# Desktop report on the ecological and wetland assessment for the proposed Kiara PV Solar development including Phase 1 to 7 and associated infrastructure situated on Portion 2 and the Remaining Extent of the Farm Hollaagte 8 near the town of Lichtenburg, North West Province.

June 2022


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**DECLARATION OF INDEPENDENCE**

**DPR Ecologists and Environmental Services is an independent company and has no financial, personal or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of ecological services. There are no circumstances that compromise the objectivity of the study.**

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| **Report Version** | **Draft 1.0** | | |
| **Title** | **Desktop report on the ecological and wetland assessment for the proposed Kiara PV Solar development including Phase 1 to 7 and associated infrastructure situated on Portion 2 and the Remaining Extent of the Farm Hollaagte 8 near the town of Lichtenburg, North West Province.** | | |
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## Executive Summary

The study area is considered to be largely natural and though fairly uniform, is still likely to contain elements of high sensitivity. The desktop study should be utilised as a baseline to provide information on areas and aspects which should form the focus of a comprehensive, on-site survey to inform the development process.

The study area is situated to the north east of the town of Lichtenburg in the North West Province (Appendix A: Map 1 – 3). The study area is quite extensive and includes large terrestrial plains while some wetlands also appear to be present, large watercourses are however absent. The site has an approximate extent of 1600 hectares. The area seems to be largely natural and still consists of grassland with scattered trees. Some areas seem to have been previously ploughed and cultivated and will likely represent transformed areas.

### Terrestrial Ecology

From the description of the remaining natural vegetation in the study area the following elements of ecological importance should be taken into account in the development (Appendix A: Map 1 – 3):

- The vegetation type occurring in this area is fairly uniform and is not currently listed as a Threatened Ecosystem.
- Despite being fairly uniform the vegetation type in the area, Carletonville Dolomite Grassland, may still contain elements of conservation value and consequently, where natural portions of these vegetation types remain they should be regarded as having a significant conservation value.
- Despite being fairly uniform, the vegetation type in this area still contain significant numbers of protected species which should also be taken into account in the sensitivity of remaining natural vegetation.
- A large portion of the study area consists of a Terrestrial ESA 1 (ESA) and functions as part of an ecological corridor. This function will most likely be affected by the development and will have to be taken into consideration.
- Marginal portion of the proposed grid connection corridor encroach into a Terrestrial CBA 2 area which functions as a critical corridor. The powerline is unlikely to significantly affect this function but will still have to be taken into consideration by the development.
- The region forms part of the Bo-Molopo Karst Belt Strategic Water Source Area (SWSA) which perform important functions in terms of groundwater resources. As a result, it is listed as an Aquatic ESA 1. The development is unlikely to affect this functioning though it will still need to be taken into consideration by the development.
- A central lower lying area is listed as an Aquatic CBA 1 as it forms a wetland system which is of high conservation value. This will be an important element which the development will have to avoid.
- The Marico Biosphere Reserve borders the study area to the north. The protected area should remain unaffected by the proposed development. However, the biosphere reserve should still be consulted during the application process.
- The Lichtenburg Game Breeding Centre is located to the west of the study area but will be affected by the grid connection powerline. It is an informal protected area, i.e. it is not formally protected by the NEMPAA. Despite this, the area will still retain a high conservation value.

From desktop assessment the actual occurrence of fauna in the study area cannot be determine but species likely to occur in the region can be determined. Given the remaining natural vegetation in the area which is largely intact, with corridors also being retained and, at least from a desktop perspective, regarded to be in a fairly good condition it is anticipated likely that species of conservation significance will still occur in the area. The habitat is however fairly uniform and the area is also not known to harbour a large amount of species being of high conservation value. However, given the large extent of the development, it also remain possible that fauna of conservation importance may occur.

The area may contain numerous species of conservation importance (Table 3). However, many of these, especially the larger antelope will only be present in conservation or game breeding areas and will not be relevant for the development. These include Tsessebe, Bontebok, Roan Antelope and Sable Antelope. The remaining smaller species are however quite likely to still occur in this area. They will however be dependent on habitat in good condition. Should such a species be present on the site the focus should be the preservation of the habitat of fauna instead of trying to preserve the animal itself. If habitat is adequately preserved and maintained the animals themselves will by default also be adequately preserved.

**Wetlands and Watercourses**

From current mapping resources the study area does not seem to contain a large degree of watercourses and wetlands. However, a few do seem to be present and will be most likely to be affected by the development. Two prominent wetland systems are indicated for the study area (Appendix A: Map 1 – 3). A large lower lying wetland area transects the northern portion of the study area while another wetland system will be crossed by the grid connection powerline. It is however not possible from a desktop assessment perspective to determine if wetland conditions are present in these and therefore, they must all be assumed to contain wetland conditions. A summary of the two prominent wetland systems in the area are given in Table 11.

These wetland systems which may likely occur in the study area may be classified into different wetland types. In the absence of a site-survey these types cannot be determined with accuracy but the available desktop information provides likely wetland types to occur:

- The wetland system transection the northern portion of the development site would possible be categorised as a valley bottom wetland without a channel (SANBI 2009).
- Desktop information indicate that this northern wetland system may also be associated with depression wetland areas (SANBI 2009).
- The wetland system which will be affected by the grid connection powerline is indicated as a seepage wetland (SANBI 2009).

Previous desktop assessment Nel *et al* (2011), Van Deventer *et al* 2018 and Kleynhans (2000) will be utilised to provide estimated conditions of the two affected wetland systems where available (Table 12). It must however be stressed that these are in themselves not very accurate and therefore should be augmented by on-site surveys.

The condition of the two wetland systems likely to be affected by the development cannot be determined with accuracy at a desktop level though indications of likely impacts that may affect these systems include the following:

- Ploughing and cultivation has occurred along portions of the northern wetland system. This will have a large impact on the system should the site survey indicate this to be the case.
- Sections of the wetland which will be affected by the powerline has clearly been affected by alluvial diamond mining. This is anticipated to have had a large impact on this system.
- Several gravel roads cross over both wetland systems, though the system along the powerline is affected to a greater degree.

The importance of wetlands and watercourses and the functioning and services they provide has become especially evident in recent times. They also provide vital functions in terms of water transportation, wetland and aquatic habitats and bio-remediation. Should the field survey confirm the presence of these wetland systems they will therefore be regarded as being highly sensitive.

**Biodiversity and Ecological Sensitivity**

Utilising information as obtained from desktop resources, a course and preliminary indication of the relative sensitivity of the area can be provided (Appendix A: Map 3). This is however likely to be fairly inaccurate and should not be used in the planning of the proposed development. This does however give an indication of areas that should be surveyed and verified during the site survey. The following relative sensitives has been allocated to the study area:

- The vegetation type occurring in this area is fairly uniform and is not currently listed as a Threatened Ecosystem. Despite being fairly uniform the vegetation type in the area, Carletonville Dolomite Grassland, may still contain elements of conservation value and consequently, where natural portions of these vegetation types remain they should be regarded as having a significant conservation value. Any remaining natural areas should therefore be afforded at least a Moderate level of sensitivity.
- A central lower lying area is listed as an Aquatic CBA 1 as it forms a wetland system which is of high conservation value. This will be an important element which the development will have to avoid. CBA 1 areas should always be afforded a Very High level of sensitivity.
- The Marico Biosphere Reserve borders the study area to the north. The protected area should remain unaffected by the proposed development. However, the biosphere reserve should still be consulted during the application process. It should be regarded as a Very High level of sensitivity.
- The Lichtenburg Game Breeding Centre is located to the west of the study area but will be affected by the grid connection powerline. It is an informal protected area, i.e. it is not formally protected by the NEMPAA. Despite this, the area will still retain a High level of sensitivity.

**List of Acronyms**

**CBA** – Critical Biodiversity Area
**ESA** – Ecological Support Area
**NFEPA** – National Freshwater Ecosystem Priority Areas
**PES** – Present Ecological State
**NBA** – National Biodiversity Assessment
**SWSA** – Strategic Water Source Areas
**TOPS** – Threatened Or Protected Species
**DWS** – Department of Water and Sanitation
**WRC** – Water Research Commission
**EIS** – Ecological Importance and Sensitivity
**EMC** – Ecological Management Class
**SAIIAE** – South African Inventory of Inland Aquatic Ecosystems
**CSIR** – Council for Scientific and Industrial Research
**SANBI** – South African National Biodiversity Institute
**BSR** – Biodiversity Sensitivity Rating
**AMSL** – Above Mean Sea Level
**POSA** – Plants of South Africa
**LC** – Least Concern
**DDD** - Data Deficient - Insufficient Information
**NT** – Near Threatened
**VU** – Vulnerable
**EN** – Endangered
**NWA** – National Water Act

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**Desktop ecological and wetland assessment.**

## 1. INTRODUCTION

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition. These units are often associated with water bodies, water transferring bodies or moisture sinks. These systems are always connected to each other through a complex pattern. Degradation of a link in this larger system, e.g. tributary, pan, wetland, usually leads to the degradation of the larger system. Therefore, degradation of such a water related system should be prevented.

Though vegetation may seem to be uniform and low in diversity it may still contain species that are rare and endangered. The occurrence of such a species may render the development unviable. Should such a species be encountered the development should be moved to another location or cease altogether.

Grasslands are driven by a number of ecological factors some of the more important factors include frost and fire. Grasslands are highly productive systems able to sustain a large population of grazers. These systems are often also exploited for crop production due to the suitable climate and soil properties of some grasslands. This has had the unfortunate result that many grasslands are under transformation pressure for the cultivation of crops. Consequently many grasslands are fragmented and transformed.

South Africa has a large amount of endemic species and in terms of plant diversity ranks third in the world. This has the result that many of the species are rare, highly localised and consequently endangered. It is our duty to protect our diverse natural resources.

South Africa's water resources have become a major concern in recent times. As a water scarce country, we need to manage our water resources sustainably in order to maintain a viable resource for the community as well as to preserve the biodiversity of the system. Thus, it should be clear that we need to protect our water resources so that we may be able to utilise this renewable resource sustainably. Areas that are regarded as crucial to maintain healthy water resources include wetlands, streams as well as the overall catchment of a river system.

In order to better manage our water resources several guidelines and research sources have been developed. Amongst these are the National Freshwater Ecosystem Priority Areas for South Africa 2011 (NFEPA).

The human population has become a power-hungry system where non-renewable resources are being utilised at an alarming rate. These resources are nearing depletion and are often associated with some form of pollution (air-, water-, atmospheric pollution). The unlimited use of these non-renewable resources is not sustainable. In recent times people have become aware of this and are attempting to alleviate this by using renewable energy sources. This has become increasingly popular and are commonplace in many first world countries. Recently it has come to light that South Africa is optimally situated for solar power production. The use of solar power will alleviate the pressure experienced by Eskom, will reduce carbon emissions and will promote the use of renewable energies. The development of solar facilities should be encouraged. Solar parks do have their disadvantages. These include the use of fertile soil for

power production rather than food supply and the disturbance and removal of natural vegetation.

The study area is situated to the north east of the town of Lichtenburg in the North West Province (Appendix A: Map 1 – 3). The study area is quite extensive and includes large terrestrial plains while some wetlands also appear to be present, large watercourses are however absent. The site has an approximate extent of 1600 hectares. The area seems to be largely natural and still consists of grassland with scattered trees. Some areas seem to have been previously ploughed and cultivated and will likely represent transformed areas.

The assessment is based on desktop information only and no on-site survey was conducted as part of this phase of the study. Information of the study area is therefore limiting and no detailed description of either vegetation or fauna can be provided. The assessment will make use of previous studies conducted in the surrounding region.

The report together with its recommendations should be utilised to inform further studies

### 1.1 Background

The Applicant, Voltalia South Africa (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the **Kiara PV facility**) located on a site approximately 16km north east of the town of Lichtenburg in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to **130MW**. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality. The site is accessible via an existing gravel road which provides access to the development area.

The development area for the PV facility and associated infrastructure will be located on Portion 2 and the Remaining Extent of the Farm Hollaagte No. 8

Six additional PV facilities (Kiara PV 1, Kiara PV 2, Kiara PV 3, Kiara PV 4, Kiara PV 5, Kiara PV 6, Kiara PV 7) are concurrently being considered on the project site (within Portion 2 of the Farm Hollaagte 8 and the Remaining Extent of the Farm Hollaagte No. 8) and are assessed through separate Environmental Impact Assessment (EIA) processes.

A facility development area (approximately 1600ha) as well as grid connection solution have been considered in the Scoping phase. The infrastructure associated with this PV facility includes:

- PV modules and mounting structures
- Inverters and transformers
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Temporary and permanent laydown area
- Grid connection solution will include:
    - Facility Substation
    - Eskom Switching Station

- A 275kV powerline (16.6km in length) (either single or double circuit), to connect the PV facility to the Watershed MTS.

To avoid areas of potential sensitivity and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer will identify a suitable development footprint within which the infrastructure of Kiara PV facility and its associated infrastructure is proposed to be located and fully assessed during the EIA Phase.

### 1.2 The value of biodiversity

The diversity of life forms and their interaction with each other and the environment has made Earth a uniquely habitable place for humans. Biodiversity sustains human livelihoods and life itself. Although our dependence on biodiversity has become less tangible and apparent, it remains critically important.

The balancing of atmospheric gases through photosynthesis and carbon sequestration is reliant on biodiversity, while an estimated 40% of the global economy is based on biological products and processes.

Biodiversity is the basis of innumerable environmental services that keep us and the natural environment alive. These services range from the provision of clean water and watershed services to the recycling of nutrients and pollution. These ecosystem services include:

- Soil formation and maintenance of soil fertility.
- Primary production through photosynthesis as the supportive foundation for all life.
- Provision of food, fuel and fibre.
- Provision of shelter and building materials.
- Regulation of water flows and the maintenance of water quality.
- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Detoxification and decomposition of wastes.
- Pollination of plants, including many crops.
- Control of pests and diseases.
- Maintenance of genetic resources.

### 1.3 Value of wetlands and watercourses

Freshwater ecosystems provide valuable natural resources, which contributes toward economic, aesthetic, spiritual, cultural and many recreational values. Yet the integrity of freshwater ecosystems in South Africa is rapidly declining in recent times. This crisis is largely a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (the need to utilise these recourses between different stakeholders, i.e. individuals, communities, corporate and industrial) and institutional (Implementing appropriate governance and management). Water affects every activity and aspiration of human society and sustains all ecosystems.

Freshwater ecosystems provide many of our fundamental needs, enable important regulating ecosystem services, supports functional faunal and floral communities:

- Water for drinking and irrigation
- Food such as fish and water plants.
- Building material such as clay and reeds.
- Preventing floods and easing the impacts of droughts.
- Remove excess nutrients and toxic substances from water
- Rivers, wetlands and groundwater systems maintain water supplies and buffer the effects of storms, reducing the loss of life and property to floods.
- Riverbanks help to trap sediments, stabilise
- river banks and break down pollutants draining from the surrounding land.

**1.4 Details and expertise of specialist**

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Membership with relevant societies and associations:
- South African Society of Aquatic Scientists (SASAQS0091)
- South African Association of Botanists
- South African Wetlands Society (3SLY4IG4)

Expertise:

- Qualifications: B.Sc. (Hons) Botany (2008), M.Sc. in Vegetation Ecology (2012) with focus on ephemeral watercourses.
- Vegetation ecologist with over 10 years experience of conducting ecological assessments.
- Founded DPR Ecologists & Environmental Services (Pty) Ltd in 2016.
- Has conducted over 200 ecological and wetland assessments for various developments.
- Regularly attend conferences and courses in order to stay up to date with current methods and trends:

  **2017:** Kimberley Biodiversity Symposium.
  **2018:** South African Association of Botanists annual conference.
  **2018:** National Wetland Indaba Conference.
  **2019:** SASS5 Aquatic Biomonitoring Training.
  **2019:** Society for Ecological Restoration World Congress 2019.
  **2019:** Wetland rehabilitation: SER 2019 training course.
  **2020:** Tools For Wetlands (TFW) training course.

## 2. SCOPE AND LIMITATIONS

- To evaluate the present state of the vegetation and ecological functioning of the development area. At a desktop level, accurate determination of the condition will not be possible and this will be a rough estimate, utilising current land use and previous studies in the region.
- To evaluate the present state of the wetlands and riparian vegetation included within the study area. The importance of the ecological function and condition will also be assessed. As above this will have to be based on available desktop data and will only provide rough estimates of the condition.
- Identify and delineate watercourses including rivers, streams, pans and wetlands and ascertain condition and status therefore and recommend mitigation. These will be done by aerial images and available mapping resources.
- Determine the Present Ecological State (PES) and Ecological Importance & Sensitivity (EIS) for the wetlands in the study area. Available information such as NFEPA (2011) will be used to give an estimated condition.

### 2.1 Vegetation (including riparian)

Aspects of the vegetation that will be assessed include:

- The vegetation types of the region with their relevance to the study area.
- The status of terrestrial and riparian vegetation cannot be determined through a desktop survey, though estimates of current impacts deduced from aerial images and current land use will be provided.
- Species composition with the emphasis on dominant-, rare- and endangered species. This will only be based on available literature and it must be assumed that they will be present in the study area.
- The boundary of wetland and watercourses cannot be determined by desktop study alone and it can only be indicated if such systems are present or not.

The amount of disturbance present on the study area assessed according to:

- The amount of grazing impacts cannot be determined but will be estimated from current land use.
- Disturbance caused by human impacts can also not be determined but will also be estimated by means of aerial images.
- Other disturbances.

