ECOLOGICAL SCOPING REPORT

PROPOSED KISON SOLAR ENERGY FACILITY SOUTH OF POLOKWANE

LIMPOPO PROVINCE

August 2013

Prepared for:

NETWORX South Africa
18 Melrose Boulevard, 2nd Floor
Melrose Arch
2076 Johannesburg
South Africa

Prepared by:

Savannah Environmental Pty Ltd

UNIT 10, BUILDING 2
5 WOODLANDS DRIVE OFFICE PARK
CNR OF WOODLANDS DRIVE AND WESTERN SERVICE ROAD
WOODMEAD
PO BOX 148, SUNNINGHILL, 2157
TEL: +27 (0)11 6563237
FAX: +27 (0)86 684 0547
E-MAIL: INFO@SAVANNAHSA.COM
WWW.SAVANNAHSA.COM

Savannah
ENVIRONMENTAL (PTY) LTD

Executive Summary

NETWORX South Africa has appointed Savannah Environmental (Pty) Ltd to manage the EIA process for a photovoltaic Solar Energy Facility near Polokwane in the Limpopo Province.

The proposed site for the PV development is located on Portions 19 of the farm Snymansdrift 738, located between the N1 and R101, about 19 km south of Polokwane. East of the proposed development site, about 1 km beyond the R101, is the Kuschke Nature Reserve. The study area falls within the Polokwane Local and Capricorn District Municipalities. The study area comprises only the area selected for the proposed development.

The three proposed facilities are envisaged to have a generating capacity of up to 80 MW each and would include:

» Arrays of photovoltaic (PV) panels
» Appropriate mounting structures (so far both tracking and fixed panel options are being considered)
» Cabling between the project components, to be lain underground where practical.
» New on-site substation and power line to evacuate the power from the facility into the Eskom grid
» Internal access roads and fencing.
» Construction of associated infrastructure such as workshops, office, guard houses and fencing
» As part of the construction process, sections of vegetation on the property will need to be cleared entirely
» It is not envisaged that the proposed development will require a borrow pit or extensive topsoil storage

At this stage the layout has not been finalised, but will be decided upon once known sensitivities of the target area have been delineated and described.

This report discusses the approach and findings of a desktop scoping survey carried out on the study area, to assess the likelihood of ecological sensitivities occurring on the study area in an effort to identify any issues regarding fauna and flora that should receive further attention during the EIA assessment phase.

The vegetation type on the study area is Polokwane Plateau Bushveld. It consists of a short open tree layer with a well-developed grass layer or grass plains with occasional scattered trees. The tree layer is dominated by deciduous microphyllous trees and shrubs, with occasional stands of high succulents.

A list of plant species that has been recorded to date in the representative grid has been obtained from the POSA SANBI website, whilst a list of animal species that might occur in the study area has been derived from the UCT ADU and SANBI SIBIS Databases, as well as from Apps (2000). These lists have been evaluated against the SANBI and IUCN Species Status database and applicable legislation to obtain a list of species that are protected and/or in any way threatened, that may occur in the study area and that could be affected by the proposed development. The presence of such species on or traversing the study area will have to be verified during field observations.

The area was briefly visited for a screening on 7 May 2013, mainly to determine the overall ecological condition of the vegetation and the possibility of protected plants and the relocation potential of such species on the site. This visit, however, does not constitute a detailed survey.

The sensitivity and associated impact analysis provided is only a preliminary assessment that needs to be verified and fully explored during a detailed field study.

A high proportion of the plant species of conservation concern that potentially could occur on the study area will only be identifiable during the growing season as they will be dormant (in underground storage organs) and not visible otherwise. Most rains fall between November and March, indicating that ***field surveys should be carried out between December and April for the most accurate assessment of vegetation (as the primary producer) and associated biodiversity****.*

Preliminary mapping of the Limpopo Conservation Plan (still in preparation) depicts most of the area on and around the study area as an Irreplaceable Natural Area. This mapping is done at a large scale (and has not yet been finalised), generalising very little available ground data to larger areas. During the screening studies, no restricted distributions or specific irreplaceable habitats that could provide specialised restricted niches for any kind of biodiversity could be identified. In addition, due to the R101 and the N1 running parallel on either side of the property, the piece of land is already highly fragmented.

Past disturbances on the site include extensive clearing of the herbaceous layer for camping sites for a large social event. Accordingly, the grass layer is, unlike the typical dominant perennial grasses listed by Mucina and Rutherford (2006) for this vegetation type, largely dominated by *Heteropogon contortus*, an increaser 2 grass that typically forms dense stands on areas subject to high and frequent disturbances (e.g. road verges, Van Oudtshoorn 2012). Remnants of facilities for the camping sites are also still present, as are a high number of small tracks.

It is not expected that the development will have any significant impact on the continued existence of any particular species of fauna or flora, despite the expected permanent clearing of all shrubs and many of the higher grass and forb species. The presence and number of red-data species, of which many may have been dormant already at the time of the screening study, will have to be verified during a detailed field visit.

Several protected and red-data species potentially occur on the site. However, there is only a small likelihood that the development will compromise the survival of any of the species of conservation concern once the final layout has been designed in accordance to findings of a field investigation. This will have to be confirmed during a detailed field survey, undertaken during the peak growing season.

The most significant potential impacts expected are:

» Reduction of a stable vegetation cover and associated below-ground biomass, which currently increases soil surface porosity, water infiltration rates and thus improves the soil stability. This may lead to increased runoff and associated accelerated erosion, which may lead to a loss of ecosystem functionality and degradation.

» Disturbed vegetation in the project area carries a high risk of invasion by alien invasive plants, which may or may not be present on the site or nearby already. The control and continuous monitoring and eradication of alien invasive plants will form and integral part of the environmental management of the facility from construction up to decommissioning.
    - A positive impact will be the removal of existing alien and invasive vegetation, reducing their spread to surrounding areas of high biodiversity importance.

» Possible impacts on larger drainage lines beyond the study area due to altered surface hydrology of the surrounding plains. This may influence species depending on these parts of the ecosystem, as well as downstream wetland ecosystems.

Table of Contents

List of figures

1. General Information

1.1. Applicant

NETWORX South Africa has appointed Savannah Environmental (Pty) Ltd to manage the EIA process for a photovoltaic Solar Energy Facility near Polokwane in the Limpopo Province.

Project
Kison Solar Energy facility

Proposed Activity
The proposed facility is envisaged to have a generating capacity of up to 80 MW each and would include:

» Arrays of photovoltaic (PV) panels
» Appropriate mounting structures (so far both tracking and fixed panel options are being considered)
» Cabling between the project components, to be lain underground where practical.
» New on-site substation and power line to evacuate the power from the facility into the Eskom grid
» Internal access roads and fencing.
» Construction of associated infrastructure such as workshops, office, guard houses and fencing
» As part of the construction process, sections of vegetation on the property will need to be cleared entirely

At this stage the layout has not been finalised, but will be decided upon once known sensitivities of the target area have been delineated and described.

Location
The proposed sites will be on the Farm Snymansdrift 738 portions 19 and 23, approximately 19 km south of Polokwane.

1.2. Specialist Investigator

This report has been prepared by:
Marianne Strohbach (MSc, PrSciNat)
In association with Blair Zoghby (B.Sc.Hons Zoology)
Savannah Environmental (Pty) Ltd
Unit 10, Building 2
5 Woodlands Drive Office Park
Cnr of Woodlands Drive and Western Service Road
Woodmead

PO Box 148, Sunninghill, 2157
Tel: +27 (0)11 656 3237
Fax: +27 (0)86 684 0547
E-mail: info@savannahsa.com
www.savannahsa.com

A *Curriculum Vitae* and summary of expertise of the compiler is attached as Appendix B of this document.

Specialist affiliation

South African Council for Natural Scientific Professions (SACNASP) (PrSciNat; Registration no. 400079/10, Botanical Science, Ecological Science).
South African Association of Botanists (www.sabotany.com)
Desert Net International (www.european-desertnet.eu)

1.3. Declaration of Independence

A signed declaration of independence for Marianne Strohbach is attached in Appendix A.

1.4. Conditions of this report

Findings, recommendations and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. The author, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document. No form of this report may be amended or extended without the prior written consent of the author. Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

1.5. Scope and Purpose of Report

To conduct an ecological desktop study for a scoping assessment of the target area where the establishment of a Solar Energy Facilities are proposed and provide a professional opinion on ecological issues pertaining to the target area to aid in future decisions regarding the proposed project.

1.6. Legislation

This study has been conducted in accordance with the following legislation (abbreviations used further indicated in bold):

1.6.1. Provincial

» The Limpopo Environmental Management Act / **LIMA** (Act 7 of 2003) in its entirety, with special reference to:
  - Schedule 1: Protected Areas – site of ecological importance, protected natural environment, resource use areas
  - Schedule 2: Specially Protected Wild Animals
  - Schedule 3: Protected Wild Animals
  - Schedule 10: Invertebrates
  - Schedule 11: Specially Protected Plants
  - Schedule 12: Protected Plants

1.6.2. National

» National Environmental Management Act / **NEMA** (Act No 107 of 1998), and all amendments and supplementary listings and/or regulations
» Environment Conservation Act (**ECA**) (No 73 of 1989) and amendments
» National Environmental Management Act: Biodiversity Act / **NEMA:BA** (Act No. 10 of 2004) and amendments
» National Forest Act 1998 / **NFA** (No 84 of 1998)
» National Veld and Forest Fire Act (Act No. 101 of 1998)
» Conservation of Agricultural Resources Act / **CARA** (Act No. 43 of 1983) and amendments

1.6.3. International

» Convention on International Trade in Endangered Species of Fauna and Flora (**CITES**)
» Convention on Biological Diversity, 1995

2. Introduction

South Africa is committed to the Convention of Biological Diversity, and has introduced several legislative mechanisms to ensure that the preservation and sustainable use of all biological diversity, including ecosystem, species, and genetic diversity, is guaranteed for the benefit of current and future generations in South Africa and beyond. The impact of past and present conversion of natural habitat types by cultivation, grazing, urban developments, forestation, mining, dams, industries, and alien plant invasions continues to have a substantial impact on South African biodiversity, with significant portions of South Africa's flora and fauna being threatened (Wynberg 2002). Arid, semi-arid and dry sub-humid areas, covering an estimated 91% of South African land area (Hoffman and Ashwell 2001), including the study area, are particularly prone to degradation arising from human activities, leading to the acceleration of soil erosion, deterioration of the biotic, abiotic and economic properties of soil, and the long-term loss of natural vegetation (UNCCD 1995) and associated habitats for fauna. Rapid recovery of degradation is inhibited by the loss of topsoil and natural seed banks, low rainfall regimes and the unpredictability of rainfall events.

