

March 2022

**TERRESTRIAL BIODIVERSITY (FLORA &
FAUNA) ASSESSMENT:
Proposed Mercury Solar PV Cluster; Parys-
Viljoenskroon, Free State Province**

A report commissioned
by



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CONTENTS OF THE SPECIALIST REPORT

The contents of this specialist report comply with the legislated requirements as described in the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity (GN R. 320 of 2020).

SPECIALIST REPORT REQUIREMENTS ACCORDING TO GN R. 320		Section/s or pages
3.1	The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Annexure 2; P 4 & 5
3.1.2	A signed statement of independence by the specialist	P 4-7
3.1.3	A statement of the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	P 5 & 6
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 2 Section 5
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	P 5 & 6 Section 5
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Section 6 Section 7
3.1.7	Additional environmental impacts expected from the proposed development;	Section 8
3.1.8	Any direct, indirect and cumulative impacts of the proposed development;	Section 8
3.1.9	The degree to which the impacts and risks can be mitigated;	Section 8
3.1.10	The degree to which the impacts and risks can be reversed;	Section 8
3.1.11	The degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 8
3.1.12	Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Section 8
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	N/A
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Section 9
3.1.15	Any conditions to which this statement is subjected.	Section 9
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	

CONDITIONS RELATING TO THIS REPORT

Declaration of interest

Enviroguard Ecological Services cc and its members/co-workers:

- Have no vested interest in the property studied nor is it affiliated with any other person/body involved with the property and/or proposed development.
- Is not a subsidiary, legally or financially of the proponent.
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).
- Declare that remuneration for services provided by Enviroguard Ecological Services cc and its members/co-workers is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA.
- Reserve the right to modify aspects pertaining to the present investigation should additional information become available through ongoing research and/or further work in this field.
- Is committed to biodiversity conservation but concomitantly recognize the need for economic development. We reserve the right to form and hold our own opinions within the constraints of our specialities and experience, and therefore will not submit willingly to the interests of other parties or change our statements to appease them.

The study was undertaken by Prof. LR Brown (PhD UP) & Mr C Cook (MSc UP). Both are registered as a Professional Natural Scientists with the following details:

Prof LR Brown: Reg. No. 400075/98 (Botanical Science and Ecological Science).

Mr C Cook: Reg. No. 400084/08 (Zoological Science).

They have the following qualifications:

SPECIALIST	QUALIFICATION
Prof. L.R. Brown	PhD Terrestrial plant ecology MSc. Water ecology BSc Hons (Botany) BSc (Ed) (Botany, Zoology, Education) Wetland and Riparian Delineation (<i>DWAF Accredited Course</i>) Soil Classification and Wetland Delineation Short Course – TERRASOIL Science Wetland Legislation Course - Wetrest

Mr C Cook	MSc Zoology (Aquatic Science) BSc Hons Zoology BSc Botany & Zoology Wetland and Riparian Delineation (<i>DWAF Accredited Course</i>)
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Indemnity

Although Enviroguard Ecological Services cc exercises due care and diligence in rendering services and preparing documents, the client takes full responsibility for this report and its implementation in terms of the National Environmental Management Act of 1998, and exempt Enviroguard Ecological Services cc and its associates and their sub-contractors from any legal responsibility based on the timing of the assessment, the result and the duration thereof, which has an influence on the credibility and accuracy of this report. Enviroguard Ecological Services cc accepts no liability, and the client, by receiving this document, indemnifies Enviroguard Ecological Services cc and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by Enviroguard Ecological Services cc and by the use of the information contained in this report.

Factors limiting the quality of this study

Flora: Once off surveys were conducted during the summer (wet) season on 18 & 19 November 2021 and verification surveys during the late summer rainfall months 7 & 8 March 2022. Thus, only those flowering plants that flowered at the time of the visit could be identified with high levels of confidence. Some of the more rare and cryptic species may have been overlooked due to their inconspicuous growth forms. Many of the rare and endangered succulent species can only be distinguished (in the veld) from their very similar relatives on the basis of their reproductive parts. These plants flower during different times of the year. Multiple visits to any site during the different seasons of the year could therefore increase the chances to record a larger portion of the total species complex associated with the area. The survey of the study site is however considered as successful with a correct identification of the different vegetation units.

Fauna: It must be stressed that no comprehensive faunal surveys of animal species occurring on the site were conducted but merely an assessment of available and specialised habitat. By surveying the site for specialised habitats, as well as the remaining vegetation and specific habitats, one can make an assumption of the possible presence or absence of threatened animal species. In order to ascertain actual species lists more intensive surveys are required over several seasons. Limitation to a faunal screening exercise or habitat assessment; based on two site visitations conducted during the summer

(wet) season on 18 & 19 November 2021, as well as during the late summer rainfall months on 7 & 8 March 2022.

A vehicle based nocturnal survey was undertaken on 7 March 2022. There was evidence of rain during both site visits and surface water present within the pans or depressions as well as drainage lines during the early March 2022 site visitation. All animals (mammals, reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as animal tracks (footprints, droppings) to identify animals. The majority of threatened or protected species are extremely secretive and difficult to observe even during intensive field surveys conducted over several years this is especially pertinent to the highly elusive and secretive Serval, South African Hedgehog, Vlei Rat, African Clawless Otter, Striped Harlequin Snake, Coppery Grass Lizard and Giant Bullfrog. There is a limitation of historic data and available databases for the majority of threatened or protected species within the immediate study area. The faunal habitat assessment was restricted to the old weed invaded fallow agricultural lands, open secondary succession grasslands, and palustrine wetlands and seasonal drainage line. Limited surveys were conducted within the adjacent homogenous transformed agricultural (*Zea mays*) lands. Surveys were restricted within the adjacent privately fenced off properties as well as existing substations and adjacent open grasslands to the north and east of the study area. The presence of threatened species on site is assessed mainly on habitat availability and suitability as well as desk research (literature, personal records on previous surveys conducted in similar habitats within the Klerksdorp-Parys area during 1997-2022).

General assumptions

This report is a combination of desktop based and field data collected on the site. Although the surrounding areas were observed and important features noted, no formal survey of any kind was conducted in such areas. Thus, the descriptions of the various ecosystems are based on limited fieldwork as specified above and available literature. However, the data collected, and time spent in the field were sufficient and provided enough information to make a decision on the status of the study area.

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- The technology described in any report.
- Recommendations delivered to the Client.

Approach

Conclusions reached, and recommendations made are based not only on occurrence of individual species, but more appropriately on habitats and ecosystem processes. Planning must therefore allow for the maintenance of species, habitats and ecosystem processes, even if Red Data or endemic plant or animal species are absent.



**Prof LR Brown *Pr.Sci.Nat*; MGSSA
Enviroguard Ecological Services cc**



Mr C Cook *Pr.Sci.Nat*.

1. INTRODUCTION

The natural resources of South Africa, with its highly complex and diversified society, are continually under threat from development especially in and close to areas richly endowed with natural resources. The natural environment and assets such as soil, water, indigenous vegetation, biodiversity, endemic and rare species and indigenous wildlife should be part of planning any new developments. New development plans should be based on scientific, ecological principles to prevent destruction or the deterioration of the environment and consequently the loss of valuable natural assets - also the loss of plant and animal species (biodiversity) and natural open spaces within the urban environment. This does not only have economic consequences, but from a conservation viewpoint, may have enormous advantages to the natural ecosystems. Development should, therefore, be planned to make the best possible use of natural resources and to avoid degradation, and therefore attention must be paid to environmental factors in the decision-making process. During the last years development became complicated and sophisticated, scientifically based, enterprises where environmental and nature systems are (or should be) accounted for in the planning stages. Modern development planning is intended to improve the way in which South African environmental resources are utilised. This provides a cost-effective procedure for ensuring that environmental concerns are carefully considered in the project development process. This procedure aims at guiding and facilitating the development process of a project. **An ecological evaluation of any area to be developed is presently considered a necessity.**

Vegetation it is the most physical representation of the environment on which all animals are ultimately dependent. As primary producers it is a major component in the environment and as such it is of immense practical importance that it be conserved. Not only does it play a major role in humankind's existence as primary producers, but it also forms a protecting layer covering the soil thereby protecting it against the onslaught of wind and water. When the vegetation is damaged or removed, there is no more protection, thus enhancing erosion and negatively affecting the faunal communities present on the area.

2. SITE SENSITIVITY VERIFICATION AND MINIMUM REPORT CONTENT REQUIREMENTS

In terms of the Protocol for the Specialist Assessment and Minimum Reporting Content Requirements for Environmental Impacts on Terrestrial Biodiversity (GN R. 320 of 2020), prior to the commencement of a specialist assessment, the current use of the land and the potential environmental sensitivity of the study site must be determined using the Department of Forestry, Fisheries & the Environment (DFFE) screening tool. The results obtained from the screening tool and the site sensitivity verification are used to determine the minimum content requirements for the assessment report.

It must be noted that the screening tool is based on a mixture of broad-scale and local-scale (site-specific) data of an area. It is not known how often new research data is incorporated into the screening tool, meaning that it is possible that the site ecological sensitivity and its conservation status could differ from that of the DFFE screening tool. Thus, it is important that a physical site visit is conducted to determine whether the results of the screening tool are indeed accurate or not.

According to the results of the Screening Report generated for the study site, the relative terrestrial biodiversity theme sensitivity is classified as HIGH with vegetation sensitivity listed as LOW/MEDIUM and faunal sensitivity as LOW/MEDIUM.

According to Section 3 (1) of GN R. 320, 'an applicant intending to undertake an activity identified in the scope of this protocol, on a site identified on the screening tool as being of "very high sensitivity" for terrestrial biodiversity, must submit a Terrestrial Biodiversity Specialist Assessment' report and an area identified as low must submit a "Terrestrial Biodiversity Compliance Statement report".

Due to the HIGH sensitivity rating of the site, a Terrestrial Biodiversity Specialist Assessment has been undertaken as part of the Basic Assessment Process for the study area.

3. AIMS OF THE STUDY

This report aims to present ecological information on the flora and fauna of the proposed five solar facilities collectively known as the Mercury Solar PV Cluster; Parys-Viljoenskroon, Free State Province (hereafter referred to as the study area).

The objectives of this study were to:

- Identify, describe, and delineate the different vegetation units present on the study site.
- Provide a description of the fauna (**mammals, reptiles, amphibians**) occurring within the study area.
- Identify species of conservation importance that could possibly occur on the proposed site.
- To provide a sensitivity map of the study area (where applicable).
- To provide management recommendations to mitigate negative and enhance positive impacts of the proposed development.

4. STUDY AREA

4.1 Location

The study area is located in the Free State Province south of the Vaal River with the Northwest town of Orkney, North of the site and the Free State town of Viljoenskroon approximately 21 km south-east of the site. The areas mostly comprise agricultural and old cultivated fields with a few remaining natural vegetation patches (Figure 1). The study area consists of three sections with the northern cluster comprising three farms and the southern cluster two farms. The sites are surrounded by other agricultural land.

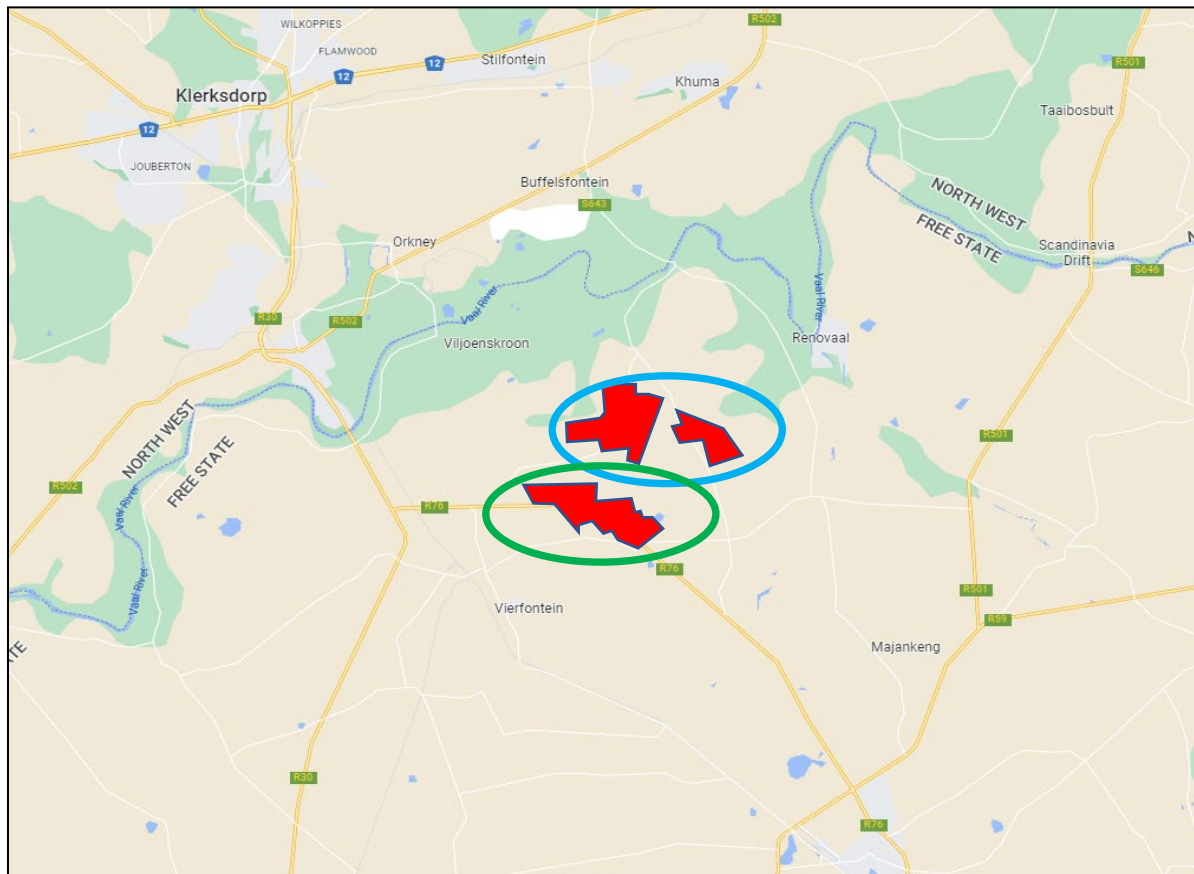


Figure 1. Locality the study area (only approximate boundary lines) (Blue circle = Northern PV Farms; Green circle = Southern PV Farms).

The site is divided into two clusters and associated connection corridor namely (Figure 2):

- Mercury Cluster Project (Northern PV Farms)
 - Zaaipplaats Solar PV1
 - Kleinfontein Solar PV1
 - Vlakfontein Solar PV1

- Mercury Cluster PV Project (Southern PV Farms)
 - Hormah Solar PV1
 - Ratpan Solar PV1

- Entire Grid Connection
 - Zaaipplaats Solar PV1 Grid Connection
 - Kleinfontein Solar PV1 Grid Connection
 - Vlakfontein Solar PV1 Grid Connection
 - Hormah Solar PV1 Grid Connection
 - Ratpan Solar PV1 Grid Connection

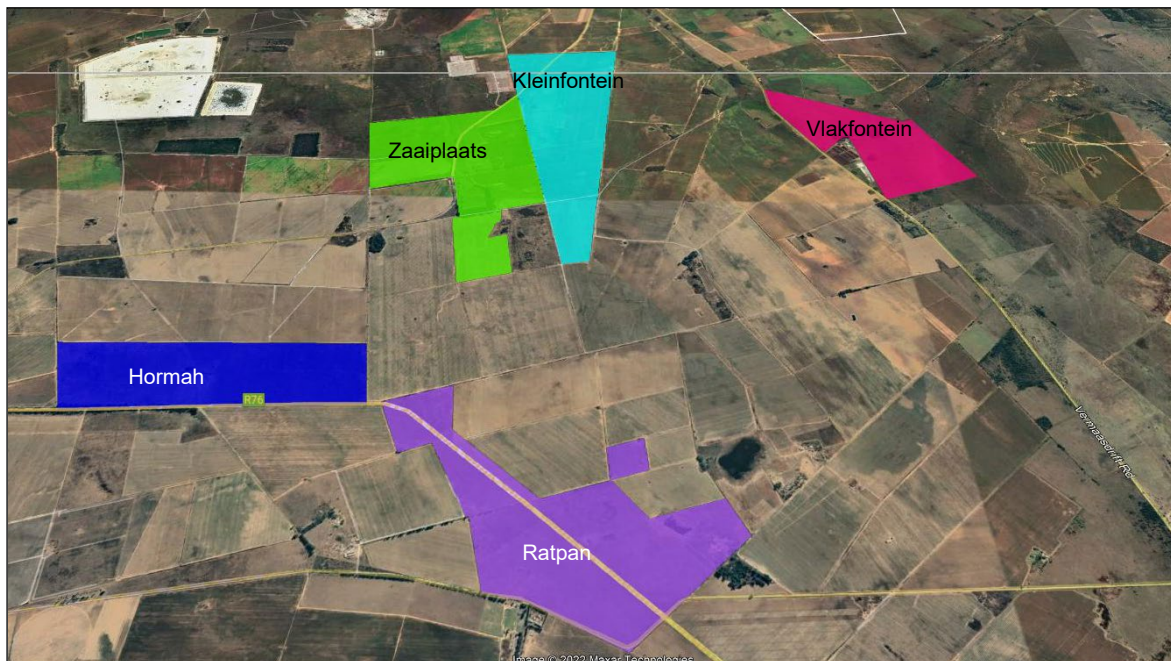


Figure 2. Locality of the different PV farms.

Existing impacts

- Certain sites are used for planted crops and grazing by cattle.
- Various two-spoor paths are present.
- Large parts of the site's areas are fenced.

5. METHODS

Prior to the site visit a desktop study was undertaken using literature, satellite imagery and other information available on the internet. Thereafter a site visit was undertaken to verify the findings and detailed floral and faunal surveys were conducted as described below:

5.1 Vegetation

The vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) was used to determine the biome and Vegetation type within which the study site is located. Additional information on the site sensitivity was obtained from South African National Biodiversity Institute's website (SANBI GIS) as well as the screening tool of DFFE.

The Braun-Blanquet survey principles to survey and describe plant communities as ecological units were used for this study. This vegetation survey method has been used as the basis of a national vegetation survey of South Africa (Mucina et al. 2000) and is considered to be an efficient method of classifying and describing vegetation (Brown et al. 2013). The study is based on the floristic composition of the different vegetation units. An overview of the vegetation was first obtained from relevant literature. The vegetation was stratified into relative homogeneous units using Google Earth images and topographic maps. All these units were verified on foot and vegetation sample plots placed in each. The different vegetation units (ecosystems) are not only described in terms of their plant species composition, but also evaluated in terms of the potential habitat for sensitive/red data plant species. Ecological sensitivity and conservation value of the plant communities were assessed and categorised according to habitat and plant species assemblages (even though red data species or suitable habitat for such species could be absent an area could still have pristine habitat comprising a high diversity of climax species giving it a high conservation value).

Data recorded included:

Data pertaining to the vegetation physiognomy and floristic composition (species richness and canopy cover of each species) was gathered. A list of all plant species present, including trees, shrubs, grasses, forbs, geophytes and succulents were compiled. All

identifiable plant species were listed. Notes were additionally made of any other features that might have an ecological influence.

Red data species

An investigation was also carried out on rare and protected plants that might possibly occur in the region. For this investigation the National Red List of Threatened Plants of South Africa, Lesotho & Swaziland, compiled by the Threatened Species Programme, South African National Biodiversity Institute (SANBI) was used. Internet sources were also consulted on the distribution and habitat of these species in the area as well as available literature.

Other information used included:

- The International Union for Conservation of Nature (IUCN) conservation status categories on which the Threatened Species Programme, Red List of South African Plants (Raimondo et al. 2009) is based, was also obtained.

The presence of rare and protected species or suitable habitat was recorded during the field visit.

Quarter Degree Grid Cells (QDGC) data as well as other red data lists are used as guidelines to assist when conducting the field work. Unless a specific species was recorded previously on the specific site under investigation, the QDGC lists cannot be used as meaning that the species listed do occur on the site. These lists are not comprehensive and continually change as people find and record new habitats and red data species. It could therefore mean that a red data species found in an adjacent QDGC or one even further away, could potentially occur in another QDGC. However, since no study has been done in that grid it will result in it not being listed for that QDGC. The fact that it is not listed does however, not mean that the species or suitable habitat is not present. It is therefore imperative that a **physical site visit is conducted** to determine firstly, the presence of the listed red data species or suitable habitat on the site, and secondly, and most importantly the suitability of the site for the presence other red data species also.

Data processing

A classification of vegetation data was done to identify, describe and map vegetation types. The descriptions of the vegetation units include the tree, shrub and herbaceous layers. The conservation priority of each vegetation unit was assessed by evaluating the plant species

composition in terms of the present knowledge of the vegetation of the Grassland and Savanna biomes of South Africa. The following four conservation priority categories were used for each vegetation unit:

- High:** Area with natural vegetation with a high species richness and habitat diversity; presence of viable populations of red data plant species OR suitable habitat for such species; presence of unique habitats; less than 5% pioneer/alien plant species present. These areas are ecologically valuable and important for ecosystem functioning. This land should be conserved and managed and is not suitable for development purposes.
- Medium-high:** Natural area with a relatively high species richness and diversity; not a threatened or unique ecosystem; moderate habitat diversity; between 5-10% pioneer/alien plant species present; that would need low financial input and management to improve its current condition; and where low-density development could be considered with limited impact on the vegetation / ecosystem. It is recommended that larger sections of the vegetation are maintained.
- Medium:** An area with a relatively natural species composition; not a threatened or unique ecosystem; moderate species diversity; between 11-20% pioneer/alien plant species present; that would need moderate to major financial input to rehabilitate to an improved condition; and where medium density development could be considered with limited impact on the vegetation / ecosystem. Where possible certain sections of the vegetation could be maintained.
- Low-medium:** Area with relatively natural vegetation, though a common vegetation type; moderate to low species and habitat diversity; previously or currently degraded or in secondary successional phase; between 20-40% pioneer and/or alien plant species; low ecosystem functioning; low rehabilitation potential.
- Low:** A totally degraded and transformed area with a low habitat diversity and ecosystem functioning; no viable populations of natural plants; >40% pioneer and/or alien plant species present; very low habitat uniqueness; whose recovery potential is extremely low; and on which development could be supported with little to no impact on the natural vegetation / ecosystem.