### 2.2 Wetlands and watercourses

Aspects of the wetlands that will be assessed include:

- Identification and delineation of watercourses including rivers, streams, pans and wetlands. The wetland type and extent cannot be determined from desktop data and the likely occurrence will therefore be determined and likely types indicated.
- Describe condition and status of watercourses and importance relative to the larger system. Condition will be estimated from desktop literature.

### 2.3 Limitations

As this assessment will only be conducted on desktop level it contains numerous limitations:

- The assessment is based on desktop information only and no on-site survey was conducted as part of this phase of the study.
- No detailed description of the study area, including fauna or flora, can be given and will only be assessed in overview.
- Protected, rare and endangered species in the study area will only be estimated and must be regarding as occurring in the area.
- The condition of riparian and terrestrial vegetation, species composition, wetlands and watercourses and any other ecological aspect will only be estimated and assessed in overview.
- The extent of wetlands and watercourses cannot be determined and delineation is therefore not possible.

It should be clear that the limitations on a desktop assessment are extensive and it is highly recommended that additional, on-site ecological surveys be conducted in order to give a more accurate description of the study area.

## 3. METHODOLOGY

### 3.1 Several literature works were used for additional information.

Background information of the region will be taken from:

- Morris, J.W. 1973. Automatic classification and ecological profiles of South-western Transvaal Highveld Grassland. D.Sc. dissertation. University of Natal, Durban.
- Morris, J.W. 1976. Automatic classification of the highveld grassland of Lichtcnburg. south-western Transvaal. Bothalia 12: 267-292.
- Bezuidenhout, H., Bredenkamp, G.J., Theron, G.K. & Morris, J.W. 1994. A Braun-Blanquet reclassification of the Bankenveld Grassland in the Lichtenburg area, south-western Transvaal. South African Journal Botany 60(6): 297-305.

Vegetation:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- NBA 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE).
- NBA 2018 Technical Report: Inland Aquatic (Freshwater) Realm.
- NBA 2018 Technical Report Volume 1: Terrestrial Realm.
- National Freshwater Ecosystem Priority Areas 2011 (NFEPA).
- Strategic Water Source Areas 2018 (SWSA).
- SANBI (2011): List of threatened ecosystems.
- NEM:BA: List of threatened ecosystems and Threatened Or Protected Species (TOPS).
- North West Province Biodiversity Sector Plan (2015).

Terrestrial fauna:

- Field guides for species identification (Smithers 1983, Child *et al* 2016, Cillié 2018).

Field guides used for species identification (Bromilow 1995, 2010, Coates-Palgrave 2002, Fish *et al* 2015, Gerber *et al* 2004, Gibbs-Russell *et al* 1990, Manning 2009, Van Ginkel *et al* 2011, Van Oudtshoorn 2004, Van Rooyen 2001, Van Rooyen & Van Rooyen 2019, Van Wyk & Malan 1998, Van Wyk & Van Wyk 1997).

Wetland methodology, delineation and identification:
Department of Water Affairs and Forestry 2004, 2005, 2008, Collins 2006, Duthie 1999, Kleynhans *et al* 2008, Marnewecke & Kotze 1999, Nel *et al* 2011, SANBI 2009.

### 3.2 Survey

The study area was only assessed by means of a desktop review.

- The study area was surveyed by means of remote sensing in terms of aerial images obtained from Google Earth (2021).
- The broad vegetation types present in the study area were determined.
- The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species but only with the aid of aerial images and comparison with studies conducted in the surrounding region.

- The state of the habitat was also assessed but again only by means of a desktop review.
- From the above it should be clear that the description of the site is limiting when only dependant on desktop information.

All rivers, streams, pans and wetlands were identified and surveyed where it occurred in the study area by means of aerial images and available mapping systems (NFEPA 2011 & SAIIAE 2018).

These wetlands and watercourses cannot be delineated by desktop assessment only and their presence will only be indicated, the DWS regulated area, i.e. 500 meters, should be taken as the affected area.

The following guidelines and frameworks were used to give background information as no site survey was performed:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

The following guidelines and frameworks were used to determine the sensitivity or importance of these identified watercourses in the study area:

- Nel *et al.* (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

- Government of South Africa. 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

- Duthie, A. 1999. Appendix W5: IER (floodplain and wetlands) determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

- Van Deventer *et al*. 2018. South African National Biodiversity Assessment 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa.

These guidelines provide the characteristics which can be utilised to determine if a wetland or watercourse is present and also aids in determining the boundary of these systems.

### 3.3 Criteria used to assess sites

Several criteria were used to assess the study area and determine the overall status of the environment. This was however applied in desktop form only and is only an estimation.

#### 3.3.1 Vegetation characteristics

Characteristics of the vegetation in its current state. The diversity of species, sensitivity of habitats and importance of the ecology as a whole.

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.
Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single nich – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The likley occurrence or potential occurrence of rare or endangered species.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas though, can vary significantly e.g. wetlands, drainage lines, ecotones, etc.
Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

Degree of rarity/conservation value:
Scoring: Very rare and/or in pristine condition – 1, Fair to good condition and/or relatively rare – 2, Not rare, degraded and/or poorly conserved – 3.

#### 3.3.2 Vegetation condition

The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practises (e.g. grazing regime, fire, management, etc.) can have a marked impact on the condition of the vegetation.

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.
Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between tree, shrub, sub-shrubs and grass layers. The ratio could be affected by grazing and browsing by animals.
Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:
Scoring: No or very slight infestation levels by weeds and invaders – 1, Medium infestation by one or more species – 2, Several weed and invader species present and high occurrence of one or more species – 3.

Degree of grazing/browsing impact:
Scoring: No or very slight notable signs of browsing and/or grazing – 1, Some browse lines evident, shrubs shows signs of browsing, grass layer grazed though still intact – 2, Clear browse line on trees, shrubs heavily pruned and grass layer almost absent – 3.

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.
Scoring: No or very little signs of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

### 3.3.3 Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely.

### 3.4 Biodiversity sensitivity rating (BSR)

The total scores for the criteria discussed in section 3.3 were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 3, five different classes are described to assess the biodiversity of the study area. The different classes are described in the Table 1:

Table 1: Biodiversity sensitivity ranking

| BSR | BSR general floral description | Floral score equating to BSR class |
|---|---|---|
| Totally transformed (5) | Vegetation is totally transformed or in a highly degraded state, generally has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area has lost its inherent ecological function. The area has no conservation value and potential for successful rehabilitation is very low. | 29 – 30 |
| Advanced Degraded (4) | Vegetation is in an advanced state of degradation, has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area's ecological function is seriously hampered, has a very low conservation value and the potential for successful rehabilitation is low. | 26 – 28 |
| Degraded (3) | Vegetation is notably degraded, has a medium level of species diversity although no species of concern are present. Invasive plants are present but are still controllable. The area's ecological function is still intact but may be hampered by the current levels of degradation. Successful rehabilitation of the area is possible. The conservation value is regarded as low. | 21 – 25 |
| Good Condition (2) | The area is in a good condition although signs of disturbance are present. Species diversity is high and species of concern may be present. The ecological function is intact and very little rehabilitation is needed. The area is of medium conservation importance. | 11 – 20 |
| Sensitive/Pristine (1) | The vegetation is in a pristine or near pristine condition. Very little signs of disturbance other than those needed for successful management are present. The species diversity is very high with several species of concern known to be present. Ecological functioning is intact and the conservation importance is high. | 0 - 10 |

## 4. PLAN OF STUDY

The site will be assessed by means of transects and sample plots. Observation w.r.t. the general ecology of the area includes:

- Noted species include rare and dominant species.
- The broad vegetation types present at the site were determined.
- The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.
- The state of the habitat was also assessed.

Ecological aspects which will be surveyed and recorded includes:

- The overall ecology of an area including the diversity of species, uniformity or diversity of habitats and different vegetation communities.
- Identification and delineation of distinct vegetation communities ad habitats and the ecological drivers responsible for these distinct communities, i.e. soil, geology, topography, aspect, etc.
- A comprehensive plant species survey including the identification of protected, rare or threatened species.
- Any ecological process or function which is important to the ecosystem including ecological drivers such as fire, frost, grazing, browsing, etc. and any changes to these processes.

Animal species will also noted as well as the probability of other species occurring on or near the site according to their distribution areas and habitat requirements.
The state of the habitat will also be assessed.

In order to provide a visually representative overview of the results obtained from the survey, site sensitivity mapping will also be done. This should indicate the relative importance of different ecological elements on the site as obtained from the survey. In general, these levels of sensitivity will include:

- Low Sensitivity – normally confined to areas that are completely transformed from the natural condition or degraded to such an extent that they are no longer representative of the natural ecosystem. Such areas will also no longer contain any ecological processes of importance relative to the surrounding areas, i.e. in some instances such as watercourses which are completely transformed but still provide important ecological functions, a low level of sensitivity will not apply.

- Moderate Sensitivity – normally applicable to areas that are still natural and therefore does still have some ecological importance but which do not contain elements of high conservation value and are not essential to the continued functioning of surrounding areas. Areas of Moderate Sensitivity usually require some mitigation but can be developed without resulting in high impacts.

- High Sensitivity – areas of high sensitivity contain one or more ecological elements which are considered of high conservation value. Such areas are normally preferred to be excluded from a development but where this is not possible, will require comprehensive mitigation and is also likely to result in high impacts.

- Very High Sensitivity – these areas are critical to the continued functioning of the ecosystem on and around the site. Development of such areas normally represent a fatal flaw and should be excluded from development. No manner of mitigation is able to decrease the anticipated impact in these areas.

All rivers, streams, pans and wetlands will be identified and surveyed where they occur in the study area. These systems will be determined by use of topography (land form and drainage pattern) and riparian vegetation with limited soil sampling. The following outlines the process applied during the on-site survey in order to obtain all required data:

- Perform desktop overview of the study area utilising available resources (Section 3). From the desktop overview identify the different landscape forms, possible wetland areas, watercourses and their relative flow patterns. Using this information, identify transects and sample plots for possible on-site survey. This should be both representative of the wetland or watercourse as a whole but should also include any prominent or significantly unique features.
- Possible sites identified during the desktop overview should be surveyed on-site. Where access is not possible or where desktop features are considered poor representatives of the wetland or watercourse the survey site or transect should be moved to another location, without compromising a comprehensive overview of the system.
- Where a lateral transect is taken of a watercourse this is done from the water's edge, across the marginal, lower and upper zones and extended across the floodplain until the edge of the riparian zone is reached.
- Where a transect is taken of a wetland system, this should preferably be taken across the entire wetland at its widest part or where it is most relevant to the proposed development, from the terrestrial surroundings, across the temporary, seasonal and perennial zones across the wetland.
- Soil samples are taken at 10 meter intervals along the survey transect, or where a distinct transition into a different zone is observed.
- A survey of the plant species within each distinct riparian or wetland zone is undertaken and includes the identification of obligate wetland species, riparian species, terrestrial species, exotic species and the general species composition and vegetation structure which allows for an accurate description of the watercourse or wetland.
- Visual survey of the general topography which substantiates the presence of riparian zones and wetland forms.
- Other general observations include any impacts observed, the overall ecosystem function, presence of fauna, surrounding land uses and the overall condition of the watercourse or wetland.
- Data is recorded by means of photographs with GPS coordinates taken at all relevant soil sampling sites and borders of riparian and wetland zones.

Data obtained during the on-site survey is utilised to provide the following information on the system:

- Desktop overview and assimilation of information on the likely impacts and functioning of the wetland system.
    - Review all available spatial data and resources in order to provide an estimate of the likely impacts and condition of the wetland or watercourse system.

- Confirm the presence of the wetland or watercourse system and provide an estimate of its borders.
    - The border of wetland conditions or the edge of the riparian zone will be confirmed by using soil sampling, obligate wetland vegetation and topography. This will also include the delineation of any temporary, seasonal or perennial zones of wetness along wetlands and the marginal, lower, upper and riparian zones along watercourses.
- Provide a description of the wetland or watercourse.
    - Provide the hydrogeomorphic setting of the wetland, a longitudinal profile which will aid in determining the erodibility of the wetland and provide an overall description of the wetland and impacts affecting it.
    - Provide a general description of the lateral zonation of the watercourse banks including the marginal, lower, upper and riparian zones and a description of the riparian vegetation along the banks of the watercourse. This will also include the description of any impacts or modification of the watercourse.
- Assess the current condition of the wetland or watercourse.
    - Utilising information obtained from the assessments listed above, determine the condition of this portion of the wetland by applying the WET-Health 2 tool.
    - Utilising information obtained from the assessments listed above, determine the condition of the relevant section of the watercourse by applying the Index of Habitat Integrity (IHI) tool.
- Utilising all of the information obtained from the assessment, provide recommendations to mitigate anticipated impacts that the development will have.

The following guidelines and frameworks were also used to determine the presence of the rivers, streams, pans and wetlands in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

The following guidelines and frameworks were used to determine the sensitivity or importance of these identified watercourses or wetlands in the study area:

- Nel *et al.* (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

- Government of South Africa. 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

- Duthie, A. 1999. Appendix W5: IER (floodplain and wetlands) determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

These guidelines provide the characteristics which can be utilised to determine if a wetland or watercourse is present and also aids in determining the boundary of these systems.

The following were utilised to inform the condition and status of watercourses:

- Kleynhans, C.J., Louw, M.D. & Graham, M. 2008. Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity. Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08.

The following were utilised to inform the condition and status of wetlands:

- Macfarlane, D.M., Ollis, D.J. & Kotze, D.C. 2020. WET-Health (Version 2.0): a refined suite of tools for assessing the present ecological state of wetland ecosystems. WRC Report No. TT 820/20.

A Risk Assessment will be conducted for the proposed development in or near watercourses and wetlands in accordance with the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use.

## 5. ECOLOGICAL OVERVIEW OF THE SITE

For the purpose of this report the terrestrial and wetland ecology will be discussed separately. A general description of the terrestrial environment will be given followed by an overall discussion of wetland and aquatic systems.

### 5.1 Ecology, vegetation and description of the study area

The study area is situated to the north east of the town of Lichtenburg in the North West Province (Appendix A: Map 1 – 3). The study area is quite extensive and includes large terrestrial plains while some wetlands also appear to be present, large watercourses are however absent. The site has an approximate extent of 1600 hectares. The area seems to be largely natural and still consists of grassland with scattered trees. Some areas seem to have been previously ploughed and cultivated and will likely represent transformed areas.

Lichtenburg, and the specific study area, is situated within the Grassland Biome and under natural conditions would be dominated by grasses with shrubs and trees being almost completely absent. However, this region is situated in a transitional area between the Grassland and Savannah Biomes and consequently a tree layer is present but sparse and represented by scattered trees. Where hills, ridges or rocky terrain occur, this will also promote the establishment of trees. Watercourses also contain differing soils conditions, climate and moisture regime which enables the establishment of shrubs and trees. Naturally, the area should therefore be dominated by open grassland but with scattered trees also present. From aerial images, this still seems to be the case for the study area (Appendix A: Map 1 – 3). However, patches and pockets of lower lying areas had previously been ploughed and cultivated. These are most probably areas containing deeper soils with a higher moisture regime. This is also relevant where the surrounding areas may be dominated by surface dolomite rock. Where farmsteads occur this has also caused localised disturbances though are confined to small areas in relation to the broader study area. Overall the vegetation composition and structure of the area would therefore seem to be largely intact.

#### Topography

The study area has a fairly large extent and as a result contains a moderate variety though overall it is a relatively flat area. From aerial images and contours of the study area the majority of the study area is dominated by relatively flat plains. The site seems to contain a gentle slope toward a lower lying area in the northern portion of the study area. Hills, ridges and rocky outcrops are not prominent though given that the area consists of Carletonville Dolomite Grassland, it is likely that a degree of surface dolomite would be present. Should this be the case it is likely to provide significantly different habitats and the vegetation composition and diversity may also be increased. The lower lying area in the northern portion of the study area may also represent a wetland area. A defined channel seems to be absent though wetland conditions may still be present. This area will again represent a different topographical unit with a differing vegetation composition and habitat. The altitude of the study area varies from 1520 m AMSL on the slightly higher lying areas to 1511 m AMSL in the lower lying in the northern portion of the site. This represents a difference of 8 m which indicates and confirms a fairly flat area.

## Climate

Lichtenburg is situated in a region experiencing moderate rainfall, with cold, dry winters and warm summers. The average annual maximum temperature is 28 °C in January and 18 °C in July but in extreme cases temperatures may rise to 37 °C and 25 °C, respectively. Average daily minimums range from about 15 °C in January to 2 °C in July, whereas extremes may drop to 6 °C and -10 °C, respectively. The period during which frost is likely to occur lasts, on average, for 106 days from May to September, during which period frost occurs on about 26 days. Sunshine duration in summer is about 60 percent and in winter 80 percent of the possible. Climate for the site can be relatively accurately represented by rainfall and evaporation data from the weather station C2E016 (Elandskuil). The area receives an average of 600.4 mm per year. Precipitation occurs mainly during summer, with most rainfall received during December to March. This is considered a moderate rainfall though the area is still considered to form part of a semi-arid region of South Africa. The mean annual evaporation is 1864 mm. Evaporation is highest during summer. As a result, surface runoff in the area is only moderate, occurs mostly during summer and results in an estimated mean annual runoff for the area between 20 – 50 mm according to a study by the Water Research Commission (WRC REPORT NO. TT 685/16, 2016).

