Nkurenkuru
ECOLOGY & BIODIVERSITY

UMMBILA EMOYENI SOLAR ENERGY FACILITY, MPUMALANGA PROVINCE

EIA PHASE:

TERRESTRIAL BIODIVERSITY AND ECOLOGICAL STUDY AND IMPACT ASSESSMENT

Version: 1.0

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UMMBILA EMOYENI WIND ENERGY FACILITY, MUPMALANGA PROVINCE.

Report Title: Terrestrial Biodiversity and Ecological Study and Impact Assessment: Ummbila Emoyeni Solar Energy Facility, Mpumalanaga Province

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I. DECLARATION OF CONSULTANT INDEPENDENCE

The consultants hereby declare that they:

- Are independent specialists in this application;
- Regard the information contained in this report as it relates to specialist input/study to be true and correct at the time of publication;
- Do not, and will not, have any financial interest(s) in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA Environmental Impact Assessment Regulations, 2014, and any specific environmental management Act;
- Do not, and will not, have any vested interest(s) in the proceedings of the proposed activities;
- Have disclosed, to the applicant, EAP, and competent authority(-ies), any information that have, or may have, the potential to influence the decision of the competent authority(-ies) or the objectivity of any report, plan, or document required in terms of the NEMA Environmental Impact Assessment Regulations 2014, and any specific environmental management Act;
- Are fully aware of, and meet, the responsibilities in terms of the NEMA Environmental Impact Assessment Regulations 2014 (specifically in terms of regulation 13 of GN No. R. 326), and any specific environmental management Act, and that failure to comply with these requirements may result in disqualification;
- Have provided the competent authority(-ies) with access to all necessary information at their disposal at the time of publication regarding the application, whether such information is favourable to the applicant or not; and
- Are aware that a false declaration is an offense in terms of regulation 48 of GN No. R. 326.

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II. LIST OF ABBREVIATIONS

CARA:	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA:	Critical Biodiversity Area
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CR:	Critically Endangered (threat status)
DAFF:	Department of Agriculture, Forestry, and Fisheries
DDD:	Data Deficient — Insufficient Information (threat status)
DDT:	Data Deficient — Taxonomically Problematic (threat status)
DEA:	Department of Environmental Affairs
DFFE:	Department of Forestry, Fisheries, and the Environment
EIA:	Environmental Impact Assessment: EIA regulations promulgated under section 24(5) of NEMA and published in Government Notice R. 543 in Government Gazette 33306 of 18 June 2010
EN:	Endangered (threat status)
EO:	Environmental Officer
ESA:	Ecological Support Area
EW:	Extinct in the Wild (threat status)
EX:	Extinct (threat status)
FEPA:	Freshwater Ecosystem Priority Area
IAPs:	Invasive Alien Plant species
IUCN:	International Union for Conservation of Nature
LC:	Least Concern (threat status)
MAL:	Maximum Acceptable Loss
MAP:	Mean Annual Precipitation
MAT:	Mean Annual Temperature
NE:	Not Evaluated (threat status)
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMA:	National Environmental Management Act (Act 107 of 1998)
NFA:	National Forest Act 1998 (No. 84 of 1998)
NFEPA:	National Freshwater Ecosystem Priority Areas; identified to meet national freshwater conservation targets (CSIR, 2011)
NT:	Near Threatened (threat status)
POSA:	Plants of southern Africa (online database)
QDGC:	Quarter Degree Grid Cell
RE:	Regionally Extinct (threat status)
SANBI:	South African National Biodiversity Institute
SoCC:	Species of Conservation Concern

VegMap: National Vegetation Map of Southern Africa, Lesotho, and Swaziland (as per Mucina and Rutherford, 2006, with subsequent updates, e.g., 2018).

VU: Vulnerable (threat status)

III. LIST OF DEFINITIONS

Alien (also called "exotic"): A species occurring outside its natural distribution range. Often originating from another country or continent, the term is commonly used to describe plants not indigenous to South Africa, and which have become problematic (e.g., spreading rapidly and threatening existing biodiversity). Note that this concept is, however, based on political, rather than ecological bounders. The latter is preferred. "Alien" is used interchangeably with "exotic.

Bare soil: Soil surface devoid of vegetation and unaltered by humans.

Biodiversity: The diversity (richness and abundance) of plant and animal species occurring in their natural environment (habitats). The term encompasses different ecosystems, landscapes, communities, populations, and genes, as well as the ecological processes that allow these elements to persist over time.