Impact analysis

An **impact analysis** was done for the vegetation units identified. This was achieved by evaluating the different vegetation units against a set of habitat criteria. For impact assessment the **potential impacts** on the vegetation were assessed by using the NEMA 2014 guidelines and criteria (National Environment Management Act, 1998). To further quantify the severity of each impact, values were assigned to criteria ratings (Table 1).

Table 1: Criteria, criteria ratings and values (in brackets) used in this study to assess possible impacts on vegetation during the proposed development

Criteria	Rating (value)
Extent of impact	Site (1), Region (2), National (3), International (4)
Duration of impact	Short term (1), Medium term (3), Long term (4), Permanent (5)
Magnitude of impact	Low (2), Moderate (6), High (8)
Probability of impact	Improbable (1), Probable (2), Highly probable (4), Definite (5)

Site Ecological Importance (SEI)

For the SEI the criteria as specified in the South African National Biodiversity Institute (2020) Species Environmental Assessment Guideline document was used and is listed below. The SEI allows for rapid spatial inspection and the evaluation of the envisaged impacts of the study area to be developed. It has been set up within the context of on-site habitat and Species of Conservation Concern (SCC). Where the site-specific assessment produces a lower or higher classification than the “environmental sensitivity” as produced by the DFFE screening tool a justification for the difference must be provided by the specialist. The SEI is considered to be a function of the Biodiversity Importance (BI) of the ecosystem and its resilience to impacts. The BI is in turn a function of Conservation Importance (CI) and the Functional Integrity (FI) of the study area/ecosystem (South African National Biodiversity Institute 2020) (Tables 2; 3 & 4). According to South African National Biodiversity Institute (2020) CI is defined as “*The importance of a site for supporting biodiversity features of conservation concern present e.g. populations of IUCN Threatened and Near-Threatened species (CR, EN, VU & NT), Rare, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes*” and FI as “*A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts*”.

Table 2. Conservation Importance Criteria (South African National Biodiversity Institute, 2020).

Conservation Importance	Criteria (Definition)
Very High	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare ¹⁵ or Critically Rare ¹⁶ species that have a global Extent of Occurrence of < 10 km ² Any area of natural habitat of a CR ecosystem type or large area (> 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type Globally significant populations of congregatory species (>10% of global population)
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global Extent of Occurrence of > 10 km ² . IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (>0.01% but < 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1 %) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (>1% but <10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under A criterion only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU Presence of range-restricted species > 50 % of receptor contains natural habitat with potential to support SCC
Low	No confirmed or highly likely populations of Species of Conservation Concern No confirmed or highly likely populations of range-restricted species < 50 % of receptor contains natural habitat with limited potential to support SCC
Very Low	No confirmed and highly unlikely populations of SCC No confirmed and highly unlikely populations of range-restricted species No natural habitat remaining

Table 3. Functional Integrity Criteria (South African National Biodiversity Institute, 2020).

Conservation Importance	Criteria (Definition)
Very High	Very large (>100 ha) intact area for any conservation status of ecosystem type or >5 ha for CR ecosystem types High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing)
High	Large (>20 ha but <100 ha) intact area for any conservation status of ecosystem type or >10 ha for EN ecosystem types Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential
Medium	Medium (>5 ha but <20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance; moderate rehabilitation potential
Low	Small (>1 ha but <5 ha) area Almost no habitat connectivity but migrations still possible across some transformed or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential Several minor and major current negative ecological impacts
Very Low	Very small (<1 ha) area No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts

Table 4. Biodiversity Matrix (South African National Biodiversity Institute, 2020).

BIODIVERSITY IMPORTANCE		Conservation Importance				
		Very High	High	Medium	Low	Very Low
Functional Integrity	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

5.2 Fauna

This faunal survey focused on mammals, reptiles and amphibians within the proposed Mercury Solar PV Cluster namely the northern, southern and grid connector/powerline servitude. The survey focused on the current status of threatened faunal species occurring, or likely to occur within the proposed Mercury Solar PV Cluster, describing the available and sensitive habitats, identifying potential impacts resulting from the Solar PV Cluster within the study site; and providing mitigation measures for the identified impacts of the proposed project.

Predictive methods

Satellite imagery of the area was obtained from Google Earth™ was studied in order to get a three-dimensional impression of the topography and current land use.

Literature Survey

A detailed literature search was undertaken to assess the current status of threatened fauna that have been historically known to occur within the 2626 DD and 2726 BB Quarter Degree Grid Cells (QDGC) in which the northern and southern Mercury PV clusters are situated as well as the grid connector corridor. The literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description as well as *National Red List of Threatened Plants of South Africa* (Raimondo et al. 2009). *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red List of Mammals of South Africa, Swaziland and Lesotho* (Taylor et al. 2016) as well as ADU's MammalMAP (http://vmus.adu.org.za/vm_sp_list.php) for mammals. *A Complete Guide to the Frogs of Southern Africa* (du Preez & Carruthers (Revised edition) 2017) and *The Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter et al. 2004) for amphibians as well as *SAFAP FrogMAP* (<http://vmus.adu.org.za>). *The Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 1998) and *Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland* (Bates et. al. 2015) as well as *SARCA* (<http://sarca.adu.org.za>) for reptiles.

Site Investigation Methodology

A preliminary faunal habitat assessment of the status, spatial requirements and habitat preferences of all priority faunal species (mammals, reptiles and amphibians) likely to occur within or surrounding the study site was undertaken. For certain species, an estimate of the expected or historical distribution for the area could be extrapolated from published information and unpublished reports, while habitat and spatial requirements were generally derived from the literature. Species assessments will be updated when additional data becomes available and where appropriate, proposed conservation targets will be revised.

A field verification survey of the site was carried out on foot during daylight hours on 18 & 19 November 2021 as well as during on 7 & 8 March 2022. The temperatures were warm ranging between 22-30^oC with rainfall 48 hours prior to the November site visitation as well as during the evenings of 7 March 2022. A vehicle-based nocturnal (18h00-22h00) survey was conducted of 7 March 2022. The survey was restricted to the major access roads adjacent to the southern seasonal wetlands and eastern drainage line.

Transects were walked-through the remnant patches of shorter secondary succession *Eragrostis curvula-Cynodon dactylon* as well as rank *Digitaria eriantha-Eragrostis curvula* planted pastures/grasslands, the palustrine wetlands including seasonally inundated depressions/pans as well as valley bottom wetland or seasonal drainage line were undertaken. Limited surveys were conducted within the transformed agricultural (maize) lands as well as *Eucalyptus camaldulensis* woodlots.

The field verification for the site was restricted to four days during the summer months. No specialist survey techniques; including camera trapping, pit-fall and funnel trapping were used during the brief field verification of the mammals, reptiles and amphibians on the site.

6. RESULTS

6.1 Vegetation units

The study area comprises seven vegetation units (Figures 3-5) namely:

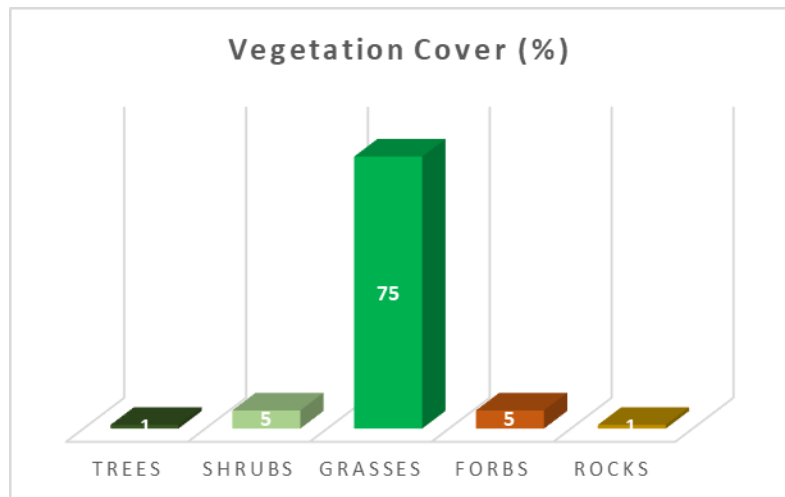
1. *Eragrostis curvula-Cynodon dactylon* grassland
2. Wetland areas
3. *Eucalyptus camaldulensis* woodland
4. Cultivated fields
5. Seasonal stream
6. *Digitaria eriantha-Eragrostis curvula* grassland
7. *Seriphium plumosum* shrubland

1. *Eragrostis curvula-Cynodon dactylon* grassland



Vegetation structure:	Short-medium tall grassland		
Topography:	Mostly level	Soil	Loam
Unit size	181 ha		
Need for rehabilitation	Medium		
Conservation Priority	Low		

This vegetation unit is located only within the northern cluster and comprises 181 ha. The soil is loamy with no rocks present. There herbaceous layer dominates the vegetation and consists of short-medium tall grasses that have the highest cover (see figure right).



The vegetation is dominated by the secondary successional grasses *Eragrostis curvula* and *Cynodon dactylon*. There are few woody species present with the shrubs *Dichrostachys cinerea* and *Asparagus larycinus* scattered throughout the area as single individuals although *Asparagus larycinus* form dense clumps in the western part of this unit. Other species present include the grasses *Heteropogon contortus*, *Pogonarthria squarrosa*, *Aristida adscensionis*, *Imperata cylindrica*, *Eragrostis rigidior* and the forbs *Walafrida densiflora*, *Felicia muricata*, *Schkuhria pinnata* and *Conyza bonariensis*.

Red data species

No red data species were found to be present in this unit and no suitable habitat exists.

Alien plant species

Eucalyptus camaldulensis; *Prosopis glandulosa*.

Farm/s where present

Vlakfontein.

The following is a list of plant species identified in unit 1a during the survey (🔴=alien invasive species; 🟢=medicinal value; 👁️=Protected species; 🌱 = Cultivated/Garden hybrid) (W=woody; G=grass; F=forb):

Cat	Species	Class
	<i>Antheophora pubescens</i>	G
	<i>Aristida adscensionis</i>	G
	<i>Aristida congesta subsp barbicollis</i>	G
	<i>Asparagus larycinus</i>	W
	<i>Bidens pilosa</i>	F

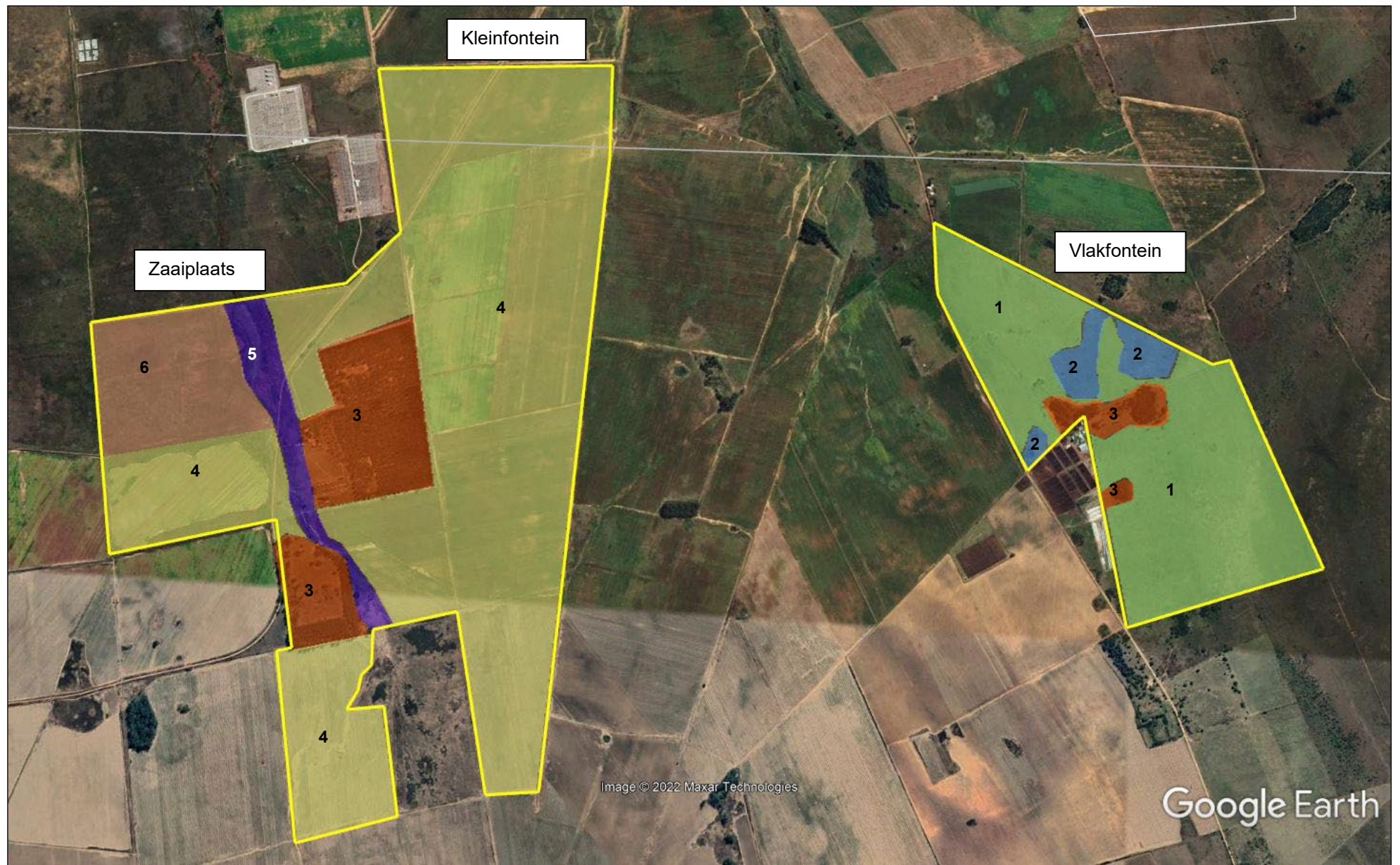


Figure 3. Vegetation units of the Northern PV Farms Cluster (Image obtained from Google Earth 2022).

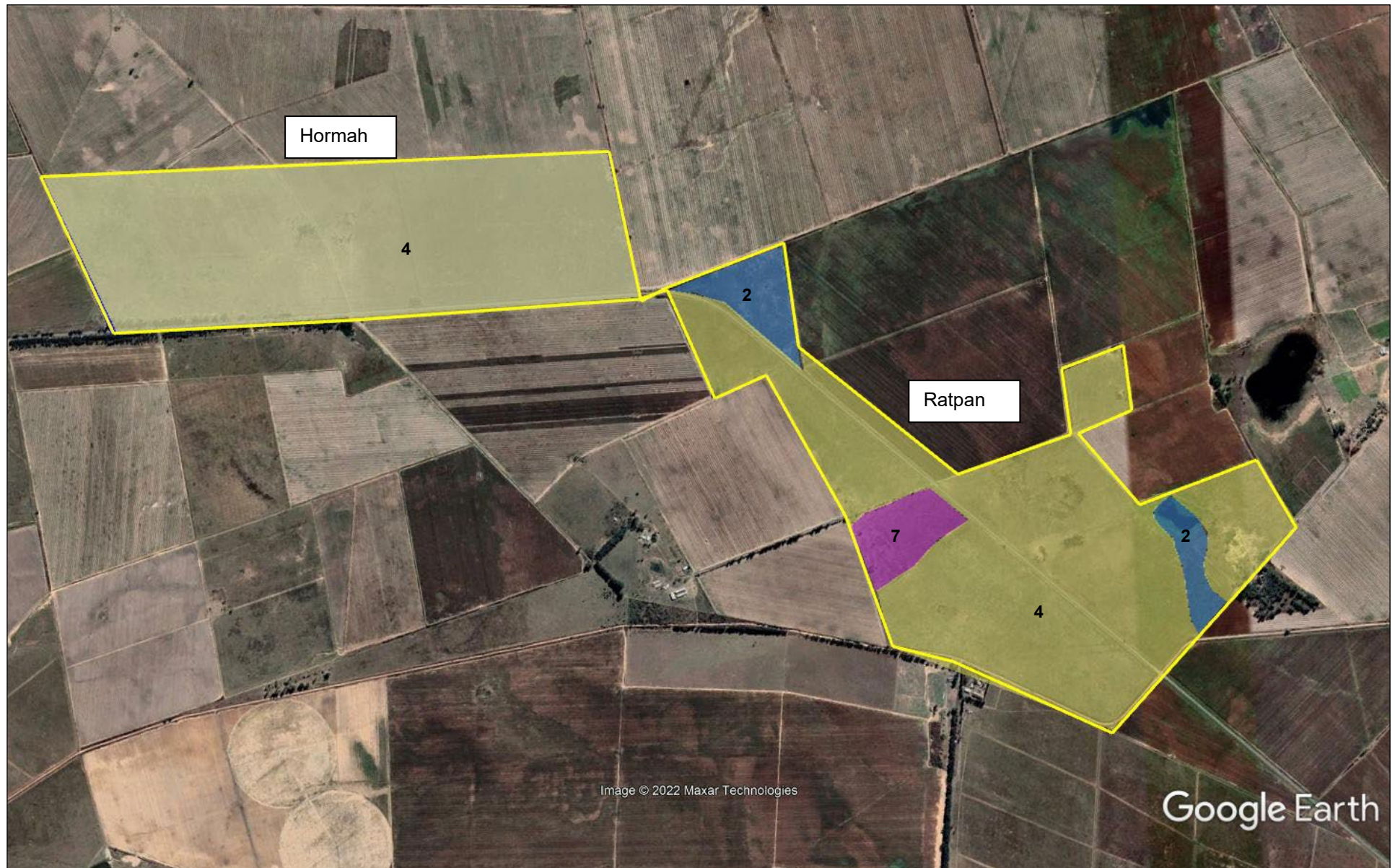


Figure 4. Vegetation units of the Southern PV Farms Cluster (Image obtained from Google Earth 2022).

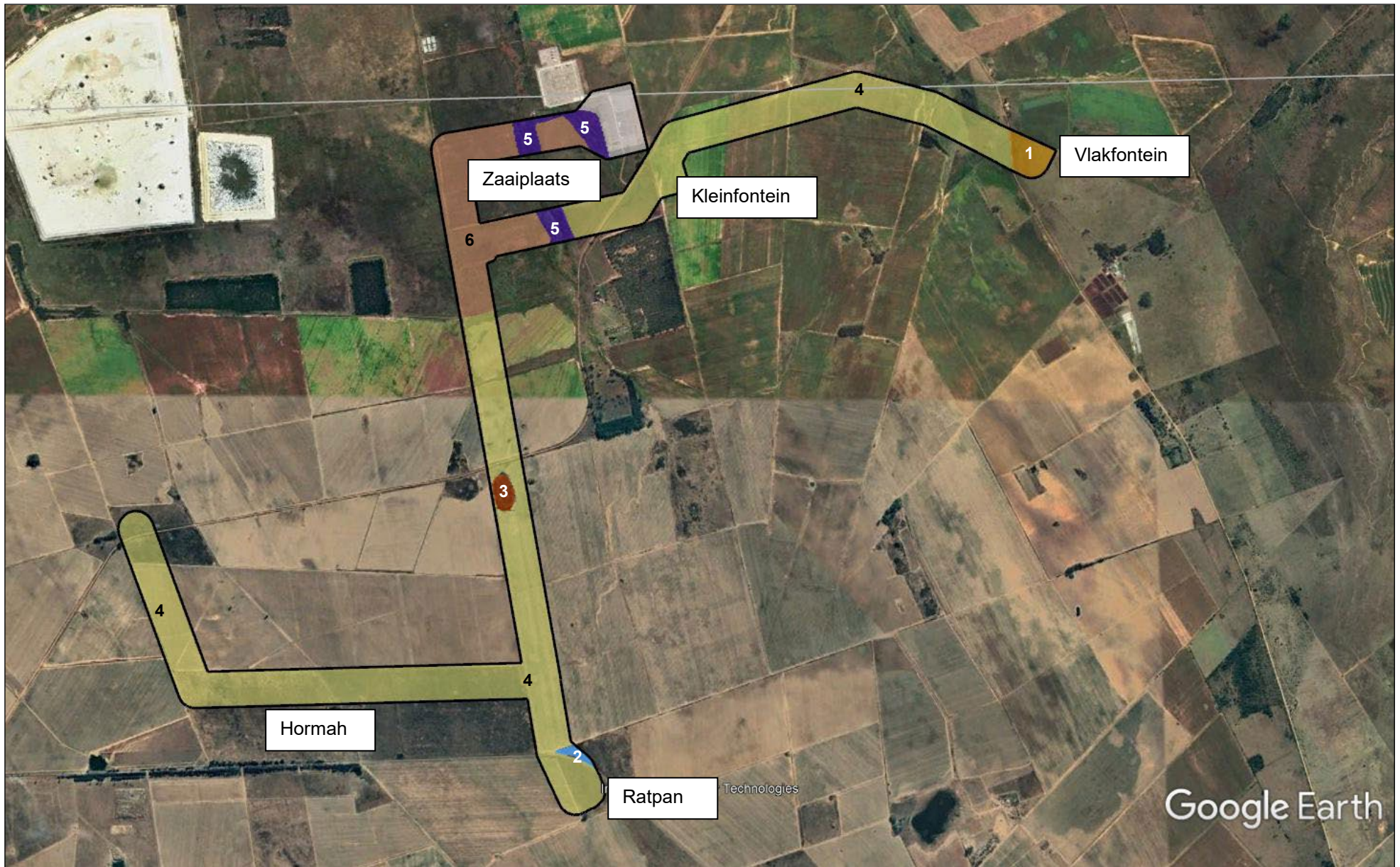


Figure 5. Vegetation units of the Grid Connection (White= existing infrastructure) (Image obtained from Google Earth 2022).