## Geology and soils

According to Morris (1976) the area is covered by dolomite and to the north of Lichtenburg, is very flat, being relieved by occasional chert ridges, shallow depressions, dry watercourses and, more frequently, by sink-holes. The geology of the area consists of Dolomite, subordinate chert, minor carbonaceous shale, limestone and quartzite of the Malmani Subgroup of the Chuniespoort Group of the Transvaal Supergroup (Council for Geoscience 2016). Dolomites are, for the most part, covered by more recent deposits, particularly of gravel and surface limestone. In many places dolomite has been weathered chemically and numerous sink-holes are found as a result. Gravel is often found mainly overlying Dolomite rocks to the north. The deposits, which vary in depth from a few centimetres to over 50 m, are made up of rounded alluvial material with which is mixed angular, eluvial chert. The site in question is most likely coupled with red and yellowish Kalahari sand, consisting in the main of slightly rounded grains of quartz, less than one mm in diameter.

## Current impacts in the area

As indicated, the area seems to still be largely natural with a few areas of notable disturbance. The geology of the area indicate that it is most likely unsuitable for agricultural cultivation and most probably why it was never ploughed and still largely natural. The main land use in this area would undoubtedly be grazing for domestic livestock. This is normally a low magnitude impact though depending on the stocking levels and grazing regime can still cause extensive degradation of areas that are heavily overgrazed. Overgrazing and -browsing and the associated trampling cause a decrease in vegetation cover and an increase in erosion. Where this is severe it may lead to a significant loss in diversity and transformation of the natural vegetation type. The extent to which this has affected the proposed development area will however have to be determined by an on-site survey. The exception to the above is a lower lying area which has clearly been affected by cultivation. This area most likely contained deeper alluvial soils and also likely a higher moisture regime which would be suitable for cultivation. A site survey will indicate the degree to which these areas have become transformed. The area is known to have been affected by historical alluvial diamond mining and

though this is not apparent on the site, a site survey may still indicate areas previously affected by small-scale mining. Other low impacts in the area include a few farmsteads and extensive dirt track network but which will only cause localised transformation.

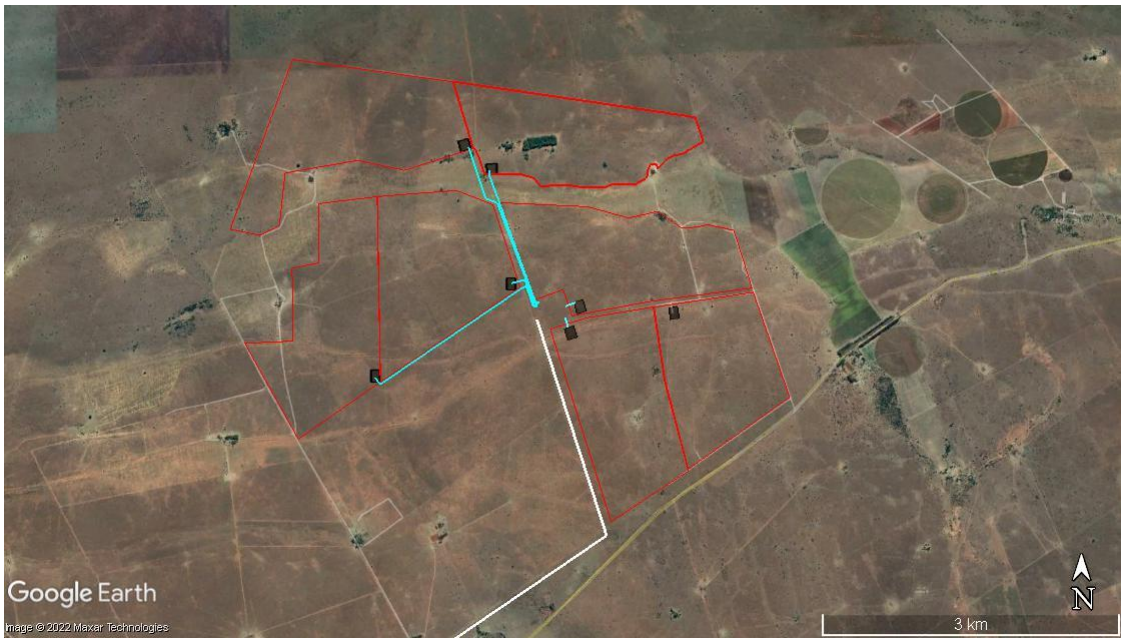



Figure 1: Aerial images (Google Earth 2021) seems to indicate that the area still consists largely of natural vegetation. Localised disturbances such as farmsteads, dirt tracks and windrows are visible. Note some agricultural crop farming is also visible in lower lying areas.

Figure 2: Historical imagery (National Geospatial 1975) also indicate a largely natural area although some cultivation in lower lying areas are also visible (red).

As can be deduced from the description of the Lichtenburg area and specific study area though significant impacts are present in the area it would seem that the site is affected to a lower degree and is still largely natural.

### 5.1.1 Vegetation Types

As indicated in the previous section, the area seems to have a fairly uniform topography as well as soils and geology and as a result contains only one main vegetation type. According to Mucina & Rutherford (2006), the study area consists exclusively of Carletonville Dolomite Grassland (Gh 15). According to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) this vegetation type is currently listed as being of Least Concern (LC) (Appendix A: Map 1). Although it is in some instances heavily affected by crop cultivation and mining this is not yet considered to be to such an extent as to warrant it being considered a Threatened Ecosystem.

This vegetation type also corresponds well to the topography and geology of the site. It is adapted to a mosaic pattern of shallow soils over dolomite. It consists of a well-developed grass layer but with scattered trees and shrubs, especially where surface rock occurs.

In the absence of a site survey a general description of the vegetation composition is given as obtained from Mucina & Rutherford (2006) and other previous vegetation studies. This is by no means a comprehensive description of the vegetation but should give a general description.

**Carletonville Dolomite Grassland (Gh 15)**

Important Taxa:

Graminoids: *Aristida congesta, Brachiaria serrata, Cynodon dactylon, Digitaria tricholaenoides, Diheteropogon amplectens, Eragrostis chloromelas, E. racemosa, Heteropogon contortus, Loudetia simplex, Schizachyrium sanguineum, Setaria sphacelata, Themeda triandra, Alloteropsis semialata subsp. eckloniana, Andropogon schirensis, Aristida canescens, A. diffusa, Bewsia biflora, Bulbostylis burchellii, Cymbopogon caesius, C. pospischilii, Elionurus muticus, Eragrostis curvula, E. gummiflua, E. plana, Eustachys paspaloides, Hyparrhenia hirta, Melinis nerviglumis, M. repens subsp. repens, Monocymbium ceresiiforme, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides, Tristachya leucothrix, T. rehmannii.*

Herbs: *Acalypha angustata, Barleria macrostegia, Chamaecrista mimosoides, Chamaesyce inaequilatera, Crabbea angustifolia, Dianthus mooiensis, Dicoma anomala, Helichrysum caespititium, H. miconiifolium, H. nudifolium var. nudifolium, Ipomoea ommaneyi, Justicia anagalloides, Kohautia amatymbica, Kyphocarpa angustifolia, Ophrestia oblongifolia, Pollichia campestris, Senecio coronatus, Vernonia oligocephala.*

Geophytic Herbs: *Boophone disticha, Habenaria mossii.*

Low Shrubs: *Anthospermum rigidum subsp. pumilum, Indigofera comosa, Pygmaeothamnus zeyheri var. rogersii, Rhus magalismontana, Tylosema esculentum, Ziziphus zeyheriana.*

Geoxylic Suffrutices: Elephantorrhiza elephantina, Parinari capensis subsp. capensis.

Endemic Taxon Succulent Shrub: Delosperma davyi.

A grass layer with moderate diversity dominates, although a prominent herbaceous component is also evident (Appendix B). Protected plant species are also evident and it is likely that the area will contain many such species.

Further studies conducted by Bezuidenhout *et al* (1994) also provide an indication of the likely vegetation communities which can be expected in this area. These are based on habitat factors such as soil depth and texture, rockiness of the soil surface and habitat disturbance. This results in two major plant communities with six sub-communities and several variants. These are (Note that several botanical name changes have since been implemented though the original naming is used in this instance to better allow for comparison with previous studies):

1. *Schizachyrium sanguineum-Diheteropogon amplectens* Major Grassland

    1.1 *Loudetia simplex-Schizachyrium sanguineum* Grassland
        1.1.1 *Andropogon schirensis-Loudetia simplex* Variant
        1.1.2 *Rhynchosia nervosa-Loudetia simplex* Variant
        1.1.3 *Triraphis andropogonoides-Loudetia simplex* Variant
    1.2 *Anthephora pubescens-Schizachyrium sanguineum* Grassland
        1.2.1 *Elionurus muticus- Anthephora pubescens* Variant
        1.2.2 *Oropetium capense-Amhephora pubescens* Variant
        1.2.3 *Stipagrostis uniplumis-Anthephora pubescens* Variant
        1.2.4 *Eragrostis trichophora-Anthephora pubescens* Variant
    1.3 *Andropogon appendiculatus- Cymbopogon excavatus* Grassland

2. *Cymbopogon plurinodis-Eragrostis superba* Major Grassland

    2.1 *Fingerhuthia africana- Aristida diffusa* Grassland
    2.2 *Digitaria argyrograpta-Eragrostis lehmanniana* Grassland
    2.3 *Aristida congesta-Crassula transvaalensis* Grassland

The vegetation of the Lichtenburg area can be described as an *Elionurus muticus- Brachiaria serrata* Grassland. The most conspicuous feature of the vegetation is the complete absence of dominants. A large number of species are represented but none succeeds in obtaining dominance. Provided the habitat descriptions it is most likely that the study area will be dominated by the *Cymbopogon plurinodis-Eragrostis superba* Major Grassland. This vegetation community is driven by dolomite sheet outcrops which occur scattered throughout the area, the soil depth varies between very shallow (0.1 - 0.2 m) to moderately deep (0.5-0.8 m).

### 5.1.2 Protected Species

As previously mentioned, the vegetation type around the Lichtenburg area contain some protected and Red Listed species (Appendix B). These are also of significant conservation value and will therefore increase the sensitivity of the study area where they occur. Furthermore, when utilising the Plants of South Africa (http://posa.sanbi.org) an analysis of plant species previously recorded in the region includes the following protected and Red Listed species recorded.

Table 2: Protected and Red Listed species recorded for the quarter degree squares (2626) (http://posa.sanbi.org).

LC – **Least Concern** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

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

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

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

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

Gh15 – **Carletonville Dolomite Grassland**

| FAMILY | Scientific name | Status | Protected | Gh15 |
|---|---|---|---|---|
| Asphodelaceae | *Aloe jeppeae* | LC | Y | ✔ |
| Apocynaceae | *Asclepias aurea* | LC | Y | ✔ |
| Apocynaceae | *Asclepias brevipes* | LC | Y | ✔ |
| Apocynaceae | *Asclepias fallax* | LC | Y | ✔ |
| Apocynaceae | *Asclepias fulva* | LC | Y | ✔ |
| Apocynaceae | *Aspidoglossum restioides* | LC | Y | ✔ |
| Orchidaceae | *Bonatea polypodantha* | LC | Y | ✔ |
| Apocynaceae | *Ceropegia circinata* | LC | Y | ✔ |
| Apocynaceae | *Ceropegia incana* | VU | Y | ✔ |
| Cleomaceae | *Cleome conrathii* | NT | Y | ✔ |
| Orchidaceae | *Eulophia hereroensis* | LC | Y | ✔ |
| Euphorbiaceae | *Euphorbia davyi* | LC | Y | ✔ |
| Iridaceae | *Gladiolus elliottii* | LC | Y | ✔ |
| Iridaceae | *Gladiolus permeabilis* | LC | Y | ✔ |
| Apocynaceae | *Pachycarpus schinzianus* | LC | Y | ✔ |
| Geraniaceae | *Pelargonium dolomiticum* | LC | Y | ✔ |
| Apocynaceae | *Raphionacme hirsuta* | LC | Y | ✔ |
| Apocynaceae | *Raphionacme velutina* | LC | Y | ✔ |

There is a high likelihood that many of these species as listed will occur within the study area. Note that only two Red Listed species occur here and these are currently Vulnerable and Near Threatened. The area therefore contains a moderate likelihood of protected plant species occurring but is not known to contain a high abundance of Red Listed species.

These species as listed are all adapted to a grassland habitat with some being more dependant on surface rock. Both of these requirements are present on the site and therefore there is a high likelihood that any of these would occur on the site.

### 5.1.3 Additional data sets

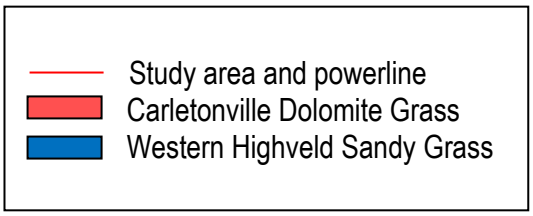
Numerous data sets and mapping resources have been developed to aid in the identification of sensitive areas and areas with a high conservation value, notably those resources developed by the South African National Biodiversity Institute (SANBI) (Appendix A: Map 1 – 3). Several of these resources were also combined with the results and discussion of the previous sections to indicate areas within the study area which should be regarded as sensitive. From these data sets the following conclusions can be made:

**National Biodiversity Assessment (NBA) 2018**

Remnants of the natural vegetation types in the area indicates that the study area is largely still natural. As indicated in previous sections, the natural vegetation type in this area, Carletonville Dolomite Grassland, does contain elements of significant conservation value and therefore all portions of remaining natural vegetation will have a significant level of sensitivity (Appendix A: Map 1).

Figure 3: View of the areas of remaining natural vegetation in the study area. The study area is notably still dominated by natural vegetation though note transformation in lower lying areas.

**Legend:**




**North West Biodiversity Sector Plan 2015**

The North West Biodiversity Sector Plan (2015) has been developed and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas (CBA), and other elements of high conservation importance. This includes both terrestrial and aquatic elements of importance.

Most probably as a result of the uniform nature of this area and the general absence of elements of high conservation value the area is listed as an Ecological Support Area 1. However, the following CBA's and elements of high conservation value are still present and must be regarded as having a significant level of sensitivity (Appendix A: Map 2):

**Terrestrial components:**

- A large portion of the study area consists of an Ecological Support Area 1 (ESA) and functions as part of an ecological corridor. This function will most likely be affected by the development and will have to be taken into consideration.
- Marginal portion of the proposed grid connection corridor encroach into a CBA 2 area which functions as a critical corridor. The powerline is unlikely to significantly affect this function but will still have to be taken into consideration by the development.

**Aquatic components:**

- The region forms part of the Bo-Molopo Karst Belt Strategic Water Source Area (SWSA) which perform important functions in terms of groundwater resources. As a result, it is listed as an ESA 1. The development is unlikely to affect this functioning though it will still need to be taken into consideration by the development.
- A central lower lying area is listed as CBA 1 as it forms a wetland system which is of high conservation value. This will be an important element which the development will have to avoid.

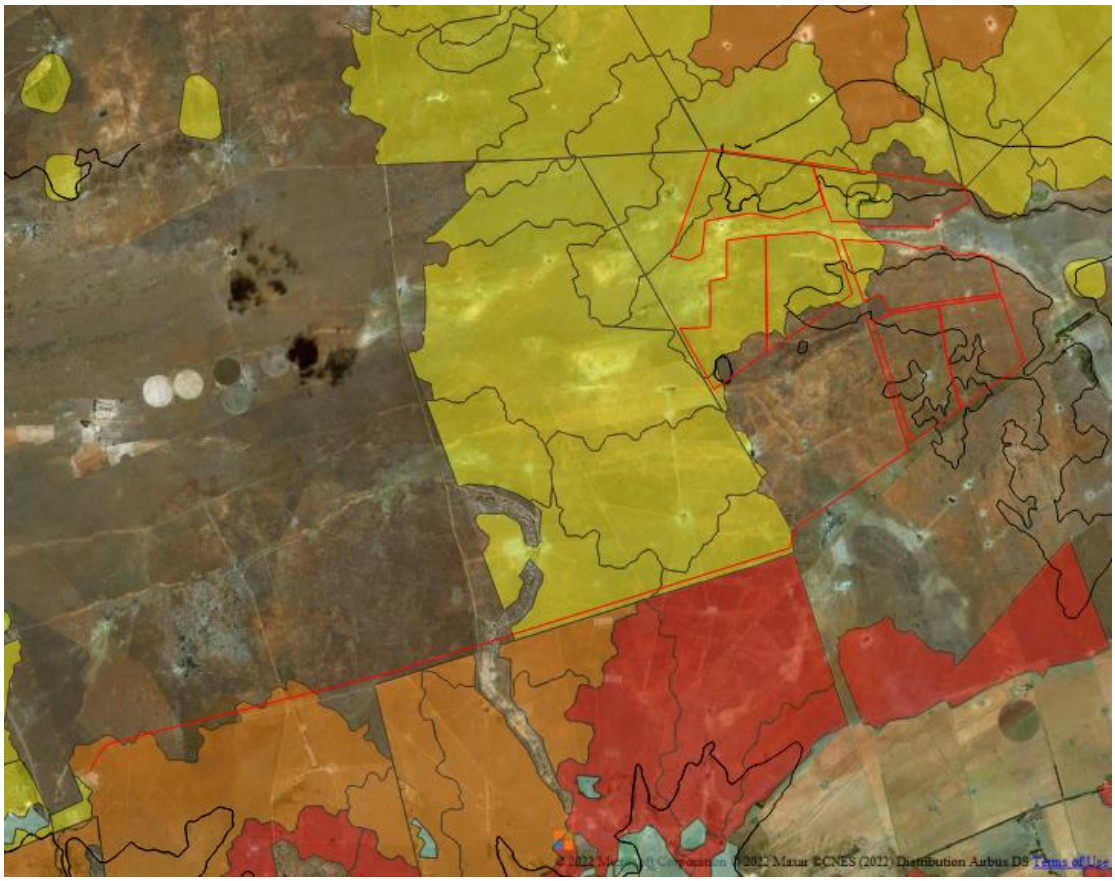
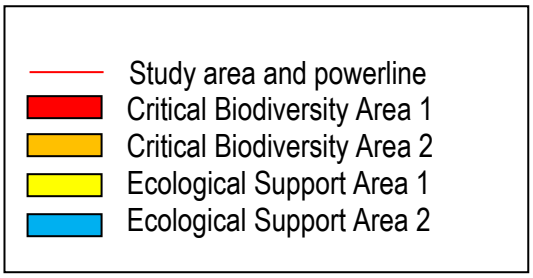



Figure 4: View of Terrestrial CBA 1 and 2 areas in the study area. The site contains a large portion of ESA.