Biome: A broad ecological spatial unit representing major life zones of large natural areas, and defined mainly by vegetation structure, climate, and major large-scale disturbance factors (e.g., fire) (Mucina and Rutherford, 2006).

Climax: The vegetation type or plant community structure at the end of the seral cycle. Climax communities may, or may not, be the final endpoint of succession: frequent or even rare events, such as fire, frost, harvesting, or hurricanes, may indefinitely hold communities in a stable subclimax.

Conservation: The safeguarding of biodiversity and its processes (often referred to as "Biodiversity Conservation").

Ecological Rehabilitation: The process of assisting the recovery of a degraded or damaged ecosystem in a trajectory that aims to render the ecosystem fully functional, stable, and able to develop further, but not necessarily returning to the original, historical state.

Ecological Restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed, in a trajectory that ultimately returns the ecosystem to its natural successional stage.

Ecosystem Goods and Services: The goods and benefits mankind obtains from natural ecosystems. Various ecosystem types provide a range of ecosystem goods and services. For example, aquatic ecosystems, such as rivers and wetlands, provide forage for livestock, grazing or sedges for craft production, and services such as pollutant trapping and flood attenuation. They also provide a habitat for a range of aquatic biota.

Ecosystem: The combination of biota within a given area, together with a suitable environment that sustains the biota and their interactions. It can have a spatial unit of any size, but shows some degree of homogeneity as far as structure, function, and species composition is concerned. Small-scale ecosystems typically link up to large-scale ecosystems, and both contribute to ecosystem functioning and services at the landscape-scale.

Endemic: Refers to a species, or a specific vegetation type, that is naturally restricted to a particular, usually small, region (not to be confused with indigenous). A plant or animal species may, for example, be endemic to South Africa, in which case it occurs naturally anywhere in the country, or endemic only to a specific geographical area within the country, and is then restricted only to that area.

Ephemeral: Refers to the life-form of an annual plant that makes occasional appearances in favourable seasons.

Exotic: See Alien.

Forb: A plant without secondary xylem/thickening (i.e., non-woody or herbaceous), usually living for only one or two seasons.

Function/functioning/functional: Used here to describe natural ecosystems working or operating in a healthy way, as opposed to being dysfunctional and working poorly or in an unhealthy way.

Geophyte/-ic: Pertaining to a plant with underground storage organs such as bulbs, corms, tubers, or rhizomes, and which resprouts during the growing season, while completely dying back aboveground during the dormant season.

Graminoid: Pertaining to a herbaceous growth form characterised by a "grass-like" appearance (e.g., tufted growth, usually long and narrow leaves, secondary root system). Examples include grasses (Poaceae), restios (Restionaceae), sedges (Cyperaceae), and rushes (Juncaceae).

Habitat: The general features of an area, inhabited by animals and/or plants, which are essential to their survival (i.e., the natural "home" of a plant or animal species).

Indigenous: Refers to a species that occurs naturally within a specific, though generally large, area. "Indigenous" is used interchangeably with "native".

Infrastructure: This can either specifically or generally refer to any developmental processes, whether permanent or temporary. Examples include, but are not limited to, buildings, roads, wind turbines, solar panels, batching plants, bridges, parking areas for vehicles, storage areas for equipment, and fences, among other things.

Intact: Used here to describe a natural environment that is not seriously damaged, and which functions properly.

Invasive Plant: A plant which has been declared as invasive under NEM:BA, and includes all propagules of the plant (seeds and any vegetative parts capable of reproducing asexually).

Land Type: Map unit denoting land over which a marked uniformity of climate, terrain form, soil, and vegetation exists. These are usually mapped based upon satellite imagery.

Landscape: Consists of a mosaic of two or more ecosystems that exchange organisms, energy, water, and nutrients.

Mitigate/Mitigation: Mitigating impacts refers to reactive practical actions that minimize or reduce *in situ* impacts. Examples of mitigation include "changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed activity, as well as restoration or rehabilitation of sites". Mitigation actions can take place anywhere, as long as it reduces site effects where a change in ecological character is likely, or the values of the site are affected by those changes (Ramsar Convention, 2012).

Rehabilitation: in an EIA context, repairing a habitat/ecosystem for functional processes and productivity maintenance. The original habitat/ecosystem condition might not necessarily be fully restored (in contrast to "restoration"). Rehabilitation is easier than restoration — especially if the pre-impacted ecological state was pristine — since the aim is not necessarily reversion to the pre-impacted ecological state. Compare with "restoration".