Cat	Species	Class
	<i>Chamaecrista mimosoides</i>	F
	<i>Conyza bonariensis</i>	F
	<i>Cynodon dactylon</i>	G
	<i>Digitaria argyropsis</i>	G
	<i>Eragrostis curvula</i>	G
	<i>Eragrostis gummiflua</i>	G
	<i>Eragrostis rigidior</i>	G
☠	<i>Eucalyptus camaldulensis</i>	W
	<i>Felicia muricata</i>	F
	<i>Gazania krebsiana</i>	F
	<i>Heteropogon contortus</i>	G
	<i>Imperata cylindrica</i>	G
	<i>Pentzia globosa</i>	W
	<i>Perotis patens</i>	G
	<i>Pogonarthria squarrosa</i>	G
☠	<i>Prosopis glandulosa</i>	W
	<i>Richardia brasiliensis</i>	F
	<i>Schkuhria pinnata</i>	F
	<i>Senecio spp</i>	F
	<i>Seriphium plumosum</i>	W
	<i>Tagetes minuta</i>	F
	<i>Wahlenbergia caledonica</i>	F

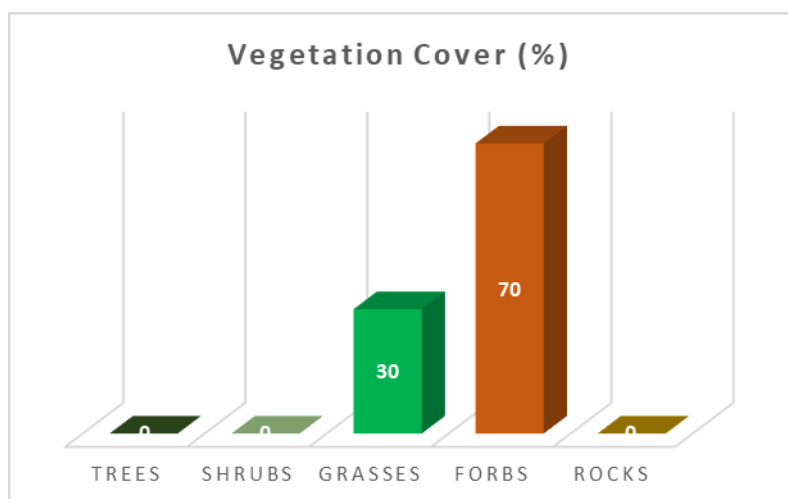
2. Wetland areas



Vegetation structure:	Medium-tall sedge/land		
Topography:	Level forming indentations	Soil	Clay
Unit size:	52.5 ha		
Need for rehabilitation	Low		
Conservation Priority	High		

This vegetation unit occurs in both the northern and southern clusters on clay soil. There are no rocks present, and the vegetation is dominated by forb (sedge) species (see figure right).

The vegetation is characterised by the prominence of various grass



and forb species such as *Paspalum dilatatum*, *Agrostis lachnantha*, *Eragrostis inamoena*, *Andropogon eucomus*, *Mariscus congestus*, *Coleochloa setifera*, *Kyllinga alba*, *Rorippa nasturtium-aquaticum*, *Cyperus rupestris*, *Cyperus congestus*, *Juncus spp.* Other species around the edges include the dwarf shrub *Seriphium plumosum*, the grasses *Eragrostis plana*, *Digitaria eriantha* and the forbs *Wahlenbergia caledonica*, *Ranunculus multifidus* and *Verbena bonariensis*.

Red data species

No red data species were found to be present within this unit though marginally suitable habitat exists for one species (see Annexure 1).

Alien plant species

Verbena bonariensis.

Farm/s where present

Vlakfontein; Ratpan.

The following is a list of plant species identified in unit 1a during the survey (❤️=alien invasive species; +=medicinal value; 👁️=Protected species; 🌿 = Cultivated/Garden hybrid) (W=woody; G=grass; F=forb):

Cat	Species	Class
	<i>Agrostis lachnantha</i>	G
	<i>Andropogon eucomus</i>	G
	<i>Arundinella nepalensis</i>	G
	<i>Asparagus laricinus</i>	W
	<i>Bulbostylis hispidula</i>	F
	<i>Chenopodium album</i>	F
	<i>Coleochloa setifera</i>	F
	<i>Cynodon dactylon</i>	G
	<i>Cyperus congestus</i>	F
	<i>Cyperus rupestris</i>	F
	<i>Digitaria eriantha</i>	G
	<i>Eragrostis gummiflua</i>	G
	<i>Eragrostis inamoena</i>	G
	<i>Eragrostis plana</i>	G
+	<i>Gomphocarpus fruticosus</i>	F
	<i>Imperata cylindrica</i>	G
	<i>Juncus spp</i>	F
	<i>Kyllinga alba</i>	F
	<i>Lobelia erinus</i>	F

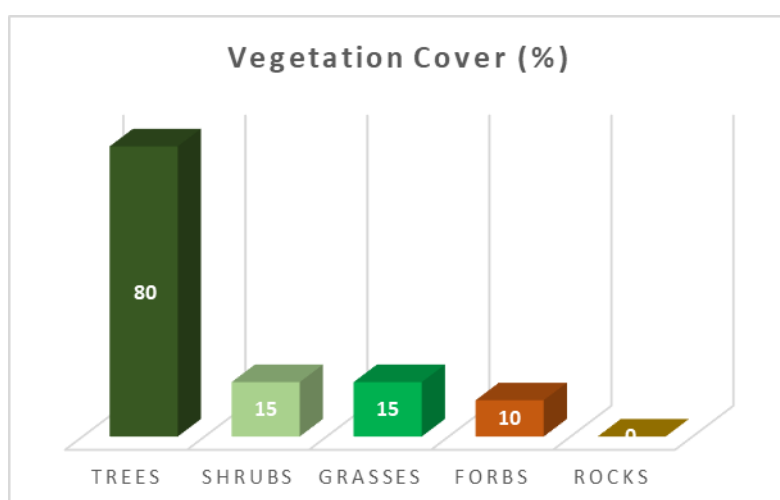
<i>Mariscus congestus</i>	F
<i>Panicum schinzii</i>	G
<i>Paspalum dilatatum</i>	G
<i>Paspalum urvillei</i>	G
<i>Persicaria lapathifolia</i>	F
<i>Ranunculus multifidus</i>	F
<i>Rorippa nasturtium-aquaticum</i>	F
<i>Rorippa nudiuscula</i>	F
<i>Seriphium plumosum</i>	W
<i>Setaria sphacelata</i>	G
 <i>Verbena bonariensis</i>	F
<i>Wahlenbergia caledonica</i>	F

3. *Eucalyptus camaldulensis* woodland



Vegetation structure:	Tall woodland/forest		
Topography:	Mostly level	Soil	Red sandy-loam
Unit size	96.2 ha		
Need for rehabilitation	High		
Conservation Priority	Low		

This vegetation unit occurs scattered throughout the whole study area in large bush clumps on sandy-loam soil. The tree layer dominates the vegetation with the highest cover while the herbaceous layer is not well-developed (see figure right).



The vegetation is dominated by tall (>12m) *Eucalyptus camaldulensis* trees and shrubs. The herbaceous layer is not well developed and include the grasses *Cynodon dactylon*, *Eragrostis chloromelas*, *Aristida*

congesta subsp. *barbicollis*, *Pogonarthria squarrosa* and the forbs *Bidens pilosa*, *Datura stramonium*, and *Lepidium bonariense*.

Red data species

No red data species were found to be present in this unit due to the transformed condition thereof.

Alien plant species

Datura stramonium; *Eucalyptus camaldulensis*.

Farm/s where present

Vlakfontein; Zaaiplaats.

The following is a list of plant species identified in unit 1a during the survey (🔴=alien invasive species; 🟢+=medicinal value; 👁=Protected species; 🌱 = Cultivated/Garden hybrid) (W=woody; G=grass; F=forb):

Cat	Species	Class
	<i>Aristida congesta</i> subsp <i>barbicollis</i>	G
	<i>Bidens pilosa</i>	F
	<i>Cynodon dactylon</i>	G
🔴+	<i>Datura stramonium</i>	F
	<i>Eragrostis chloromelas</i>	G
	<i>Eragrostis rigidior</i>	G
🔴	<i>Eucalyptus camaldulensis</i>	
	<i>Lepidium bonariense</i>	F
	<i>Pogonarthria squarrosa</i>	G
	<i>Setaria verticillata</i>	G
	<i>Tagetes minuta</i>	F
	<i>Urochloa panicoides</i>	G

4. Cultivated fields



Vegetation structure:	Crops & weeds		
Topography:	Mostly level	Soil	Loam
Unit size	1005 ha		
Need for rehabilitation	High		
Conservation Priority	Low		

This vegetation unit is the largest section of the study area and occurs throughout the various clusters. The soil is deep loamy red with no rocks present. The area is used for the planting of pastures dominated by mostly maize crops while others are fallow land dominated by pioneer weeds such as *Conyza bonariensis*, *Conyza pyramidalis*, *Tagetes minuta* and *Bidens pilosa*.

Red data species

No red data species were found to be present in this unit and no suitable habitat exists.

Alien plant species

None.

Farm/s where present

Kleinfontein; Zaaiplaats; Hormah; Ratpan.

The following is a list of plant species identified in unit 1a during the survey (🔴=alien invasive species; 🌿=medicinal value; 👁️=Protected species; 🧑=Cultivated/Garden hybrid) (W=woody; G=grass; F=forb):

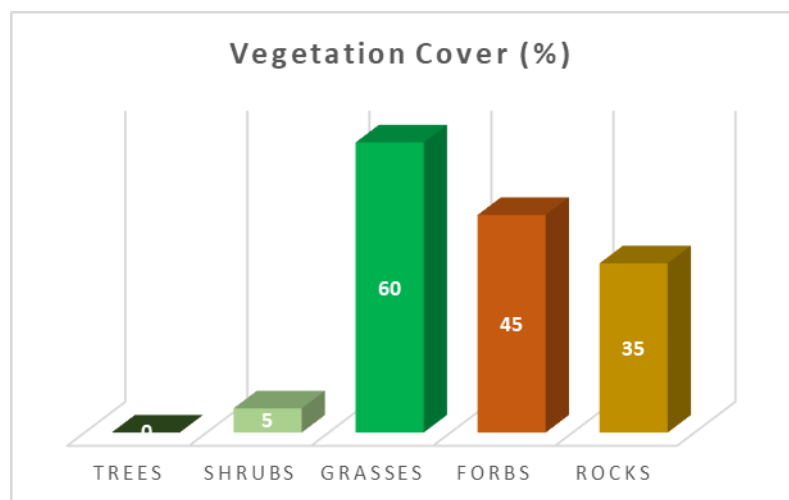
Cat	Species	Class
	<i>Aristida laricinus</i>	W
	<i>Bidens pilosa</i>	F
🔴	<i>Cirsium vulgare</i>	F
	<i>Conyza bonariensis</i>	F
	<i>Conyza pyramidalis</i>	F
	<i>Cynodon dactylon</i>	G
	<i>Hyparrhenia hirta</i>	G
	<i>Striga elegans</i>	F
	<i>Tagetes minuta</i>	F
🔴	<i>Verbena bonariensis</i>	F
🧑	<i>Zea mays</i>	G

5. Seasonal stream



Vegetation structure:	Short-medium tall grassland		
Topography:	N/A	Soil	Clay-Loam
Unit size	29 ha		
Need for rehabilitation	Medium		
Conservation Priority	High		

This seasonally wet stream is located in the eastern part of the Northern PV Farm cluster and comprises 29 ha. The area consists of large rock sheets with clay soil in-between. There herbaceous layer dominates the vegetation and consists of short-medium tall grasses that have the highest cover (see figure right).



The vegetation is dominated by the grasses *Agrostis lachnantha*, *Paspalum dilatatum* and the forb *Typha capensis*. The dwarf shrub *Asparagus laricinus* form dense clumps along its edge. Other species present include the grasses *Cynodon dactylon*, *Imperata cylindrica*, *Setaria pallide-fusca*, *Arundinella nepalensis* and the forbs *Ranunculus multifidus*, *Rorippa nasturtium-aquaticum*, *Persicaria lapathifolia*, *Cirsium vulgare* and *Verbena bonariensis*.

Red data species

No red data species were found to be present in this unit though marginal suitable habitat exists for one species (see Annexure 1).

Alien plant species

Cirsium vulgare; *Verbena bonariensis*.

Farm/s where present

Zaaiplaats.

The following is a list of plant species identified in unit 1a during the survey (☠=alien invasive species; +=medicinal value; 👁=Protected species; 🌱 = Cultivated/Garden hybrid) (W=woody; G=grass; F=forb):

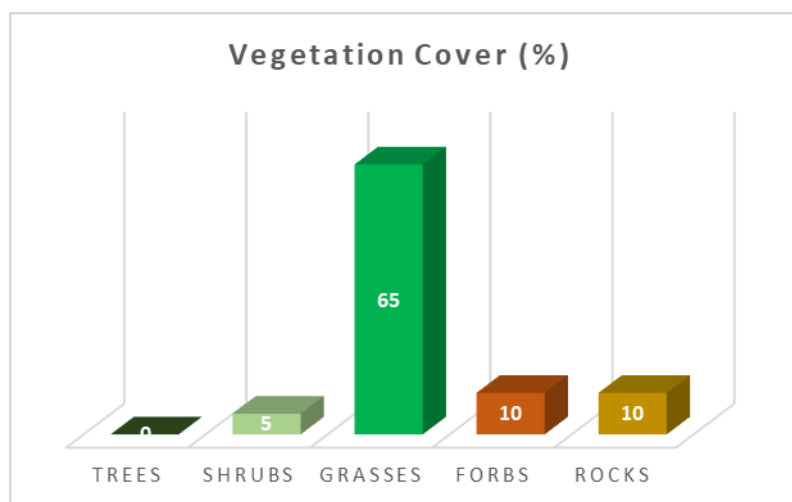
Cat	Species	Class
	<i>Agrostis lachnantha</i>	G
	<i>Andropogon eucomus</i>	G
	<i>Arundinella nepalensis</i>	G
	<i>Asparagus laricinus</i>	W
	<i>Bidens pilosa</i>	F
	<i>Chenopodium album</i>	F
☠	<i>Cirsium vulgare</i>	F
	<i>Cucumis spp</i>	F
	<i>Cynodon dactylon</i>	G
	<i>Cyperus esculentus</i>	F
	<i>Eragrostis gummiflua</i>	G
	<i>Eragrostis plana</i>	G
+	<i>Gomphocarpus fruticosus</i>	F
	<i>Imperata cylindrica</i>	G
	<i>Oenothera rosea</i>	F
	<i>Papaver aculeatum</i>	F
	<i>Paspalum dilatatum</i>	G
	<i>Persicaria lapathifolia</i>	F
	<i>Ranunculus multifidus</i>	F
	<i>Rorippa nasturtium-aquaticum</i>	F
	<i>Senecio harveyanus</i>	F
	<i>Setaria pallide-fusca</i>	G
+	<i>Typha capensis</i>	F
☠	<i>Verbena bonariensis</i>	F

6. *Digitaria eriantha-Eragrostis curvula* grassland



Vegetation structure:	Tall grassland		
Topography:	Slight eastern slope (1-3°)	Soil	Shallow loam
Unit size	64.6 ha		
Need for rehabilitation	Medium		
Conservation Priority	Low		

This vegetation unit is located only within the northern cluster occurring adjacent to vegetation unit 5 (Seasonal stream). The soil is shallow loam with small quartzite rocks present. The herbaceous layer dominates the vegetation and consists of tall grasses that have the highest cover (see figure right).



The vegetation is dominated by the planted pasture grass *Digitaria eriantha* and the secondary successional grass *Eragrostis curvula*. There are few woody species present with the shrubs *Asparagus laricus* and *Seriphium plumosum* scattered throughout the area as single individuals. Other species present include the grasses *Pogonarthria squarrosa*, *Cynodon dactylon*, *Sporobolus africanus*, *Trichoneura grandiglumis* and the forbs *Felicia muricata*, *Crotalaria sphaerocarpa*, *Polygala hottentotica* and *Monsonia angustifolia*.

Red data species

No red data species were found to be present in this unit and no suitable habitat exists.

Alien plant species

Verbena bonariensis.

Farm/s where present

Zaaiplaats.

The following is a list of plant species identified in unit 1a during the survey (♥=alien invasive species; +=medicinal value; 👁=Protected species; 🌱 = Cultivated/Garden hybrid) (W=woody; G=grass; F=forb):

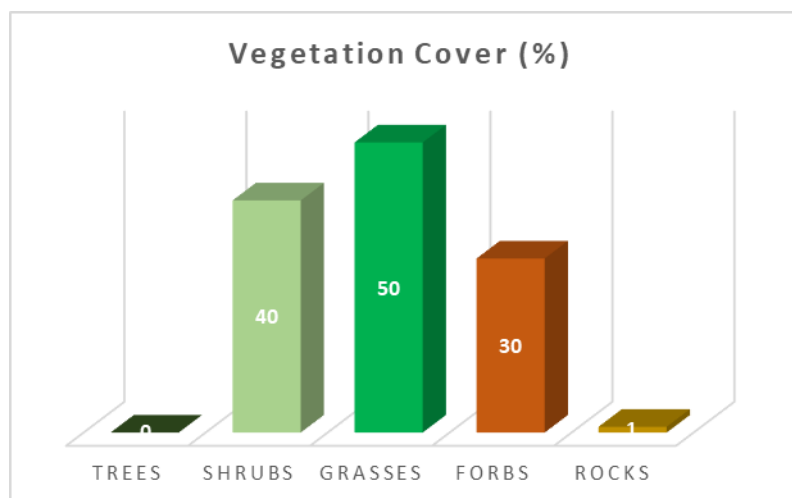
Cat	Species	Class
	<i>Aristida congesta subsp. barbicollis</i>	G
	<i>Aristida junciformis</i>	G
	<i>Bidens pilosa</i>	F
	<i>Crotalaria sphaerocarpa</i>	F
	<i>Cynodon dactylon</i>	G
	<i>Digitaria eriantha</i>	G
	<i>Eragrostis curvula</i>	G
	<i>Felicia muricata</i>	F
	<i>Melinis repens</i>	G
	<i>Monsonia angustifolia</i>	F
	<i>Nidorella hottentotica</i>	F
	<i>Pogonarthria squarrosa</i>	G
	<i>Polygala hottentotica</i>	F
	<i>Schkuhria pinnata</i>	F
	<i>Seriphium plumosum</i>	W
	<i>Sporobolus africana</i>	G
	<i>Trichoneura grandiglumis</i>	G
	<i>Urochloa mosambicensis</i>	G
♥	<i>Verbena bonariensis</i>	F
	<i>Vernonia poskeana</i>	F

7. *Seriphium plumosum* shrubland



Vegetation structure:	Short shrubland		
Topography:	Mostly level	Soil	Loam
Unit size	16.5ha		
Need for rehabilitation	High		
Conservation Priority	Low		

This vegetation unit is located only within the southern cluster and comprises 16.5 ha. The soil is loamy with few rocks present. There shrub and herbaceous layers dominate the vegetation with high cover values (see figure right).



The vegetation is dominated by the encroacher shrub *Seriphium plumosum* and the grass *Eragrostis gummiflua*. Other species present include the shrub *Asparagus laricinus*, the grasses *Melinis repens*, *Digitaria eriantha* and the forbs *Cleome rubella*, *Gomphocarpus fruticosus* and *Conyza bonariensis*.

Red data species

No red data species were found to be present in this unit and no suitable habitat exists due to the degraded condition of the unit.

Alien plant species

None.

Farm/s where present

Ratpan.

The following is a list of plant species identified in unit 1a during the survey (🔴=alien invasive species; +=medicinal value; 👁=Protected species; 🌱 = Cultivated/Garden hybrid) (W=woody; G=grass; F=forb):

Cat	Species	Class
	<i>Seriphium plumosum</i>	
	<i>Verbena bonariensis</i>	
	<i>Tagetes minuta</i>	
	<i>Eragrostis gummiflua</i>	
	<i>Senecio spp</i>	
	<i>Bidens pilosa</i>	
+	<i>Gomphocarpus fruticosa</i>	
	<i>Urochloa mosambicensis</i>	
	<i>Asparagus laricinus</i>	
	<i>Conyza bonariensis</i>	
	<i>Cleome rubella</i>	
	<i>Melinis repens</i>	
	<i>Eragrostis curvula</i>	

6.2 Results of faunal survey

The faunal survey focused on mammals, reptiles and amphibians of the Mercury PV study area. The preliminary faunal survey focused on the current status of threatened animal species occurring, or likely to occur within the proposed Mercury PV study area, describing the available and sensitive habitats, identifying potential impacts resulting from the development and providing mitigation measures for the identified impacts. Faunal surveys should ideally be conducted over extended periods during the summer rainy season between November and March. Faunal data was obtained during the 4-day site visitation carried out mainly by vehicle and remaining open secondary succession grasslands, palustrine wetlands and seasonal drainage line were traversed on foot.