**Legend:**



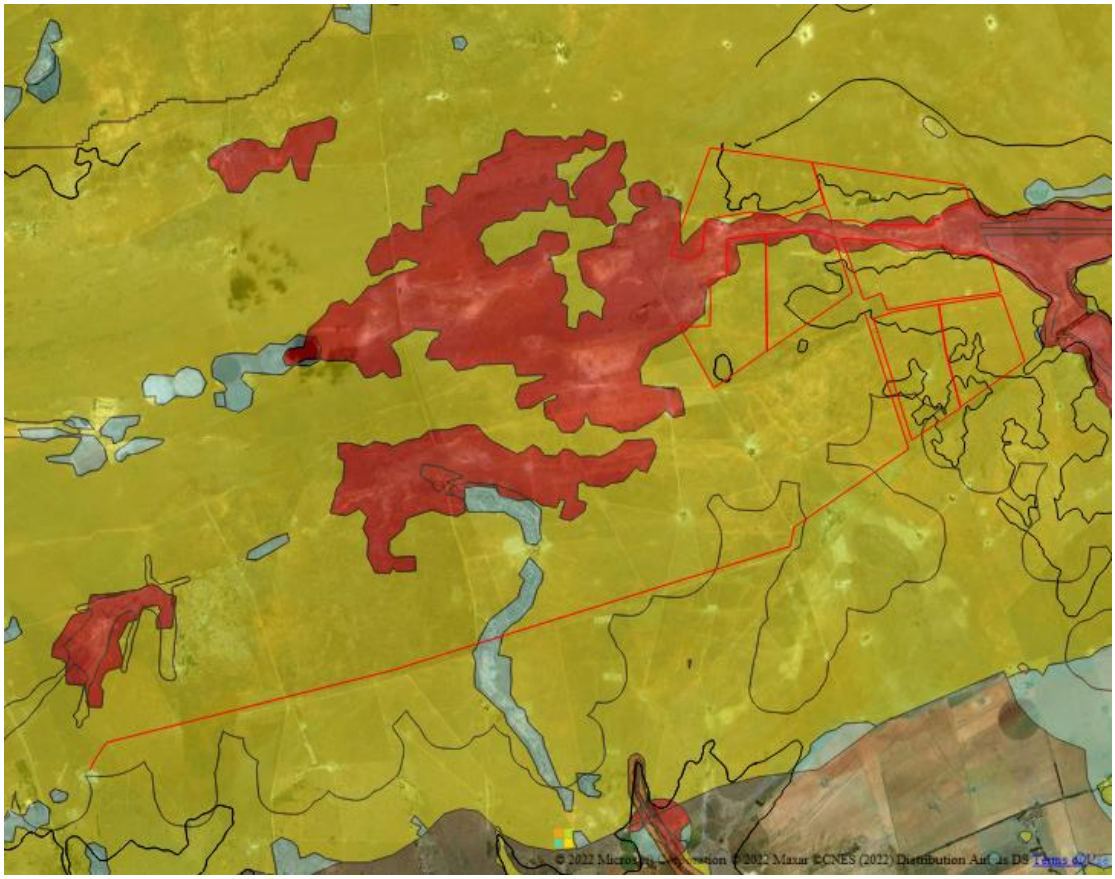
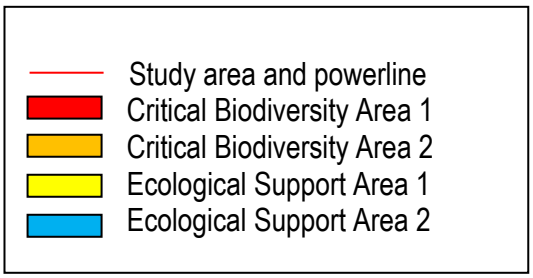



Figure 4: View of Aquatic CBA 1 and 2 areas in the study area. The area is dominated by as ESA 1 while the also contains a large wetland area designated as CBA 1.

**Legend:**



**Additional data sets**

- **National Protected Areas Expansion Strategy (NPAES)**

As development increases through time, the expansion of protected areas should also be increased. The NPAES has been developed to identify areas which represent areas of natural vegetation in good condition, with significant diversity and in need of increased conservation. These NPAES Focus Areas therefore represent areas with a significant sensitivity. The study area being considered for development does not contain any NPAES Focus Areas which would otherwise increase the conservation value of the area.

- **Threatened Ecosystems**

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) has identified ecosystem which area considered Threatened Ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. Such endangered ecosystems are normally vegetation types which are subjected to severe development pressures and which will require protected in some form in order to meet conservation targets.

The study area and vegetation type in this area, Carletonville Dolomite Grassland (Gh 15) is not currently subjected to high development pressures, is currently listed as being of Least Concern and therefore not regarded as a Threatened Ecosystem. Western Highveld Sandy Grassland (Gh 14) is currently being subjected to extensive transformation for agricultural crop production and is therefore currently listed as a CR system. There are however no remnants of this vegetation type located near the site and is therefore irrelevant for the development (Appendix A: Map 1).

- **Protected Areas**

Formally and informally protected areas function in the preservation of natural areas and these areas are normally regarded as having a very high conservation value. The National Environmental Management Protected Areas Act (NEMPAA of 2003) allows for the proclamation of an area as a protected area. The following conservation areas have been identified in this area (Appendix A: Map 1):

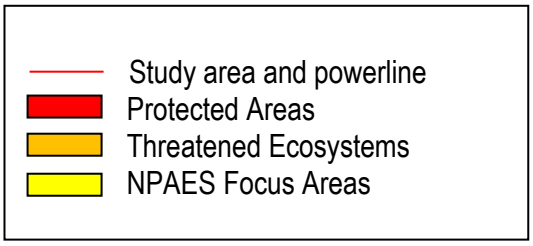
- Lichtenburg Game Breeding Centre – This protected area is located to the west of the study area but will be affected by the grid connection powerline. It is an informal protected area, i.e. it is not formally protected by the NEMPAA. Despite this, the area will still retain a high conservation value.

- Marico Biosphere Reserve – This protected area borders the study area to the north. A biosphere reserve is large parcel of land within which the land use is determined by the local society. The protected area should remain unaffected by the proposed development. However, the biosphere reserve should still be consulted during the application process.

- Rall Broers Private Nature Reserve – A private nature reserve is a conservation area governed by the NEMPAA but which is under private ownership. The protected area is located to the north east of the site and will be irrelevant to the development.

Figure 5: View of additional datasets which are relevant to the development. This includes Threatened Ecosystems, NPAES Focus Areas and protected areas.

**Legend:**




### 5.1.4 Conclusions

From the description of the remaining natural vegetation in the study area the following elements of ecological importance should be taken into account in the development (Appendix A: Map 1 – 3):

- The vegetation type occurring in this area is fairly uniform and is not currently listed as a Threatened Ecosystem.
- Despite being fairly uniform the vegetation type in the area, Carletonville Dolomite Grassland, may still contain elements of conservation value and consequently, where natural portions of these vegetation types remain they should be regarded as having a significant conservation value.

- Despite being fairly uniform, the vegetation type in this area still contain significant numbers of protected species which should also be taken into account in the sensitivity of remaining natural vegetation.
- A large portion of the study area consists of a Terrestrial ESA 1 (ESA) and functions as part of an ecological corridor. This function will most likely be affected by the development and will have to be taken into consideration.
- Marginal portion of the proposed grid connection corridor encroach into a Terrestrial CBA 2 area which functions as a critical corridor. The powerline is unlikely to significantly affect this function but will still have to be taken into consideration by the development.
- The region forms part of the Bo-Molopo Karst Belt Strategic Water Source Area (SWSA) which perform important functions in terms of groundwater resources. As a result, it is listed as an Aquatic ESA 1. The development is unlikely to affect this functioning though it will still need to be taken into consideration by the development.
- A central lower lying area is listed as an Aquatic CBA 1 as it forms a wetland system which is of high conservation value. This will be an important element which the development will have to avoid.
- The Marico Biosphere Reserve borders the study area to the north. The protected area should remain unaffected by the proposed development. However, the biosphere reserve should still be consulted during the application process.
- The Lichtenburg Game Breeding Centre is located to the west of the study area but will be affected by the grid connection powerline. It is an informal protected area, i.e. it is not formally protected by the NEMPAA. Despite this, the area will still retain a high conservation value.

### 5.2 Overview of terrestrial fauna

From desktop assessment the actual occurrence of fauna in the study area cannot be determined but species likely to occur in the region can be determined. Given the remaining natural vegetation in the area which is largely intact, with corridors also being retained and, at least from a desktop perspective, regarded to be in a fairly good condition it is anticipated likely that species of conservation significance will still occur in the area. The habitat is however fairly uniform and the area is also not known to harbour a large amount of species being of high conservation value. However, given the large extent of the development, it also remains possible that fauna of conservation importance may occur.

Table 3: Red Listed mammals likely to occur in the study area (Child *et al* 2016).

| Scientific name | Common name | Status |
|---|---|---|
| *Damaliscus lunatus lunatus* | (Southern African) Tsessebe | Vulnerable |
| *Damaliscus pygargus pygargus* | Bontebok | Vulnerable |
| *Hippotragus equinus* | Roan Antelope | Endangered |
| *Hippotragus niger niger* | Sable Antelope | Vulnerable |
| *Pelea capreolus* | Vaal Rhebok | Near Threatened |
| *Atelerix frontalis* | Southern African Hedgehog | Near Threatened |
| *Felis nigripes* | Black-footed Cat | Vulnerable |
| *Leptailurus serval* | Serval | Near Threatened |
| *Hyaena brunnea* | Brown Hyena | Near Threatened |
| *Otomys auratus* | Southern African Vlei Rat | Near Threatened |

| | | |
|---|---|---|
| | (Grassland type) | |
| *Aonyx capensis* | African Clawless Otter | Near Threatened |
| *Mystromys albicaudatus* | African White-tailed Rat | Vulnerable |
| *Crocidura mariquensis* | Swamp Musk Shrew | Near Threatened |

It is clear that the area may contain numerous species of conservation importance (Table 3). However, many of these, especially the larger antelope will only be present in conservation or game breeding areas and will not be relevant for the development. These include Tsessebe, Bontebok, Roan Antelope and Sable Antelope. The remaining smaller species are however quite likely to still occur in this area. They will however be dependent on habitat in good condition. Should such a species be present on the site the focus should be the preservation of the habitat of fauna instead of trying to preserve the animal itself. If habitat is adequately preserved and maintained the animals themselves will by default also be adequately preserved.

Table 4: Likely faunal species in the region.

| Family | Scientific name | Common name |
|---|---|---|
| Bathyergidae | *Cryptomys hottentotus* | Southern African Mole-rat |
| Bovidae | *Aepyceros melampus* | Impala |
| | *Alcelaphus buselaphus caama* | Red Hartebeest |
| | *Antidorcas marsupialis* | Springbok |
| | *Connochaetes gnou* | Black Wildebeest |
| | *Connochaetes taurinus* | Blue Wildebeest |
| | *Damaliscus lunatus lunatus* | (Southern African) Tsessebe |
| | *Damaliscus pygargus phillipsi* | Blesbok |
| | *Damaliscus pygargus pygargus* | Bontebok |
| | *Hippotragus equinus* | Roan Antelope |
| | *Hippotragus niger niger* | Sable Antelope |
| | *Kobus ellipsiprymnus* | Waterbuck |
| | *Oryx gazella* | Gemsbok |
| | *Pelea capreolus* | Vaal Rhebok |
| | *Raphicerus campestris* | Steenbok |
| | *Redunca arundinum* | Southern Reedbuck |
| | *Redunca fulvorufula* | Mountain Reedbuck |
| | *Sylvicapra grimmia* | Bush Duiker |
| | *Syncerus caffer* | African Buffalo |
| | *Taurotragus oryx* | Common Eland |
| | *Tragelaphus angasii* | Nyala |
| | *Tragelaphus scriptus* | Bushbuck |
| | *Tragelaphus strepsiceros* | Greater Kudu |
| Camelidae | *Camelus dromedarius* | One-humped Camel |
| Canidae | *Canis mesomelas* | Black-backed Jackal |
| | *Otocyon megalotis* | Bat-eared Fox |
| | *Vulpes chama* | Cape Fox |
| Cercopithecidae | *Chlorocebus pygerythrus pygerythrus* | Vervet Monkey (subspecies pygerythrus) |
| | *Papio ursinus* | Chacma Baboon |
| Cervidae | *Dama dama* | Fallow Deer |
| | *Elaphurus davidianus* | Père David's Deer |

| | | |
|---|---|---|
| Equidae | *Equus quagga* | Plains Zebra |
| Erinaceidae | *Atelerix frontalis* | Southern African Hedgehog |
| Felidae | *Caracal caracal* | Caracal |
| | *Felis catus* | Domestic Cat |
| | *Felis nigripes* | Black-footed Cat |
| | *Leptailurus serval* | Serval |
| | *Panthera leo* | Lion |
| Giraffidae | *Giraffa giraffa giraffa* | South African Giraffe |
| Gliridae | *Graphiurus (Graphiurus) platyops* | Flat-headed African Dormouse |
| Herpestidae | *Atilax paludinosus* | Marsh Mongoose |
| | *Cynictis penicillata* | Yellow Mongoose |
| | *Herpestes sanguineus* | Slender Mongoose |
| | *Ichneumia albicauda* | White-tailed Mongoose |
| | *Suricata suricatta* | Meerkat |
| Hyaenidae | *Hyaena brunnea* | Brown Hyena |
| | *Proteles cristata* | Aardwolf |
| Hystricidae | *Hystrix africaeaustralis* | Cape Porcupine |
| Leporidae | *Lepus capensis* | Cape Hare |
| | *Lepus saxatilis* | Scrub Hare |
| | *Pronolagus randensis* | Jameson's Red Rock Hare |
| Macroscelididae | *Elephantulus myurus* | Eastern Rock Elephant Shrew |
| Molossidae | *Chaerephon pumilus* | Little Free-tailed Bat |
| | *Tadarida aegyptiaca* | Egyptian Free-tailed Bat |
| Muridae | *Aethomys ineptus* | Tete Veld Aethomys |
| | *Aethomys namaquensis* | Namaqua Rock Mouse |
| | *Gerbilliscus brantsii* | Highveld Gerbil |
| | *Gerbilliscus leucogaster* | Bushveld Gerbil |
| | *Mastomys coucha* | Southern African Mastomys |
| | *Mastomys natalensis* | Natal Mastomys |
| | *Mus (Nannomys) indutus* | Desert Pygmy Mouse |
| | *Mus (Nannomys) minutoides* | Southern African Pygmy Mouse |
| | *Otomys auratus* | Southern African Vlei Rat (Grassland type) |
| | *Rhabdomys pumilio* | Xeric Four-striped Grass Rat |
| Mustelidae | *Aonyx capensis* | African Clawless Otter |
| | *Ictonyx striatus* | Striped Polecat |
| | *Mellivora capensis* | Honey Badger |
| Nesomyidae | *Dendromus melanotis* | Gray African Climbing Mouse |
| | *Mystromys albicaudatus* | African White-tailed Rat |
| | *Saccostomus campestris* | Southern African Pouched Mouse |
| Orycteropodidae | *Orycteropus afer* | Aardvark |
| Pedetidae | *Pedetes capensis* | South African Spring Hare |
| Procaviidae | *Procavia capensis* | Cape Rock Hyrax |
| Rhinolophidae | *Rhinolophus clivosus* | Geoffroy's Horseshoe Bat |
| Sciuridae | *Paraxerus cepapi* | Smith's Bush Squirrel |

| | | |
|---|---|---|
| | *Xerus inauris* | South African Ground Squirrel |
| Soricidae | *Crocidura mariquensis* | Swamp Musk Shrew |
| | *Myosorex varius* | Forest Shrew |
| | *Suncus varilla* | Lesser Dwarf Shrew |
| Suidae | *Phacochoerus africanus* | Common Warthog |
| | *Potamochoerus larvatus koiropotamus* | Bush-pig (subspecies koiropotamus) |
| | *Potamochoerus porcus* | Red River Hog |
| Thryonomyidae | *Thryonomys swinderianus* | Greater Cane Rat |
| Vespertilionidae | *Miniopterus natalensis* | Natal Long-fingered Bat |
| | *Myotis tricolor* | Temminck's Myotis |
| | *Neoromicia capensis* | Cape Serotine |
| Viveridae | *Genetta maculata* | Common Large-spotted Genet |
| | *Genetta genetta* | Common Genet |
| | *Genetta tigrina* | Cape Genet (Cape Large-spotted Genet) |

### 5.3 Wetland Assessment

#### 5.3.1 Wetland and watercourse indicators

From current mapping resources the study area does not seem to contain a large degree of watercourses and wetlands. However, a few do seem to be present and will be most likely to be affected by the development. Two prominent wetland systems are indicated for the study area (Appendix A: Map 1 – 3). A large lower lying wetland area transects the northern portion of the study area while another wetland system will be crossed by the grid connection powerline. It is however not possible from a desktop assessment perspective to determine if wetland conditions are present in these and therefore, they must all be assumed to contain wetland conditions.