This report lists the findings of a scoping evaluation of the site selected by NETWORX SA for the development of a photovoltaic energy facility to help evaluate the possible impacts of such a development on the affected environment.

3. Study Area

3.1. Locality

The proposed site for the PV development is located across Portions 19 and 23 of the farm Snymansdrift 738, and is located between the N1 and R101, about 19 km south of Polokwane. East of the proposed development site, about 1 km beyond the R101, is the Kuschke Nature Reserve. The study area falls within the Polokwane Local and Capricorn District Municipalities. The study area, as can be seen in the maps under section 3.2.3, comprises only the area selected between the two national roads for the proposed development.

3.2. Surrounding environment

3.2.1. Climate and rainfall

The climate for the study area has been derived from recorded data (worldweatheronline, meteoblue) for Polokwane. The area receives summer rainfall and has very dry winters. Long term average rainfall ranges from 400 – 600 mm. Most rains fall between November and March, indicating that field surveys should be carried out between December and April for the most accurate assessment of vegetation (as the primary producer) and associated biodiversity.

Long-term climatic data has been summarised by worldweatheronline in the graphs presented in Figures 1 and 2 below.

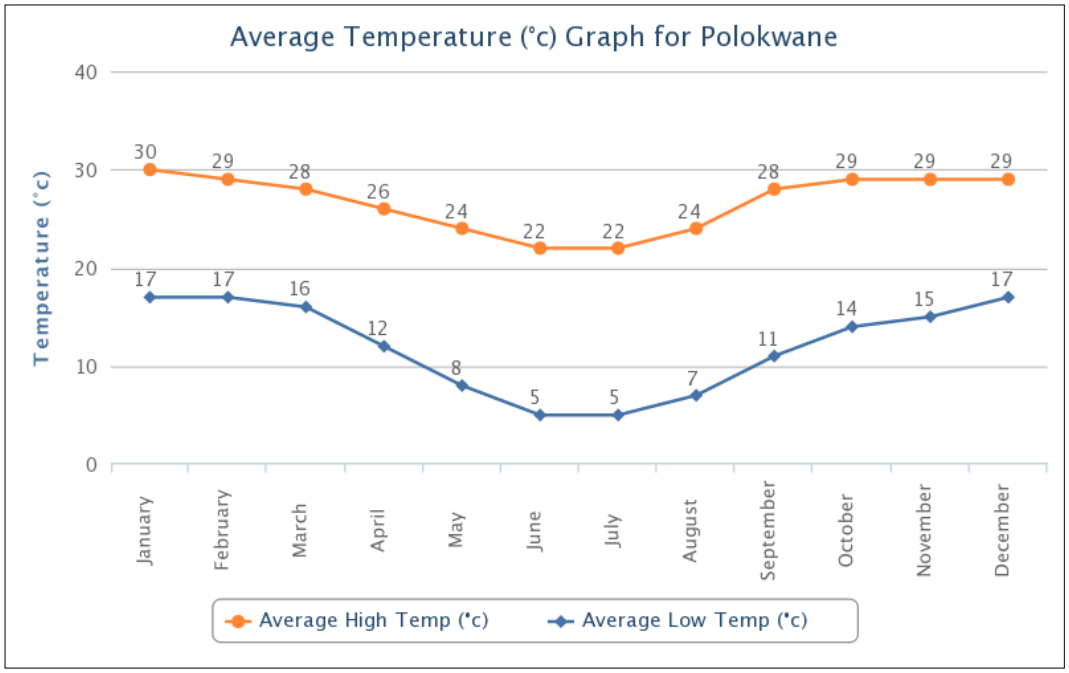

Figure 1: Average minimum and maximum temperatures for Polokwane.

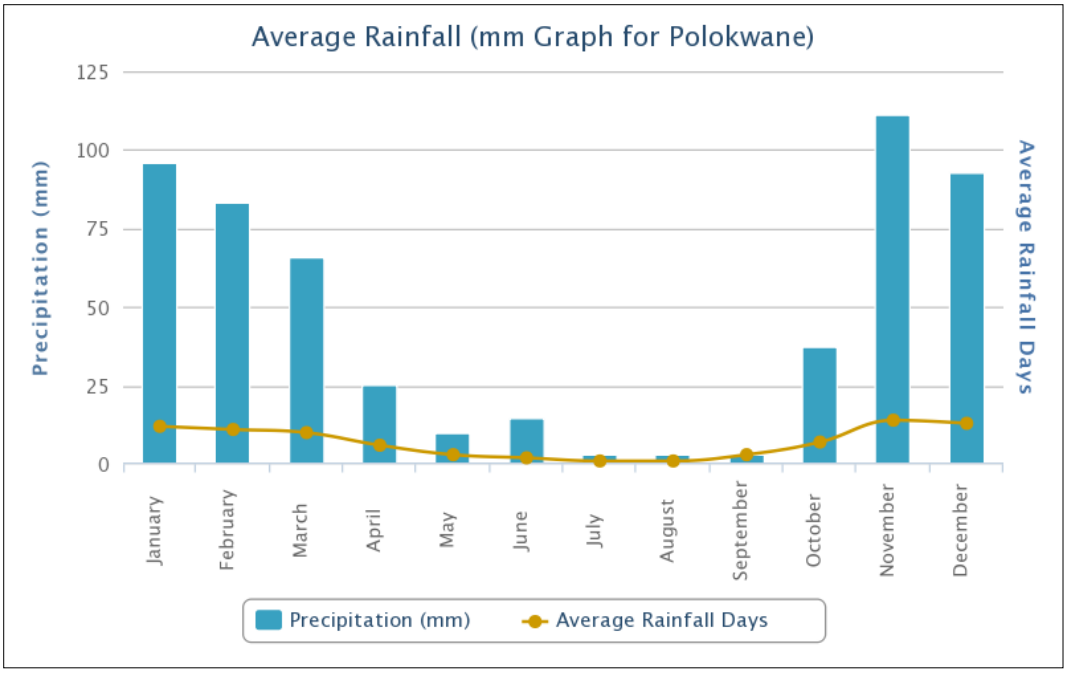

Figure 2: Average monthly precipitation for Polokwane.

3.2.2. Topography and drainage

The site can be described as slightly undulating to flat, but with an overall slight slope with a north-westerly aspect. It is flanked on the NW side by the N1, on the SE side by the R101, with drainage being channelled through culverts from areas above the R101 onto the site, and again downslope under the N1 to lower-lying areas N of the N1 and the adjacent railway line.

The geology of the study area is relatively varied, but magmatites, gneisses and granites are the dominant bedrock formations. Quartzites and conglomerates with red-yellow, clay-rich soils are indicated for the area by AGIS.

Small depressions within the more undulating areas where water occasionally can collect after rainstorms have been observed, but during the screening visit, no signs were visible that water remains in these depressions for a prolonged period. Siltation observed in these depressions appeared to be relatively recent and most likely due to accelerated erosion after disturbance of higher-lying areas, whilst the absence of a localised vegetation composition preferring moister habitats further indicated that these depressions do not constitute pans or any other wetland. Although such depressions will be investigated in more detail during a field study, up to date no wetlands or drainage channels were identified on the proposed development area.

3.2.3. Vegetation overview

The study area is situated in the Savanna biome. The vegetation types on and in close proximity of the study area are (Figure 3):

» Polokwane Plateau Bushveld covering study area (SVcb 23)
» Mamabolo Mountain Bushveld in close proximity (SVcb 24)

The Polokwane Plateau Bushveld has been described by Mucina and Rutherford (2006) as consisting of a short open tree layer with a well-developed grass layer or grass plains with occasional scattered trees. The high shrub and tree layer is mostly dominated by *Acacia caffra, A. permixta, A. rehmanniana, Ziziphus mucronata,* and *A. tortilis*. Sporadic stands of the tall *Aloe marlothii* are common. Other prominent shrubs include *Acacia hebeclada, Gymnosporia senegalensis, Euclea crispa,* and *Diospyros lycioides*. The grass layer of relatively intact veld is dominated by the perennial *Aristida diffusa*, *Brachiaria nigropedata, Eragrostis curvula,* and *Themeda triandra* (Mucina and Rutherford 2006), of which the latter three species are valuable for grazing.

Mucina and Rutherford (2006) considered the conservation status of the Polokwane Plateau Bushveld as possibly becoming vulnerable, despite it being currently regarded as least threatened. This concern is due to low statutory

conservation levels and more than a third of the vegetation type being considered as degraded by overutilization.

During the screening study (more detail under section 4.1), it could be established that most of the proposed development site has been extensively disturbed in the past, when it was periodically and selectively cleared for recreational purposes. The existing fragmentation of this area by the two highways running either side of the study area has already cause a great reduction of any remaining core areas of ecosystems with a significant increase in edge habitats, which are prone to the influence of altered microclimates, biodiversity distributions and thus also prone to the influences of accelerated erosion and alien invasion (Perlman and Milder 2005).

More concise information on the conservation value and ecological state of the vegetation will have to be gathered during a detailed field study (as outlined under section 4.2). Such study will also reveal possible changes in the species composition and thus erosion protection by vegetation (and erosion risks) that will occur as the result of long-term shading by the planned PV arrays.

Disturbed vegetation in the project area carries a high risk of invasion by alien invasive plants, which are already present on and in close proximity to the site. The control and continuous monitoring and eradication of alien invasive plants will form and integral part of the environmental management of the facility from construction up to decommissioning.

The Mamabolo Mountain Bushveld can be found in close proximity to the study area, covering large parts of the Kuschke Nature Reserve SE of the study area. Mucina and Rutherford (2006) describe this vegetation type as low mountains, lower moderate to steep slopes and rocky hills. Plant density and composition will vary greatly depending on edaphic factors. Limited soil depth between rocks creates several xeric localities, on which only succulents or resurrection plants manage to persist. Common species include Croton gratissimus, various *Combretum* and *Acacia* species and high succulents such as *Aloe marlothii*, *Euphorbia ingens* (Naboom) and *E. cooperi*. This habitat is also suitable for the Marula (*Sclerocarya birrea*). The great niche diversity on these mountain ranges creates habitat for a high diversity of plants, which most likely contributed most to the high diversity of plant species being recorded in the area on the SANBI databases (see section 5.2).

The vegetation type is not currently listed as threatened ecosystem (Mucina and Rutherford 2006). Further, because it is situated more than one km away and on a higher elevation that the proposed development site, it is highly unlikely that the development will have any impact whatsoever on this vegetation.