All animals (mammals (larger), birds, reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as animal tracks (footprints, droppings/scats) to identify mammals. Reptiles were actively searched for beneath any loosely embedded rocks (limited), stumps and moribund termite mounds and identified by actual specimens or observations of specimens. Amphibians were identified by visual observations of adults as well as sweep and dip-netting for juveniles (tadpoles) within roadside rain-pools as well as shallow margins of the seasonally inundated depressions. The data was supplemented by previous surveys conducted in the Klerksdorp-Parys area, literature investigations, personal records and historic data.

General observations applicable across the vegetation of the entire site are as follows:

- The transformation of the natural open grasslands and palustrine wetlands into homogenous transformed agricultural lands will have resulted in the alteration of the faunal composition within the study areas as well as adjacent transformed agricultural, mining (north and east of the site) and degraded or alien invaded areas.
- The majority of the site and adjacent areas are utilised for intensive agricultural (maze) and planted pasture activities as well as livestock (cattle and sheep) grazing.
- Well-developed grass layer was observed within the planted pastures, especially the rank *Digitaria eriantha-Eragrostis curvula* planted pastured adjacent to the seasonal stream/valley bottom wetland on the northern portion of the site. The *Eragrostis curvula-Cynodon-dactylon* on the north-eastern portion of the site shows evidence of overgrazing by cattle (only moderate overgrazing in sections).

- Basal cover was low adjacent to current off-road tracks, livestock pathways as well as kraals or feeding lots.
- Forb species diversity was low throughout the property due to utilisation of the remnant patches of open secondary succession grasslands for livestock (Cattle) grazing activities as well as planted pastures.
- Dense weed and alien invader floral species (*Verbena bonariensis*) were observed on site especially within the moist fallow lands as well as *Eucalyptus camaldulensis* woodlots.

Amphibians

Amphibians are an important component of South Africa's exceptional biodiversity (Siegfried 1989) and are such worthy of both research and conservation effort. This is made additionally relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but as yet is poorly understood (Wyman 1990; Blaustein & Wake 1995). Frog populations throughout the world have crashed dramatically in the last twenty years. Deforestation, wetland draining, and pollution are immediately obvious causes. But other, more fundamental, man-made impacts are causing population declines in 'pristine' habitats such as national parks and remote rainforests. Reductions in atmospheric ozone levels are allowing increased UV-radiation, pollutants are accumulating in natural systems and bacterial and virus distribution is accelerating across the globe (Carruthers 2001). Most frogs have a biphasic life cycle, where eggs laid in water develop into tadpoles and these live in the water until they metamorphose into juvenile frogs living on the land. This fact, coupled with being covered by a semi-permeable skin makes frogs particularly vulnerable to pollutants and other environmental stresses. Consequently, frogs are useful environmental bio-monitors (bio-indicators) and may act as an early warning system for the quality of the environment. The Giant Bullfrog (*Pyxicephalus adspersus*) has been chosen as a flagship species for the grassland ecoregion (Cook in le Roux 2002)

Breeding in African frogs is strongly dependent on rain, especially in the drier parts of the country where surface water only remains for a short duration. The majority of frog species in the Free State Province can be classified as explosive breeders. Explosive breeding frogs utilise palustrine, lacustrine (dams) or endorheic systems such as ephemeral pans and depressions for their short duration reproductive cycles. A few species utilise riverine systems; especially permanent rivers, mountain streams and floodplains. There are also terrestrial breeders such as *Breviceps*.

As the survey was undertaken predominantly during daylight hours during the summer months (November and March), only a few species of frogs were recorded. A vehicle-based nocturnal survey was conducted on the evening of 7 March 2022. Ideally, a herpetological survey should be undertaken throughout the duration of the wet season (November-March).

It is only during this period accurate frog lists can be compiled. During this survey; fieldwork was augmented with species lists compiled from personal records (Klerksdorp area; data from the South African Frog Atlas Project (SAFAP) and published data, and the list provided in Table below is therefore regarded as likely to be fairly comprehensive.

Table 5. Frog species likely to occur and recorded (*) by the consultant on the Mercury PV sites.

COMMON NAME	SCIENTIFIC NAME	BREEDING HABITAT
*Guttural Toad	<i>Sclerophrys gutturalis</i>	Seasonally inundated depressions/ pools, farm dams. Recorded calling from dams as well as road fatality.
Power's Toads	<i>Sclerophrys powerii</i>	Seasonally inundated depressions/ pools and edges of farm dams.
*Red Toad	<i>Schismaderma carens</i>	Deeper <i>Typha capensis</i> dominated depressions and dams. Road fatality recorded during nocturnal survey
*Common Platanna	<i>Xenopus laevis</i>	Seasonally inundated depressions/ pools. Caught in net within road-side rain-pool.
*Boettger's or Common Caco	<i>Cacosternum boettgeri</i>	Seasonally inundated depressions/ pools and ditches on the northern and southern clusters. Recorded calling.
*Bubbling Kassina	<i>Kassina senegalensis</i>	Seasonally inundated depressions/ pools. Recorded calling.
Tremelo Sand Frog	<i>Tomopterna cryptotis</i>	Seasonally inundated depressions/ pools and roadside pools.
Natal Sand Frog	<i>Tomopterna natalensis</i>	Seasonally inundated depressions/ pools and roadside pools.
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Seasonally inundated depressions. No suitable breeding habitat observed on the site.
Delalande's River Frog	<i>Amietia delalandii</i>	Farm dams and drainage line (perennial)
Cape River Frog	<i>Amietia fuscicula</i>	Farm dams and drainage line (perennial)
Striped Grass Frog	<i>Strongylopus fasciatus</i>	Seasonally inundated depressions/ pools in valley bottom wetland (autumnal & winter breeder). Recorded calling.
Snoring Puddle Frog	<i>Phrynobatrachus natalensis</i>	Seasonally inundated depressions/ pools.

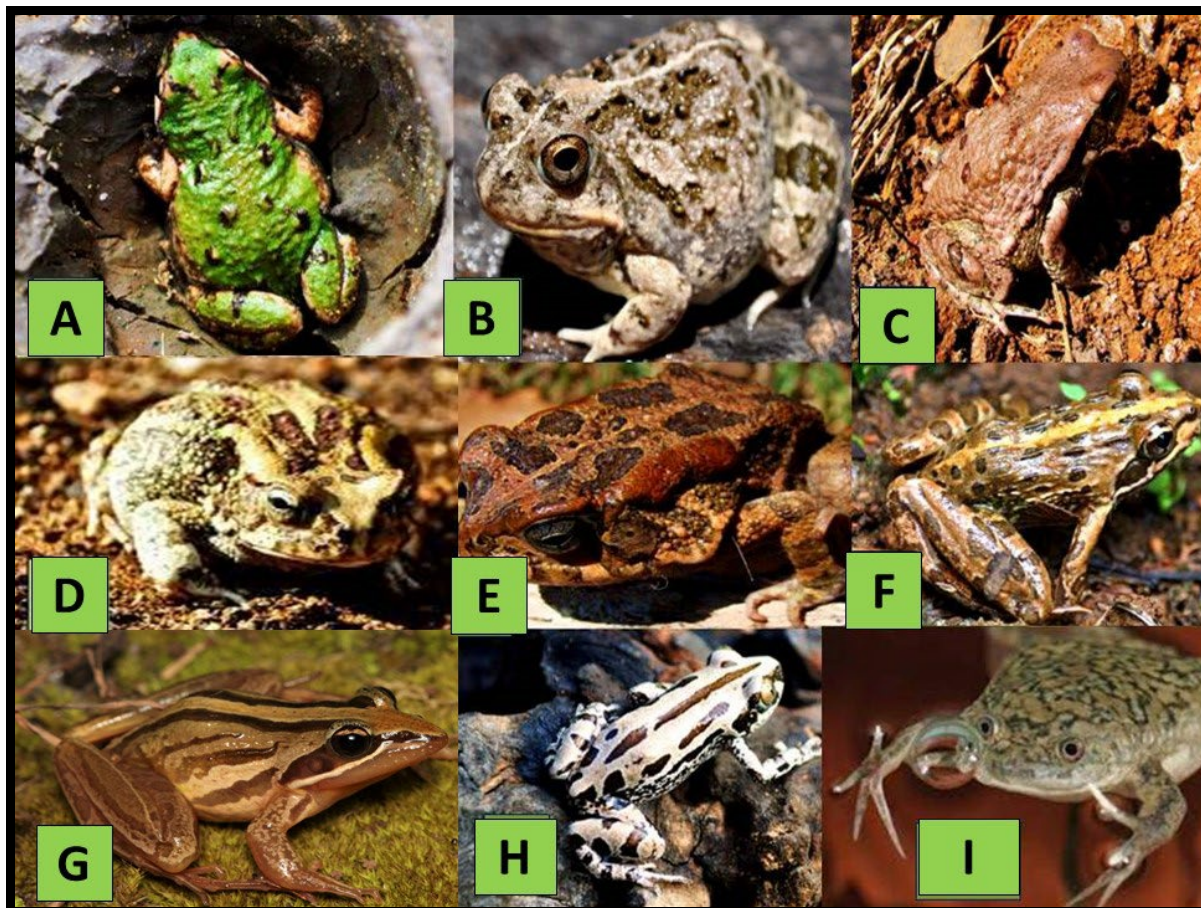


Figure 6. A conglomerate of photographs of the frog species recorded (*) or likely to occur or in suitable habitat within the proposed Mercury PV site. A: *Boettger's or Common Caco (*Cacosternum boettgeri*), B: Tremelo Sand Frog (*Tomopterna cryptotis*), C: *Red Toad (*Schismaderma carens*), D: Power's Toad (*Sclerophrys powerii*), E: *Guttural Toad (*Sclerophrys gutturalis*), F: *Delalande's River Frog (*Amietia delalandii*), G: *Striped Stream Frog (*Strongylopus fasciatus*), H: *Bubbling Kassina (*Kassina senegalensis*) and I: *Common Platanna (*Xenopus laevis*).

The majority of the Mercury PV study area comprises homogenous transformed agricultural lands. Fallow agricultural lands have been re-colonised by pioneer weedy plant and grass species. Frogs are heavily impacted on by habitat destruction, transformation of wetlands as well as pesticides and fertilizers associated with intensive agricultural activities.

Seven frog species were recorded during the two site visitations. Road fatalities of Guttural Toad (*Sclerophrys gutturalis*) as well as Red Toad (*Schismaderma carens*) were observed on the secondary access roads bisecting the northern cluster. Several rain-pools had formed on the secondary access roads during the March site visit.

No tadpoles or male frog species were observed or heard calling from the shallow pools or are likely to successfully breed due to high levels of traffic on the road. It is highly unlikely the road-pools persists for an adequate period for successful breeding activity (minimum 30

days). Several smaller poorly defined seasonally depressions and valley bottom wetlands occur on the northern and southern clusters. The non-perennial or seasonal drainage line offers extremely limited suitable habitat as there was no evidence of any surface water during the March site visit. The inundated depressions and wetland adjacent to the poorly defined (in certain areas) non-perennial drainage line offer the most favourable breeding habitat for the majority of frog species likely to occur in the area.

Frog species recorded calling during the day included Striped Stream Frogs (*Strongylopus fasciatus*) from the moist *Digitaria eriantha* along the seasonal drainage line on the eastern boundary of the northern cluster. Several Common Caco (*Cacosternum boettgeri*) were observed calling from the seasonally inundated depressions. Bubbling Kassina (*Kassina senegalensis*) were calling from rank grassland adjacent to the seasonal drainage line during the nocturnal survey. Guttural Toads (*Sclerophrys gutturalis*) were calling from the edges of the adjacent farm dam during the nocturnal survey. The mosaic of inundated grassland patches and depressions within the north-eastern secondary succession grasslands offer suitable breeding habitat during high-rainfall years for Tremelo Sand Frogs (*Tomopterna cryptotis*), Common Caco (*Cacosternum boettgeri*). The artificially created dams situated outside the northern and southern clusters offer suitable habitat for Common Platanna (*Xenopus laevis laevis*), Power's Toad (*Sclerophrys powerii*) and Guttural Toads (*Sclerophrys gutturalis*).

Reptiles

Comprehensive reptile species lists are impossible to determine without extensive fieldwork over a number of months or even years. No pitfall or funnel trapping was conducted due to time constraints and the survey was based primarily on visual encounters. This method entails active searching in suitable habitat components such as searching in the different vegetation communities, turning over objects such as logs and loosely embedded rocks, searching in crevices in rocks and bark and replacing all surface objects after examining the ground beneath. Logs, termite mounds and other substrates are not torn apart to minimize disturbance to important habitat elements in the sample unit. Observers note only presence of individuals or sign and identify the detection to the most specific taxonomic level possible. Specimens are only captured when necessary to confirm identification especially of difficult to distinguish species. Because of human presence in the area (livestock grazing, pathways, roads) coupled with extensive habitat destruction and disturbances with the conversion of open grassland into monocultured maze lands; alterations to the original reptilian fauna are expected to have already occurred within and adjacent to the Mercury PV sites.

The indiscriminate killing of all snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations especially snake populations drastically. No evidence of illegal reptile harvesting or collecting were observed. The frequent burning of the open grasslands on the site will have a high impact on remaining reptiles. Fires during the winter months will severely impact on species undergoing brumation (hibernation) and are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

No scattered low-lying rocky outcrops or extrusion were observed. Rocky sheets were observed adjacent to the seasonal drainage line on the eastern boundary of the northern cluster. The rock sheets provide limited favourable refuges for Common Girdled Lizard (*Cordylus vittifer*) due to lack of refugial habitat (adjacent rocky outcrops) for rupicolous snake and lizard species.

The *Eragrostis curvula*-*Cynodon dactylon* grasslands within the northern cluster on the north-eastern boundary with scattered Eucalyptus logs and individual rocks and termite mounds offers suitable habitat for Cape Gecko (*Pachydactylus capensis*), Transvaal Thick-toed Gecko (*Pachydactylus affinis*), Eastern Ground Agama (*Agama aculeata distantii*), Variable Skink (*Trachylepis varia*), Speckled Rock Skink (*Trachylepis punctatissima*), Cape Skink (*Trachylepis capensis*), Wahlberg's Snake-eyed Skink (*Afroablepharus wahlbergii*) and Yellow-throated Plated Lizard (*Gerrhosaurus flavigularis*).

The ubiquitous Common Gecko (*Lygodactylus capensis*) and Speckled Rock Skink (*Trachylepis punctatissima*) were observed on the fence posts as well as buildings and reservoir walls on the northern cluster. Low reptile diversity was observed within the fallow weed invaded old agricultural lands. No reptiles were observed within the transformed maze lands.

Several juvenile Marsh Terrapin (*Pelomedusa subrufa*) were caught with dip-netting for tadpoles within the larger road-side rain-pools. The artificially created dams and permanently inundated pans offer suitable habitat for Marsh Terrapin (*Pelomedusa subrufa*) and Nile Monitors (*Varanus niloticus*).

Snake species likely to occur include Bibron's Blind Snake (*Afrotyphlops bibronii*), Boomslang (*Dispholidus typus*), Puff Adder (*Bitis arietans arietans*), Horned adder (*Bitis caudalis*), Striped Grass Snake (*Psammophylax tritaeniatus*), Mole Snake (*Pseudaspis*

cana), Black Mamba (*Dendroaspis polylepis*), Snouted Cobra (*Naja annulifera*), Mozambique Spitting Cobra (*Naja mossambica*), Common House Snake (*Boaedon capensis*), Rhombic Egg-Eater (*Dasypeltis scabra*) and Rhombic Night Adder (*Causus rhombeatus*).

Table 6. A list of reptile species observed (*) on the site (highlighted in yellow) as well as species likely to occur on the site using habitat as an indicator of presence; is presented below. The list has been heavily supplemented by previous surveys (*) in similar habitats as well as species distributions by Branch (1998) and Alexander & Marais (2007).

Common Name	Scientific Name	Habitat Requirements
Bibron's Blind Snake	<i>Afrotyphlops bibronii</i>	Fossorial found in soil under rocks or logs, in moribund termite mounds.
Delalande's Beaked Blind Snake	<i>Rhinotyphlops lalandei</i>	Fossorial found in soil under rocks or logs, in moribund termite mounds.
Peter's Thread Snake	<i>Leptotyphlops scutifrons</i>	Fossorial found in soil under rocks or logs, in moribund termite mounds.
*Cape Skink	<i>Trachylepis capensis</i>	Terrestrial digging tunnels in loose sand at the base of bushes or boulders, also favours dead trees and fallen Aloes.
*Montane Speckled Skink	<i>Trachylepis punctatissima</i>	A mostly rock-living diurnal skink the Spotted Skink often occurs in association with man-made structures where it is able to find refuge and food and may be unwittingly translocated in boxes, firewood and other items where it has taken refuge
Wahlberg's Snake-eyed Skink	<i>Afroablepharus wahlbergii</i>	Amongst grass roots under rotting logs and around stones and old termitaria (Moribund) on broken ground. Eats termites and other small insects.
*Variable Skink	<i>Trachylepis varia</i>	Another terrestrial and diurnal skink, the Variable Skink is widespread although not very frequently recorded from disturbed habitats. It occupies a wide variety of habitats where there is sufficient vegetative cover. It takes refuge in a wide range of shelters including under rocks on soil, in crevices, under building rubble and in the burrows of other animals.
Flap-neck Chameleon	<i>Chamaeleo dilepis</i>	Adults are arboreal and usually found in trees and shrubs but hatchlings appear to favour perching on grass stems.
*Transvaal Thick-toed gecko	<i>Pachydactylus affinis</i>	Rocky outcrops and old termite mounds.
Cape Thick-toed Gecko	<i>Pachydactylus capensis</i>	Rocky outcrops, under logs and old termite mounds as well as houses.
*Cape Dwarf Gecko	<i>Lygodactylus capensis</i>	Well-wooded savanna but also thrives in urban areas.
Yellow-throated Plated Lizard	<i>Gerrhosaurus flavigularis</i>	A common and widespread terrestrial lizard, usually associated with a dense ground cover. They dig burrows at the base of bushes, under boulders and also under rubbish piles. The often take refuge in the burrows of other animals
*Distant's Ground Agama	<i>Agama aculeata distanti</i>	Terrestrial but will often climb in a low shrub to bask. A short hole dug at the base of a bush or under a rock serves as a retreat.

Nile Monitor	<i>Varanus niloticus</i>	Common and widespread and often associated with wetlands and rivers. Hunted for food as well as killed for raiding chicken runs.
Herald or red-lipped Snake	<i>Crotaphopeltis hotamboeia</i>	A common and widespread nocturnal snake, the Herald Snake on frogs and toads which it finds around houses and in moister areas. Takes refuge under rocks and in moribund termitaria and in building rubble but may rest up by day in a variety of cover.
Rinkals	<i>Haemachatus haemachatus</i>	Widespread snake primarily inhabiting moister areas in Highveld grassland in Gauteng. Although formerly common in parts of the province, its habitat has been depleted by urban expansion. It tends to inhabit the burrows of other animals and is mostly nocturnal although basking in the sun during the day. Feeds mostly on amphibians and rodents.
Mole Snake	<i>Pseudaspis cana</i>	Adults may reach 2m in length but are mostly smaller in this area. A diurnal snake they feed on mice and rats and also African Molerats which are widespread, also occurring on the site. It takes refuge within the burrows of other animals. A recent shed skin was observed during the March site visit
Rhombic Night Adder	<i>Causus rhombeatus</i>	Favours damp environments in moist savanna where it seeks refuge in old termite mounds, under logs and large flat stones as well as amongst building rubble.
Puff Adder	<i>Bitis arietans</i>	Puff Adders are common throughout southern Africa, except for mountain tops, true desert and dense forests.
Brown House Snake	<i>Boaedon capensis</i>	Frequents human habitation as well as under loosely embedded rocks.
Aurora House Snake	<i>Lamprophis aurora</i>	Favours moist grassland habitat adjacent to wetlands/valley bottom; often use moribund termite mounds in grassland; loosely embedded rocks
Brown water Snake	<i>Lycodonomorphus rufulus</i>	Associated with aquatic habitats including dams, streams and rivers.
Common or Rhombic Egg Eater	<i>Dasypeltis scabra</i>	A common and widespread nocturnal snake, the Common Egg-eater is largely dependent on dead termitaria on the Highveld where little other cover is available. It will also shelter under rocks, in crevices, under building rubble and in a variety of other refuges when available. The snake is dependent on bird's eggs as a source of food which they locate by means of a fine sense of smell.
Spotted Grass Snake/Skaapsteker	<i>Psammophylax rhombeatus</i>	A common and widespread diurnal snake mostly in Highveld grassland and often seen foraging in rocky and moist areas but takes refuge under rocks, in dead termitaria, old building rubble and animal burrows sometimes in the company of other snakes. Feeds mostly on frogs, lizards and rodents
Striped Grass Snake/Skaapsteker	<i>Psammophylax tritaeniatus</i>	A common and widespread diurnal snake mostly in Highveld grassland. It is often seen foraging in rocky and moist areas but takes refuge under rocks, in dead termitaria, old building rubble and animal burrows sometimes in the company of other snakes. Feeds mostly on frogs, lizards and rodents
Cape or Black-Headed Centipede Eater	<i>Aparallactus capensis</i>	A burrowing (fossorial) species usually found in deserted (moribund) termite mounds, under rotting logs or beneath sun-warmed rocks.
Spotted Harlequin Snake	<i>Homoroselaps lacteus</i>	Usually found in deserted termite mounds or under rocks.