Available mapping resources and previous studies in the surrounding areas will be utilised to provide a basic description of the study area (Appendix A: Map 1-3).

The term watercourse refers to a river, stream, wetland or pan. The National Water Act (NWA, 1998) includes rivers, streams, pans and wetlands in the definition of the term watercourse. This definition follows:

Watercourse means:

- A river or spring.
- A natural channel in which water flows regularly or intermittently.
- A wetland, lake or dam into which water flows.
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Riparian habitat is an accepted indicator of watercourses used to delineate the extent of wetlands, rivers, streams and pans (Department of Water Affairs and Forestry 2005). In the

absence of a site survey the delineation of the border of the riparian zone is however not possible and the regulated area (DWS 2016) should be used:

**"regulated area of a watercourse"** for section 21(c) or (i) of the Act water uses in terms of this Notice means:
(a) The outer edge of the 1 in 100 year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
(b) In the absence of a determined 1 in 100 year flood line or riparian area **the area within 100m from the edge of a watercourse** where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or
(c) **A 500 m radius from the delineated boundary (extent) of any wetland or pan**.

In the absence of a site survey the following guidelines and frameworks will be used to give background information in terms of delineation of the watercourses and wetlands in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

The classification of stream orders from 1 to 3 can be illustrated by means of the Strahler 1952 classification:

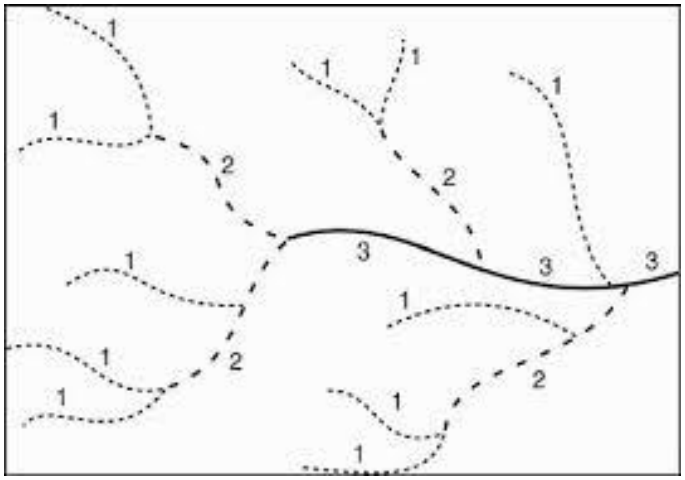


Figure 6: The classification of stream orders from 1 to 3 (Strahler 1952)

A summary of the two prominent wetland systems in the area are given below (Table 5).

Table 5: Summary of wetland systems in the study area (See also Appendix A: Map 1-3).

| Bioregion | Wetland type | Artificial | Location |
|---|---|---|---|
| Highveld Dry Grassland | Seep | NO | Northern portion of study area |
| Highveld Dry Grassland | Depression | NO | Grid connection powerline |

### 5.3.2 Classification of wetland systems

The wetland systems which may likely occur in the study area as listed in the previous section may be classified into different wetland types. In the absence of a site-survey these types cannot be determined with accuracy but the available desktop information provides likely wetland types to occur:

**The wetland system transection the northern portion of the development site would possible be categorised as a valley bottom wetland without a channel (SANBI 2009):**

A mostly flat valley-bottom wetland area without a major channel running through it, characterised by an absence of distinct channel banks and the prevalence of diffuse flows, even during and after high rainfall events. Water inputs are typically from an upstream channel, as the flow becomes dispersed, and from adjacent slopes (if present) or groundwater. Water generally moves through the wetland in the form of diffuse surface flow and/or interflow (with some temporary containment of water in depressional areas), but the outflow can be in the form of diffuse or concentrated surface flow. Infiltration and evaporation from unchannelled valley-bottom wetlands can be significant, particularly if there are a number of small depressions within the wetland area. Horizontal, unidirectional diffuse surface-flow tends to dominate in terms of the hydrodynamics.

Aerial images indicate that this may be an accurate identification of the wetland conditions along this linear, lower lowing area.

**Desktop information indicate that this northern wetland system may also be associated with depression wetland areas (SANBI 2009):**

A depression wetland is a basin shaped area with a closed elevation contour with an increase in depth from the perimeter to the central areas that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. For 'depressions with channelled inflow', concentrated overland flow is typically a major source of water for the wetland, whereas this is not the case for 'depressions without channelled inflow'. Dominant hydrodynamics are (primarily seasonal) vertical fluctuations. Depressions may be flatbottomed (in which case they are often referred to as 'pans') or round-bottomed (in which case they are often referred to as 'basins') and may have any combination of inlets and outlets or lack them completely. For 'exorheic depressions', water exits as concentrated surface flow while, for 'endorheic depressions', water exits by means of evaporation and infiltration.

Though this is difficult to confirm from desktop information isolated depressions may form separate depression wetland areas.

**The wetland system which will be affected by the grid connection powerline is indicated as a seepage wetland (SANBI 2009):**

**Hillslope seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Water inputs are primarily from groundwater or precipitation that that enters the wetland from an up-slope direction in the form of subsurface flow. Water movement through the wetland is mainly in the form of interflow, with diffuse overland flow ('sheetwash') often being significant during and after rainfall events. Water leaves a 'hillslope seep with channelled outflow' mostly by means of concentrated surface flow, whereas water leaves a 'hillslope seep without channelled outflow' by means of a combination of diffuse surface flow, interflow, evaporation and infiltration (as distinguished at Level 4C).

Given the aerial images and shape of the wetland this may not necessarily be accurate but will be confirmed by on-site surveys.

### 5.3.3 Condition and importance of the affected watercourses and wetlands

Previous desktop assessment Nel *et al* (2011), Van Deventer *et al* 2018 and Kleynhans (2000) will be utilised to provide estimated conditions of the two affected wetland systems where available (Table 5). It must however be stressed that these are in themselves not very accurate and therefore should be augmented by on-site surveys.

Table 6 refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of rivers relative to the natural or close to the natural reference condition. The purpose of the EcoClassification process is to gain insights and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the river (Kleynhans & Louw 2007).

Table 7 refers to the Ecological Importance and Sensitivity (EIS) of wetlands. "Ecological importance" of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. "Ecological sensitivity" refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The Ecological Importance and Sensitivity (EIS) provides a guideline for determination of the Ecological Management Class (EMC).

Table 6: Ecological categories for Present Ecological Status (PES).

| Ecological Category | Description |
|---|---|
| A | Unmodified, natural |
| B | Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. |
| C | Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominately unchanged. |
| D | Largely modified. A large loss of natural habitat, biota and basic ecosystem function has occurred. |
| E | Seriously modified. The loss of natural habitat, biota and basic |

| | |
|---|---|
| | ecosystem functions is extensive. |
| F | Critically/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible. |

Table 7: Ecological importance and sensitivity categories.

| **Ecological Importance and Sensitivity Category (EIS)** | **Range of Median** | **Recommended Ecological Management Class** |
|---|---|---|
| Very High<br>Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers. | >3 and <=4 | A |
| High<br>Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers. | >2 and <=3 | B |
| Moderate<br>Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers. | >1 and <=2 | C |
| Low/marginal<br>Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers. | >0 and <=1 | D |

Table 8: Desktop summary of the Present Ecological State (PES) of the two wetland systems likely to be affected by the development (NFEPA – National Freshwater Ecosystem Priority Areas) (Appendix A: Map 1 – 3).

| | **Northern wetland system** | **Powerline wetland system** |
|---|---|---|
| Regional Setting | Highveld Dry Grassland Bioregion | Highveld Dry Grassland Bioregion |
| Landscape Setting | Plain | Slope |
| Hydrogeomorphic types | Depression | Seep |
| Wetland size | 5 ha | 320 ha |
| Current impacts | None | Roads and mining |
| Quaternary Catchment | C31A | C31A |
| Desktop PES | D/E/F | A/B |
| Ecosystem Threat Status | Least Concern | Critically Endangered |
| Ecosystem Protection Level | Poorly Protected | Not Protected |

The condition of the two wetland systems likely to be affected by the development cannot be determined with accuracy at a desktop level though indications of likely impacts that may affect these systems include the following:

- Ploughing and cultivation has occurred along portions of the northern wetland system. This will have a large impact on the system should the site survey indicate this to be the case.
- Sections of the wetland which will be affected by the powerline has clearly been affected by alluvial diamond mining. This is anticipated to have had a large impact on this system.
- Several gravel roads cross over both wetland systems, though the system along the powerline is affected to a greater degree.

The determination of the Ecological Importance & Sensitivity (EI&S) for the wetland systems is not possible at a desktop level as this requires the input of site-specific data.

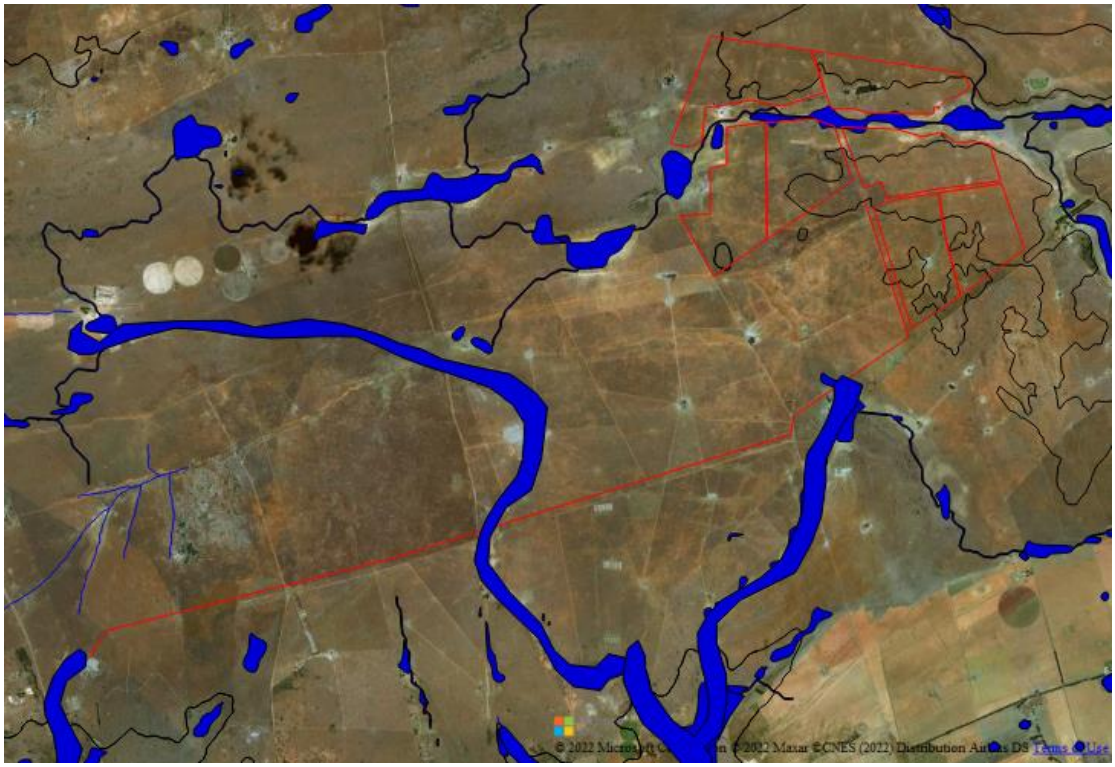
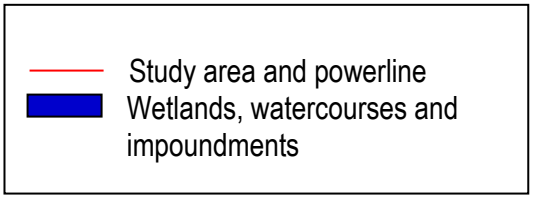


Figure 6: View of the wetlands which will be affected by the development. This consists of a wetland system in the northern portion of the development site and a wetland system which will be affected by the grid connection powerline.

**Legend:**



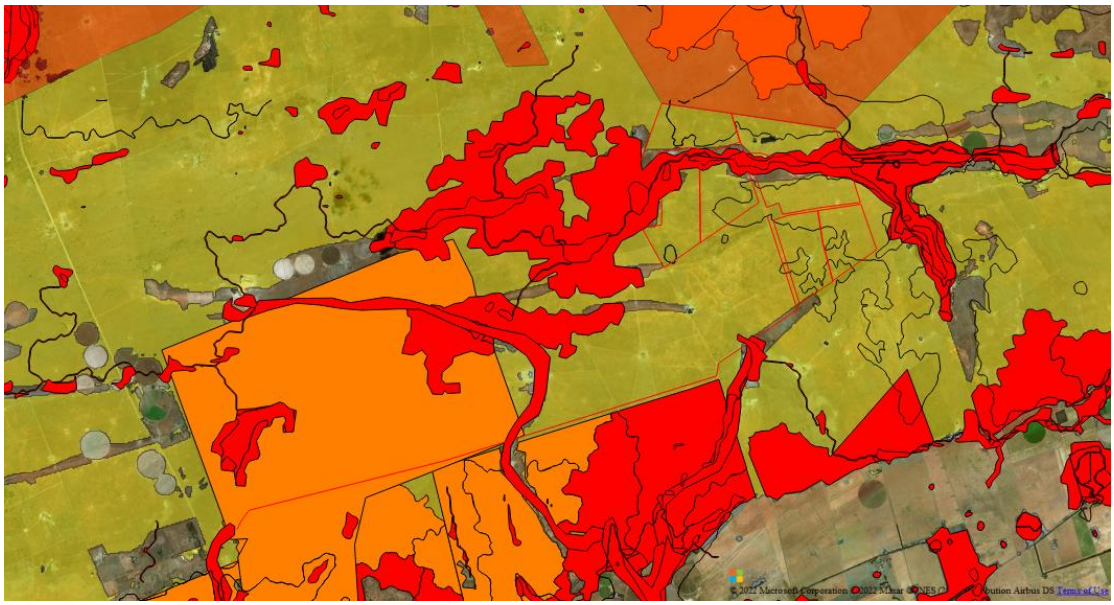

### 5.4 Desktop sensitivity

Utilising information as obtained from desktop resources, a course and preliminary indication of the relative sensitivity of the area can be provided (Appendix A: Map 3). This is however likely to be fairly inaccurate and should not be used in the planning of the proposed development. This does however give an indication of areas that should be surveyed and verified during the site survey. The following relative sensitives has been allocated to the study area:

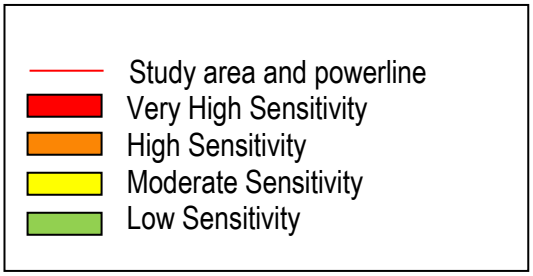
- The vegetation type occurring in this area is fairly uniform and is not currently listed as a Threatened Ecosystem. Despite being fairly uniform the vegetation type in the area, Carletonville Dolomite Grassland, may still contain elements of conservation value and consequently, where natural portions of these vegetation types remain they should be regarded as having a significant conservation value. Any remaining natural areas should therefore be afforded at least a Moderate level of sensitivity.
- A central lower lying area is listed as an Aquatic CBA 1 as it forms a wetland system which is of high conservation value. This will be an important element which the

development will have to avoid. CBA 1 areas should always be afforded a Very High level of sensitivity.

- The Marico Biosphere Reserve borders the study area to the north. The protected area should remain unaffected by the proposed development. However, the biosphere reserve should still be consulted during the application process. It should be regarded as a Very High level of sensitivity.
- The Lichtenburg Game Breeding Centre is located to the west of the study area but will be affected by the grid connection powerline. It is an informal protected area, i.e. it is not formally protected by the NEMPAA. Despite this, the area will still retain a High level of sensitivity.



**Legend:**



## 6. ANTICIPATED IMPACTS

From a desktop perspective it is not possible to provide any accurate assessment of the impacts that the development will have. Instead, the likely anticipated impacts will be listed which will be assessed during a subsequent field assessment.