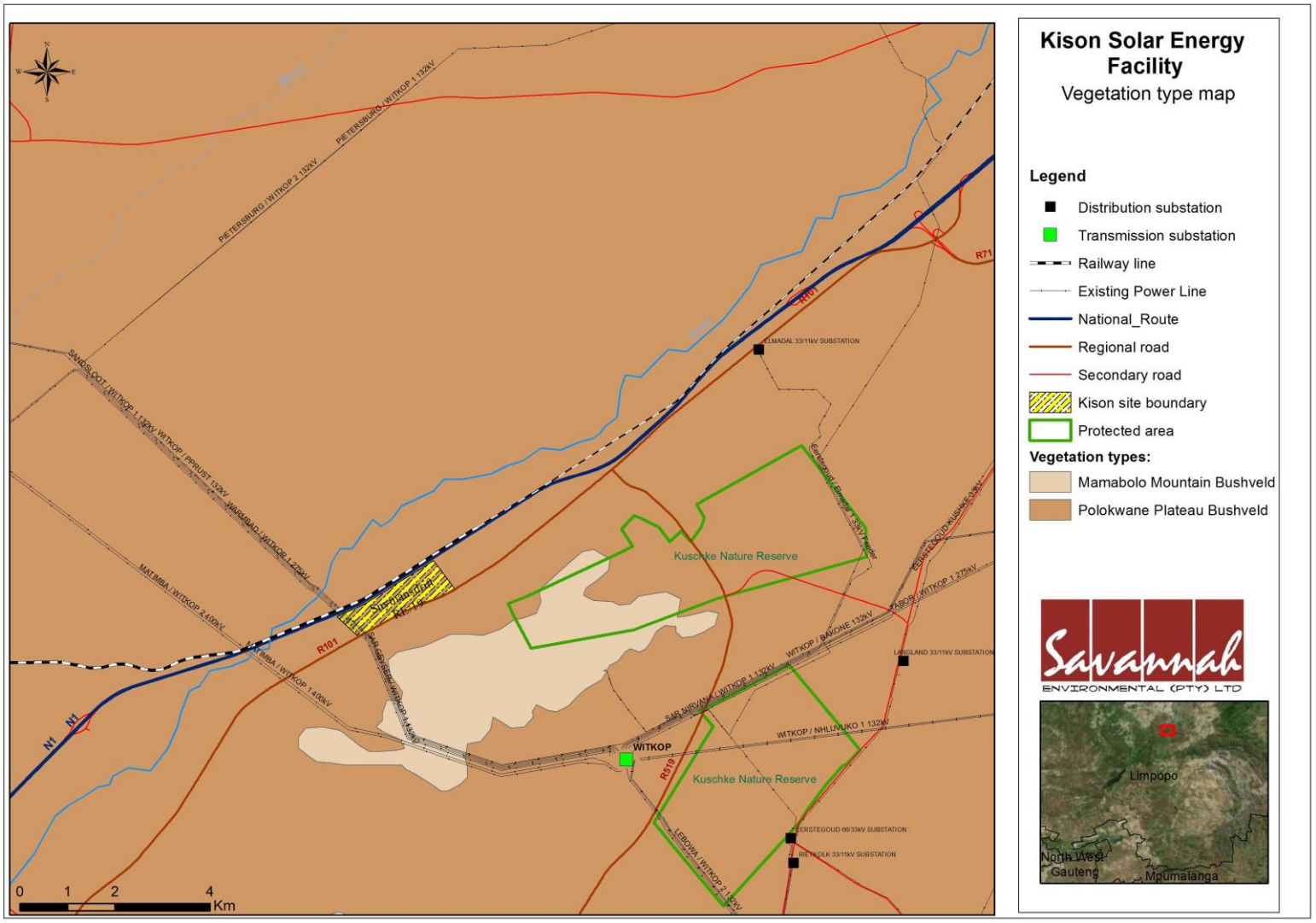

Figure 3: Map of the vegetation types as defined by Mucina and Rutherford (2006) on and around the study area.

3.3. Existing Land Use and Infrastructure

The farm portion is currently not really used, most likely due to its location between two large national roads and the associated risk of theft of livestock. Most grasses are relatively hard, 'sour' grasses, and the grazing capacity is most likely low relative to the region. The specific area selected is not regarded as suitable for cultivation.

An existing Eskom powerline runs parallel to the south-western boundary of the selected site, enabling a relatively direct, short grid connection.

3.4. Natural Water Courses and Wetlands

There is no drainage line or wetland as such on the selected area. The nearest river, the Sand River, is approximately 1 km from the proposed project site, and separated from the project site by the N1 on one side and the farm Hollandsdrift and dense vegetation on the other side.

3.5. Man-made wetlands

No man-made wetlands were observed.

3.6. Contamination risk

Soils are relatively fine-textured, preventing excessive leaching into groundwater resources. However, because they are prone to capping and rapid runoff – contaminants could be washed onto surrounding areas if not contained. The risk should be minimal if adequate efforts to prevent and mitigate any contamination and erosion from the development are in place.

3.7. Access

From the R101, a relative large gravel roads runs across the site, whilst there are also numerous smaller tracks all over the proposed project site, enabling relatively easy access.

4. Methods

4.1. Flora Survey

The area was briefly visited for a screening on 7 May 2013, mainly to determine the overall ecological condition of the vegetation and the possibility of protected plants and the relocation potential of such species on the site.

A species list from POSA (http://posa.sanbi.org, May 2013, Grid reference: 2429) containing the species that have been recorded up to date in the Polokwane area was obtained. POSA generated species lists also contain updated Red Data species status according to the Red List of South African Plants published by SANBI in *Strelitzia* 25 (Raimondo *et al.* 2009, updated 2013). Only protected and red data species that may potentially occur on the study area have been listed under results. The actual field survey will confirm which of the species already recorded in will actually occur on site, and may reveal the presence of additional species that may not have been recorded in official databases up to date. A full plant species list for the study area will be established during the EIA field survey.

The status of plant species recorded in each plant association will be indicated by using the following symbols:

Protected and red data species, are indicated according to relevant legislation (see section 1.6):

LIMA Schedule 11
LIMA Schedule 12
NFA
NEMA:BA
I: CITES Appendix 1
II: CITES Appendix 2

end = endemic to South Africa (or green text)
Red data listed species are indicated by their status (red text)

Plant species nomenclature follows Germishuizen and Meyer (2003).

4.2. Proposed vegetation survey methods for the EIA

The vegetation types as described by Mucina and Rutherford (2006) give a general, large scale overview of the most common vegetation in the area based on very limited ground-truthing data. Vegetation types themselves consist of a multitude of smaller-scale plant communities, which again consist of vegetation associations, based on the specific habitat characteristics of a location. Vegetation type descriptions thus give very little indication of the actual, finer-scale plant associations, the prevailing habitats, and hence ecological sensitivities of a project site – these have to be determined by detailed field work and associated data collection.

As part of the EIA process, a field survey of the vegetation will be undertaken, preferably between December/January and April, and results will include:

» A phytosociological classification of the vegetation found on the study area according to a TWINSPAN analysis of survey data

- » A corresponding description of all defined plant associations and their typical habitats, including a full species list for each plant association and a representative photographic record taken on site of each association
- » A map of all plant communities within the boundaries of the study area
- » A description of the sensitivity of each plant association, based on sensitivity criteria outlined in section 4.5
- » A full assessment of impacts according to section 4.6

4.3. Fauna Survey

The SANBI SIBIS and ADU databases were queried regarding vertebrate fauna and arachnid species historically recorded in the study area and surroundings. The likelihood of such species still occurring in the area was verified according to Apps (2000), and species of conservation concern or that are protected and most likely to occur in the study area listed. Protected and red data species that may be expected to occur on the study area are listed under results.

The status of species previously recorded in the wider Polokwane area is indicated by using the following symbols:

Protected species, indicated according to relevant legislation (see section 1.6):

LIMA Schedule 2
LIMA Schedule 3
LIMA Schedule 10
NEMA:BA
I: CITES Appendix 1
II: CITES Appendix 2

end = endemic to South Africa (or green text)
Red data listed species are indicated by their status (red text)

4.4. Explanations of Red Data classes

Critically Endangered (CR): A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.

Endangered (EN): A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.

Vulnerable (VU): A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.

Near Threatened (NT): A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.

Critically Rare: A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.

Rare: A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria.

Declining: A species is Declining when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline of the species.

Data Deficient - Insufficient Information (DDD): A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.

Data Deficient - Taxonomically Problematic (DDT): A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.

Not Evaluated (NE): A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in Plants of southern Africa: an online checklist are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

4.5. Sensitivity Analysis and Criteria

The determination of specific ecosystem services and the sensitivity of ecosystem components, both biotic and abiotic, is rather complex and no single overarching criterion will apply to all habitats studied. The main aspects of an ecosystem that need to be incorporated in a sensitivity analysis, however, include the following:

» Describing the nature and number of species present, taking into consideration their conservation value as well as the probability of such species to survive or re-establish itself following disturbances, and alterations to their specific habitats, of various magnitudes
» Identifying the species or habitat features that are 'key ecosystem providers' and characterising their functional relationships (Kremen 2005)
» Determining the aspects of community structure that influence function, especially aspects influencing stability or rapid decline of communities (Kremen 2005)
» Assessing key environmental factors that influence the provision of services (Kremen 2005)
» Gaining knowledge about the spatio-temporal scales over which these aspects operate (Kremen 2005).

This implies that in the sensitivity analysis not only aspects that currently prevail on the area should be taken into consideration, but also if there is a possibility of a full restoration of the original environment and its biota, or at least the rehabilitation of ecosystem services resembling the original state after an area has been significantly disturbed.

According to the above, sensitivity classes have been summarised as follows:

High Sensitivity: Areas that are relatively undisturbed or pristine and
» either very species-rich relative to immediate surroundings,
» or have a very unique and restricted indigenous species composition
» or constitute specific habitats or a high niche diversity for fauna and/or flora species of conservation concern, and where the total extent of such habitats and associated species of conservation concern remaining in southern Africa is limited.
» Excessive disturbance of such habitats may lead to ecosystem destabilisation and/or species loss.
» This would also include areas where the abiotic environment is of such nature that the habitat and its niche-diversity are the main reason for a higher species diversity and cannot be reconstructed or rehabilitated once physically altered in any way.

Medium Sensitivity: Areas where disturbances are at most limited and

» Areas with a species diversity representative of its natural state, but not exceptionally high or unique compared to its surroundings
» Areas that whose biotic configuration does not constitute a very specific or restricted habitat or very high niche diversity
» Areas that provide ecosystem services needed for the continued functioning of the ecosystem and the continued use thereof (e.g. grazing).
» Although species of conservation concern may occur on the area, these are not restricted to these habitats only.
» Areas that need to remain intact to ensure the functioning of adjacent ecosystems, or wildlife corridors or portions of land that prevent the excessive fragmentation of natural fauna and flora populations, or areas that will be difficult or impossible to rehabilitate to a functional state after physical alteration

    - **Medium high sensitivity** would include areas:
    - where the landscape can be rehabilitated to allow the re-establishment of some of the original species composition after physical alteration, but some of the species of conservation concern or ecosystem functionality may be lost
    - with a high species diversity and potentially higher number of species of conservation concern,

    - **Medium low sensitivity** would include areas:
    - with a high species diversity with few species of conservation concern,
    - this could also include areas with previous disturbance or transformation, where the impact of the development will lead to irreversible, unjustified degradation of the landscapes that will be difficult to prevent and mitigate
    - where the landscape can be rehabilitated to allow the re-establishment of most or all of the original species composition after physical alteration

Low Sensitivity: Areas that have been previously transformed or disturbed or

» Areas that provide limited ecosystem services, or have a low ecological value.
» Species diversity may be low or all species present have a much wider distribution beyond this habitat or locality.
» Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease.
» Further arguments may include landscapes where the abiotic nature is such that it can be rehabilitated relatively easy to allow the re-establishment of the original species composition, and where the development will not lead to any unjustified degradation of landscapes or ecosystem services if adequately mitigated.

