoocellata*	*lineoocellata*	Spotted Sand Lizard	Least Concern	39
Lacertidae	*Pedioplanis*	*namaquensis*		Namaqua Sand Lizard	Least Concern	9
Scincidae	*Acontias*	*lineatus*		Striped Dwarf Legless Skink	Least Concern	1
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern	2
Scincidae	*Trachylepis*	*occidentalis*		Western Three-striped Skink	Least Concern	6
Scincidae	*Trachylepis*	*sparsa*		Karasburg Tree Skink	Least Concern	1
Scincidae	*Trachylepis*	*spilogaster*		Kalahari Tree Skink	Least Concern	2
Scincidae	*Trachylepis*	*sulcata*	*sulcata*	Western Rock Skink	Least Concern	6
Scincidae	*Trachylepis*	*variegata*		Variegated Skink	Least Concern	17
Testudinidae	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed	12
Testudinidae	*Stigmochelys*	*pardalis*		Leopard Tortoise	Least Concern	1
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked	Least Concern	1
						40

				Blind Snake		
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern	1

11 ANNEX 3. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in the vicinity of the Straussheim Charlie site, according to the Southern African Atlas of Frogs.

Family	Genus	Species	Common name	Red list category
Brevicepitidae	*Breviceps*	*adspersus*	Bushveld Rain Frog	Least Concern
Bufonidae	*Amietophrynus*	*gutturalis*	Guttural Toad	Least Concern
Bufonidae	*Amietophrynus*	*poweri*	Power's Toad	Least Concern
Bufonidae	*Amietophrynus*	*rangeri*	Raucous Toad	Least Concern
Bufonidae	*Poyntonophrynus*	*vertebralis*	Southern Pygmy Toad	Least Concern
Bufonidae	*Vandijkophrynus*	*gariepensis*	Karoo Toad	Least Concern
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern
Pyxicephalidae	*Amietia*	*angolensis*	Common or Angola River Frog	Least Concern
Pyxicephalidae	*Cacosternum*	*boettgeri*	Common Caco	Least Concern
Pyxicephalidae	*Tomopterna*	*cryptotis*	Tremelo Sand Frog	Least Concern