Southern Stiletto Snake	<i>Atractaspis bibronii</i>	Arid and moist savanna and grassland. A burrowing species usually found in deserted termite mounds, under rotting logs or beneath sun-warmed rocks.
Crossed-marked Grass Snake	<i>Psammophis crucifer</i>	Moist savanna seeking refuge under stones or disused termitaria.
Common or Cape Wolf Snake	<i>Lycophidion capense capense</i>	Moist savanna and grassland and are fond of damp localities and is often found under stones, logs, piles of thatch grass, rubbish heaps or in deserted termite mounds.
Delalande's Beaked Blind Snake	<i>Rhinotyphlops lalandei</i>	Fossorial species usually found in soil under rocks or logs, deserted termite mounds or on the surface at night, especially after rain.
*Marsh Terrapin	<i>Pelomedusa subrufa</i>	Wetlands, farm dams and backwater pools in rivers. Juvenile caught in road-side rain-pool in March 2022.

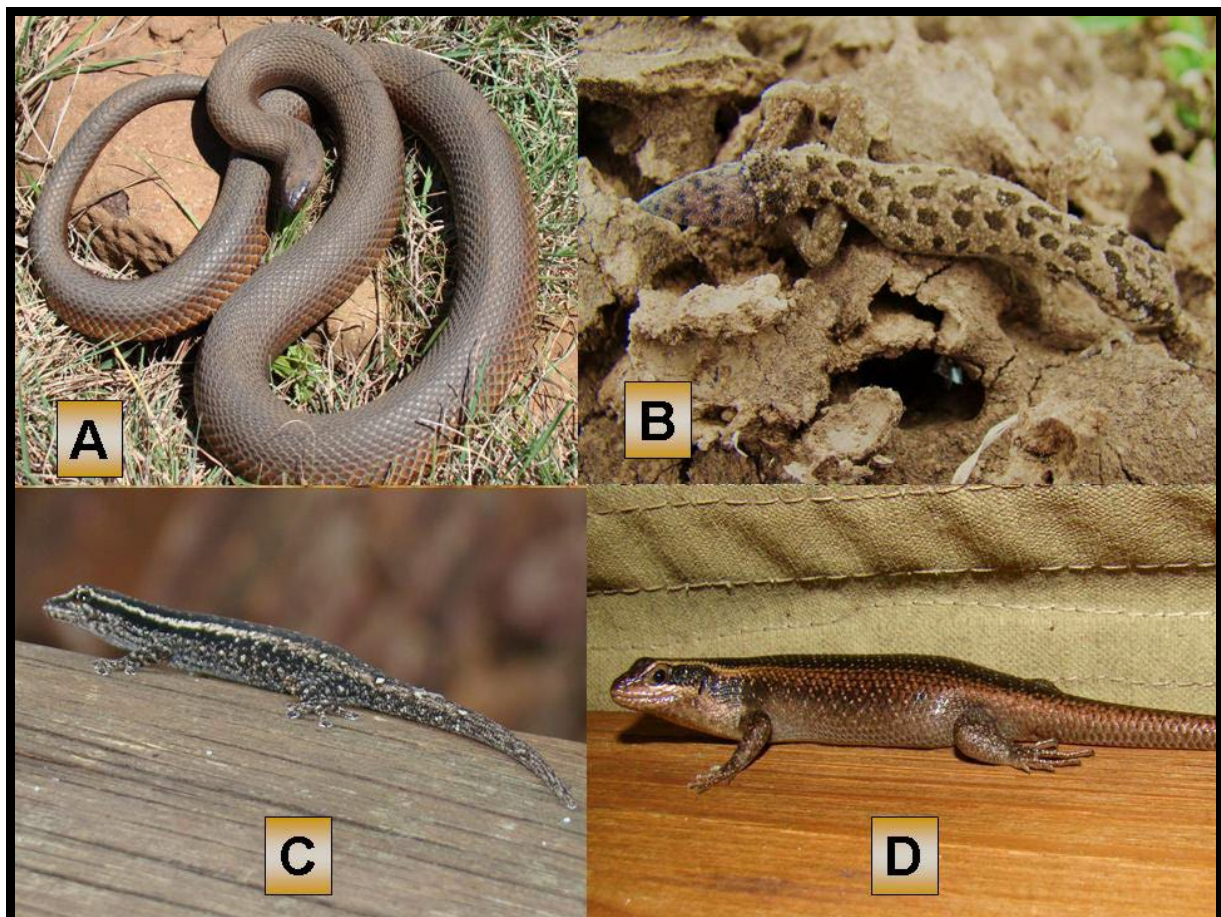


Figure 7. Reptile species recorded within the Mercury PV sites. A: A shedding of a Mole Snake (*Pseudaspis cana*) was observed on the *Eragrostis curvula*-*Cynodon dactylon* grasslands on the north-eastern portion of the site in March 2022. **B:** A Transvaal Thick-toed Gecko (*Pachydactylus affinis*) was observed in a moribund termite mound situated in the *Eragrostis curvula*-*Cynodon dactylon* grasslands in March 2022. **C:** The urban exploiting commensal reptile species namely Cape Dwarf Gecko (*Lygodactylus capensis*) and **D:** Speckled Rock Skink (*Trachylepis punctatissima*) were observed during the November and March field surveys.

The majority of reptile species recorded are common and widespread (Eukaryotic) and typical of a transformed agricultural and degraded grassland habitat.

Mammals

The mammal survey was based primarily from a desktop screening perspective and two-site visitations (24 hours); assessing the habitat availability mainly during daylight hours. No small mammal trapping or camera trapping was conducted during the site visitation. Fieldwork was augmented with previous surveys in similar habitats within the Klerksdorp-Parys area as well as published data. The remaining open secondary succession grasslands situated on the north-eastern portion, the seasonal drainage line or stream and palustrine wetlands were initially traversed on foot to flush any larger mammals and ascertain the presence of available refuges, spoor or droppings. For medium and large mammals, visual encounters of the actual animal as well as spoor or tracks, scat, foraging marks were noted and used for species identification.

Larger carnivores which are likely to occur in the greater Mercury PV study area include Caracal (*Caracal caracal*), Serval (*Leptailurus serval*) and Blacked-backed Jackal (*Canis mesomelas*). The scat of a Caracal was observed on the flat rock sheets adjacent to the seasonal drainage line on the eastern boundary of the northern cluster.

Antelope species recorded from the study area included several Bush Duiker (*Sylvicapra grimmia*), Steenbok (*Raphicerus campestris*) as well as Southern Reed Buck (*Redunca arundinum*). No evidence of any large mammal or antelope species was observed during the two site visitations. The majority of larger mammal species are likely to have been eradicated or have moved away from the area, as a result of previous and current agricultural activities, hunting and poaching as well as severe habitat alteration and degradation.

Several Bush Duiker (*Sylvicapra grimmia*), Slender Mongoose (*Herpestes sanguineus*), Yellow Mongoose (*Cynictis penicillata*), Scrub hare (*Lepus saxatilis*) as well as South African Ground Squirrels (*Xerus inauris*) were observed within the open *Eragrostis curvula*-*Cynodon dactylon* grasslands on the north-eastern portion of the northern cluster. The quills of a Cape Porcupine (*Hystrix africaeaustralis*) were observed on the northern cluster access road as well as several abandoned burrows were observed within the site as well as

fresh digging activities within the *Eragrostis curvula*-*Cynodon dactylon* grasslands on the north-eastern portion of the northern cluster.

No low-lying rocky outcrops of hills occur hence the lack of rupicolous mammal species such as Namaqua Rock Mouse (*Aethomys namaquensis*), Spiny Mouse (*Acomys spinosissimus*), Eastern Rock Elephant Shrew (*Elephantulus myurus*) and Chacma Baboon (*Papio ursinus*).

Rodent species likely to occur within the open grasslands on the site include Springhare (*Pedetes capensis*), Highveld Gerbil (*Tatera brantsii*), Bushveld Gerbil (*Tatera leucogaster*), Fat Mouse (*Steatomys protensis*), Grey Climbing Mouse (*Dendromys melanotis*), Chestnut Climbing Mouse (*Dendromus mysticalis*), Pouched Mouse (*Saccostomus campestris*), Multimammate Mouse (*Mastomys* sp.), Striped Mouse (*Rhabdomys pulilio*) and Red Veld Rat (*Aethomys chrysophilus*). Several Common Molerat (*Cryptomys hottentotus*) burrows and mounds were observed within the *Cynodon dactylon* dominated grasslands on the north-eastern portion. The burrows of Ground Squirrels (*Xerus inauris*) were observed within the planted pastures as well as fallow old lands within the northern and southern clusters.

The rank *Digitaria eriantha* as well as *Imperata cylindrica* grasslands within the upper catchment of the seasonal drainage line as well as adjacent reed invaded farm dams provide suitable habitat for Greater Canerat (*Thryonomys swinderianus*). The palustrine wetlands dominated by hygrophilous grasses and sedge offer suitable habitat for the wetland associated mammals including Swamp Musk Shrew (*Crocidura mariquensis*) and Vlei Rat (*Otomys irrotatus*). Vervet Monkeys (*Cercopithecus pygerythrus*) were observed foraging within *Vachellia karroo* in the riparian zone along the eastern seasonal drainage line. The seasonal drainage line as well as adjacent seasonal wetlands offer suitable habitat for Marsh Mongoose (*Atilax paludinosus*) as well as African Clawless Otter (*Aonyx capensis*).

Bat species recorded from the area include Egyptian Free-tailed Bat (*Tadarida aegyptiaca*), Rusty Pipistrelle (*Pipistrellus rusticus*), Cape serotine bat (*Eptesicus capensis*), Schreiber's Long-fingered Bat (*Miniopterus schreibersii*), Yellow House Bat (*Scotophilus dinganii*), Common Slit-faced Bat (*Nycteris thebaica*). No bat surveys were undertaken during the faunal habitat assessment.

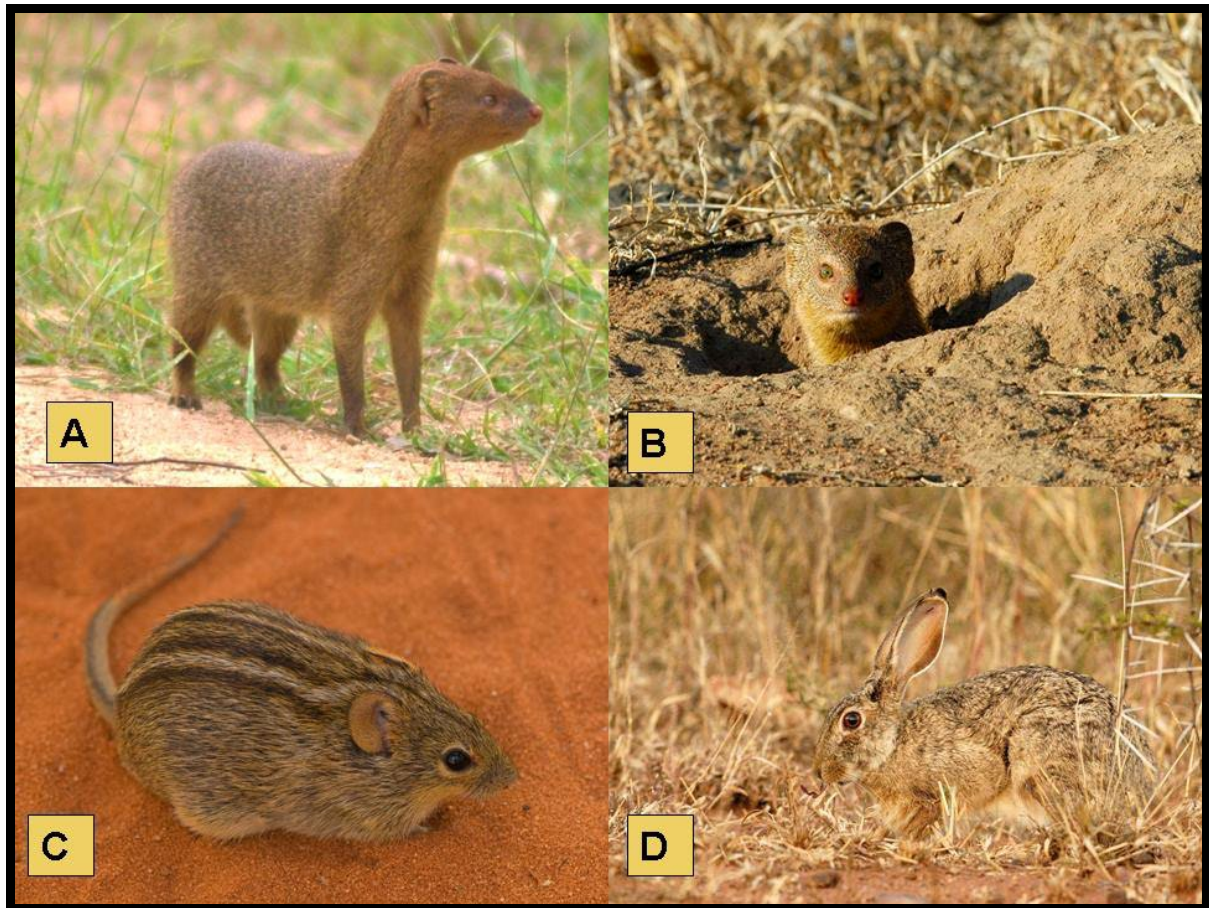


Figure 8. A collage of photographs of smaller mammal species likely to occur on the site. **A:** Slender Mongoose (*Galerella sanguinea*); **B:** Yellow Mongoose (*Cynictis penicillata*) were recorded darting across the secondary access roads as well as open grasslands. **C:** Suitable habitat for Striped Mouse (*Rhabdomys pumilio*) occurs within the open grasslands on the NE portion of the site. **D:** A Scrub Hare (*Lepus saxatilis*) was flushed from the rank *Digitaria eriantha* on the north-eastern section of the site during the March 2022 site visitation.

7. DISCUSSION

7.1 Vegetation

7.1.1 Vegetation type

The vegetation of the study area belongs to the **endangered Vaal-Vet Sandy Grassland vegetation type** (Gh 10) (Mucina & Rutherford 2006). This vegetation type occurs at altitudes ranging between 1260-1360 m within the Northwest and Free State Provinces. It occurs on plains dominated areas and consist of undulating terrain. The dominance of the vegetation by the climax grass *Themeda triandra* is characteristic. Areas that are heavily overgrazed are characterised by the prominence of the grasses *Elionurus muticus* and *Cymbopogon* spp. The vegetation type is found on aeolian and colluvial sand overlying sand and mudstone.

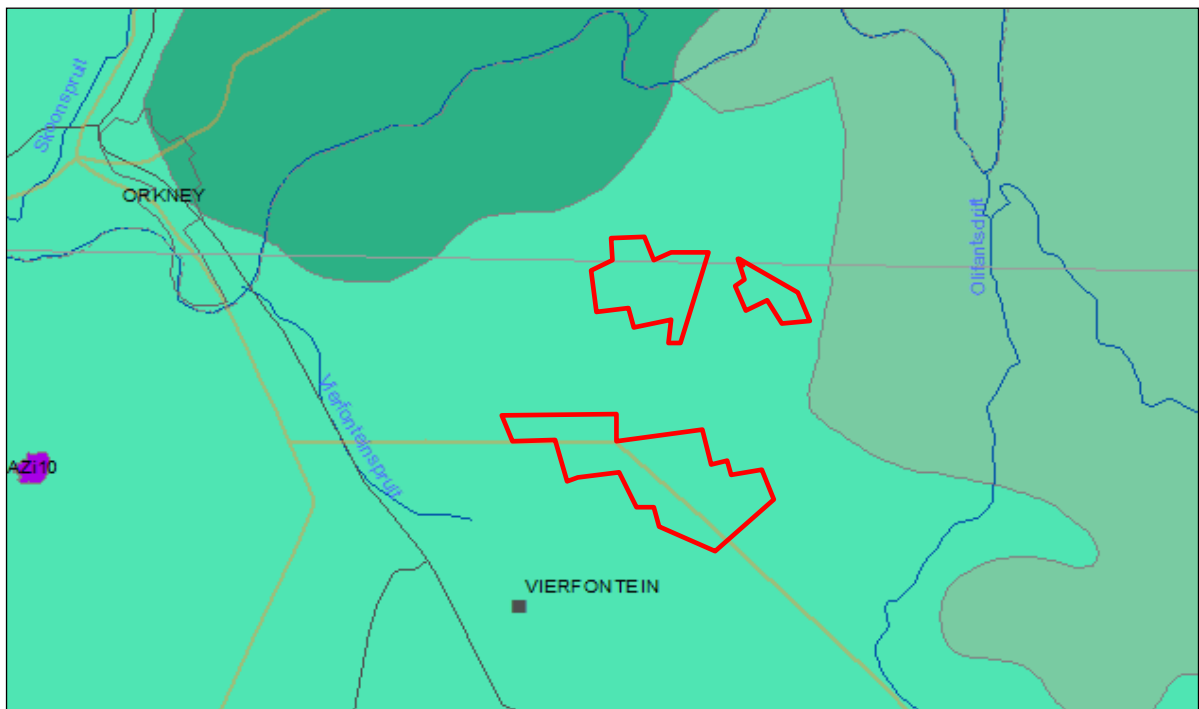


Figure 9. Approximate location (red lines) of the study area within the Vaal-Vet Sandy Grassland vegetation type (Gh 10) (image obtained Mucina & Rutherford, 2006).

The vegetation is dominated by the grasses *Antheophora pubescens*, *Aristida congesta*, *Cymbopogon caesius*, *Cynodon dactylon*, *Digitaria argyrograpta*, *Elionurus muticus*, *Eragrostis chloromelas*, *Setaria sphacelata*, *Themeda triandra*, *Eragrostis trichophora*, *Heteropogon contortus*, and the forbs *Stachys spathulata*, *Barleria macrostegia*, *Geigeria*

aspera, *Monsonia burkeana*, *Hermannia depressa*, *Hibiscus pusillus* *Selago densiflora*. The low shrubs *Pentzia globosa* and *Ziziphus mucronata* are also prominent.

This vegetation type is regarded as being endangered with only 0.3% statutorily conserved of the target of 24%. More than 60% is already transformed due to cultivation and overgrazing.

The vegetation of the study area shows little resemblance with this vegetation type.

7.1.2 Ecosystem classification

According to the Free State Nature Conservation (SANBIGIS) the larger area including the study sites the largest part of the site is listed as degraded or “other”. The seasonal stream (unit 5) is also listed as “other” (Figure 10). None of the PV cluster areas are listed as areas of concern.

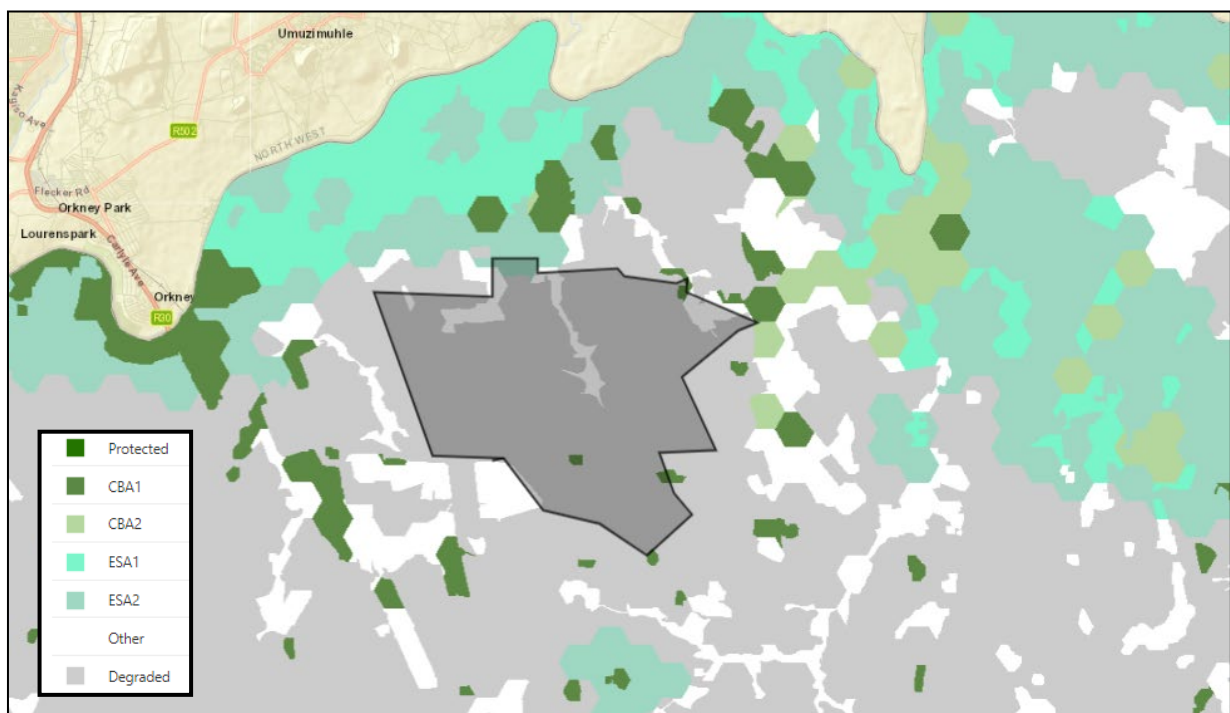


Figure 10. Ecosystem classification of the site according to Free State Nature Conservation (source: SANBI GIS, 2021).