4.6. Proposed methodology for the Assessment of Impacts

The Scoping report only identifies and lists anticipated impacts of the proposed development. For the EIA report and following a more detailed field study, a full evaluation of the impacts will be possible.

The Environmental Impact Assessment methodology that will be used in the evaluation of the overall effect of a proposed activity on the environment includes an assessment of the significant direct, indirect, and cumulative impacts. The significance of environmental impacts is to be assessed by means of the criteria of extent (scale), duration, magnitude (severity), probability (certainty) and direction (negative, neutral or positive).

The **nature** of the impact refers to the causes of the effect, what will be affected and how it will be affected.

Extent (E) of impact

Local (site or surroundings) to Regional (provincial)
Rating = 1 (low) to 5 (high).

Duration (D) rating is awarded as follows:
Whether the life-time of the impact will be:

- Very short term – up to 1 year: Rating = 1
- Short term – >1 – 5 years: Rating = 2
- Moderate term - >5 – 15 years: Rating = 3
- Long term – >15 years: Rating = 4

  The impact will occur during the operational life of the activity, and recovery may occur with mitigation (restoration and rehabilitation).
- Permanent – Rating = 5

  The impact will destroy the ecosystem functioning and mitigation (restoration and rehabilitation) will not contribute in such a way or in such a time span that the impact can be considered transient.

Magnitude (M) (severity):
A rating is awarded to each impact as follows:

- Small impact – the ecosystem pattern, process and functioning are not affected.
  Rating = 0
- Minor impact - a minor impact on the environment and processes will occur.
  Rating = 2
- Low impact - slight impact on ecosystem pattern, process and functioning.
  Rating = 4
- Moderate intensity – valued, important, sensitive or vulnerable systems or communities are negatively affected, but ecosystem pattern, process and functions can continue albeit in a slightly modified way.

Rating = 6

- High intensity – environment affected to the extent that the ecosystem pattern, process and functions are altered and may even temporarily cease. Valued, important, sensitive or vulnerable systems or communities are substantially affected.
  Rating = 8
- Very high intensity – environment affected to the extent that the ecosystem pattern, process and functions are completely destroyed and may permanently cease.
  Rating = 10

Probability (P) (certainty) describes the probability or likelihood of the impact actually occurring, and is rated as follows:

- Very improbable – where the impact will not occur, either because of design or because of historic experience.
  Rating = 1
- Improbable – where the impact is unlikely to occur (some possibility), either because of design or historic experience.
  Rating = 2
- Probable - there is a distinct probability that the impact will occur (<50% chance of occurring).
  Rating = 3
- Highly probable - most likely that the impact will occur (50 – 90% chance of occurring).
  Rating = 4
- Definite – the impact will occur regardless of any prevention or mitigating measures (>90% chance of occurring).
  Rating = 5

Significance (S) - Rating of low, medium or high. Significance is determined through a synthesis of the characteristics described above where:
S = (E+D+M)*P

The **significance weighting** should influence the development project as follows:

- Low significance (significance weighting: <30 points)

If the negative impacts have little real effects, it should not have an influence on the decision to proceed with the project. In such circumstances, there is a significant capacity of the environmental resources in the area to respond to change and withstand stress and they will be able to return to their pre-impacted state within the short-term.

- Medium significance (significance weighting: 30 – 60 points)

If the impact is negative, it implies that the impact is real and sufficiently important to require mitigation and management measures before the proposed project can be approved. In such circumstances, there is a reduction in the capacity of the environmental resources in the area to withstand stress and to return to their pre-impacted state within the medium to long-term.

- High significance (significance weighting: >60 points)

The environmental resources will be destroyed in the area leading to the collapse of the ecosystem pattern, process and functioning. The impact strongly influences the decision whether or not to proceed with the project. If mitigation cannot be effectively implemented, the proposed activity should be terminated.

5. Results

5.1. Important biodiversity areas

Preliminary mapping of the Limpopo Conservation Plan (still in preparation) depicts most of the area on and around the study area as an Irreplaceable Natural Area. This mapping is done at a large scale (and has not yet been finalised), generalising very little available ground data to larger areas. During the screening studies, no restricted distributions or specific irreplaceable habitats that could provide specialised restricted niches for any kind of biodiversity could be identified. In addition, due to the R101 and the N1 running parallel on either side of the property, the piece of land is already highly fragmented.

Past disturbances on the site include extensive clearing of the herbaceous layer for camping sites for a large social event. Accordingly, the grass layer is, unlike the typical dominant perennial grasses listed by Mucina and Rutherford (2006) for this vegetation type, largely dominated by *Heteropogon contortus*, an increaser 2 grass that typically forms dense stands on areas subject to high and frequent disturbances (e.g. road verges, Van Oudtshoorn 2012). Remnants of facilities for the camping sites are also still present, as are a high number of small tracks.

Nevertheless, a more detailed field study will have to look at the following issues:

5.1.1. Areas of high biodiversity importance

These are defined as protected area buffers (including buffers around National Parks, World Heritage Sites, and Nature Reserves). These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, for maintaining important ecosystem services for particular communities or the country as a whole.

In general, this affects an area of 10 km wide buffers around National Parks and Nature Reserves and 5 km buffers around other protected areas, excluding Gauteng where there are no buffers around protected areas.

The project area thus falls entirely within the 5 km buffer zone of the Kuschke Nature Reserve (shown in green on Figure 1). However, as the proposed development site is separated by the R101 and at least one km of natural veld from the reserve, as well as at a much lower elevation, it is highly unlikely that the proposed development will have any impact on the Nature Reserve.

5.2. Flora Survey

A total of 1506 indigenous plant species have been recorded in the Polokwane Area according to the SANBI database. It is expected that only a smaller percentage of listed species will occur within the project area, as a high proportion

of this diversity occurs in niches of the mountain ranges that are in close proximity to the proposed project area.

Of those species, 107 are endemic to South Africa and 56 species have a red-data status. The presence of these species on site will have to be verified during a detailed field study.

For the scoping phase, only recorded species that are protected or otherwise of conservation concern and that could potentially occur in the study area, are listed in Table 1.

A full description of plant communities on the site and associated habitats can only be provided after a field study has been conducted during the growing season.

Table 1: Plant species of conservation concern that could be expected in the study area:

Species	Status
Succulents	
Adenia fruticosa subsp. *fruticosa*	NT
Adenia gummifera var. *gummifera*	NT
Aloe affinis	LIMA 12
Aloe arborescens	LIMA 12
Aloe chabaudii var. *chabaudii*	LIMA 12
Aloe cryptopoda	LIMA 12
Aloe littoralis	LIMA 12
Aloe reitzii var. *reitzii*	LIMA 12, NT
Aloe spicata	LIMA 12
Aloe verecunda	LIMA 12
Aloe zebrina	LIMA 12
Ceropegia ampliata var. *ampliata*	LIMA 12
Ceropegia carnosa	LIMA 12
Ceropegia haygarthii	LIMA 12
Ceropegia stapeliiformis subsp. *serpentina*	LIMA 12
Euphorbia barnardii	LIMA 12, EN
Euphorbia clivicola	LIMA 12,

Species	Status
	NEMA:BA, CR
Euphorbia sekukuniensis	Rare
Huernia kirkii	LIMA 12
Orbea hardyi	LIMA 12, Rare
Orbea lutea subsp. *lutea*	LIMA 12
Orbea melanantha	LIMA 12
Stapelia gettliffei	LIMA 12
Stapelia gigantea	LIMA 12
Tavaresia barklyi	LIMA 12
Low shrubs	
Argyrolobium velutinum	EN
Asparagus intricatus	DDT
Asparagus sekukuniensis	EN
Felicia fruticosa subsp. *brevipedunculata*	LIMA 12
Indigofera leendertziae	DDT
Jamesbrittenia macrantha	NT
Myrothamnus flabellifolius	DDT
Pentatrichia alata	DDD
Plectranthus porcatus	VU

Species	Status
Plectranthus venteri	Rare
Psoralea repens	NT
Herbs and forbs	
Acalypha caperonioides var. *caperonioides*	DDT
Alepidea peduncularis	DDT
Aneilema longirrhizum	NT
Aster nubimontis	EN
Callilepis leptophylla	Declining
Cyphia corylifolia	DDD
Dicliptera fionae	VU
Dicliptera fruticosa	NT, end
Hermbstaedtia capitata	LIMA 12
Kniphofia coralligemma	LIMA 12
Lotononis anthyllopsis	Rare
Monsonia lanuginosa	LIMA 12, Rare
Riocreuxia torulosa var. torulosa	LIMA 12
Grasses	
Enneapogon spathaceus	DDT
Geophytes	
Bonatea antennifera	LIMA 12
Bonatea polypodantha	LIMA 12
Boophone disticha	Declining
Bowiea volubilis subsp. *volubilis*	VU
Brachystelma circinatum	LIMA 12
Brachystelma coddii	LIMA 12
Brachystelma hirtellum	LIMA 12, NT

Species	Status
Crinum macowanii	Declining
Cyrtanthus breviflorus	LIMA 12
Disa patula var. *transvaalensis*	LIMA 12
Drimia altissima	Declining
Drimia elata	DDT
Drimia sanguinea	NT
Eulophia hians var. *hians*	LIMA 12
Eulophia hians var. *inaequalis*	LIMA 12
Eulophia hians var. *nutans*	LIMA 12
Eulophia leachii	LIMA 12
Eulophia ovalis var. *bainesii*	LIMA 12
Eulophia speciosa	LIMA 12, Declining
Eulophia streptopetala	LIMA 12
Gladiolus dolomiticus	Rare
Gladiolus rufomarginatus	Rare
Gladiolus sekukuniensis	VU
Holothrix randii	LIMA 12
Hypoxis hemerocallidea	Declining
Ledebouria dolomiticola	VU
Scadoxus puniceus	LIMA 12
Watsonia transvaalensis	LIMA 12, end
Zantedeschia jucunda	LIMA 12, NEMA:BA, VU
High shrubs and trees	
Acacia ormocarpoides	NT
Boscia albitrunca	NFA
Catha edulis	NFA
Curtisia dentata	NFA, NT
Elaeodendron transvaalense	NFA, NT
Spirostachys africana	LIMA 12

The status of plant species listed above is indicated by the following symbols:

Protected species, indicated according to relevant legislation (see section 1.6):

LIMA 11: Schedule 11
LIMA 12: Schedule 12
NFA
NEMA:BA

end = endemic to South Africa (or green text)
Red data listed species are indicated by their status (red text)

5.2.1. Vegetation Screening

The vegetation on the selected area consists of disturbed but dense grasslands interspersed with mosaics of dense mixed high shrubs and low trees (Figure 4). Most of the tree species are *Acacia*, *Ziziphus, Maytenus* and *Searsia* species, which are not of conservation concern. Should the presence of protected trees be confirmed during a detailed field survey, the number of individuals is expected to be very low.