**Likely impacts**

- Loss of vegetation and consequently habitat and species diversity as a result. The study area still consists largely of natural vegetation which may contain elements of high conservation value. The development will require the removal of vegetation and altering the surface topography and will lead to the loss of habitat and species diversity.
- Loss of protected, rare or threatened plant species. Desktop information indicates the area may contain numerous protected species of which several are also Red Listed species. The development will require the removal of vegetation and the subsequent loss of any species of conservation importance.
- Impacts on watercourses, wetlands or the general catchment. Desktop information indicate the presence of at least two wetland systems in the study area. The development and grid connection powerline will certainly have an effect on these systems.
- The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions. Disturbance caused by the development will result in the increased establishment of exotic and invasive plant species.
- Any increased erosion that the development may cause. The development will require the removal of the natural vegetation which in turn will result in increased runoff. In combination with the rain shadow effect caused by solar panels and concentrated flowpaths it is highly likely that erosion will increase.
- Fragmentation of habitat, disruption of ecological connectivity and -functioning in terms of the surrounding areas. The development will transform a large portion of natural land and which will then alter the current ecological corridors and will result in a disruption of migration routes.
- Impacts that will result on the mammal population on and around the site. As the development will result in the loss of habitat and transformation of natural areas this will decrease the available habitat for mammals.
- Any significant cumulative impacts that the development will contribute towards. The development will entail seven separate development areas as well as a grid connection powerline. Although separately they may still entail a significant impact, cumulatively they will also further increase the initial impact. The region is also being considered for several other solar developments and cumulatively the impact would therefore be significant.

| Issue | Nature of impact | Extent of impact | No-go areas |
|---|---|---|---|
| Loss of vegetation and consequently habitat and species diversity as a result. | The study area still consists largely of natural vegetation which may contain elements of high conservation value. The development will | **National** – Loss of vegetation and habitat may have an impact on meeting national conservation targets for specific habitats and | Likely but not possible to determine at a desktop level. |

| | | | |
|---|---|---|---|
| | require the removal of vegetation and altering the surface topography and will lead to the loss of habitat and species diversity. | vegetation types. | |
| Loss of protected, rare or threatened plant species. | Desktop information indicates the area may contain numerous protected species of which several are also Red Listed species. The development will require the removal of vegetation and the subsequent loss of any species of conservation importance. | **National** – Depending on the rarity and status, the loss of any Red Listed species will compromise the national status of the species and consequently the risk of extinction. | Likely but not possible to determine at a desktop level. Should any Red Listed species occur this may require exclusion of the population or part of it. |
| Impacts on watercourses, wetlands or the general catchment. | Desktop information indicate the presence of at least two wetland systems in the study area. The development and grid connection powerline will certainly have an effect on these systems. | **Regional** – Impacts on watercourses and wetlands may be propagated to downstream systems in which case the broader system will also be affected by the development. | Highly likely but not possible to determine at a desktop level. Should wetland systems be confirmed to be present they will be regarded as no-go areas and should be excluded from development. |
| The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions. | Disturbance caused by the development will result in the increased establishment of exotic and invasive plant species. | **Regional** – Increased establishment of weeds will form a dispersion node from where weeds will most likely spread into the surrounding areas. | Unlikely. |
| Any increased erosion that the development may cause. | The development will require the removal of the natural vegetation which in turn will result in increased runoff. In combination with the rain shadow effect caused by solar panels and concentrated | **Regional** – Erosion induced by developments entails the unnatural removal of topsoil which results in high sediment loads in watercourses which when transported to downstream systems | Unlikely. |

| | | | |
|---|---|---|---|
| | flowpaths it is highly likely that erosion will increase. | will also affect the broader system. | |
| Fragmentation of habitat, disruption of ecological connectivity and -functioning in terms of the surrounding areas. | The development will transform a large portion of natural land and which will then alter the current ecological corridors and will result in a disruption of migration routes. | **Regional** – Where corridors are affected and loss of habitat occurs this will affect the surrounding population dynamics and may also affect the regional mammal population. | Highly likely but not possible to determine at a desktop level. Should critical corridors be present this may require exclusion of at least a portion of these areas. |
| Impacts that will result on the mammal population on and around the site. | As the development will result in the loss of habitat and transformation of natural areas this will decrease the available habitat for mammals. This may in turn affect the population size of endangered species. | **National** – Should any populations of conservation concern be present on the site, the resulting development will reduce the overall population size which may then affect its national status. | Likely but not possible to determine at a desktop level. Should any Red Listed species occur this may require exclusion of the population or part of it. |
| Any significant cumulative impacts that the development will contribute towards.. | The development will entail seven separate development areas as well as a grid connection powerline. Although separately they may still entail a significant impact, cumulatively they will also further increase the initial impact. The region is also being considered for several other solar developments and cumulatively the impact would therefore be significant | **Regional** – Increasing transformation for solar developments in this region will increase the regional impact. | Likely but not possible to determine at a desktop level. Should the cumulative impact of transformation be considered too high, a decrease in the transformation area may be required. |
| **Description of expected significance of impact**<br>In the absence of on-site data, areas that are still perceived to be in a natural condition, should always be regarded as having a significant conservation value. The anticipated impacts should therefore likewise be regarded as significant. In addition, the extent of a development should always be considered when anticipating the desktop impacts. In this instance the extent of the development area is fairly large (approximately 1600 hectares) and as a result this will also increase the significance of anticipated impacts. | | | |
| **Gaps in knowledge & recommendations for further study** | | | |

From the information obtained during the desktop assessment, it should be clear that only scant and vague descriptions of the area are provided. The desktop assessment should therefore not be utilised in planning of the development since it is based on incomplete information. A comprehensive on-site survey should be conducted and the following should be determined by the assessment:

- Survey and describe the vegetation composition on the site.
- Estimate the habitat and species diversity and delineate any unique habitats or areas with a significant species diversity.
- Determine the presence of protected, rare or endangered plant species in the area and delineate colonies where possible.
- Assess the overall condition of the vegetation type and habitat on the site in order to determine the overall conservation value of it.
- Assess current impacts on the site which will also inform the conservation value.
- Conduct a broad overview of the mammal population on the site and estimate the likelihood that species of conservation concern may occur.
- Survey and confirm the presence of watercourses and wetland areas on the site. Where such systems have been confirmed, they should be delineated and their Present Ecological State (PES) determined.

## 7. BIODIVERSITY SENSITIVITY RATING (BSR)

From a desktop perspective it is not possible to provide area specific assessments for the study area. Instead, the study area will be discussed in overview to give an indication of the overall condition and sensitivity which will then indicate the need for further detailed assessment.

**Habitat diversity and species richness:**
The study area has a fairly large extent and as a result contains a moderate habitat diversity though overall it is a relatively flat area. Hills, ridges and rocky outcrops are not prominent though given that the area consists of Carletonville Dolomite Grassland, it is likely that a degree of surface dolomite would be present. The vegetation type in the area is also adapted to a mosaic pattern of shallow soils over dolomite It consists of a well-developed grass layer but with scattered trees and shrubs, especially where surface rock occurs. Protected plant species are also evident and it is likely that the area will contain many such species. Should this be the case it is likely to provide significantly different habitats and the vegetation composition and diversity may also be increased. The lower lying area in the northern portion of the study area may also represent a wetland area. As a result, at least a moderate habitat diversity is anticipated and species diversity may also be high in some areas.

**Presence of rare and endangered species:**
The vegetation type around the Lichtenburg area contain some protected and Red Listed species (Appendix B). These are also of significant conservation value and will therefore increase the sensitivity of the study area where they occur. There is a high likelihood that many of these species as listed will occur within the study area. Only two Red Listed species occur here and these are currently Vulnerable and Near Threatened. The area therefore contains a moderate likelihood of protected plant species occurring but is not known to contain a high abundance of Red Listed species. These species as listed are all adapted to a grassland habitat with some being more dependant on surface rock. Both of these habitat requirements are present on the site and therefore there is a high likelihood that any of these would occur on the site.

**Ecological function:**
Desktop information indicate the area to still largely consist of natural vegetation and the majority of ecological functions would therefore still be intact (Appendix A: Map 1 – 3). The site functions as habitat for a variety of fauna, supports specific vegetation types and the likely presence of wetland system would also provide vital functions in terms of water transportation, wetland and aquatic habitats and bio-remediation. The default situation would therefore be that the area contains important ecological functions and only a site survey would be able to indicate the relevant importance of these functions in terms of the site and surrounding areas.

**Degree of rarity/conservation value:**
According to Mucina & Rutherford (2006) the area consists of Carletonville Dolomite Grassland (Gh 15). This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). Although it is in some instances heavily affected by crop cultivation and mining this is not yet considered to be to such an extent as to warrant it being considered a Threatened Ecosystem. The general conservation value of this vegetation type would therefore be regarded as moderate.

The North West Biodiversity Sector Plan (2015) has recently been published and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas. The site in question is listed as being an Ecological Support Area (ESA) 1 (Appendix A: Map 2). Areas identified as ESA 1 are associated with and functions as part of an ecological corridor. This function will most likely be affected by the development and will have to be taken into consideration.

A central lower lying area is listed as CBA 1 as it forms a wetland system which is of high conservation value (Appendix A: Map 2). This will be an important element which the development will have to avoid.

**Percentage ground cover:**
From a desktop perspective, it is not possible to accurately determine the modification in terms of the vegetation cover. If assumptions are correct in that the area is still dominated by natural grassland the percentage ground cover is still anticipated to be high. The current land use is most likely associated with domestic livestock farming and if we assume that this is managed at acceptable stocking levels, the percentage ground cover should still be largely intact.

**Vegetation structure:**
Likewise, the modification of the natural vegetation structure in the study area based only on desktop information cannot be determined with accuracy. However, from available desktop information it seems likely that the natural grassland still dominates. It is possible that encroachment of trees may be possible but in the absence of on-site data we have to assume that the vegetation structure is still intact.

**Infestation with exotic weeds and invader plants:**
The presence of exotic weeds and invasive plants cannot be determined at a desktop level. However, if we assume that in general all natural remaining areas in the country contain at least some weeds we can estimate a moderate infestation by exotics (Appendix B).

**Degree of grazing/browsing impact:**
The main land use in the area is coupled with domestic livestock farming. Grazing and trampling is therefore anticipated to be moderate.

**Signs of erosion:**
From desktop information it is difficult to estimate the amount of erosion occurring in the study area. However, when taking into account the known land uses the amount of erosion is anticipated to be moderate. Areas which is anticipated to be most affected by erosion will occur in those portions affected by overgrazing, which will decrease the vegetation cover, increase trampling and consequently erosion of the topsoil. Higher erosion values is also likely where infrastructure cross watercourses and where these structures caused obstruction to flow they may increase erosion of the banks.

**Terrestrial animals:**
From desktop assessment the actual occurrence of fauna in the study area cannot be determine but species likely to occur in the region can be determined. Given the remaining natural vegetation in the area which is largely intact, with corridors also being retained and, at least from a desktop perspective, regarded to be in a fairly good condition it is anticipated likely that species of conservation significance will still occur in the area. The habitat is however fairly uniform and the area is also not known to harbour a large amount of species being of high

conservation value. However, given the large extent of the development, it also remain possible that fauna of conservation importance may occur.

Table 9: Biodiversity Sensitivity Rating for the proposed solar development.

| | Low (3) | Medium (2) | High (1) |
|---|---|---|---|
| Vegetation characteristics | | | |
| Habitat diversity & Species richness | | 2 | |
| Presence of rare and endangered species | | | 1 |
| Ecological function | | | 1 |
| Uniqueness/conservation value | | 2 | |
| | | | |
| Vegetation condition | | | |
| Percentage ground cover | | | 1 |
| Vegetation structure | | | 1 |
| Infestation with exotic weeds and invader plants or encroachers | | 2 | |
| Degree of grazing/browsing impact | | 2 | |
| Signs of erosion | | 2 | |
| | | | |
| Terrestrial animal characteristics | | | |
| Presence of rare and endangered species | | 2 | |
| Sub total | 0 | 12 | 4 |
| Total | | 16 | |

## 8. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 10: Interpretation of Biodiversity Sensitivity Rating.

| Site | Score | Site Biodiversity Rating | Value |
|---|---|---|---|
| Lichtenburg solar development | 16 | Good Condition | 2 |

In terms of the biodiversity sensitivity for the study area, when considered from an overall desktop perspective, it is clear that the vegetation characteristics contain several aspects with high sensitivity values and which therefore indicates the need for comprehensive survey thereof in order to accurately determine the site specific areas which will be most relevant to the development.

## 9. DISCUSSION AND CONCLUSION (Appendix A: Map 1 - 3)

The study area is considered to be largely natural and though fairly uniform, is still likely to contain elements of high sensitivity. The desktop study should be utilised as a baseline to provide information on areas and aspects which should form the focus of a comprehensive, on-site survey to inform the development process.

The study area is situated to the north east of the town of Lichtenburg in the North West Province (Appendix A: Map 1 – 3). The study area is quite extensive and includes large terrestrial plains while some wetlands also appear to be present, large watercourses are however absent. The site has an approximate extent of 1600 hectares. The area seems to be largely natural and still consists of grassland with scattered trees. Some areas seem to have been previously ploughed and cultivated and will likely represent transformed areas.

Lichtenburg, and the specific study area, is situated within the Grassland Biome and under natural conditions would be dominated by grasses with shrubs and trees being almost completely absent. However, this region is situated in a transitional area between the Grassland and Savannah Biomes and consequently a tree layer is present but sparse and represented by scattered trees. Where hills, ridges or rocky terrain occur, this will also promote the establishment of trees. Watercourses also contain differing soils conditions, climate and moisture regime which enables the establishment of shrubs and trees. Naturally, the area should therefore be dominated by open grassland but with scattered trees also present. From aerial images, this still seems to be the case for the study area. However, patches and pockets of lower lying areas had previously been ploughed and cultivated. These are most probably areas containing deeper soils with a higher moisture regime. This is also relevant where the surrounding areas may be dominated by surface dolomite rock. Where farmsteads occur this has also caused localised disturbances though are confined to small areas in relation to the broader study area. Overall the vegetation composition and structure of the area would therefore seem to be largely intact.

### 9.1 Terrestrial Ecology

As indicated, the area seems to have a fairly uniform topography as well as soils and geology and as a result contains only one main vegetation type. According to Mucina & Rutherford (2006), the study area consists exclusively of Carletonville Dolomite Grassland (Gh 15). According to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) this vegetation type is currently listed as being of Least Concern (LC) (Appendix A: Map 2). Although it is in some instances heavily affected by crop cultivation and mining this is not yet considered to be to such an extent as to warrant it being considered a Threatened Ecosystem. This vegetation type also corresponds well to the topography and geology of the site. It is adapted to a mosaic pattern of shallow soils over dolomite It consists of a well-developed grass layer but with scattered trees and shrubs, especially where surface rock occurs.

The vegetation type around the Lichtenburg area contain some protected and Red Listed species (Appendix B). These are also of significant conservation value and will therefore increase the sensitivity of the study area where they occur. There is a high likelihood that many of these species as listed will occur within the study area. Only two Red Listed species occur here and these are currently Vulnerable and Near Threatened. The area therefore contains a moderate likelihood of protected plant species occurring but is not known to contain a high

abundance of Red Listed species. These species as listed are all adapted to a grassland habitat with some being more dependant on surface rock. Both of these habitat requirements which are present on the site and therefore there is a high likelihood that any of these would occur on the site.

From the description of the remaining natural vegetation in the study area the following elements of ecological importance should be taken into account in the development (Appendix A: Map 1 – 3):

- The vegetation type occurring in this area is fairly uniform and is not currently listed as a Threatened Ecosystem.
- Despite being fairly uniform the vegetation type in the area, Carletonville Dolomite Grassland, may still contain elements of conservation value and consequently, where natural portions of these vegetation types remain they should be regarded as having a significant conservation value.
- Despite being fairly uniform, the vegetation type in this area still contain significant numbers of protected species which should also be taken into account in the sensitivity of remaining natural vegetation.
- A large portion of the study area consists of a Terrestrial ESA 1 (ESA) and functions as part of an ecological corridor. This function will most likely be affected by the development and will have to be taken into consideration.
- Marginal portion of the proposed grid connection corridor encroach into a Terrestrial CBA 2 area which functions as a critical corridor. The powerline is unlikely to significantly affect this function but will still have to be taken into consideration by the development.
- The region forms part of the Bo-Molopo Karst Belt Strategic Water Source Area (SWSA) which perform important functions in terms of groundwater resources. As a result, it is listed as an Aquatic ESA 1. The development is unlikely to affect this functioning though it will still need to be taken into consideration by the development.
- A central lower lying area is listed as an Aquatic CBA 1 as it forms a wetland system which is of high conservation value. This will be an important element which the development will have to avoid.
- The Marico Biosphere Reserve borders the study area to the north. The protected area should remain unaffected by the proposed development. However, the biosphere reserve should still be consulted during the application process.
- The Lichtenburg Game Breeding Centre is located to the west of the study area but will be affected by the grid connection powerline. It is an informal protected area, i.e. it is not formally protected by the NEMPAA. Despite this, the area will still retain a high conservation value.

From desktop assessment the actual occurrence of fauna in the study area cannot be determine but species likely to occur in the region can be determined. Given the remaining natural vegetation in the area which is largely intact, with corridors also being retained and, at least from a desktop perspective, regarded to be in a fairly good condition it is anticipated likely that species of conservation significance will still occur in the area. The habitat is however fairly uniform and the area is also not known to harbour a large amount of species being of high conservation value. However, given the large extent of the development, it also remain possible that fauna of conservation importance may occur.

The area may contain numerous species of conservation importance (Table 3). However, many of these, especially the larger antelope will only be present in conservation or game breeding areas and will not be relevant for the development. These include Tsessebe, Bontebok, Roan Antelope and Sable Antelope. The remaining smaller species are however quite likely to still occur in this area. They will however be dependent on habitat in good condition. Should such a species be present on the site the focus should be the preservation of the habitat of fauna instead of trying to preserve the animal itself. If habitat is adequately preserved and maintained the animals themselves will by default also be adequately preserved.

### 9.2 Wetlands and Watercourses

From current mapping resources the study area does not seem to contain a large degree of watercourses and wetlands. However, a few do seem to be present and will be most likely to be affected by the development. Two prominent wetland systems are indicated for the study area (Appendix A: Map 1 – 3). A large lower lying wetland area transects the northern portion of the study area while another wetland system will be crossed by the grid connection powerline. It is however not possible from a desktop assessment perspective to determine if wetland conditions are present in these and therefore, they must all be assumed to contain wetland conditions.

A summary of the two prominent wetland systems in the area are given below (Table 11).

Table 11: Summary of wetland systems in the study area (See also Appendix A: Map 1-3).

| Bioregion | Wetland type | Artificial | Location |
|---|---|---|---|
| Highveld Dry Grassland | Seep | NO | Northern portion of study area |
| Highveld Dry Grassland | Depression | NO | Grid connection powerline |

These wetland systems which may likely occur in the study area may be classified into different wetland types. In the absence of a site-survey these types cannot be determined with accuracy but the available desktop information provides likely wetland types to occur:

- The wetland system transection the northern portion of the development site would possible be categorised as a valley bottom wetland without a channel (SANBI 2009). Aerial images indicate that this may be an accurate identification of the wetland conditions along this linear, lower lowing area.