7.1.3 Department of Forestry, Fishery & the Environment (DFFE)

Fauna

According to the DFFE screening tool the study area has an overall Low faunal sensitivity with smaller sections regarded as having a Medium faunal sensitivity.

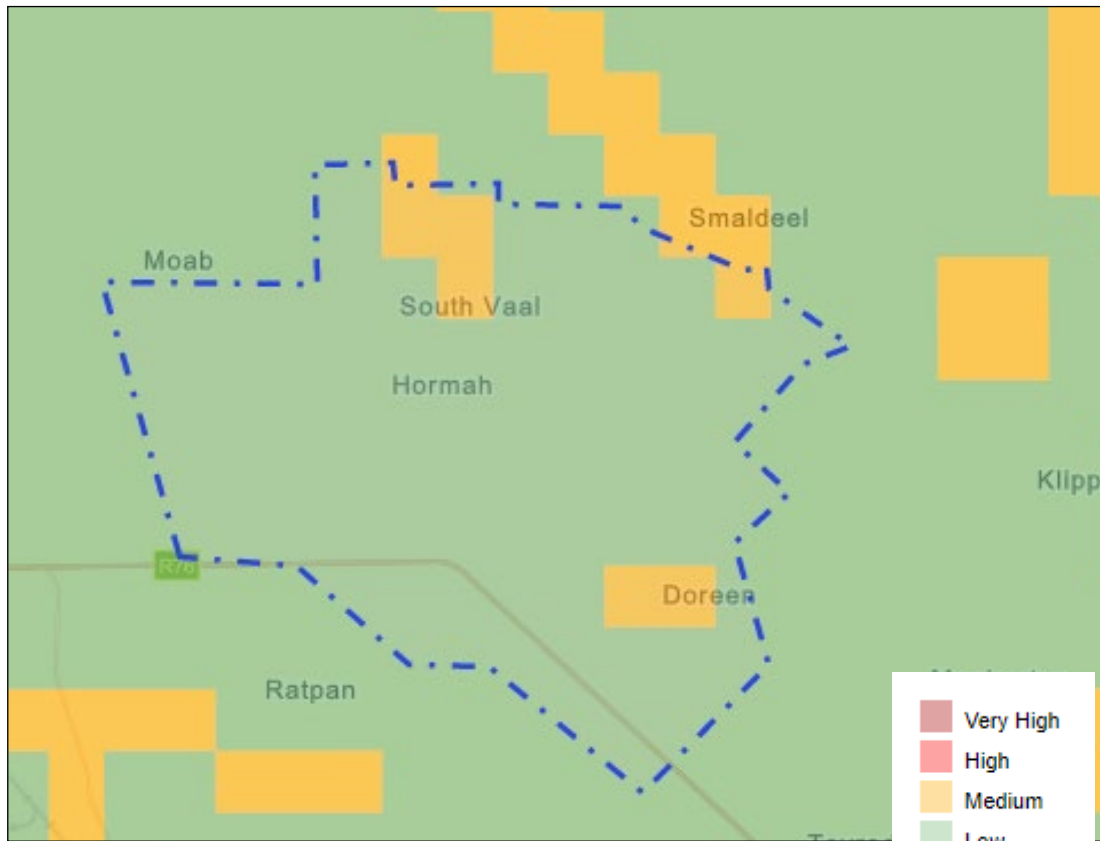


Figure 11. Map of relative faunal sensitivity (Source: Department of Forestry Fishery & Environment, 2022).

Flora

According to the DFFE screening tool the vegetation of the study area has an overall Low floral sensitivity with smaller sections regarded as having a Medium floral sensitivity.



Figure 12. Map of relative plant sensitivity (Source: Department of Forestry Fishery & Environment, 2022).

Terrestrial biodiversity

According to the DFFE screening tool the study area has a High terrestrial biodiversity sensitivity.



Figure 13. Map of relative terrestrial biodiversity sensitivity (top = Northern PV Farms; bottom = Southern PV Farms) (red= High) (Source: Department of Forestry Fishery & Environment, 2022).

7.1.4 Vegetation units

The ***Eragrostis curvula-Cynodon dactylon* grassland (vegetation unit 1)** is dominated by two secondary successional grasses *Eragrostis curvula* and *Cynodon dactylon*. Both these grasses are indicative of previous disturbance though *Eragrostis curvula* is used as a planted pasture grass in many areas and could have been overseeded in the area hence its dominance. This unit is used for grazing by cattle and as a result the grasses are grazed short (see top photo right). In the areas where either water points or supplementary feeding was placed and where overgrazing has taken place, the opportunistic indigenous invader shrub *Asparagus laricinus* forms dense clumps (see bottom photo right). Single individuals of the declared invader tree *Eucalyptus camaldulensis* are present in some areas. In the northern section of this unit a few moist grass patches



where the grass *Imperata cylindrica* occurs are present. The area is mostly level while the grass layer has a high cover resulting in little signs of erosion. This vegetation unit has a low species diversity with mostly pioneer and secondary successional plant species. From a plant ecological and ecosystem functioning point of view this unit has a **low conservation value and ecosystem functioning**. From a faunal perspective the secondary grasslands have a **Medium Conservation value** as they offer suitable habitat for foraging, dispersal and refuge for remaining faunal species.



The **Wetland areas (vegetation unit 2)** occur in the eastern section of the Northern PV farms and in the south of the Southern PV farms. These ecosystems occur in small depressions within the surrounding grassland areas and are either permanently or seasonally wet (see photo right). The vegetation of these areas is mostly natural and undisturbed. These sensitive ecosystems play an important role in water retention as well as habitat for various bird, aquatic and insect species. The unit has a moderate-high species richness for such ecosystems and from a plant ecological and ecosystem functioning point of view they have a **high conservation value and ecosystem functioning**.



Vegetation unit 3 (*Eucalyptus camaldulensis* woodland) occurs scattered in planted bush clumps / old plantation stands on two farms of the study area. Some of these stands especially in the northern cluster have most probably been planted for commercial purposes in the past while others were in all likelihood planted in the past to act as wind break areas. These areas comprise tall



Eucalyptus trees some that have already become too old and died, while young seedlings are also visible. Due to the high vegetation cover the herbaceous layer is not well developed and consists of pioneer weedy species. *Eucalyptus camaldulensis* is a declared alien invader tree that may be planted for commercial purposes, but all landowners must submit a management plan to the conservation authorities that would prevent the species from spreading. This vegetation unit has from a plant ecological and ecosystem functioning point of view a **low conservation value and ecosystem functioning**.

The **Cultivated fields (vegetation unit 4)** is the largest unit within the study area and occurs in most of the PV farm clusters of the study area. This unit comprises current cultivated fields that are planted with maize crops (*Zea mays*) while the other sections comprise old, cultivated fields that have been left fallow. As a result, these areas are in an early secondary successional phase dominated by a large number of pioneer weedy species that covers approximately 90% of these areas. These areas have been transformed due to cultivation and as a result this vegetation unit has a **low conservation value and ecosystem functioning**.

The **Seasonal stream (vegetation unit 5)** stretches from south to west through the northern part of the study site. It forms a moderate to narrow waterway that channels surface water received from the adjacent grassland areas during the wet season. Large rock sheets occur

throughout the area (see top photo right) while the indigenous invader dwarf shrub *Asparagus larycinus* form dense clumps along the edge of the system (see bottom photo right).



The vegetation is mostly natural and although these areas are used for grazing by cattle, it has not been overgrazed with the vegetation cover remaining high and the vegetation composition being natural typical of seasonal systems. Watercourses are important ecosystems not only due to their water channeling and retention functions, but also due to the habitat it provides for various insect and aquatic organisms contributing to high biodiversity. From a plant ecological point of view this area is regarded as having a **high conservation value and ecosystem functioning**.

The ***Digitaria eriantha-Eragrostis curvula* grassland (vegetation unit 6)** is located in the northern cluster of the study site along the edges of the Seasonal stream (vegetation unit 5). The area is used for grazing by cattle, and it seems as though the grass *Digitaria eriantha* has been planted in the past. The vegetation is characterised by plant species indicative of disturbance such as the grasses *Eragrostis curvula*, *Pogonarthria squarrosa*,

Trichoneura grandiglumis and the forbs *Crotalaria sphaerocarpa*, *Felicia muricata* and *Monsonia angustifolia*. The area has a moderate vegetation cover with only a few areas where some signs of erosion and trampling are present. The terrain is undulating with small rocks present. The vegetation has been disturbed in the past, but there are still some natural species present, though it is not resembling the original native vegetation that occurred in the area. The unit has a moderate species richness and from a plant ecological and ecosystem functioning a **low conservation value and ecosystem functioning**. From a faunal perspective the secondary grasslands have a **medium conservation value** as they offer suitable habitat for foraging, dispersal and refuge for remaining faunal species.

Vegetation unit 7 (*Seriphium plumosum* shrubland) is an old, cultivated field that have been left fallow for many years. The area has become encroached by the dwarf shrub *Seriphium plumosum* that will displace all other vegetation and become the dominant species with a resulting low species richness and diversity as is the case in this unit. The area has a low species richness with mostly pioneer and secondary successional species dominating. From a plant ecological and ecosystem functioning point of view this unit has a **low conservation value and ecosystem functioning**.

7.1.5 Topography and drainage

The study site is mostly level to undulating with only slight slopes towards the Seasonal stream (vegetation unit 6).

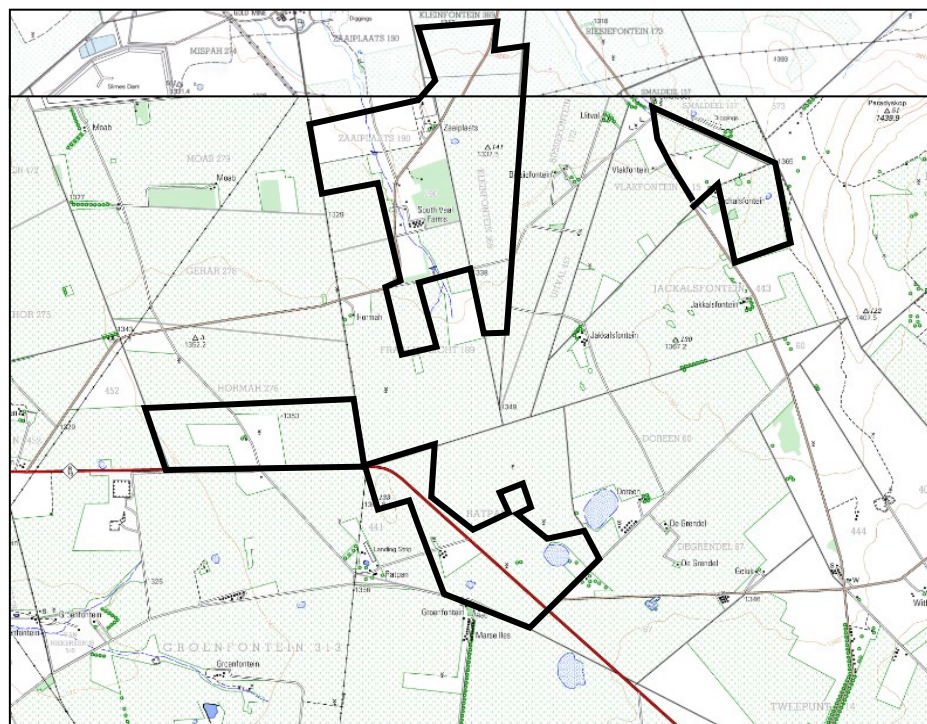


Figure 14. Topography and drainage of the study site (Image obtained from 1:50 000 Topographic maps, Chief Directorate Surveys & mapping, 1996; 1997).

7.1.6 Connectivity

The study site is surrounded by cultivated lands in all directions with only the Seasonal stream (vegetation unit 5) having connectivity with a similar system in the north.

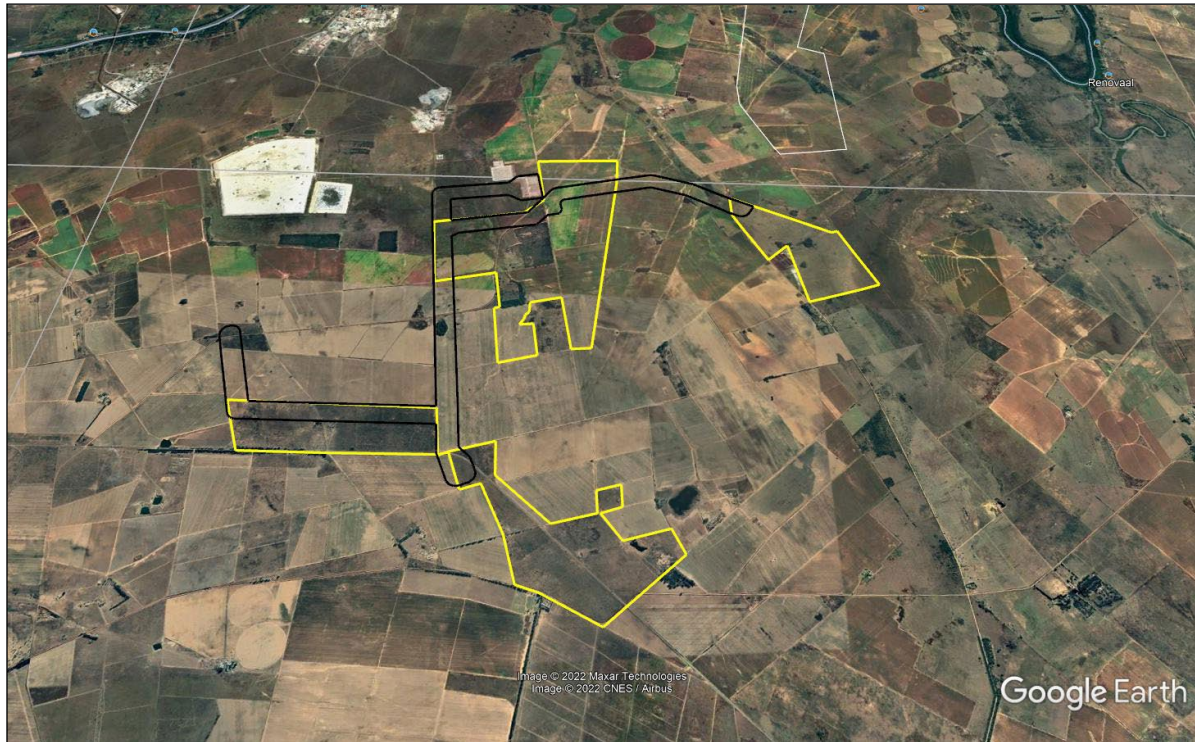


Figure 15. Connectivity of the study site (Yellow lines=clusters; Black lines=Powerline corridors) (Source: Google Earth 2022)

7.1.7 Red data species

The presence of a subpopulation of a species of conservation concern on a site is used as an indicator amongst other, of the sensitivity of the vegetation ecosystem. If such a species is found to be present, the competent authority may refuse authorisation for the proposed activity or require mitigation measures to be implemented. Lists of red data species are normally acquired via various resources and if no specific recording was made/confirmed on the site, lists obtained from the Quarter Degree Grid Cells (QDGC) are used as a broad guideline. At this broad scale, the list will include species that may not necessarily be found on the proposed site since no suitable habitat exists. These lists therefore provide broad guidelines only but are nonetheless useful tools to assess the habitat suitability of the site for these species.

According to the lists obtained from literature and previous studies in the QDGC there is a total of 13 red data plant species that could be found in similar habitats as the study area.

The confidential list is included as Annexure 1. No such species were found within the study area though vegetation units 2 and 5 provide marginal habitat for one species.

7.1.8 Protected species

No protected plant species were observed during the field surveys.

7.1.9 Medicinal plants

Only three (3) medicinal plant species were recorded on the study site and are listed in the table below.

Table 7 List of medicinal plant species identified in the study area

Plant name	Plant part used	Medicinal use	Vegetation unit
<i>Datura stramonium</i>	Leaves & green fruit	Asthma, rheumatism, abscesses, bronchitis, tonsillitis	3
<i>Gomphocarpus fruticosus</i>	Leaves, sometimes roots	Headache, stomach pain, tuberculosis.	2; 5; 7
<i>Typha capensis</i>	Fleshy rhizomes	Diarrhea, dysentery, male potency enhancer, blood circulation improvement	5

None of the medicinal plant species present are threatened and occur abundantly within the Province, while *Datura stramonium* is a category 1 alien invasive weed.

7.1.10 Alien plant species

Only five (5) declared alien invasive species were noted throughout the area and are listed below:

Table 8 List of alien plant species identified in the study area.

Species	CARA	NEMBA	Vegetation units						
			1	2	3	4	5	6	7
<i>Cirsium vulgare</i> (Savi) Ten.	1	1b				●	●		
<i>Datura stramonium</i> L.	1	1b			●				
<i>Eucalyptus camaldulensis</i> Dehnh.	1	2	●		●				
<i>Prosopis glandulosa</i>	2	1b EC; FS; NW; WC	●						
<i>Verbena bonariensis</i> L.		1b				●	●	●	

7.1.11 Site Ecological Importance

According to the **Site Ecological Importance** analysis vegetation units 1, 3, 4, 6 & 7 have a VERY LOW biodiversity importance, while vegetation units 2 & 5 have a MEDIUM biodiversity importance.

Table 9. Biodiversity Matrix for vegetation units 3, 4 & 7 (South African National Biodiversity Institute, 2020).

BIODIVERSITY IMPORTANCE		Conservation Importance				
		Very High	High	Medium	Low	Very Low
Functional Integrity	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

Table 10. Biodiversity Matrix for vegetation units 1 & 6 (South African National Biodiversity Institute, 2020).

BIODIVERSITY IMPORTANCE		Conservation Importance				
		Very High	High	Medium	Low	Very Low
Functional Integrity	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

Table 11. Biodiversity Matrix for vegetation units 2 & 5 (South African National Biodiversity Institute, 2020).

BIODIVERSITY IMPORTANCE		Conservation Importance				
		Very High	High	Medium	Low	Very Low
Functional Integrity	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

7.2 Fauna

7.2.1 Amphibians



Figure 16. The Giant Bullfrog (*Pyxicephalus adspersus*) has been recorded by the consultant within the Klerksdorp-Potchefstroom areas. Remaining populations are threatened due to extensive habitat transformation due to increased urban sprawl and degradation to the breeding habitats (endorheic pans) within the area. Large numbers are killed annually after heavy summer downpours migrating towards suitable breeding habitats on the adjacent major road networks. Adults are also harvested for human consumption. No suitable breeding habitat for Giant Bullfrogs on the site or adjacent property. The seasonal wetlands are degraded due to adjacent agricultural activities or invaded by dense thickets of pioneer and alien invasive vegetation (*Verbena bonariensis*).

Threatened species

The Giant Bullfrog (*Pyxicephalus adspersus*) is a protected frog species whose conservation status has been revised and was previously included as a Red Data Species under the category 'Lower Risk near threatened' (Minter et al. 2004). The Giant Bullfrog has been down-graded to 'Least-Concern' (Measey et. al. 2011). The seasonal wetlands on the

site offer no suitable breeding habitat for Giant Bullfrogs as they have been heavily impacted by previous agricultural activities. The shallow seasonal pans or depressions have been ploughed and planted with maize. The valley bottom wetlands have been artificially embanked into permanent dams with predatory fish. Remaining pans or depressions within the southern cluster are heavily invaded by the Category 1b *Verbena bonariensis*. There are no records of Giant Bullfrogs for the 2626DD and 2726BB QDGC according to FrogMAP.

7.2.2 Reptiles

Threatened species

Continual destruction of suitable open grassland habitats has resulted in the disappearance of numerous reptile species on the site. One snake species (Mole Snake) was recorded during the brief field survey. No threatened reptile species have been recorded within the 2626DD and 2726BB QDGC according to ReptiMAP or are likely to occur on the site due to lack of suitable habitat. The wetlands and stream offer suitable habitat for the 'protected' Nile Monitor (*Varanus niloticus*).

7.2.3 Mammals

Threatened species

Table 12 Red Data List mammal species with confirmed records from the 2626DD & 2726BB QDGC and for which suitable habitat is present, and which may therefore occur within the study area

TAXONOMIC INFORMATION				RED LISTING INFORMATION				
Order	Family	Scientific name	Common name	2016 Regional Listing	2016 Regional listing Criteria	Current global listing	Global listing criteria	TOPS 2007
Carnivora	Felidae	<i>Leptailurus serval</i>	Serval	Near Threatened	A2c; C2a(i)	Least Concern	None	Protected
Carnivora	Mustelidae	<i>Aonyx capensis</i>	Cape Clawless Otter	Near Threatened	C2a(i)	Near Threatened	A2cde+3cde	Protected
Erinaceomorpha	Erinaceidae	<i>Atelerix frontalis</i>	South African Hedgehog	Near Threatened	A4cde	Least Concern	None	Protected

Several red listed mammal species have been recorded from the 2626DD and 2726BB QDGC according to MammalMAP including the Near-Threatened Cape Clawless Otter (*Aonyx capensis*), the “Vulnerable’ Tsessebe (*Damaliscus lunatus*) *lunatus*, Bontebok (*Damaliscus pygargus pygargus*), Hartman’s Mountain Zebra (*Equus zebra hartmannae*) and “Near-Threatened” Lechwe (*Kobus lechwe*). The site offers no suitable habitat for Tsessebe, Bontebok, Hartman’s Mountain Zebra or Lechwe. These will be restricted to the private and provincial nature reserves. The open secondary succession grasslands and palustrine wetlands and seasonal drainage line offer marginally suitable habitat for Serval, African Clawless Otters and South African Hedgehogs.