Figure 4: View of the vegetation on the farm portion selected for the proposed development.

Within the vegetation are numerous bulbous plants and some succulents, of which some are protected – these species can, however, be relocated with relative ease. These species (see figure 5) include at least three *Aloe* species (none with a red data status) and a *Kniphofia* species. The larger *Aloe* species, although not protected, could be used as an effective visual screening of the development if replanted along the periphery of the development. It would be necessary to have

these plants moved by a suitably qualified professional, and the relocated plants will need initial support until established.

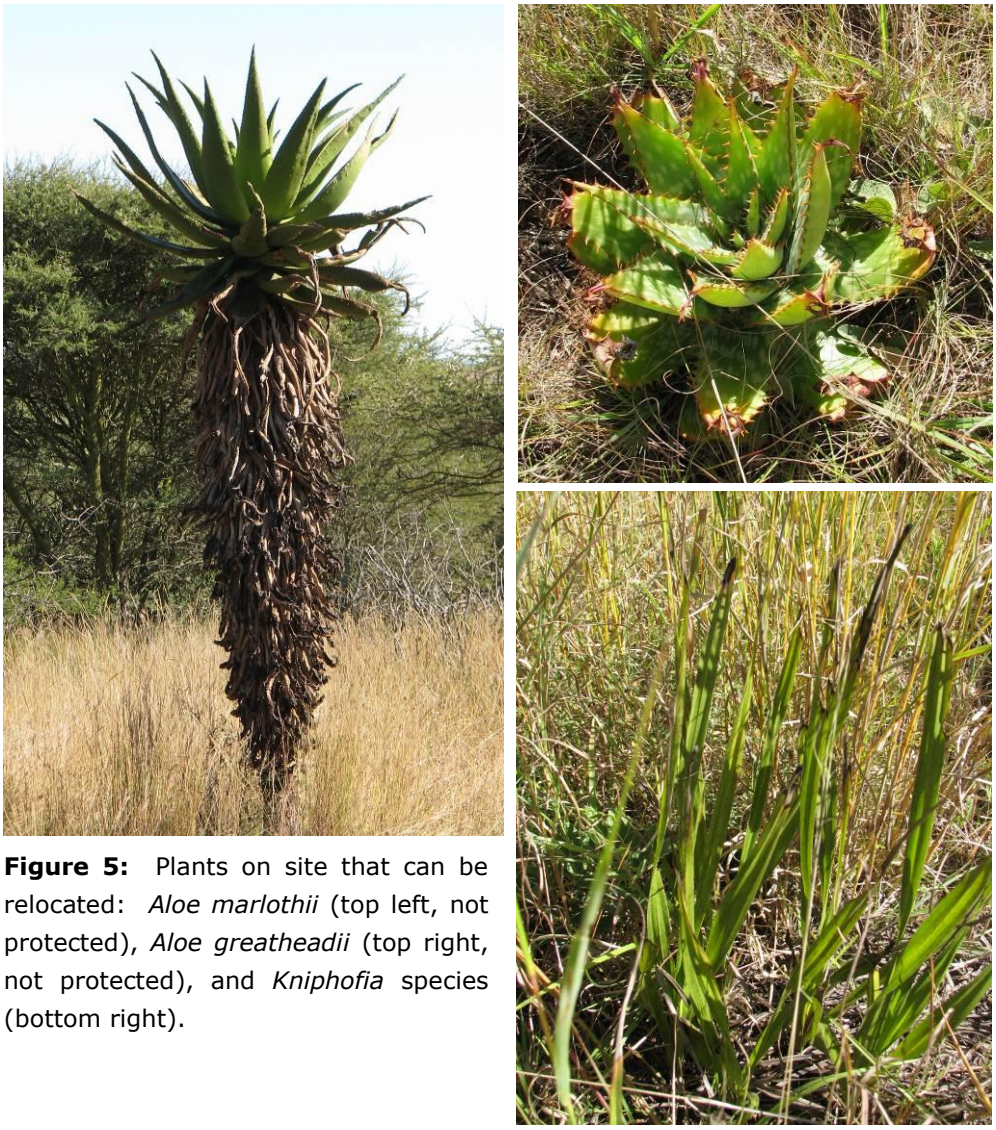

Figure 5: Plants on site that can be relocated: *Aloe marlothii* (top left, not protected), *Aloe greatheadii* (top right, not protected), and *Kniphofia* species (bottom right).

5.2.2. Invasive Plants

Invasives are relatively limited on the farm portion, but are present with an added risk of invasion from surrounding areas and the access routes. The most problematic species on site are the alien *Opuntia* and the indigenous invasive *Dichrostachys cinerea* (Sickle Bush).

The highest risk of invasion from access routes and surrounding properties would be *Eucalyptus* trees, *Solanum mauritianum.* A continued monitoring and eradication programme should enable a relatively low-cost control of these plants on site.

5.3. Fauna Survey

Invertebrates

Theraphosidae (baboon spiders), are known to occur widely in Limpopo. Actual databases for locality-specific occurrences of Arachnids are limited (South African National Survey of Arachnida). Baboon spiders are nocturnal, hiding during the day in silk-lined burrows – referred to as scrapes – from where they will jump at unsuspecting prey at night. Due to an increasing trade in exotic animals, wild populations of Baboon spider are starting to decline, and hence they are protected by LIMA Schedule 10. The presence of such spiders on the study area is very likely, and needs to be confirmed during the field study. Should their burrows be noted, a suitably qualified entomologist must be contracted to relocate all affected specimens prior to any commencement of activity.

5.3.1. Amphibians

The ADU lists 23 amphibian species for the greater project area. Of these, one species is listed as *Endangered,* the Forest Rain Frog (*Breviceps slyvestris*), with the remaining 22 species listed as *Least Concern.*

Forest Rain Frog *(Breviceps slyvestris)*

This species is endemic to the Limpopo Province, with a distribution considered to be severely fragmented. It is locally common to abundant, favouring natural forests, grassy forest fringes, and adjacent open grasslands. The main threat to the species is loss of habitat due to afforestation and agriculture (www.iucnredlist.org). This species is not expected to be a resident within the project area due to the lack of suitable habitat.

5.3.2. Reptiles

The ADU lists 94 reptile species for the greater project area. Of these, one species is considered *Near Threatened,* the Striped Harlequin Snake (*Homoroselaps dorsalis*), and two species protected provincially under LIMA Schedule 3. It should however be noted that most species have not had their population status evaluated at this stage.

Striped Harlequin Snake *(Homoroselaps dorsalis)*

The distribution, biology, and habitat requirements of this species are poorly known. No specific threats to the species have been identified, but habitat loss through land clearance for agricultural use in much of its range is thought to pose the greatest threat (Branch, 1996). The suitability of the proposed project area for the breeding and foraging of this species will have to be verified.

LIMA Schedule 3 species recorded for the project area include:

» Southern African Python (*Python natalensis*)
» Common File Snake (*Gonionotophis capensis*).

5.3.3. Birds/Avifauna

The SABAP 2 database lists 188 bird species for the pentad (2400_2915) incorporating the project area. Of these, none are endemic or listed as red data species. Certain species are however protected provincially under LIMA Schedule 2 and Schedule 4.

LIMA Schedule 2 species recorded for the project area include:
» Cape Vulture (*Gyps coprotheres*)

LIMA Schedule 4 species recorded for the project area include:
» White-faced Duck (*Dendrocygna viduata*)
» Yellow-billed Duck (*Anas undulata*)
» Crested Francolin (*Dendroperdix sephaena*)
» Natal Spurfowl (*Pternistis natalensis*)
» Swainson's Spurfowl (*Pternistis swainsonii*)
» Egyptian Goose (*Alopochen aegyptiacus*)
» Helmeted Guineafowl (*Numida meleagris*)
» Red-billed Teal (*Anas erythrorhyncha*)
» Red-knobbed Coot (*Fulica cristata*)
» Speckled Pigeon (*Columba guinea*)

Of the Schedule 4 listed species, terrestrial breeders such as the Crested Francolin(*Dendroperdix sephaena*), Natal Spurfowl (*Pternistis natalensis*), Swainson's Spurfowl (*Pternistis swainsonii*) and Helmeted Guineafowl (*Numida meleagris*) may be directly affected by the proposed development due to habitat alteration, disturbance and the loss of suitable breeding sites.

5.3.4. Mammals

The ADU database currently has an underrepresented species list for mammals of the region, although some smaller mammals are expected to occur on the proposed project area. It is, however, not expected that any threatened mammal species rely on the proposed project area for survival, although this will have to be verified.

5.4. Sensitivity analysis

The sensitivity of the site has currently been determined as medium to low (Figure 6): despite the extensive disturbances that have occurred on site, natural areas in close proximity are regarded as Irreplaceable Natural Areas by the Limpopo Conservation Plan (in preparation). This indicates that habitat disturbances should be kept low and that species of conservation concern may be present on the site. The latter are expected to be mostly geophytes, herbs and succulents that can in most cases be relocated and have the potential to be re-established after construction.

It is not expected that the development will have any significant impact on the continued existence of any particular species of fauna or flora, despite the expected permanent clearing of all shrubs and many of the higher grass and forb species. The presence and number of red-data species, of which many may have been dormant already at the time of the screening study, will have to be verified during a detailed field visit. The only red data species detected at this stage is *Boophane disticha* (classified as declining), which – as a bulbous species – is relatively easy to relocate.

Soils consist of mostly shallow sandy loams, are prone to surface capping and extensive sheet erosion, indicating that it will be important to rehabilitate a vegetation layer immediately after construction and maintain a low grass layer throughout the operational phase of the proposed development. It is expected that the low-growing couch grass, *Cynodon dactylon*, which is already present on site, will be the first grass to re-establish. This grass, as well as numerous low-growing herbaceous plants that resprout annually from woody rootstocks should be able to persist underneath and between the PV panels to create the vegetation layer necessary to protect the soil for erosion. The integrity of this vegetation layer will have to be monitored and maintained during the lifetime of the development. Higher-growing grasses (currently up to 150 cm), should be mowed to reduce the risk of fires.