- Desktop information indicate that this northern wetland system may also be associated with depression wetland areas (SANBI 2009). Though this is difficult to confirm from desktop information isolated depressions may form separate depression wetland areas.

- The wetland system which will be affected by the grid connection powerline is indicated as a seepage wetland (SANBI 2009). Given the aerial images and shape of the wetland this may not necessarily be accurate but will be confirmed by on-site surveys.

Previous desktop assessment Nel *et al* (2011), Van Deventer *et al* 2018 and Kleynhans (2000) will be utilised to provide estimated conditions of the two affected wetland systems where

available (Table 12). It must however be stressed that these are in themselves not very accurate and therefore should be augmented by on-site surveys.

Table 12: Desktop summary of the Present Ecological State (PES) of the two wetland systems likely to be affected by the development (NFEPA – National Freshwater Ecosystem Priority Areas) (Appendix A: Map 1 – 3).

| | **Northern wetland system** | **Powerline wetland system** |
|---|---|---|
| Regional Setting | Highveld Dry Grassland Bioregion | Highveld Dry Grassland Bioregion |
| Landscape Setting | Plain | Slope |
| Hydrogeomorphic types | Depression | Seep |
| Wetland size | 5 ha | 320 ha |
| Current impacts | None | Roads and mining |
| Quaternary Catchment | C31A | C31A |
| Desktop PES | D/E/F | A/B |
| Ecosystem Threat Status | Least Concern | Critically Endangered |
| Ecosystem Protection Level | Poorly Protected | Not Protected |

The condition of the two wetland systems likely to be affected by the development cannot be determined with accuracy at a desktop level though indications of likely impacts that may affect these systems include the following:

- Ploughing and cultivation has occurred along portions of the northern wetland system. This will have a large impact on the system should the site survey indicate this to be the case.
- Sections of the wetland which will be affected by the powerline has clearly been affected by alluvial diamond mining. This is anticipated to have had a large impact on this system.
- Several gravel roads cross over both wetland systems, though the system along the powerline is affected to a greater degree.

The importance of wetlands and watercourses and the functioning and services they provide has become especially evident in recent times. They also provide vital functions in terms of water transportation, wetland and aquatic habitats and bio-remediation. Should the field survey confirm the presence of these wetland systems they will therefore be regarded as being highly sensitive.

### 9.3 Biodiversity and Ecological Sensitivity

In terms of the biodiversity sensitivity for the study area, when considered from an overall desktop perspective, it is clear that the vegetation characteristics contain several aspects with high sensitivity values and which therefore indicates the need for comprehensive survey thereof in order to accurately determine the site specific areas which will be most relevant to the development.

Utilising information as obtained from desktop resources, a course and preliminary indication of the relative sensitivity of the area can be provided (Appendix A: Map 3). This is however likely to be fairly inaccurate and should not be used in the planning of the proposed development. This does however give an indication of areas that should be surveyed and verified during the site survey. The following relative sensitives has been allocated to the study area:

- The vegetation type occurring in this area is fairly uniform and is not currently listed as a Threatened Ecosystem. Despite being fairly uniform the vegetation type in the area, Carletonville Dolomite Grassland, may still contain elements of conservation value and consequently, where natural portions of these vegetation types remain they should be regarded as having a significant conservation value. Any remaining natural areas should therefore be afforded at least a Moderate level of sensitivity.
- A central lower lying area is listed as an Aquatic CBA 1 as it forms a wetland system which is of high conservation value. This will be an important element which the development will have to avoid. CBA 1 areas should always be afforded a Very High level of sensitivity.
- The Marico Biosphere Reserve borders the study area to the north. The protected area should remain unaffected by the proposed development. However, the biosphere reserve should still be consulted during the application process. It should be regarded as a Very High level of sensitivity.
- The Lichtenburg Game Breeding Centre is located to the west of the study area but will be affected by the grid connection powerline. It is an informal protected area, i.e. it is not formally protected by the NEMPAA. Despite this, the area will still retain a High level of sensitivity.

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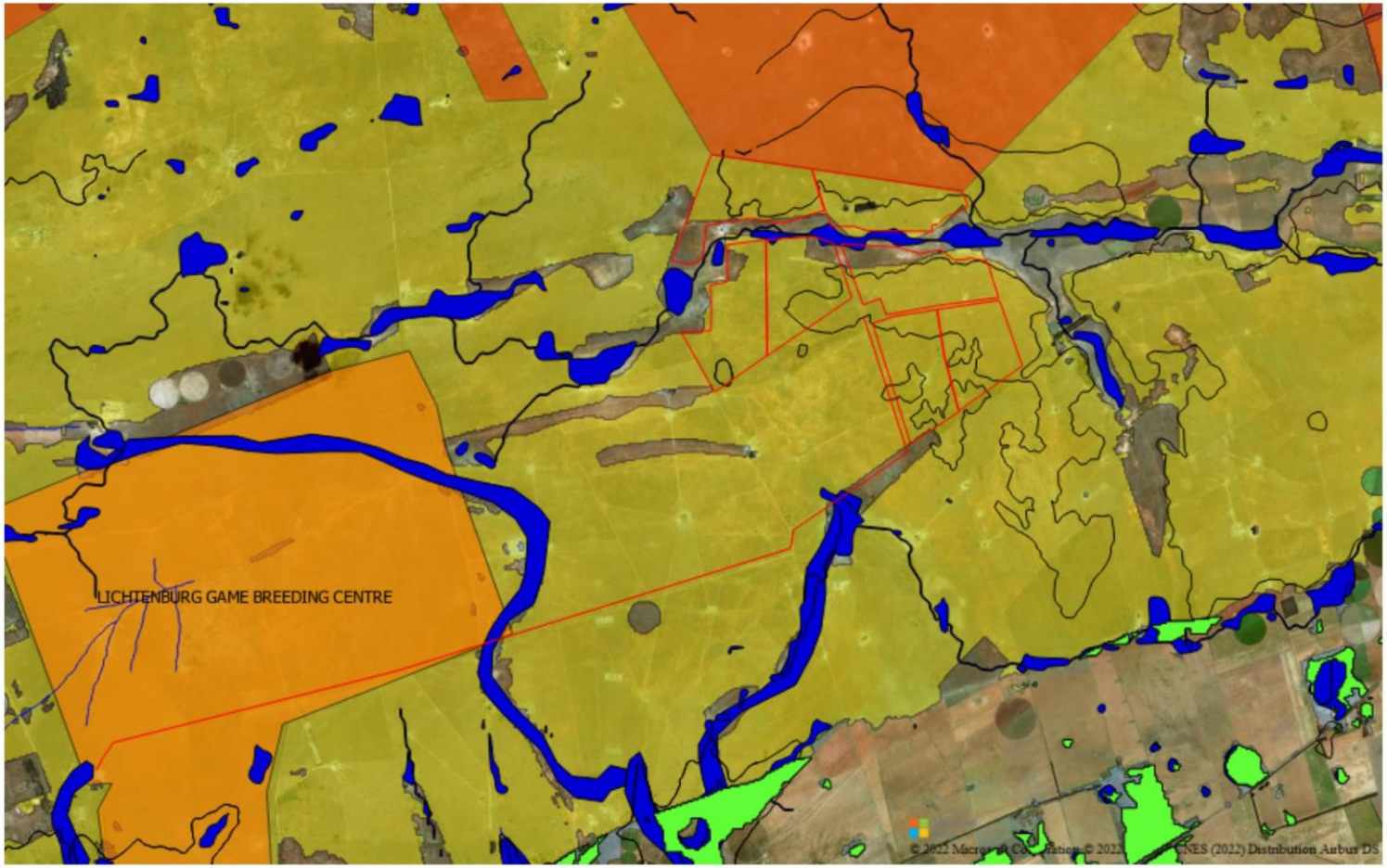
## Annexure A: Maps

**General ecology map for the proposed Kiara PV solar development including Phase 1 to 7 and associated infrastructure situated on Portion 2 and the Remaining Extent of the Farm Hollaagte 8 near the town of Lichtenburg, North West Province.**




Map 1: General ecology map of the proposed Kiara PV solar development on the Farm Hollaagte 8 near the town of Lichtenburg. Areas still consisting of the local vegetation type, Carletonville Dolomite Grassland is indicated. Note that the majority of the study area still consists of natural vegetation. Watercourses and wetlands in the area is also indicated. Two wetland systems are likely to be affected by the development. Threatened ecosystems consisting of Western Highveld Sandy Grassland is located to the south of the site. The Lichtenburg Game Breeding Centre is located to the west of the site and is likely to be affected by the proposed powreline. The Marico Biosphere Reserve also borders the site to the north.

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**Legend:**

- Relief Lines
- Study area and powerline
- Watercourses
- Wetlands and impoundments
- Carletonville Dolomite Grass
- Threatened Ecosystems
- Informal Protected Areas
- Formal Protected Areas

**Map Information**

**Spheroid**: WGS 84

Quantum GIS

**Scale:** 1:100 000

DPR Ecologists
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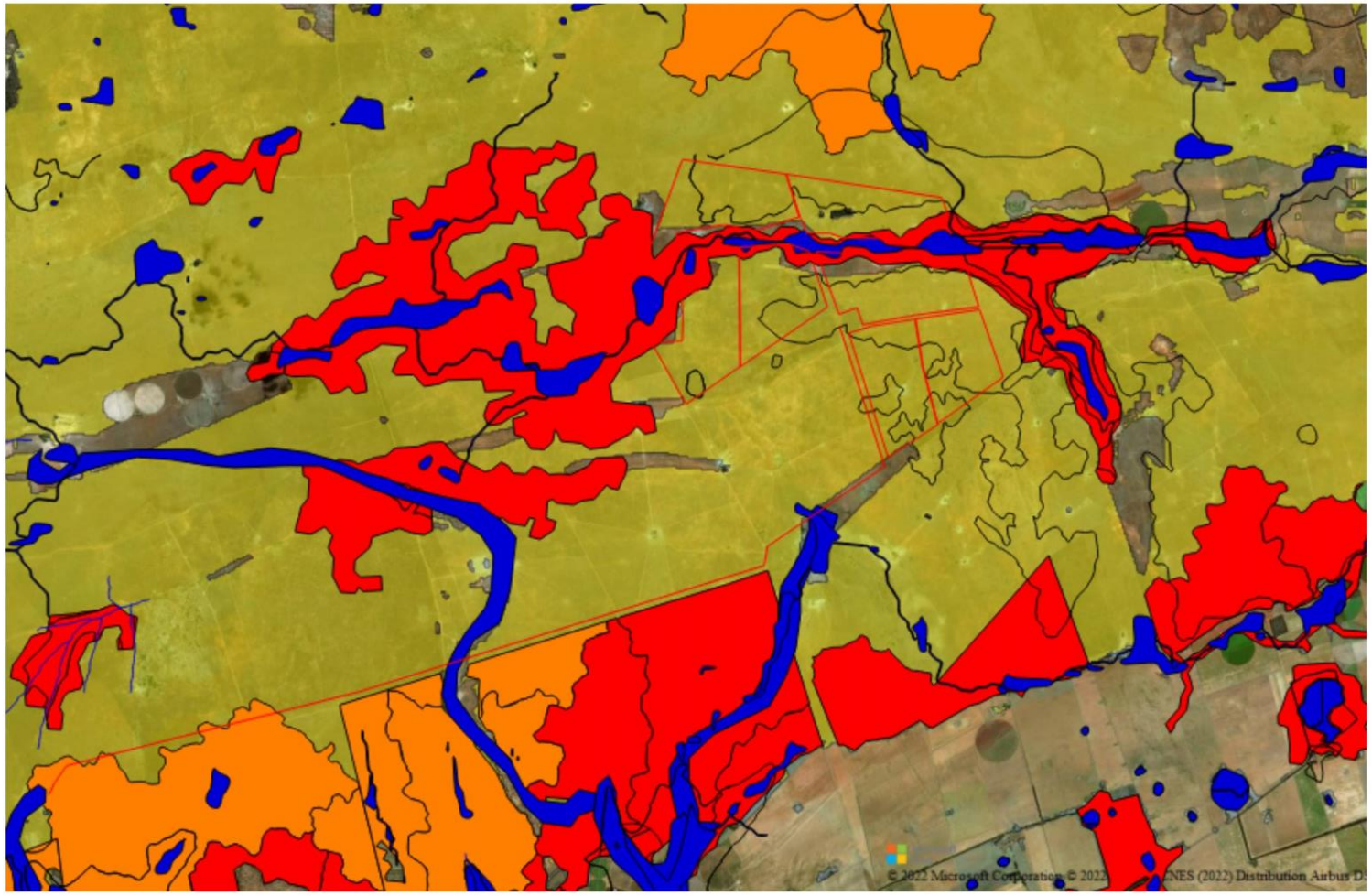
P.O. Box 12726, Brandhof, 9324
**Tel**: 083 410 0770

**North West Biodiversity Sector Plan map for the proposed Kiara PV solar development including Phase 1 to 7 and associated infrastructure situated on Portion 2 and the Remaining Extent of the Farm Hollaagte 8 near the town of Lichtenburg, North West Province.**

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**Legend:**

- Relief Lines
- Study area and powerline
- Watercourses
- Wetlands and impoundments
- Critical Biodiversity Area 1
- Critical Biodiversity Area 2
- Ecological Support Area 1
- Ecological Support Area 2

**Map Information**

**Spheroid**: WGS 84

Quantum GIS

**Scale:** 1:100 000

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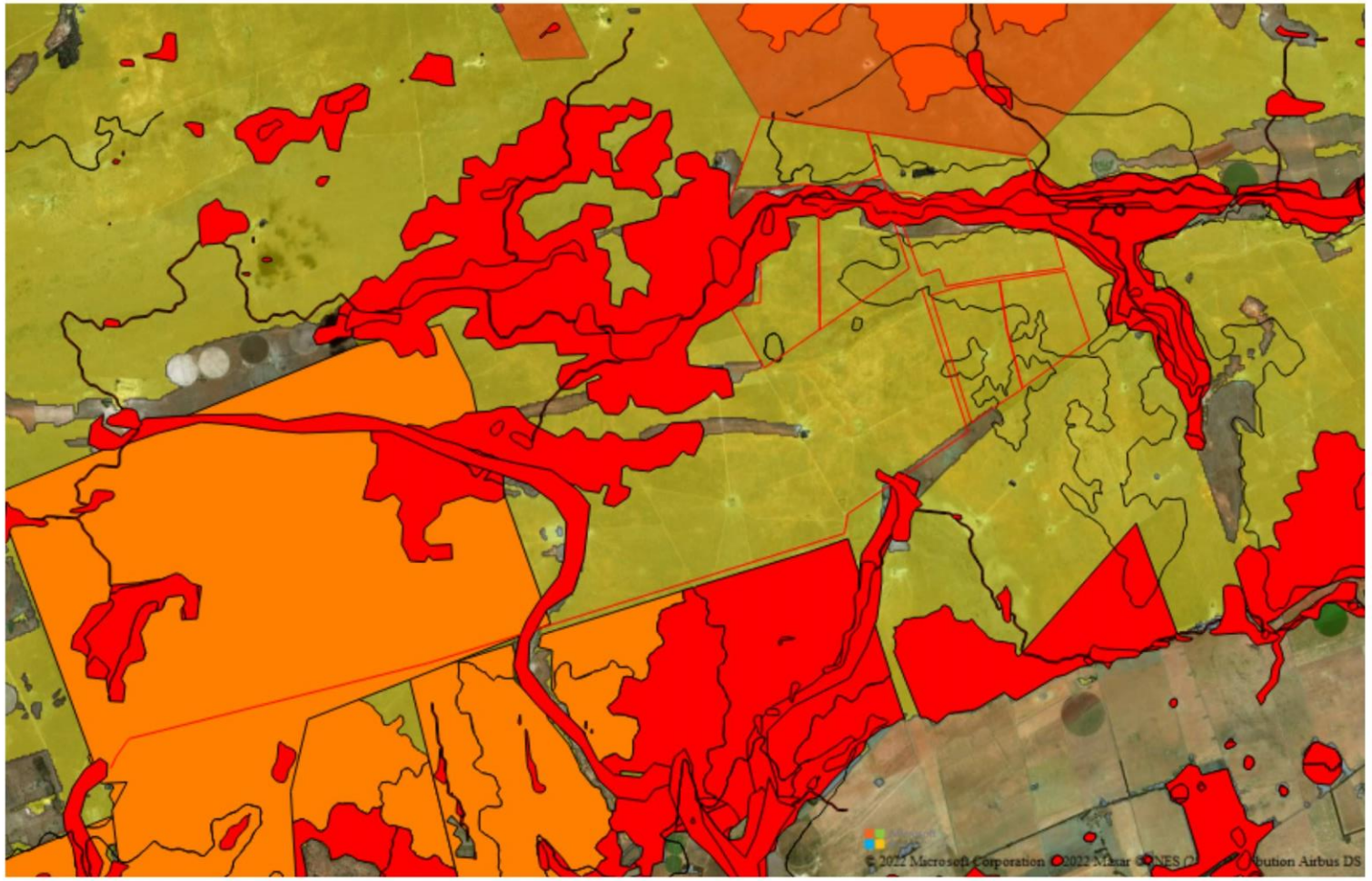
Map 2: Biodiversity Sector Plan map of the proposed Kiara PV solar development on the Farm Hollaagte 8 near the town of Lichtenburg. The site itself and proposed powerline route both consist largely of an Ecological Support Area 1 which functions in support of surrounding Critical Bioidversity Areas and also functions as ecological corridors. A portion of the site consists of a Critical Biodiversity Area 1 and has been identified as a wetland system. The powerline also encroaches marginally into a few areas being Critical Biodiversity Area 2.