Serval (*Leptailurus serval*)

Serval occur in dense, well-watered grassland and reed beds and are always associated with water. In South Africa they occur from the Eastern Cape northwards into Mpumalanga lowveld and Limpopo Valley. Servals have been recorded in the Drakensberg highlands and inland mountain highlands (Magaliesberg, Soutpansberg, Waterberg). Servals are predominantly nocturnal, with limited activity during the early morning and late afternoon. Diurnal activity is unusual and adequate cover is required during periods of inactivity. Servals have been displaced mainly due to habitat loss through agricultural and forestry activities. Populations are secure within protected areas. Servals have been experiencing a recent range expansion due to the formation of several farm dams and have moved into the Free State Province along the rivers and drainage lines. The rank grasslands and hygrophilous sedges within the seasonal wetlands and drainage line/stream as well as adjacent macrophyte/reed invaded dams and depressions offer suitable foraging, dispersal and refuge habitat for the highly secretive and elusive Serval.

Significantly

African Clawless Otter (*Aonyx capensis*)

The African or Cape Clawless Otter is distributed widely in sub-Saharan Africa where there is suitable aquatic habitat. They occur in Limpopo, Mpumalanga, Gauteng, North West, Kwazulu-Natal, Eastern Cape, Western Cape and Northern Cape provinces. Being predominantly aquatic they don’t wander widely from water and throughout their range they occur in rivers, lakes, swamps and dams and up the tributaries of rivers into small streams. The otters feed on crabs, fish, frogs and other aquatic life. As the small streams dry up they move down to more permanent water. If they wander away from water, they invariably return to it as it is an essential requirement. The association in which the terrestrial aquatic habitat occurs can range from forest to woodland to open grassland and otters occurrence bears no relation to surrounding terrain provided that the aquatic conditions are suitable

and there is adequate cover which to rest. The seasonal stream and adjacent wetlands offer suitable foraging, dispersal and refuge habitat for African Clawless Otter.



Figure17. The South African Hedgehog has been recorded in open grasslands in Kelrksdorp by the consultant. They still persist in some well-established suburban gardens and residential plots.

South African Hedgehog (*Atelerix frontalis*)

South African Hedgehogs occur in such a wide variety of habitats that it is difficult to assess its habitat requirements. The one factor that is common to all the habitats in which they occur is dry cover, which they require for resting places and breeding purposes. Habitat must provide a plentiful supply of insects and other foods.

Suburban gardens provide these requirements, and this may explain their occurrence in this type of habitat. South African Hedgehogs are predominantly nocturnal, becoming active after sundown, although, after light rains at the commencement of the wet season, they may be active during daylight hours (Skinner & Smithers, 1990). The secondary succession *Eragrostis curvula-Cynodon dactylon* grasslands on the North-eastern portion of the site offers suitable habitat for South African Hedgehogs.

No evidence of any threatened mammal species was recorded during the brief site visitations (24 hours). More intensive surveys (using camera traps) are required in order to ascertain the current conservation status of these secretive, threatened mammal species on the site.

7.3 Cumulative loss

According to the DFFE database, there are seven (7) other renewable energy projects within a 30 km radius of the proposed development area studied in this report. In addition, there are another four (4) projects associated with this current one. The cumulative impact is affecting a mostly agricultural environment that has been declared a Renewable Energy Development Zones (REDZ) because it is an environment that can accommodate numerous renewable energy developments without exceeding acceptable levels of agricultural land loss.

This is primarily because farms in the area have a proportion of their surface area covered by lower potential soils that are unsuitable for crop production and can therefore be utilised for solar development without significantly lowering the future production potential of the farmland. In quantifying the cumulative impact, the area of land that is to be used for REDZ (mostly grazing) as a result of all 12 developments (total generation capacity of 1,140 MW) will amount to a total of approximately 2,850 hectares. As a proportion of the total area within a 30km radius (approximately 282,700 ha) (Figure 18), this amounts to only 1.01% of the surface area. This is within an acceptable limit in terms of loss of land that is only suitable as grazing land. Furthermore, of the approximately 1 444 ha studied for this project a total area of 1 357 ha (94%) was found to be agricultural, degraded or transformed meaning only small areas (Vegetation units 1, 2, 5 & 6) comprising approximately 87 ha (0.03% of the 30km radius area) were found to provide habitat for indigenous plant and animal species. Thus, the cumulative impact of this proposed development on the fauna and flora of the areas is regarded as being minimal and being within an acceptable level.

As discussed above, the proposed developments pose a low risk in terms of causing terrestrial (fauna & flora) degradation (which can be adequately and fairly easily managed by standard best practice mitigation management actions included in this report).

Due to all of the considerations discussed above, the cumulative impact of loss of future natural ecosystems and their associated fauna will not have an unacceptable negative impact on the natural environment of the area. The proposed developments are therefore acceptable in terms of cumulative impact, and it is therefore recommended that it be approved.

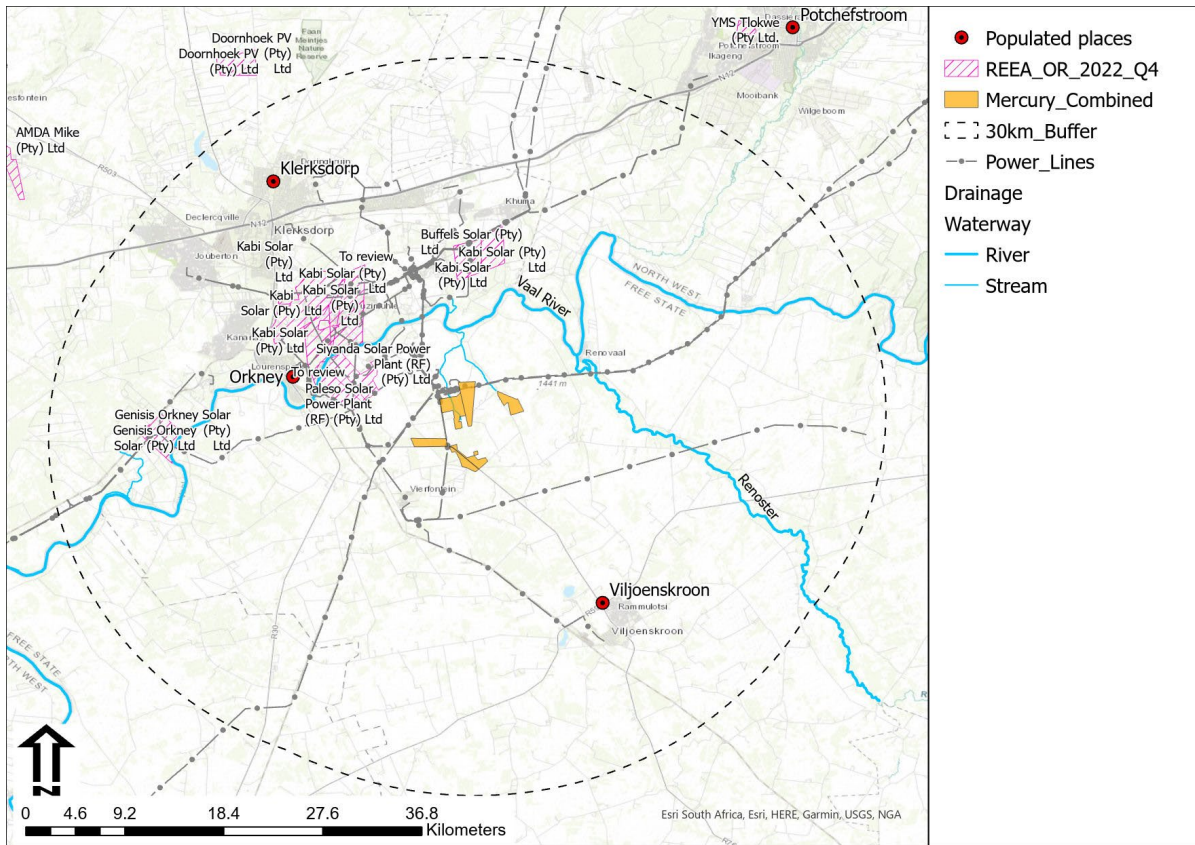


Figure 18. Total area within a 30 km buffer zone around the project where REDZ developments are planned.

8. POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE ASSOCIATED FAUNA & FLORA

The following assessment of impacts was done and was guided by the requirements of the NEMA EIA Regulations (2014) and is presented in the tables below:

DESIGN AND PRE-CONSTRUCTION PHASE

IMPACT DESCRIPTION (Zaaiplaats, Kleinfontein, Vlakfontein, Hormah, Ratpan; Corridor)

Site clearing and preparation

Certain areas of the site will need to be cleared of vegetation and some areas may need to be levelled. Envisaged impacts:

- Loss of plant species
- Loss of rare/medicinal species
- Loss of animal species
- Loss of biodiversity
- Increased soil erosion
- Alien plant invasion

Cumulative impact description

Based on the proposed development as well as the known developments planned in the region the cumulative impact on biodiversity (as listed above) should be negligible if all mitigation as recommended is implemented.

Mitigation

No development should be allowed in vegetation units 2 & 5 (Wetland areas & Seasonal Stream). These areas should be fenced off prior to construction and zoned as no-go areas.

- The entire area to be developed must be clearly demarcated prior to initial site clearance and prevent construction personnel from leaving the demarcated area
- To minimise the effect on the vegetation, insects, small mammals, and environment it is recommended that the construction be done within the winter period as far as possible, when most plants are dormant and animals less active
- Where vegetation of areas not to be developed needs to be “opened” to gain access it is recommended that the herbaceous species are cut short rather than removing them.
- Vegetation clearance should be restricted to the approved development areas allowing remaining animals the opportunity to move away from the disturbance. The Environmental Control Officer (ECO) should recommend, and the ECO should monitor these areas.
- Any disturbed or eroded areas within the PV sites should be appropriately revegetated.

Only indigenous (to the area) grass species are recommended.

- Storage of equipment, fuel and other materials should be limited to demarcated areas. They should be established outside of the demarcated buffers as per the Aquatic Impact Assessment as well as outside any no-go area previously mentioned.
- No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site
- A Re-vegetation and Rehabilitation Manual should be prepared for the use of contractors, landscape architects and groundsmen to rehabilitate areas that became degraded due to construction activities.
- Alien invasive plants present within the various vegetation units must be removed and eradicated throughout all stages of the project.
- All stormwater and runoff generated by the development activities must be appropriately managed
- Monitoring of all these activities must be done on at least a weekly basis by the ECO during the construction phase of the development to ensure that minimal impact is caused to the fauna and flora of the area. Any transgressing of rules must be reported to and by the ECO.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of plant and animal species	Site	Medium term	Probable	Medium	Moderate	Low
Impact on Irreplaceable Resources (<i>after</i> mitigation) If yes, please explain					YES	NO
Cumulative impact rating (<i>after</i> mitigation) If high, please explain				Low	Medium	High

IMPACT DESCRIPTION (Zaaiplaats, Vlakfontein, Ratpan; Corridor)

Wetland/Seasonal stream area degradation

Envisaged impacts:

Soil compaction, erosion and sedimentation for the river and riparian area

Soil and water pollution for the stream and riparian area

Spread and establishment of alien invasive species in the stream and riparian area

Cumulative impact description

Based on the proposed development as well as the known developments planned in the region the cumulative impact on watercourses of the area should be negligible if all mitigation as recommended (excluding all watercourses from development) is implemented.

Mitigation

No development should be allowed in vegetation units 2 & 5 (Wetland areas & Seasonal Stream). These areas should be fenced off prior to construction and zoned as no-go areas.

- The palustrine wetlands, seasonal stream and appropriate buffer zones must be fenced off prior to construction and declared as a No-Go area.
- Fences must not restrict the dispersal or exploratory movements of remaining faunal species. Palisade fencing with a minimum of 15cm gap is recommended adjacent to the conserved wetlands and buffer zones as well as along the seasonal stream and buffer zone.
- An alien vegetation removal programme needs to be implemented within the conserved wetland areas.
- Disturbed areas around the wetlands as well as the proposed buffer zones must be re-vegetated with an indigenous (to the area) grass seed mixture.
- No hazardous materials should be stored within the demarcated buffers of the river area as per the Aquatic Impact Assessment.
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) and surface water in the area.
- No cleaning of equipment should be done within the demarcated buffers as per the Aquatic Impact Assessment. This includes the establishment of temporary and permanent offices and ablution facilities
- All vehicles and equipment should be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area outside of the demarcated buffers as per the Aquatic Impact Assessment of the watercourses to prevent ingress of hydrocarbons into topsoil.
- No dumping or storage of waste should take place within the watercourse areas.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Watercourse degradation	Local	Medium term	Probable	Low	High	Low
Impact on Irreplaceable Resources (<i>after</i> mitigation) If yes, please explain					YES	NO
Cumulative impact rating (<i>after</i> mitigation) If high, please explain				Low	Medium	High

CONSTRUCTION PHASE

IMPACT DESCRIPTION (Zaaiplaats, Kleinfontein, Vlakfontein, Hormah, Ratpan; Corridor)

Loss of Fauna & Flora

Envisaged impacts:

- Vegetation clearance/habitat destruction
- Soil erosion and pollution
- Spread and establishment of alien invasive plant species
- Negative effect of human activities on fauna and road mortalities
- Loss of biodiversity

Cumulative impact description

Based on the proposed development the cumulative impact on biodiversity (as listed above) would be negligible if all mitigation as recommended is implemented.

Mitigation

- All temporary stockpile areas, litter and dumped material and rubble must be removed and disposed of at a licensed land fill facility. Proof of safe disposal must be obtained and kept on record for monitoring purposes.
- The careful position of soil piles, and runoff control, during all phases of development, and planting of some vegetative cover after completion (indigenous groundcover, grasses etc.) will limit the extent of erosion occurring on the site.
- Undeveloped areas that were degraded due to human activities must be rehabilitated using indigenous to the area vegetation.
- Hazardous chemicals must be stored on an impervious surface accompanied by Safety Data Sheets (SDS) and protected from the elements. These chemicals must be strictly controlled, and records kept of when it was used and by whom
- Limit human activity in the no-developed areas as well as the completed areas to the minimum required for ongoing operation
- Any alien plant observed should be reported to the environmental manager and should be removed as soon as possible.
- Regular monitoring (monthly) for damage to the environment as well as establishment of alien plant species must be conducted.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of fauna & flora	Site	Medium term	Probable	Medium	Moderate	Low
Impact on Irreplaceable Resources (after mitigation) If yes, please explain					YES	NO
Cumulative impact rating (after mitigation) If high, please explain				Low	Medium	High

IMPACT DESCRIPTION (Zaaiplaats, Vlakfontein, Ratpan; Corridor)

Degradation of watercourse areas

Envisaged impacts:

- Erosion of streambank
- Loss of wetland habitat
- Soil & water pollution

Cumulative impact description

Based on the proposed development the cumulative impact on watercourses during the construction phase of the area would be negligible if all mitigation as recommended below is implemented.

Mitigation

No development should be allowed in vegetation units 2 & 5 (Wetland areas & Seasonal Stream). Drainage must be controlled to ensure that runoff from the site will not culminate in off-site pollution or result in rill and gully erosion or any erosion of the watercourses

- Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage
- The release of storm water must be designed such that the force of the water is reduced to prevent unnecessary erosion
- No dumping of waste should take place within the watercourse areas. If any spills occur, they should be cleaned up immediately.
- Adequate toilet facilities must be provided for all staff to prevent pollution of the environment
- No person/s must be allowed within the fenced-off watercourse areas unless for rehabilitation or alien plant removal.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Watercourse degradation	Local	Long term	Possible	Low	High	Low
Impact on Irreplaceable Resources (<i>after</i> mitigation) If yes, please explain					YES	NO
Cumulative impact rating (<i>after</i> mitigation) If high, please explain				Low	Medium	High

POST-CONSTRUCTION AND OPERATIONAL PHASE

IMPACT DESCRIPTION (Zaaiplaats, Kleinfontein, Vlakfontein, Hormah, Ratpan; Corridor)

Loss of Fauna & Flora

Envisaged impacts:

- Habitat destruction caused by clearance of vegetation
- Soil and water pollution
- Spread and establishment of alien invasive species
- Negative effect of human activities on fauna and road mortalities
- Negative effect of fences on dispersal movements of fauna
- Negative effect of light pollution on nocturnal fauna

Cumulative impact description

Based on the implementation of the recommended mitigation measures, it is not thought that the continued maintenance of the sites would have an negative cumulative effect on biodiversity.

Mitigation

- All temporary stockpile areas, litter and dumped material and rubble must be removed and discarded in an environmentally friendly way
- Undeveloped areas that were degraded due to human activities must be rehabilitated with indigenous vegetation.
- Hazardous chemicals must be stored on an impervious surface and protected from the elements. These chemicals must be strictly controlled, and records kept of when it was used and by whom.
- Palisade fencing with adequate gaps (>15cm) is recommended for the conserved private open space around the seasonally inundated seepage wetlands and seasonal stream on the site.
- During the post-construction phase, artificial lighting must be restricted to security areas and not directed towards the conserved areas (seasonally inundated seepage wetlands and seasonal stream) in order to minimize the potential negative effects of the lights on the natural nocturnal activities.
- Regular monitoring must be undertaken to determine and degradation of the vegetation and or animal habitat.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Degradation of ecosystem	Site	Medium term	Unlikely	Medium	Moderate	Low
Impact on Irreplaceable Resources (<i>after</i> mitigation) If yes, please explain					YES	NO
Cumulative impact rating (<i>after</i> mitigation) If high, please explain				Low	Medium	High

IMPACT DESCRIPTION (Zaaiplaats, Vlakfontein, Ratpan; Corridor)

Surface water / watercourses

Envisaged impacts:

- Erosion
- Soil and water pollution
- Increase in stormwater run-off

Cumulative impact description

If all mitigation as recommended below is implemented the effect on the watercourses would be

negligible with no accumulated loss of water ecosystems.

Mitigation

- The release of storm water must be designed such that the force of the water is reduced to prevent unnecessary erosion
- No dumping of waste should take place within the riparian area. If any spills occur, they should be cleaned up immediately.
- Remove all substances which can result in groundwater (or surface water) pollution

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Degradation of ecosystem	Site	Medium term	Unlikely	Medium	Moderate	Low
Impact on Irreplaceable Resources (<i>after</i> mitigation) If yes, please explain					YES	NO
Cumulative impact rating (<i>after</i> mitigation) If high, please explain				Low	Medium	High

Environmental Control Officer (ECO)

A suitably qualified ECO should be appointed to monitor all activities and to report any actions that could or potentially could have a negative effect on the environment. It is recommended that photographic records are kept before, during and after construction of the various activities.

9. IMPACT STATEMENT

9.1 Conclusion & recommendations

The study area comprises farmland of which the largest sections are cultivated or left as fallow land. The few remaining grassland areas are used for grazing by cattle and is mostly degraded due to the planting of pastures or the continued grazing for many years. Various areas are present where the declared invader tree *Eucalyptus camaldulensis* has been planted in the past for various reasons. The vegetation of the three clusters is not representative of the original native vegetation and vegetation type that occurred in the area mainly as a result of the past and current agricultural activities.

Vegetation units 1 and 6 (*Eragrostis curvula*-*Cynodon dactylon* grassland & *Digitaria eriantha*-*Eragrostis curvula* grassland) have been used and currently are for grazing purposes by cattle. It seems as though some overseeding of the grasses *Eragrostis curvula* and *Digitaria eriantha* has taken place in the past to improve grazing value. These areas are thus dominated by these grasses as well as the secondary successional / pioneer grass *Cynodon dactylon*. The areas are used for rotational grazing practices and are thus fairly well managed with the vegetation cover remaining high. The vegetation has a moderate to low species richness and is mostly not representative of the original native vegetation that occurred in the area. There are, however, no signs of erosion or habitat degradations. These two units are from a faunal and floral ecological perspective regarded as having a **medium ecological sensitivity**.

Vegetation unit 3 (*Eucalyptus camaldulensis* woodland) are old forest plantations that are dominated by the declared alien invader tree *Eucalyptus camaldulensis* and is from an ecological point of view regarded as being transformed with no resemblance to the original native vegetation. This unit is regarded as having a **low ecological sensitivity**.

Vegetation units 4 and 7 (Cultivated fields & *Seriphium plumosum* shrubland) are used for the cultivation of crops with some areas left fallow for some years. The areas are transformed with no native vegetation resembling the original vegetation present in the area and as a result have a **low ecological sensitivity**.