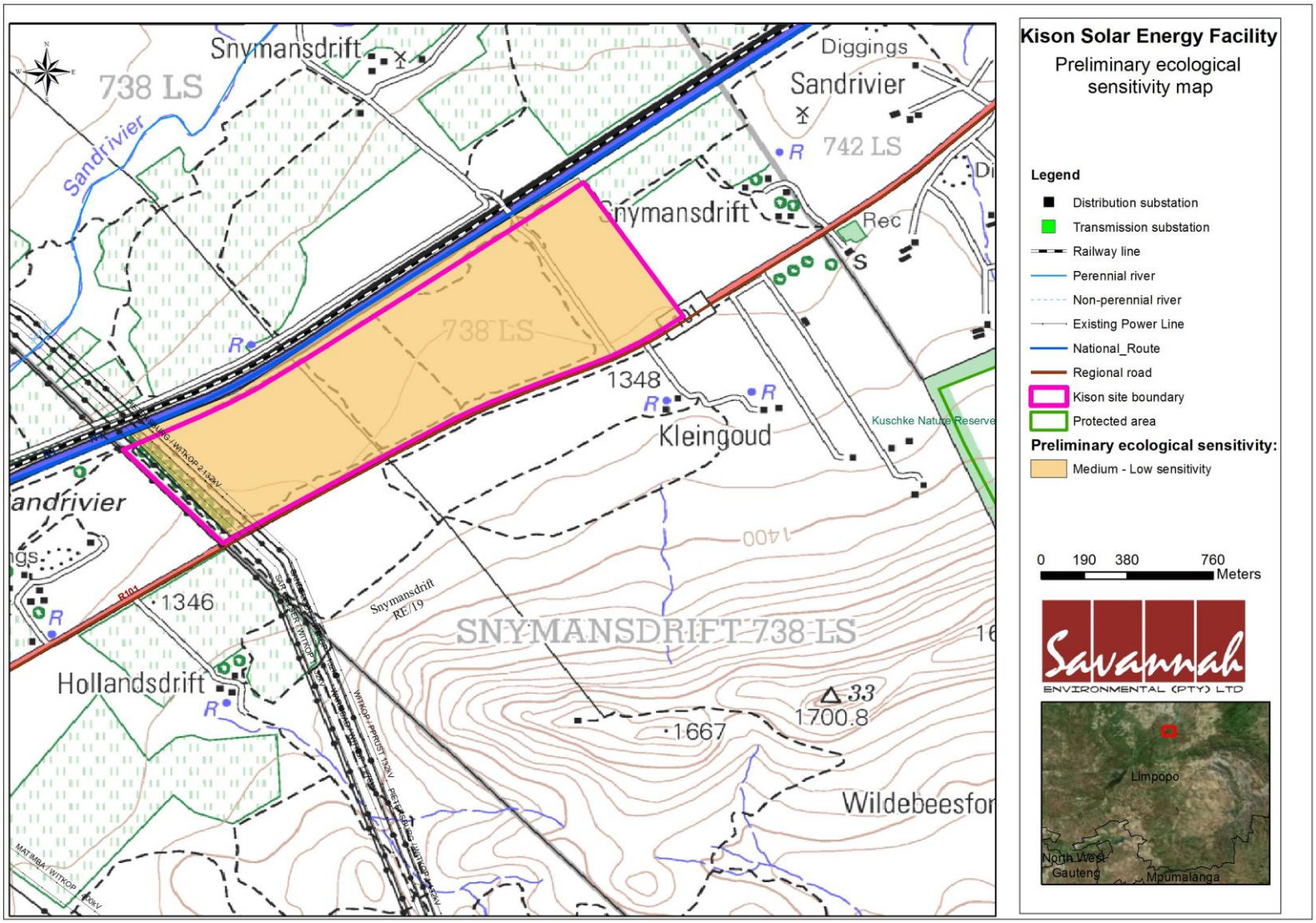

Figure 6: Preliminary ecological sensitivity map of the study area.

5.5. Potential impact of development

Expected impacts of the proposed development will be mostly on the vegetation and supporting substrate. Possible impacts could also be expected on bird species or smaller mammals, whose habitat will be either further reduced, fragmented or significantly altered.

Overview of habitat

The landscapes within the study area are generally flat to slightly undulating. The vegetation type on the study area is Polokwane Plateau Bushveld. It consists of a short open tree layer with a well-developed grass layer with occasional scattered trees. The tree layer is dominated by deciduous microphyllous trees and shrubs, with occasional stands of high succulents. Within the vegetation are numerous geophytic plants and some succulents, of which some are protected – these species can, however, be relocated with relative ease.

Past disturbances on the site include extensive clearing of the herbaceous layer for camping sites for a large social event. Accordingly, the grass layer is, unlike the typical dominant perennial grasses listed by Mucina and Rutherford (2006) for this vegetation type, largely dominated by *Heteropogon contortus*, an increaser 2 grass that typically forms dense stands on areas subject to high and frequent disturbances (e.g. road verges, Van Oudtshoorn 2012). Remnants of facilities for the camping sites are also still present, as are a high number of small tracks.

The study area is already relatively fragmented due to two national roads (N1 and R101) and a railway aligned either side of the site.

Overview of the most significant effects of the proposed development

» For the construction of the PV arrays, even if some form of vegetation is permissible during the operational phase, the area affected is usually cleared of all vegetation prior to construction. This reduces construction effort and limits residual pollution that may be caused by possible breakages or spills. All permissible vegetation will thus have to be re-established after construction.
» The PV arrays introduce a high level of shading to vegetation that has evolved to function in environments with high levels of irradiation. Depending on the final mechanism of the PV array chosen, the intensity and duration of the shade on any particular area within the array may vary. Despite that, the highly altered levels of shading will lead to a change in plant species composition that is able to persist underneath the panels, which may cause secondary effects, including altered forage and breeding grounds for birds and small mammals and altered runoff and erosion patterns.
» Depending on the type of PV panel used, these may contain heavy metals and/or other toxic substances, even if only in small amounts.

Accidental breakage of panels can happen, and toxins could be leached into lower lying riverine and adjacent ecosystems if immediate mitigation is not followed			
Issue	**Nature of Impact during the Operational Phase**	**Extent of Impact**	**No-Go Areas**
Disturbance to and loss of indigenous natural vegetation	Construction of infrastructure will lead to direct loss of vegetation, causing a localised or more extensive reduction in the overall extent of vegetation. Consequences of the clearing and loss of indigenous natural vegetation occurring may include: » Increased vulnerability of remaining vegetation to future disturbance, including extreme climatic events; » General loss of habitat for sensitive fauna and flora species; » Loss in variation within sensitive habitats due to loss of portions of it; » General reduction in biodiversity; » Increased fragmentation (depending on location of impact) and associated reduced viability of species populations; » Alteration of the habitat suitable for plant populations by altering surface structure. This will change species composition and associated species interactions. » Disturbance to processes maintaining biodiversity and ecosystem goods and services; and » Loss of ecosystem goods and services.	Local	No No-Go area could be identified so far. This must be verified during a detailed investigation as part of the EIA phase.
Disturbance or loss of threatened / protected plants	Several red-data plant species could potentially occur on the site. Flora is affected by overall loss or alteration of habitat and due to its limited ability to extend or change its distribution range. In the case of threatened plant species, a loss of a population or individuals could lead to a direct change in the conservation status of	Local	No No-Go area could be identified so far; the possible presence and locality of Red

	the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences of this may include: » Fragmentation and decline of populations of affected species; » Reduction in area of occupancy of affected species; » Loss of genetic variation within affected species; » Alteration of the habitat suitable for plant associations by altering surface structure. This will change species composition and associated species interactions and species ability to persist; » Future extinction debt of particular species of flora and fauna. These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chance of survival of the species.		Data species requires further investigation in the EIA phase.
Loss of protected trees	According to the National Forests Act, no person may cut, disturb, damage or destroy any listed protected tree species. The loss of protected trees may have wider consequences than losing individuals of species of conservation concern: » The loss of mature, large trees can lead to a permanent loss of these trees and their ecosystem function from the environment, as trees grow slowly and recruitment events in the study area may be limited. » Some of the protected trees, if present, may be a food source for various fauna species in the area.	Local and surroundings	The likelihood of protected trees on site is expected to be very low. Their possible presence and density needs to be confirmed during the EIA field study.
Loss of habitat for fauna species of conservation concern	Fauna species of conservation concern are indirectly affected primarily by loss of or alteration of habitat and associated resources. Animals are mobile and, in most cases, can move away from a potential threat, unless they are bound to a specific habitat that is also spatially limited and will be negatively impacted by a	Local	No No-Go area could be identified so far. This must be verified during a detailed

	development. Nevertheless, the proposed development will reduce the extent of habitat available to fauna. For any species, a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a suitable habitat, population, or individuals could lead to a direct change in the conservation status of the species. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include: » Loss of populations of affected species; » Reduction in area of occupancy of affected species; » Loss of genetic variation within affected species; » Future extinction debt of a particular species. There are a number of red data species that have been recorded for the wider area within which the study area is located. Their presence and the necessity to keep their habitats intact on the study area need to be confirmed during a field survey.		investigation as part of the EIA phase.
Disturbance to migration routes and associated impacts to species populations	Site preparation and construction activities may interfere with current migration routes of fauna species. This may lead to: » Reduced ability of species to move between breeding and foraging grounds, reducing breeding success rates; » Increased mortality rates due to fatal collisions with infrastructure; » Reduced genetic variation due to reduced interaction amongst individuals or	Local and surroundings	No No-Go area could be identified so far. This must be verified during a detailed investigation as part of the EIA phase.

	populations due to fragmentation effects caused by the proposed developments		
Impacts on wetlands	No wetlands could be detected on the study area up to date. Runoff from the site will to some degree be constricted by the N1 and Railway line, before it will be able to enter the Sandriver. Nevertheless, in the absence of mitigation measures on the proposed development, could lead to an impact on wetlands beyond the site: » The nature of the site preparation and construction activities for the proposed development will change surface characteristics, rainfall interception patterns and hence runoff characteristics of the area; » This may affect the geohydrology, susceptibility to erosion and potential erosion rates of the landscape, which may lead to a significant alteration to or loss of habitat for fauna and flora species, especially those that depend on riparian and wetland habitats; » A decline in ecosystem functionality of smaller wetlands and riparian areas of smaller drainage lines will impact lower-lying larger wetlands, such as the Sand River, whilst also reducing the ability of the environment to buffer effects of extreme climatic events.	Local to regional	No No-Go area could be identified so far. This must be verified during a detailed investigation as part of the EIA phase.
Establishment and spread of declared weeds and alien invader plants.	Major factors contributing to invasion by alien invader plants includes excessive disturbance to vegetation, creating a window of opportunity for the establishment of alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the site by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species. Consequences of the establishment and spread of invasive plants include: » Loss of indigenous vegetation; » Change in vegetation structure leading to change in or loss of various habitat	Local to regional	Invasives (alien and indigenous) are still limited on the study area, but are present with an added risk of invasion from surrounding areas

	characteristics; » Change in plant species composition; » Altered and reduced food resources for fauna; » Change in soil chemical properties; » Loss or disturbance to individuals of rare, endangered, endemic and/or protected species; » Fragmentation of sensitive habitats; » Change in flammability of vegetation, depending on alien species; » Hydrological impacts due to increased transpiration and runoff; » Increased production and associated dispersal potential of alien invasive plants, especially to lower-lying wetland areas, and » Impairment of wetland function. The extent to which the site contains alien plants will be determined in the EIA phase.		and access routes.