**Desktop sensitivity map for the proposed Kiara PV solar development including Phase 1 to 7 and associated infrastructure situated on Portion 2 and the Remaining Extent of the Farm Hollaagte 8 near the town of Lichtenburg, North West Province.**




Map 3: Desktop sensitivity map of the proposed Kiara PV solar development on the Farm Hollaagte 8 near the town of Lichtenburg. Areas indicated as Very High Sensitivity include all CBA 1 areas, all wetlands and watercourses, formally protected areas and Threatened Ecosystems. These areas will probably all have to be avoided by development. Areas of High Sensitivity include all CBA 2 areas and informally protected areas (Lichtenburg Game Breeding Centre). Areas of Moderate Sensitivity include all areas of remaining natural vegetation. These areas are also still likely to contain elements of high conservation value which should be determined by a comprehensive on-site survey.

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**Legend:**

- Relief Lines
- Study area and powerline
- Very High Sensitivity
- High Sensitivity
- Moderate Sensitivity
- Low Sensitivity

**Map Information**

**Spheroid**: WGS 84

Quantum GIS

**Scale:** 1:100 000

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**Appendix B: Species list**

Species indicated with an * are exotic.

Plant species recorded for the quarter degree squares (2626) (http://posa.sanbi.org). Protected species are coloured orange and Red Listed species red.

| Family | Genus | Species | Growth form |
|---|---|---|---|
| Euphorbiaceae | *Acalypha* | *angustata* | Herb |
| Cucurbitaceae | *Acanthosicyos* | *naudinianus* | Climber |
| Asteraceae | **Acanthospermum* | *glabratum* | Herb |
| Asteraceae | **Acanthospermum* | *hispidum* | Herb |
| Lamiaceae | *Acrotome* | *inflata* | Herb |
| Pteridaceae | *Adiantum* | *capillus-veneris* | Fern |
| Poaceae | *Agrostis* | *lachnantha var. lachnantha* | Grass |
| Hyacinthaceae | *Albuca* | *virens subsp. virens* | Geophyte |
| Hyacinthaceae | *Albuca* | *prasina* | Geophyte |
| Asphodelaceae | *Aloe* | *jeppeae* | Succulent |
| Amaranthaceae | *Amaranthus* | *thunbergii* | Herb |
| Amaranthaceae | **Amaranthus* | *hybridus subsp. hybridus* | Herb |
| Rubiaceae | *Anthospermum* | *rigidum subp. rigidum* | Herb |
| Menispermaceae | *Antizoma* | *angustifolia* | Herb |
| Scrophulariaceae | *Aptosimum* | *elongatum* | Herb |
| Asteraceae | *Arctotis* | *arctotoides* | Herb |
| Poaceae | *Aristida* | *congesta subsp. congesta* | Grass |
| Apocynaceae | *Asclepias* | *fallax* | Geophyte |
| Apocynaceae | *Asclepias* | *aurea* | Geophyte |
| Apocynaceae | *Asclepias* | *fulva* | Geophyte |
| Apocynaceae | *Asclepias* | *brevipes* | Geophyte |
| Asparagaceae | *Asparagus* | *suaveolens* | Dwarf shrub |
| Apocynaceae | *Aspidoglossum* | *restioides* | Geophyte |
| Acanthaceae | *Barleria* | *macrostegia* | Herb |
| Acanthaceae | *Blepharis* | *natalensis* | Herb |
| Orchidaceae | *Bonatea* | *polypodantha* | Geophyte |
| Poaceae | *Bothriochloa* | *bladhii* | Grass |
| Poaceae | *Brachiaria* | *serrata* | Grass |
| Poaceae | *Bromus* | *sp.* | Grass |
| Cannabaceae | **Cannabis* | *sativa var. sativa* | Shrub |
| Cannabaceae | *Celtis* | *africana* | Tree |
| Asteraceae | **Centaurea* | *melitensis* | Herb |
| Apocynaceae | *Ceropegia* | *circinata* | Succulent |
| Apocynaceae | *Ceropegia* | *incana* | Succulent |
| Scrophulariaceae | *Chaenostoma* | *patrioticum* | Herb |
| Fabaceae | *Chamaecrista* | *comosa var. capricornia* | Herb |
| Verbenaceae | *Chascanum* | *pinnatifidum var. pinnatifidum* | Herb |

| | | | |
|---|---|---|---|
| Verbenaceae | *Chascanum* | *adenostachyum* | Herb |
| Pteridaceae | *Cheilanthes* | *viridis var. glauca* | Fern |
| Pteridaceae | *Cheilanthes* | *hirta var. brevipilosa* | Fern |
| Cleomaceae | *Cleome* | *conrathii* | Herb |
| Cleomaceae | *Cleome* | *maculata* | Herb |
| Cucurbitaceae | *Coccinia* | *sessilifolia* | Climber |
| Combretaceae | *Combretum* | *erythrophyllum* | Tree |
| Combretaceae | *Combretum* | *molle* | Tree |
| Combretaceae | *Combretum* | *sp.* | Tree |
| Combretaceae | *Combretum* | *hereroense* | Tree |
| Commelinaceae | *Commelina* | *africana var. krebsiana* | Herb |
| Convolvulaceae | *Convolvulus* | *thunbergii* | Herb |
| Convolvulaceae | *Convolvulus* | *ocellatus var. ocellatus* | Herb |
| Acanthaceae | *Crabbea* | *angustifolia* | Herb |
| Crassulaceae | *Crassula* | *lanceolata subps. transvaalensis* | Succulent |
| Euphorbiaceae | *Croton* | *gratissimus var. subgratissimus* | Shrub |
| Cucurbitaceae | *Cucumis* | *hirsutus* | Climber |
| Cucurbitaceae | *Cucumis* | *myriocarpus subsp. myriocarpus* | Climber |
| Orobanchaceae | *Cycnium* | *adonense* | Herb |
| Cyperaceae | *Cyperus* | *sp.* | Sedge |
| Cyperaceae | *Cyperus* | *esculentus var. esculentus* | Sedge |
| Cyperaceae | *Cyperus* | *congestus* | Sedge |
| Cyperaceae | *Cyperus* | *sexangularis* | Sedge |
| Lobeliaceae | *Cyphia* | *persicifolia* | Herb |
| Amaranthaceae | *Cyphocarpa* | *angustifolia* | Herb |
| Solanaceae | **Datura* | *stramonium* | Herb |
| Aizoaceae | *Delosperma* | *sp.* | Succulent |
| Poaceae | *Digitaria* | *ternata* | Grass |
| Poaceae | *Digitaria* | *sp.* | Grass |
| Hyacinthaceae | *Dipcadi* | *viride* | Geophyte |
| Fabaceae | *Dolichos* | *angustifolius* | Herb |
| Acanthaceae | *Dyschoriste* | *transvaalensis* | Herb |
| Amaranthaceae | **Dysphania* | *multifida* | Herb |
| Poaceae | *Eleusine* | *coracana subsp. africana* | Grass |
| Poaceae | **Eragrostis* | *tef* | Grass |
| Poaceae | *Eragrostis* | *curvula* | Grass |
| Poaceae | *Eragrostis* | *racemosa* | Grass |
| Poaceae | *Eragrostis* | *biflora* | Grass |
| Asteraceae | **Erigeron* | *bonariensis* | Herb |
| Fabaceae | *Eriosema* | *burkei var. burkei* | Herb |
| Ruscaceae | *Eriospermum* | *porphyrium* | Geophyte |
| Brassicaceae | *Erucastrum* | *strigosum* | Herb |
| Ebenaceae | *Euclea* | *natalensis subsp. angustifolia* | Shrub |

| | | | |
|---|---|---|---|
| Ebenaceae | *Euclea* | *undulata* | Shrub |
| Orchidaceae | *Eulophia* | *hereroensis* | Geophyte |
| Euphorbiaceae | *Euphorbia* | *davyi* | Succulent |
| Euphorbiaceae | *Euphorbia* | *inaequilatera* | Herb |
| Asteraceae | *Felicia* | *fascicularis* | Herb |
| Poaceae | *Fingerhuthia* | *africana* | Grass |
| Asteraceae | **Flaveria* | *bidentis* | Herb |
| Asteraceae | *Gazania* | *krebsiana subsp. serrulata* | Herb |
| Asteraceae | *Geigeria* | *burkei subsp. burkei* | Herb |
| Asteraceae | *Geigeria* | *brevifolia* | Herb |
| Asteraceae | *Gerbera* | *piloselloides* | Herb |
| Gisekiaceae | *Gisekia* | *pharnaceoides var. pharnaceoides* | Herb |
| Iridaceae | *Gladiolus* | *elliotii* | Geophyte |
| Iridaceae | *Gladiolus* | *permeabilis subsp. edulis* | Geophyte |
| Scrophulariaceae | *Hebenstretia* | *comosa* | Herb |
| Asteraceae | *Helichrysum* | *cerastioides var. cerastioides* | Herb |
| Asteraceae | *Helichrysum* | *callicomum* | Herb |
| Asteraceae | *Helichrysum* | *aureum var. monocephalum* | Herb |
| Asteraceae | *Helichrysum* | *caespititium* | Herb |
| Malvaceae | *Hermannia* | *sp.* | Herb |
| Malvaceae | *Hermannia* | *stellulata* | Herb |
| Malvaceae | *Hermannia* | *tomentosa* | Herb |
| Malvaceae | *Hermannia* | *lancifolia* | Herb |
| Malvaceae | *Hibiscus* | *pusillus* | Herb |
| Poaceae | *Hyparrhenia* | *anamesa* | Grass |
| Poaceae | *Hyparrhenia* | *hirta* | Grass |
| Hypoxidaceae | *Hypoxis* | *rigidula var. rigidula* | Geophyte |
| Fabaceae | *Indigofera* | *heterotricha* | Herb |
| Fabaceae | *Indigofera* | *filipes* | Herb |
| Convolvulaceae | *Ipomoea* | *bolusiana* | Creeper |
| Convolvulaceae | *Ipomoea* | *crassipes var. crassipes* | Creeper |
| Convolvulaceae | *Ipomoea* | *oenotherae var. oenotherae* | Creeper |
| Convolvulaceae | *Ipomoea* | *gracilisepala* | Creeper |
| Scrophulariaceae | *Jamesbrittenia* | *sp.* | Herb |
| Acanthaceae | *Justicia* | *anagalloides* | Herb |
| Crassulaceae | *Kalanchoe* | *luciae subps. luciae* | Succulent |
| Rubiaceae | *Kohautia* | *amatymbica* | Herb |
| Rubiaceae | *Kohautia* | *caespitosa subps. brachyloba* | Herb |
| Cyperaceae | *Kyllinga* | *alba* | Sedge |
| Verbenaceae | *Lantana* | *rugosa* | Herb |
| Thymelaeaceae | *Lasiosiphon* | *capitatus* | Herb |
| Thymelaeaceae | *Lasiosiphon* | *sericocephalus* | Herb |
| Thymelaeaceae | *Lasiosiphon* | *kraussianus* | Herb |
| Hyacinthaceae | *Ledebouria* | *ovatifolia* | Geophyte |

| | | | |
|---|---|---|---|
| Fabaceae | *Leobordea* | *divaricata* | Herb |
| Brassicaceae | *Lepidium* | *africanum subsp. africanum* | Herb |
| Limeaceae | *Limeum* | *fenestratum var. fenestratum* | Herb |
| Limeaceae | *Limeum* | *viscosum subsp. viscosum* | Herb |
| Limeaceae | *Limeum* | *viscosum subps. viscosum* | Herb |
| Boraginaceae | *Lithospermum* | *cinereum* | Herb |
| Geraniaceae | *Monsonia* | *burkeana* | Herb |
| Iridaceae | *Moraea* | *pallida* | Geophyte |
| Myrsinaceae | *Myrsine* | *africana* | Shrub |
| Scrophulariaceae | *Nemesia* | *fruticans* | Herb |
| Ochnaceae | *Ochna* | *pulchra* | Shrub |
| Lamiaceae | *Ocimum* | *obovatum subsp. obovatum* | Herb |
| Onagraceae | **Oenothera* | *tetraptera* | Herb |
| Rubiaceae | *Oldenlandia* | *herbacea var. herbacea* | Herb |
| Fabaceae | *Ophrestia* | *oblongifolia var. oblongifolia* | Herb |
| Polygonaceae | *Oxygonum* | *dregeanum subps. canescens* | Herb |
| Anacardiaceae | *Ozoroa* | *paniculosa var. paniculosa* | Shrub |
| Apocynaceae | *Pachycarpus* | *schinzianus* | Geophyte |
| Poaceae | *Panicum* | *coloratum* | Grass |
| Poaceae | *Panicum* | *sp.* | Grass |
| Chrysobalanaceae | *Parinari* | *capensis subsp. capensis* | Herb |
| Poaceae | **Paspalum* | *dilatatum* | Grass |
| Fabaceae | *Pearsonia* | *cajanifolia subsp. cajanifolia* | Herb |
| Geraniaceae | *Pelargonium* | *dolomiticum* | Geophyte |
| Solanaceae | **Physalis* | *peruviana* | Herb |
| Solanaceae | **Physalis* | *angulata* | Herb |
| Plantaginaceae | *Plantago* | *lanceolata* | Herb |
| Poaceae | *Pogonarthria* | *squarrosa* | Grass |
| Caryophyllaceae | *Pollichia* | *campestris* | Herb |
| Asteraceae | *Polydora* | *angustifolia* | Herb |
| Portulacaceae | **Portulaca* | *oleracea* | Herb |
| Potamogetonaceae | *Potamogeton* | *pusillus* | Herb |
| Asteraceae | *Pseudopegolettia* | *tenella* | Herb |
| Pteridaceae | *Pteris* | *vittata* | Fern |
| Ranunculaceae | *Ranunculus* | *multifidus* | Herb |
| Brassicaceae | **Raphanus* | *raphanistrum* | Herb |
| Apocynaceae | *Raphionacme* | *hirsuta* | Geophyte |
| Apocynaceae | *Raphionacme* | *velutina* | Geophyte |
| Vitaceae | *Rhoicissus* | *tridentata subsp. cuneifolia* | Climber |
| Fabaceae | *Rhynchosia* | *totta var. totta* | Herb |
| Ricciaceae | *Riccia* | *crinita* | Herb |
| Ricciaceae | *Riccia* | *congoana* | Herb |
| Rubiaceae | **Richardia* | *scabra* | Herb |
| Lamiaceae | *Rotheca* | *hirsuta* | Herb |

| | | | |
|---|---|---|---|
| Rubiaceae | *Rubia* | *horrida* | Herb |
| Polygonaceae | **Rumex* | *acetosella subps. angiocarpus* | Herb |
| Lamiaceae | *Salvia* | *disermas* | Herb |
| Lamiaceae | *Salvia* | *radula* | Herb |
| Dipsacaceae | *Scabiosa* | *columbaria* | Herb |
| Poaceae | *Schizachyrium* | *sanguineum* | Grass |
| Anacardiaceae | *Searsia* | *lancea* | Tree |
| Scrophulariaceae | *Selago* | *sp.* | Herb |
| Asteraceae | *Senecio* | *venosus* | Herb |
| Asteraceae | *Senecio* | *burchellii* | Herb |
| Asteraceae | *Senecio* | *coronatus* | Herb |
| Fabaceae | *Senegalia* | *hereroensis* | Tree |
| Pedaliaceae | *Sesamum* | *triphyllum var. triphyllum* | Herb |
| Caryophyllaceae | *Silene* | *burchellii subsp. pilosellifolia* | Herb |
| Caryophyllaceae | *Silene* | *burchellii subps. modesta* | Herb |
| Brassicaceae | *Sisymbrium* | *turczaninowii* | Herb |
| Solanaceae | *Solanum* | *retroflexum* | Herb |
| Solanaceae | *Solanum* | *campylacanthum* | Herb |
| Solanaceae | **Solanum* | *nigrum* | Herb |
| Asteraceae | **Sonchus* | *oleraceus* | Herb |
| Orobanchaceae | *Striga* | *bilabiata subps. bilabiata* | Herb |
| Orobanchaceae | *Striga* | *asiatica* | Herb |
| Talinaceae | *Talinum* | *caffrum* | Geophyte |
| Asteraceae | *Tarchonanthus* | *parvicapitulatus* | Shrub |
| Fabaceae | *Tephrosia* | *elongata var. elongata* | Herb |
| Lamiaceae | *Teucrium* | *trifidum* | Herb |
| Santalaceae | *Thesium* | *utile* | Herb |
| Asphodelaceae | *Trachyandra* | *laxa var. rigida* | Geophyte |
| Asphodelaceae | *Trachyandra* | *asperata var. basutoensis* | Geophyte |
| Poaceae | *Trachypogon* | *spicatus* | Grass |
| Malvaceae | *Triumfetta* | *sonderi* | Herb |
| Alliaceae | *Tulbaghia* | *cernua* | Geophyte |
| Asteraceae | *Ursinia* | *nana subps. leptophylla* | Herb |
| Fabaceae | *Vigna* | *unguiculata subsp. stenophylla* | Herb |
| Campanulaceae | *Wahlenbergia* | *denticulata var. denticulata* | Herb |
| Campanulaceae | *Wahlenbergia* | *undulata* | Herb |
| Tecophilaeaceae | *Walleria* | *nutans* | Herb |
| Solanaceae | *Withania* | *somnifera* | Herb |
| Asteraceae | **Xanthium* | *strumarium* | Herb |
| Apocynaceae | *Xysmalobium* | *brownianum* | Geophyte |
| Fabaceae | *Zornia* | *linearis* | Herb |