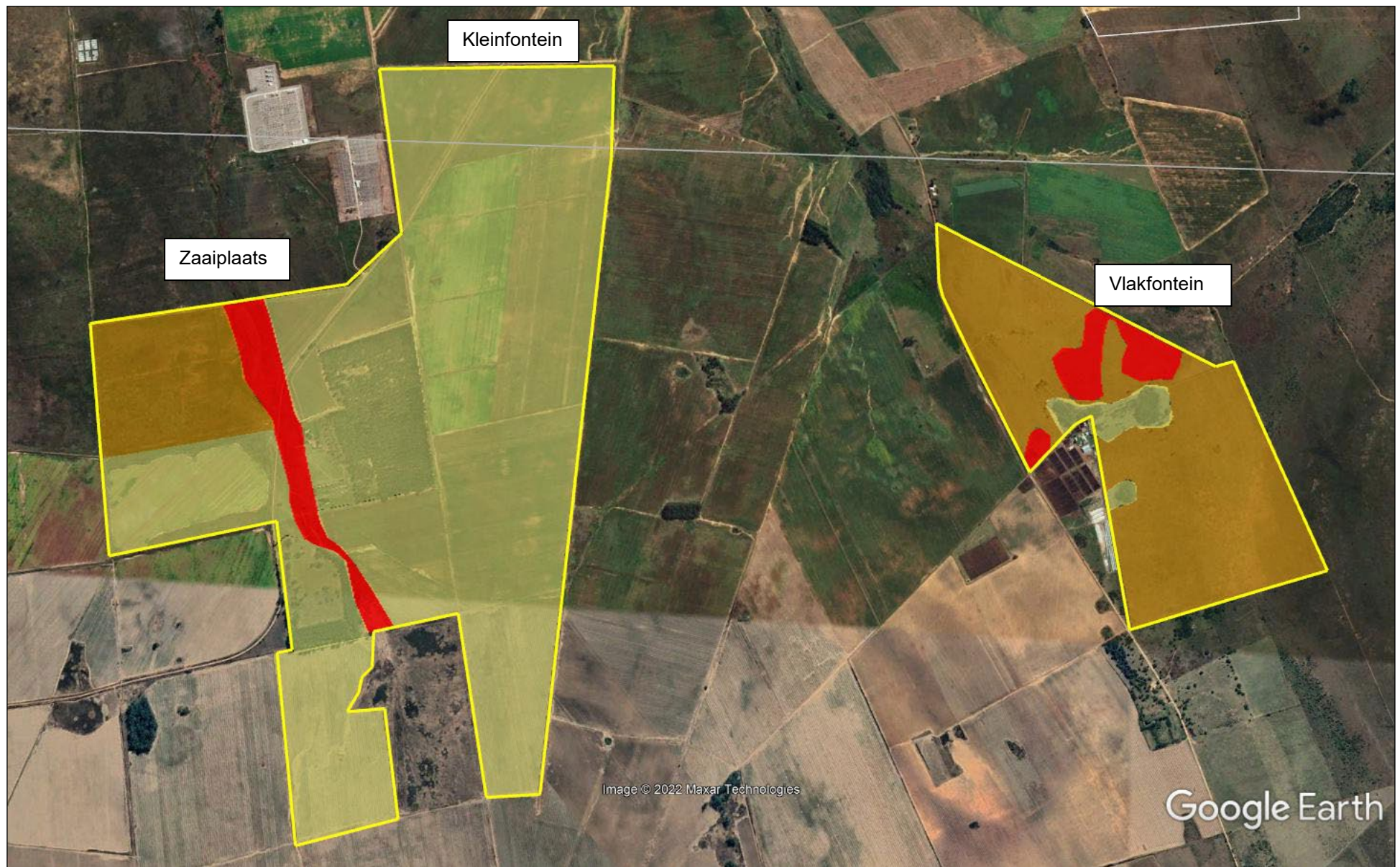


Figure 19. Sensitivity map of the different vegetation units of the Northern PV Farms cluster (Yellow=Low; Orange=Medium; Red=High) (Source: Google Earth, 2022).

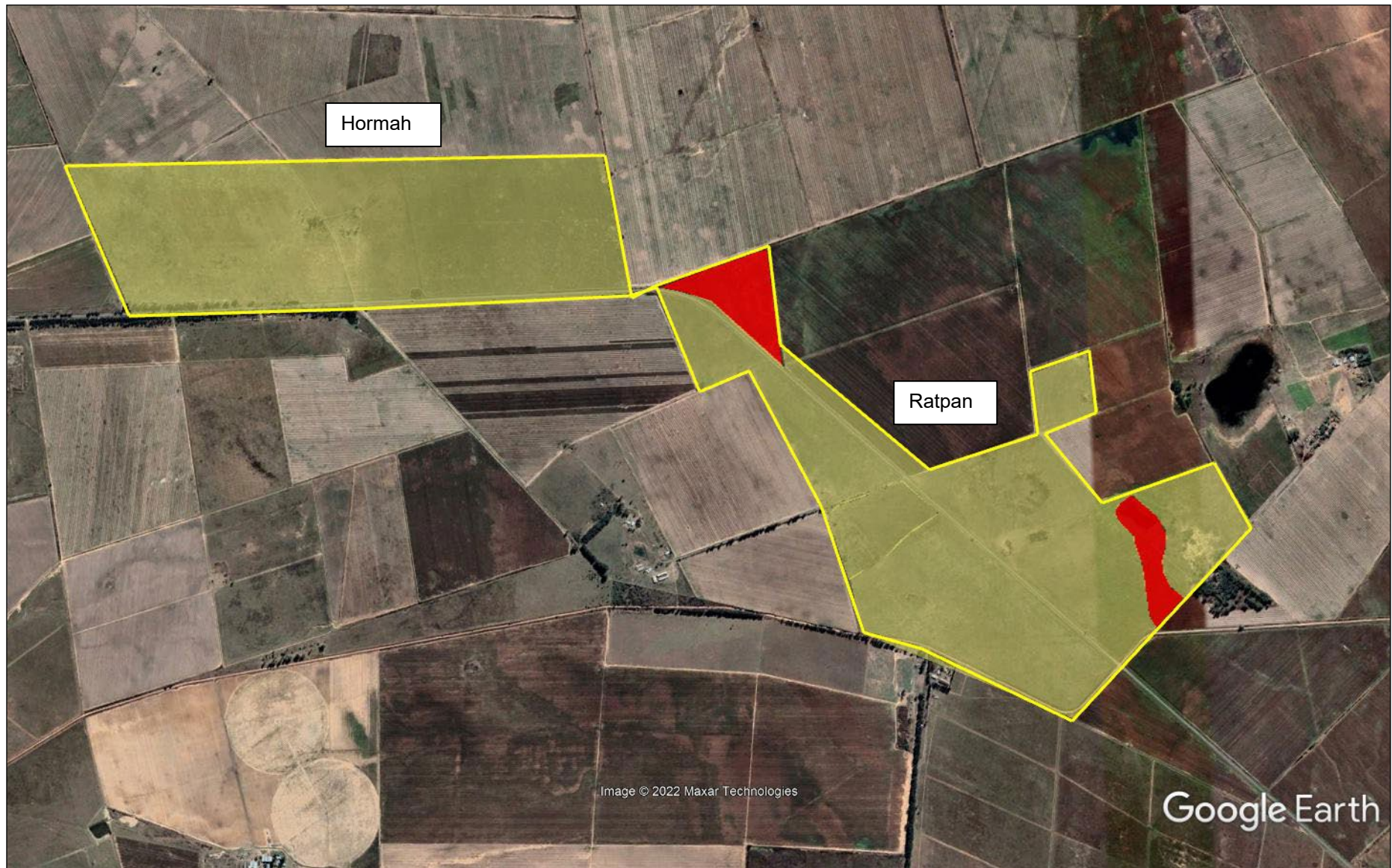


Figure 20. Sensitivity map of the different vegetation units of the Southern PV Farms cluster (Yellow=Low; Red=High) (Source: Google Earth, 2022).

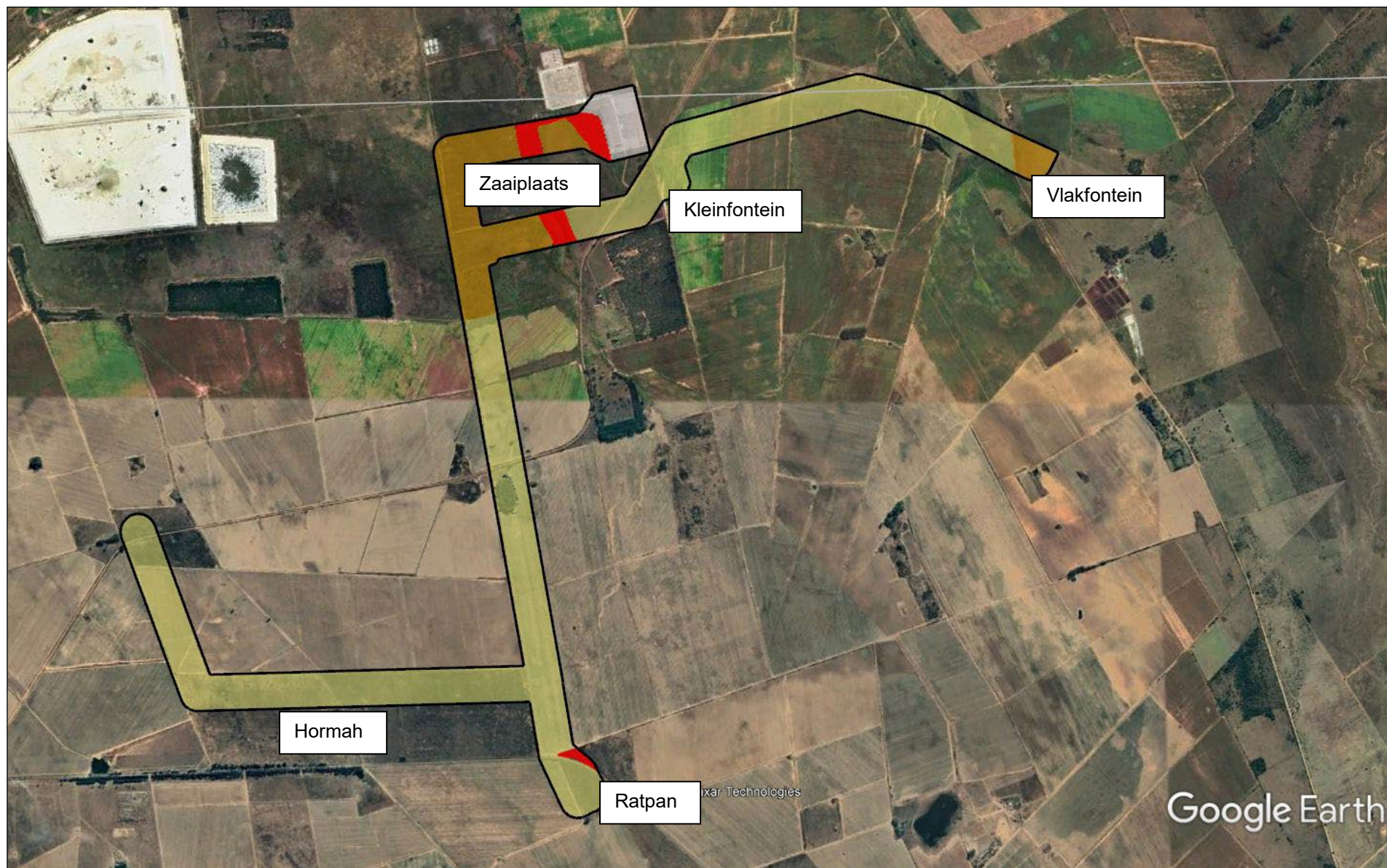


Figure 21. Sensitivity map of the different vegetation units of the 300m Line Connecting Corridor (Yellow=Low; Orange=Medium; Red=High) (Source: Google Earth, 2022).

The **Wetland areas (vegetation unit 2)** and **Seasonal stream (vegetation unit 5)** occur throughout the study area and are mostly natural although some sections are slightly degraded due to anthropogenic influences. These units have a moderate-high species richness as well as important ecosystem functions and are regarded as having a **high ecological sensitivity**.

No threatened species were found to be present on the study area while the medicinal plants identified are not threatened and occur abundantly throughout the province.

The few individuals of the declared alien invader species present must be controlled. Alien invader species are a cause for concern since these species are not only spreading into the adjacent vegetation units, but also spread their seeds via bird species that utilise their fruits.

9.2 Ecological statement and opinion of the specialists

Based on the site verification and detailed survey visit, the ecological impacts of the proposed development of the area as solar farms were assessed and is not thought that development of vegetation units 1, 3, 4, 6 & 7 would have a large negative impact on the environment provided that the mitigation measures as indicated in this report are incorporated into the management plan and adhered to. No development within vegetation units 2 & 5 (watercourses) and their associated buffer zones is recommended. According to the DFFE screening tool the **vegetation** of the study site has an overall low sensitivity, the **faunal** aspects a low sensitivity with smaller sections regarded as medium sensitivity for both plants and animals. Overall, the **terrestrial biodiversity** regarded as **high**. Due to the past and current agricultural activities the only areas regarded as having a high biodiversity sensitivity are the water courses (units 2 & 5). All of the envisaged impacts identified were either Low or Negligible. The surrounding areas are also used for the cultivation of crops and are similarly transformed. Only the **Seasonal Stream** (vegetation unit 5) has connectivity with similar areas further north and act as a potential dispersal or biological corridor for remaining wetland associated faunal species. It is imperative that the dispersal movements of remaining faunal species are not further restricted by impenetrable fences or walls. Suitable migratory fences must be erected adjacent to the conserved wetlands and seasonal stream and buffer zones. No artificial lighting must be directed into the conserved wetlands and stream as well as appropriate rehabilitated buffer zones.

It is therefore not thought that the proposed impact of the development should not have a long-term negative effect on the environment provided all the recommendations and mitigation measures listed in this report are adhered to. The implementation of an on-going alien vegetation removal programmes as well as the rehabilitation and revegetation of the seasonal wetlands and seasonal stream's buffer zones could potentially result in a positive impact or on certain wetland associated faunal species.

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ANNEXURE 1 Red data plant species previously recorded in the region

CONFIDENTIAL


The data in the table below is confidential and may not be made available in any document available for public perusal. This annexure must be removed from any document that is published or made available to public or any third party.

Genus	Species	Family	National Status	Present on site	Comments
<i>Acacia</i>	<i>erioloba</i>	FABACEAE	Declining	✘	No suitable habitat
<i>Boophone</i>	<i>disticha</i>	AMARYLLIDACEAE	Declining	✘	No suitable habitat
<i>Crinum</i>	<i>bulbispermum</i>	AMARYLLIDACEAE	Declining	✘	Units 2 & 5 marginal
<i>Crinum</i>	<i>macowanii</i>	AMARYLLIDACEAE	Declining	✘	No suitable habitat
<i>Dioscorea</i>	<i>sylvatica</i>	DIOSCOREACEAE	VU	✘	No suitable habitat
<i>Drimia</i>	<i>altissima</i>	HYACINTHACEAE	Declining	✘	No suitable habitat
<i>Eucomis</i>	<i>autumnalis</i>	HYACINTHACEAE	Declining	✘	No suitable habitat
<i>Gladiolus</i>	<i>robertsoniae</i>	IRIDACEAE	NT	✘	No suitable habitat
<i>Gunnera</i>	<i>perpensa</i>	GUNNERACEAE	Declining	✘	No suitable habitat
<i>Hypoxis</i>	<i>hemerocallidea</i>	HYPOXIDACEAE	Declining	✘	No suitable habitat
<i>Ilex</i>	<i>mitis</i>	AQUIFOLIACEAE	Declining	✘	No suitable habitat
<i>Kniphofia</i>	<i>ensifolia</i>	ASPHODELACEAE	EN	✘	No suitable habitat
<i>Trachyandra</i>	<i>erythrorrhiza</i>	ASPHODELACEAE	NT	✘	No suitable habitat




ANNEXURE 2 Site verification reports

VLAKFONTEIN		
Site verification results summary		
Description	DFFE Ranking	Site inspection finding
Fauna	Medium & Low	Agree mostly, though watercourse present that needs investigation
Flora	Medium & Low	Agree mostly, though watercourse present that needs investigation
Terrestrial	High	Disagree, mostly low, though smaller sections (watercourse) could have High sensitivity
Images	Semi-natural to degraded grassland	
	Watercourse areas	
General comments	Although areas are mostly low in sensitivity as ranked by DFFE, the watercourses and semi-natural grasslands should be investigated.	


KLEINFONTEIN	Site verification results summary	
Description	DFFE Ranking	Site inspection finding
Fauna	Medium & Low	Disagree, should be low
Flora	Medium & Low	Disagree, should be low
Terrestrial	High	Disagree, mostly low, due to agricultural lands

Images	Sections are agricultural land and old fields	
General comments	Area is mostly low in sensitivity as ranked by DFFE.	




ZAAIPLAATS	Site verification results summary	
Description	DFFE Ranking	Site inspection finding
Fauna	Medium & Low	Agrees mostly, though watercourses present that needs investigation
Flora	Medium & Low	Agrees mostly, though watercourses and semi-natural grassland needs investigation
Terrestrial	High	Disagree, mostly low, though watercourse section could have High sensitivity

Images	Watercourse areas	
	Semi-natural to degraded grassland	
	Alien woodland	
General comments	Although areas are mostly low in sensitivity as ranked by DFFE, the watercourses and semi-natural grasslands should be investigated	

HORMAH	Site verification results summary	
Description	DFFE Ranking	Site inspection finding
Fauna	Medium & Low	Disagree, low habitat diversity, no natural vegetation
Flora	Medium & Low	Disagree, low habitat diversity, no natural vegetation
Terrestrial	High	Disagree, low habitat diversity, no natural vegetation, low floral and faunal sensitivity

Images	Mostly agricultural land and old fields	
General comments	Although areas are mostly low in sensitivity as ranked by DFFE, the semi-natural grasslands should be investigated	

RATPAN	Site verification results summary	
Description	DFFE Ranking	Site inspection finding
Fauna	Medium & Low	Agrees mostly, though watercourse present that needs investigation
Flora	Medium & Low	Agrees mostly, though watercourse present that needs investigation
Terrestrial	High	Disagree, mostly low, though smaller sections could have High sensitivity

Images	Mostly agricultural land and old fields	
	Semi-natural to degraded grassland	
	Watercourse areas	
General comments	Although areas are mostly low in sensitivity as ranked by DFFE, the watercourses and semi-natural grasslands should be investigated	

ANNEXURE 3 Additional specialist info

LR BROWN

Personal details

Title: Professor
Nationality: South African
SACNASP registration: 400075/98 (Ecological Science & Botanical Science)
Name of Consulting Firm: Enviroguard Ecological Services cc.
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Personal profile

He is and an applied ecologist with a particular interest in plant communities. His research focuses on the classification and description of southern African ecosystems as the basis for the appropriate management of natural areas. His research is directed at long-term studies of plant communities and wetlands (classification, description and assessment of conservation status) in relation to local climate, the identification of different environmental gradients within and between communities, and the reaction of communities to different patterns of land use and management practices. He is the main author of a publication setting the guidelines for vegetation phytosociological (classification) surveys in southern Africa. He was on the editorial board of the *South African Journal of Botany* and is currently on the editorial board of the international journal *Vegetation Classification & Description*, while also serving as a section editor for *Koedoe, CABI & Royal Society Open Science*. He has collaborative research projects with various organisations/institutions nationally and internationally. He is a member of both the Quality Assurance Committee of SACNASP and the International Association of Vegetation Scientists Vegetation Classification Working Group. He has served as an evaluator of qualifications in the botanical sciences for the South African Council for Scientific Professions, been an advisory committee member of the African Vegetation and Plant Diversity Research Centre at the University of Pretoria, an executive board member of the Institute of Environment and Recreation Management of SA, and secretary of the SAASA (2002-2004), chairperson of the Professional Affairs Committee for the Grassland Society of southern Africa and also the past President of the Grassland Society of southern Africa. He is also a board member of Elephants Alive: South Africa, the chairperson of the evaluating committee of the Senior Captain Scott Memorial Medal for Biology for the SAASA.

Specialisation

- Vegetation impact assessments (Grassland, Savanna & Nama-karoo Biomes)
- Botanical surveying
- Vegetation mapping
- Wetland delineation
- Veld management & restoration
- Veld condition & grazing capacity
- Bush encroachment/ densification monitoring
- Game farm planning & vegetation management

Scientific involvement

Author of:

- 240+ impact assessment reports on natural resources and utilisation.
- 68 scientific papers published in accredited and non-accredited scientific/other journals.
- 72 papers/posters at national and international congresses
- 11 invited talks as workshops, interest groups, societies etc.
- 2 Scientific reports published by WRC.
- 12 commissioned research projects
- Co-author of the book titled "The story of Life and the Environment: and African perspective"
- 5 chapters in scientific books

C COOK

Personal details

Title: Mr
Nationality: South African
SACNASP registration: 400084/08 (Zoological Science)
E-mail: giant.bullfrog@gmail.com
Contact: 082 688 9585

Specialisation

- Faunal & Ecological surveys
- Herpetological Surveys
- Wetland delineations

Scientific involvement

- Registered professional member of The South African Council for Natural Scientific Professions (Zoological Science), registration number 400084/04.
- Faunal and Specialist Herpetological consultant since 1997.
- Conducted over 250 preliminary faunal surveys and over 150 specialist surveys as a faunal consultant.
- Regional Organiser for Gauteng Province for the South African Frog Atlas Project 1999-2003.
- Published a scientific paper on *Pyxicephalus adspersus*, 8 scientific conference presentations, co-wrote the species accounts for the genus *Pyxicephalus* for the Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland South African as well as W.R.C Report No. 1258/1/06 on "A Biophysical framework for The Sustainable Management of Wetlands in Limpopo Province with Nylsvley as a Reference Model". WRC PROJECT K5/1928: "Assessment of the Current Biodiversity of The Wetland Amphibians Associated With Major River Systems Of The Kruger National Park (And The Physical And Chemical Factors Affecting Their Distribution)". VLOK, W¹, Fouche, P², Cook, C.L.³ and Pieterse, I⁴.
- Attended 5 national and international herpetological congresses & 4 expert workshops, 6 Zoological Conferences as well as 4 South African Aquatic Sciences conferences lectured zoology and botanical science at University of Limpopo (2001-2004).
- Participant and author in the State of the Rivers project for the upper reaches of the Letaba River System.
- Participant in the South African Reptile Conservation Assessment (SARCA).
- Participant in the EWT Giant Bullfrog species survival programme as well as African Grass Owl Workshops.