Gaps in knowledge & recommendations for further study

» The initial desk-top investigation of the study area indicates that placement of components of the solar energy facility will have to be carefully aligned according to ecological sensitivities that are currently assumed but need to be confirmed with a detailed field study. Several protected and red-data species as well as highly sensitive habitats potentially occur on the site. However, the likelihood that the development, once the final layout has been designed in accordance to findings of a field investigation, will compromise the survival of any species of conservation concern may be limited.

» **Plant species of conservation concern will only be identifiable during the growing season, thus any field survey of vegetation should only commence after sufficient rains from December/January and be completed by April.**

» Previous collection records from the Polokwane area exist, but the study area itself may never have been surveyed and there may be additional species that have not yet been captured in current databases.

» A detailed ecological survey and sensitivity assessment will be undertaken during the EIA phase according to the methods outlined in section 4.

Issue	Nature of Impact during the Operational Phase	Extent of Impact	No-Go Areas
Disturbance or loss of indigenous natural vegetation	PV panels create large areas of altered surface characteristics, rainfall interception patterns, and intensive shade that will not be tolerated by most of the species present on site, as these have evolved with a high daily irradiance. Consequently, it can be expected that within the Solar Energy Facility footprint, species composition and topsoil characteristics will change significantly. No equivalent experiments have been undertaken in similar environments up to date, thus the nature and density of vegetation may persist cannot be predicted at this stage. A sparser or less stable vegetation beneath the PV panels, together with the altered surface and runoff characteristics may lead to: » Increased vulnerability of remaining vegetation to future disturbance, including erosion; » General loss or significant alteration of habitats for sensitive species; » Loss in variation within sensitive habitats due to loss of portions of it; » General reduction in biodiversity; » Increased fragmentation (depending on location of impact); » Future extinction debt of a particular species; » Disturbance to processes maintaining biodiversity and ecosystem goods and services; and » Loss of ecosystem goods and services.	Local	No No-Go area could be identified so far. This must be verified during a detailed investigation as part of the EIA phase.
Altered runoff patterns due to rainfall interception by PV panels and compacted	The PV panels create large surfaces of rainfall interception, where rainfall is collected and concentrated at the edges from where it then moves onto the ground in larger, concentrated quantities opposed to small drops being directly intercepted and raindrop impact dispersed by vegetation, then absorbed by the	Local and surroundings	No No-Go area could be identified so far. This must be verified during a detailed

areas	ground. This may lead to a localised increase in runoff during rainfall events, which may result in localised accelerated erosion. Likewise, access roads and areas where soils have been compacted during construction will have a low rainfall infiltration rate, hence creating more localised runoff from those surfaces. This runoff will thus have to be monitored and channelled where necessary to prevent erosion over larger areas.		investigation as part of the EIA phase.
Disturbance to migration routes and associated impacts to species populations	All components of the proposed development may interfere with current migration routes of especially fauna species. This may lead to: » Reduced ability of species to move between breeding an foraging grounds, reducing breeding success rates; » Increased mortality rates due to fatal collisions with infrastructure; » Reduced genetic variation due to reduced ability of especially smaller organisms' to have individual interacting; » Future extinction debt of a particular species.	Local and surroundings	No No-Go area could be identified so far. This must be verified during a detailed investigation as part of the EIA phase.
Increase in mortalities of low-flying and perching birds	The construction of overhead power lines and exposed electrical infrastructure could increase mortality rates of avifauna by: » Collision of low-flying birds into overhead power lines » Electrocution of birds perching on exposed electrical components It should be possible to prevent such mortalities by ensuring adequate protection of all electrical components as well as increasing the visibility of overhead power lines and installing perch-deterrents on electrical components	Local and surroundings	No No-Go areas have been identified up to date. This must be verified during a detailed investigation as part of the EIA phase.

Impacts on wetlands	No wetlands could be detected on the study area up to date. Runoff from the site will to some degree be constricted by the N1 and Railway line, before it will be able to enter the Sandriver. Nevertheless, in the absence of mitigation measures on the proposed development, could lead to an impact on wetlands beyond the site: » Accidental breakage of PV panels and accidental spills, if not contained and mitigated immediately, may results in harmful/toxic substances ending up in wetlands. Whilst damages to small isolated pans may remain localised, spillage into larger drainage lines may result in adverse effects along the lower lying Sand River and all associated ecosystems; » The nature of the proposed development, especially the PV arrays and new hard surfaces, will change surface characteristics, rainfall interception patterns and hence runoff characteristics of the project area; » This may affect the geohydrology, susceptibility to erosion and potential erosion rates of the landscape, which may lead to a significant alteration to or loss of habitat for fauna and flora species that depend on riparian and wetland habitats;	Local to regional	No Wetlands could be identified so far. This must be verified during a detailed investigation as part of the EIA phase. Strict mitigation measures must be in place to prevent impacts on lower-lying rivers.
Establishment and spread of declared weeds and alien invader plants.	The envisaged altered vegetation cover after construction and during the operation phase of the proposed development will eliminate invasive species present, but at the same time create a window of opportunity for the establishment of new alien invasive species. In addition, regenerative material of alien invasive species may have been introduced to the site by machinery or persons traversing through areas infested with such plants. Consequences of the establishment and spread of invasive plants include: » Loss of indigenous vegetation or change in vegetation structure leading to an	Local to regional	Present invasion by indigenous and alien invasives is low, but with a high risk to spread. Another high risk of potential introduction from material transport to the site does exist.

	even more significant change in or loss of various habitat characteristics; » Loss of plant resources available to fauna; » Change in soil chemical properties; » Loss or fragmentation of sensitive or restricted habitats; » Loss or disturbance to individuals of rare, endangered, endemic and/or protected species; » Change in flammability of vegetation, depending on alien species; » Hydrological impacts due to increased transpiration and runoff; » Increased production and associated dispersal potential of alien invasive plants, especially to lower-lying wetland areas, and » Impairment of wetland function. The extent to which the site contains alien plants will be determined in the EIA phase.		

Gaps in knowledge & recommendations for further study

» The largest opportunity for mitigating any negative impacts exists during the design phase, if layouts adhere to the findings and recommendations of detailed field studies carried out during the EIA phase

» It can also be expected that during the initial detailed survey several species may have been dormant, either as seed reserves or underground storage tubers, and such species may suddenly emerge after construction

» Limited knowledge does, however exist on the potential and ease with which vegetation can be re-established after construction given the unpredictable rainfall regime of the region. It is also not known which species will be able to persist in the altered environment on and around the proposed development, and what effect will this altered species composition and –density have on ecosystem intactness and –functionality.

- Regular monitoring of a minimum set of environmental parameters throughout the operational phase, coupled with an adaptive environmental management program, will thus be essential to prevent any environmental degradation and any cumulative effects of the development beyond its periphery

5.6. Limitations of study

There is a key difference between the approach of the ecological consultant and that of the ecological researcher. In consultancy, judgements have to be made and advice provided that is based on the best available evidence, combined with collective experience and professional opinion. The available evidence may not be especially good, potentially leading to over-simplification of ecological systems and responses, and do contain a considerable deal of uncertainty. This is opposed to ecological research, where evidence needs to be compelling before conclusions are reached and research is published (Hill & Arnold 2012). The best option available to the consulting industry is to push for more research to be conducted to address its questions. However, such research is often of a baseline nature and thus attracts little interest by larger institutions that need to do innovative research to be able to publish and attract the necessary funding. Clients in need of ecological assessments are used to funding such assessments, but are seldom willing to fund further research to monitor the effects of developments. Furthermore, a review to test the accuracy of the predictions of an ecologist following completion of the development is very rarely undertaken, which means the capacity to predict the future is not tested and therefore remains unknown (Hill & Arnold 2012).

Predictions on future changes on ecosystems and populations once a development has happened are seldom straightforward, except in cases of such as the total loss of a habitat to development. However, most development impacts are indirect, subtle, and cumulative or unfold over several years following construction or commencement of the operation of the development. Whilst a possible mechanism for an impact to occur can usually be identified, the actual likelihood of occurrence and its severity are much harder to describe (Hill & Arnold 2012).

A closely related issue is that of the effectiveness of ecological mitigation which stems from ecological assessments, as well as in response to legal and planning policy requirements for development. Many recommendations may be incorporated into planning conditions or become conditions of protected species licences, but these recommendations are implemented to varying degrees, with most compliance being for the latter category, protected species, because there is a regulatory framework for implementation. What is often missing is the follow-up monitoring and assessment of the mitigation with sufficient scientific rigour or duration to determine whether the mitigation, compensation or enhancement measure has actually worked in the way intended (Hill & Arnold 2012).

6. Discussion and Conclusion

The area was briefly visited for a screening on 7 May 2013, mainly to determine the overall ecological condition of the vegetation and the possibility of protected plants and the relocation potential of such species on the site.

Preliminary mapping of the Limpopo Conservation Plan (still in preparation) depicts most of the area on and around the study area as an Irreplaceable Natural Area. This mapping is done at a large scale (and has not yet been finalised), generalising very little available ground data to larger areas. During the screening studies, no restricted distributions or specific irreplaceable habitats that could provide specialised restricted niches for any kind of biodiversity could be identified. In addition, due to the R101 and the N1 running parallel on either side of the property, the piece of land is already highly fragmented.

Past disturbances on the site include extensive clearing of the herbaceous layer for camping sites for a large social event. Accordingly, the grass layer is, unlike the typical dominant perennial grasses listed by Mucina and Rutherford (2006) for this vegetation type, largely dominated by *Heteropogon contortus*, an increaser 2 grass that typically forms dense stands on areas subject to high and frequent disturbances (e.g. road verges, Van Oudtshoorn 2012). Remnants of facilities for the camping sites are also still present, as are a high number of small tracks.

It is not expected that the development will have any significant impact on the continued existence of any particular species of fauna or flora, despite the expected permanent clearing of all shrubs and many of the higher grass and forb species. The presence and number of red-data species, of which many may have been dormant already at the time of the screening study, will have to be verified during a detailed field visit.

Several protected and red-data species potentially occur on the site. However, there is only a small likelihood that the development will compromise the survival of any of the species of conservation concern once the final layout has been designed in accordance to findings of a field investigation. This will have to be confirmed during a detailed field survey, undertaken during the peak growing season.

The most significant potential impacts expected are:

» Reduction of a stable vegetation cover and associated below-ground biomass, which currently increases soil surface porosity, water infiltration rates and thus improves the soil stability. This may lead to increased runoff and associated accelerated erosion, which may lead to a loss of ecosystem functionality and degradation.

» Disturbed vegetation in the project area carries a high risk of invasion by alien invasive plants, which may or may not be present on the site or nearby already. The control and continuous monitoring and eradication of alien invasive plants will form and integral part of the environmental management of the facility from construction up to decommissioning.
    - A positive impact will be the removal of existing alien and invasive vegetation, reducing their spread to surrounding areas of high biodiversity importance.

» Possible impacts on larger drainage lines beyond the study area due to altered surface hydrology of the surrounding plains. This may influence species depending on these parts of the ecosystem, as well as downstream wetland ecosystems.

7. References

Apps, P. (ed). 2000. Smither's Mammals of Southern Africa. A field guide. Random House Struik, Cape Town, RSA

Branch, W.R. 1996. South African Red Data Book – Reptiles and Amphibians. South African National Scientific Programmes Report No 151.

Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria. 100 pages.

Germishuizen, G. and Meyer, N.L. (eds). 2003. Plants of southern Africa: an annotated checklist. Strelitzia 14. South African National Biodiversity Institute, Pretoria.

Hill, D. and R. Arnold. 2012. Building the evidence base for ecological impact assessment and mitigation. Journal of Applied Ecology 49(1): 6-9.

Hoffman, T. & Ashwell, A. 2001. Nature divided: Land degradation in South Africa. University of Cape Town Press, Cape Town.

Kremen, C. 2005. Managing ecosystem services: what do we need to know about their ecology? Ecology Letters 8: 468-479.

Mucina, L, & Rutherford, M.C. (Eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Perlman, D.L., and Milder, J.C. 2005. Practical ecology for planners, developers and citizens. Island Press, Washington.

Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. Red list of South African plants 2009. Strelitzia 25:1-668.

South African Frog Re-assessment Group (SA-FRoG), IUCN SSC Amphibian Specialist Group 2010. *Breviceps sylvestris*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. <www.iucnredlist.org>. Downloaded on **12 August 2013**.

UNCCD: United Nations Convention to Combat Desertification, 1995.

Van Oudtshoorn, F. 2012. Guide to Grasses of Southern Africa. Briza Publications, South Africa

Wynberg, R. 2002. A decade of biodiversity conservation and use in South Africa: tracking progress from the Rio Earth Summit to the Johannesburg World Summit on Sustainable Development. South African Journal of Science 98: 233 – 243.

Legislation:

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)

The Environmental Conservation Act, 1989 (Act No. 73 of 1989)

The National Environment Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). Government Gazette RSA Vol. 467, 26436, Cape Town, June 2004.

The National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). National List of Ecosystems that are threatened and in need of protection. Government Gazette RSA Vol. 1002, 348093, Cape Town, 9 Dec 2011.

The Natural Scientific Professions Act (Act 27 of 2003)

The Limpopo Environmental Management Act (Act 7 of 2003)

Websites:

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za on [29 March 2012]

ADU, 2012. Animal Demography Unit, Department of Zoology, University of Cape Town. http://www.adu.org.za (with links to the SA Bird Atlas project)

BGIS: http://bgis.sanbi.org/website.asp

SANBI databases:

http://posa.sanbi.org/searchspp.php

http://SIBIS.sanbi.org

Climate:

http://www.meteoblue.com/en_ZA/weather/charts/yearclimate/polokwane_za_78612

http://www.worldweatheronline.com/Polokwane-weather-averages/Limpopo/ZA.aspx

South African National Survey of Arachnida:

http://www.arc.agric.za/home.asp?pid=3282

8. Appendix A: Declaration of Independence

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEAT/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Kison Solar Energy Facility

Specialist:	Marianne Strohbach		
Contact person:	Marianne Strohbach		
Postal address:	PO Box 148, Sunninghill		
Postal code:	2157	Cell:	
Telephone:	(011) 656 3237	Fax:	*086 684 0547*
E-mail:	marianne@savannahsa.com		
Professional affiliation(s) (if any)	SACNASP (Reg No 400079/10) Desert Net International South African Association of Botanists		

Project Consultant:	Savannah Environmental (Pty) Ltd		
Contact person:	Karen Jodas		
Postal address:	PO Box 148, Sunninghill		
Postal code:	2157	Cell:	
Telephone:	(011) 656 3237	Fax:	*086 684 0547*
E-mail:	karen@savannahsa.com		

4.2 The specialist appointed in terms of the Regulations_

I, Marianne Strohbach , declare that --

General declaration:

- I act as the independent specialists in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- **all the particulars furnished by me in this form are true and correct; and**
- **I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.**

Signature of the specialist:

Savannah Environmental (Pty) Ltd

Name of company (if applicable):

14 August 2013

Date:

9. Appendix B: Curriculum Vitae of specialist

CURRICULUM VITAE

MARIANNE STROHBACH
SAVANNAH ENVIRONMENTAL (PTY) LTD

Profession : Specialist Scientist
Specialisation: Plant Ecology and Botany, with special reference to vegetation mapping, vegetation state assessment, dynamics of arid and semi-arid vegetation and population dynamics of harvested plants, conservation planning
Work experience: Twenty (20) years active in Plant Ecology

SKILLS BASE AND CORE COMPETENCIES

- Four years Plant Conservation (Namibia)
- 16 years active research in vegetation mapping, vegetation state assessment, vegetation and plant population dynamics, long-term vegetation monitoring
- Advisory to International Standards for plant species that are harvested for commercial purposes
- Research Project Management
- Ecological assessments for developmental purposes (BAR, EIA)
- Working knowledge of environmental planning policies, regulatory frameworks and legislation
- Identification and assessment of potential environmental impacts and benefits
- Development of practical and achievable mitigation measures and management plans and evaluation of risk to project execution
- Experienced in environmental monitoring
- Completed projects in several Provinces of South Africa, as well as Zimbabwe and Namibia

EDUCATION AND PROFESSIONAL STATUS

Degrees:
2003 M.Sc. in Botany, University of Pretoria, Pretoria, RSA
1991 B.Sc. Hons in Botany, Nelson Mandela Metropolitan University, Port Elizabeth, RSA
1990 B.Sc. in Biological Sciences, Nelson Mandela Metropolitan University, Port Elizabeth

Short Courses:
2008 Landscape Functional Analysis for vegetation condition and restoration monitoring
2002 Satellite Image Analysis for Vegetation Mapping, German Aerospace Centre (DLR) Cologne/Würzburg, Germany
Methods and Techniques of Environmental Management, Deutsche Stiftung für Internationale Entwicklung, Berlin, Germany
1993 Conservation Law Enforcement, Ministry of Environment and Tourism, Namibia

Professional Society Affiliations:
South African Association for Botanists

Association of Desert Net International
The South African Council for Natural Scientific Professions: Pr. Sci. Nat. Reg. No. 400079/10 (Botany and Ecology)

Publications:
Peer- reviewed scientific journal articles
Book-chapters
Popular articles
Scientific conferences
Contributions to TV documentaries
Project-specific reports

EMPLOYMENT
Current: Ecologist, Savannah Environmental (Pty) Ltd
2011: Lecturer, Plant Ecology, University of Pretoria
1997 onwards: working as vegetation ecologist on a freelance basis, involved in part-time positions and contractual research as outlined below
1995 to 1996: Agricultural Researcher at the National Botanical Research Institute, Windhoek, Namibia
1992 to 1995: Vegetation ecologist at the Ministry of Environment and Tourism, Namibia, Directorate of Scientific Services
Past Affiliations and Research

2001 – 2010: contractual work with BIOTA (BIOdiversity Transect analysis in Africa) as affiliate to the National Botanical Research Institute, Namibia.
Deliverables:
Project management, including research proposal, financial management, and project implementation.

Modelling of Savanna Dynamics:
Collating and summarising available phytosociological data for ecological modellers to use in creating a generic savanna model for the Namibian savannas
Defining plant functional types to simplify vegetation data and to use as indicators in monitoring techniques by livestock farmers

Vegetation Patterns and Processes in Namibian Savannas:
Small scale monitoring of vegetation dynamics over a range of soil conditions and seasons
Determine ecological barriers to and best practice for rangeland restoration

Vegetation classification and mapping in Central Namibia:
Collection and analysis of phytosociological baseline data for the central Thornbush Savanna in Namibia, delineation of vegetation types with the aid of satellite imagery

2006: German Scientific Authority to CITES, Plants, Federal Agency for Nature Conservation

International Standard for the Sustainable Wild Collection of Medicinal & Aromatic Plants
Assisting in the compilation of a reference guide for minimum research standards necessary to ensure sustainable use of economically utilised plants (updated in FairWild Standard Version 2, 2010)

2004: contractual work for Desert Research Foundation of Namibia
Vegetation description and mapping of the Namibian Eastern Communal Areas and assess possible development options using indigenous plant resources

1997 to 2010: contractual work with CRIAA-SADC as ecologist.
Deliverables:

The Sustainably Harvested Devil's Claw Project:
Annual surveys of Harpagophytum populations to determine harvesting quotas for rural communities
Determine and monitor impact of harvesting frequency and techniques on survival of Harpagophytum procumbens
Educate harvester communities on issues of resource management
In collaboration with the German Federal Agency for Nature Conservation
This work was extended in 2006 to the Hwange Area, NW Zimbabwe, together with Africa Now

Pilot Devil's Claw cultivation trials:
Increase available resources of Harpagophytum procumbens
Give communities ownership and better access of their resources to improve their income

Namibian National Devil's Claw Situation Analysis:
Design and implement a country-wide survey of Harpagophytum species to assess resource availability compared to annual export figure

1999 to 2001: Assistant curator at the Swakopmund Museum (part-time position)
Help maintain existing collections and exhibits , design and create new exhibits for the museum in collaboration with the Museum Hannover, Germany

Specialist Scientist Vegetation Surveys and related Impact Assessments were done for following clients:
Langer Heinrich Uranium Pty (Ltd): Central Namib Desert, Namibia
University of Namibia, Hentiesbay Research Centre: West Coast, Namibia
Sasol – Limpopo Province
EcoAgent – Northern Cape, Eastern Cape, Limpopo and Mpumalanga
Namwater – Karst aquifers, north-central Namibia
ENVASS (for AfriDevo) – Northern Cape