Risk: A prediction of the likelihood and impact of an outcome; usually referring to the likelihood of a variation from the intended or desired outcome.

Restoration: in an EIA context, recovering/restoring a degraded or destroyed habitat/ecosystem to its pre-impacted ecological state, that is, prior to the activity/action that caused the degradation or destruction. This is more difficult to achieve than "rehabilitation", especially if the pre-impacted ecological state was pristine. Compare with "rehabilitation".

Soil Erosion: A natural process whereby the ground level is lowered by wind or water action, and may occur as a result of, among other things, chemical processes and/or physical transport on the land surface.

Species Richness: The number of species occurring within a delimited area, for example, a plot or vegetation/land type. Species richness does not include individual abundance.

Succession: A series of stages in which different plants and animals colonise an area following some kind of disturbance. The final stage of succession is called the "climax", but various disturbances may prevent the vegetation from attaining its potential climax.

Threat Status: Threat status (of a species or community type) is a simple but highly integrated indicator of vulnerability. It contains information about past loss (of numbers and/or habitat), the number and intensity of threats, and current prospects as indicated by recent population growth or decline. Any one of these metrics could be used to measure vulnerability. One much-used example of a threat status classification system is the IUCN Red List of Threatened Species (BBOP, 2009).

Threatened Ecosystem: In the context of this document, this refers to Critically Endangered, Endangered, or Vulnerable ecosystems.

Topsoil: Uppermost soil layer; in natural vegetation maximally 30 cm deep; in cultivated landscapes the total depth of cultivation, containing a layer of humus, seeds, and nutrients. Topsoil applied to landscapes requiring rehabilitation must be free of refuse, large roots and branches, stones, alien weeds, and/or any other agents that would adversely affect the topsoil's suitability for revegetation.

Transformation: The conversion of a specific ecosystem or land use type to a different ecosystem or land use type.

Turnover: Turnover related to the concept of "unique species", or species unique to specific areas/types/plots, and is a measure of community compositional change — that is, beta diversity. Specifically, the beta diversity of specific areas can differ between each other in the components of turnover and nestedness (Baselga, 2013, 2010a, 2010b). A high species turnover indicates that species are replaced on going from one area to another (high number of unique biodiversity), whereas a low turnover (also termed high nestedness) indicates that species form subsets of a larger community when going from one area to another (low number of unique biodiversity).

Watercourse: A river or spring, or a natural channel in which water flows regularly or intermittently, or a wetland, lake, or dam into which, or from 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 (National Water Act, 1998).

Weed: A plant that grows where it is unwanted; it can, therefore, be either indigenous or alien.

Wetland: Refers to land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports, or would support, vegetation typically adapted to life in water saturated soil (National Water Act, 1998).

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1. INTRODUCTION

1.1. Applicant

Emoyeni Renewable Energy Farm (Pty) Ltd

1.2. Project

The project will be known as Ummbila Emoyeni Solar Energy Facility (SEF), and the entire study area with its collection of sites will generally be referred to either as the "study area" or the "study site".

1.3. Proposed Activity

Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of a commercial Solar Energy Facility and associated infrastructure on a site located ~6km south-east of Bethal and 1km east of Morgenzon, within the Mpumalanga Province. The project site is located across the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities within the Gert Sibande District on the following properties.

A preferred project focus area with an extent of 27 819 ha been identified by Emoyeni Renewable Energy Farm (Pty) Ltd as a technically suitable area for the development of the Ummbilla Emoyeni Renewable Energy Farm with a contracted capacity of up to 666 MW of wind energy and 150 MW of solar energy. This study and report focus solely on the proposed SEF. This layout, and project capacity, will be reduced as the EIA and scoping process identifies environmental constraints that exclude areas for development.

The project site comprises the following farm portions:

Parent Farm Number	Farm Portions
Farm 264 – Geluksplaats	0, 11
Farm 420 – Rietfontein	0 R/E, 1, 5 R/E, 22
Farm 423 – Bekkerust	8, 9, 10, 32

As mentioned the SEF will have a contracted capacity of up to 150MW and will be known as the Ummbila Emoyeni Solar Energy Facility. The grid connection infrastructure for both facilities (WEF and SEF) will include a 400/132kV Main Transmission Substation (MTS), to be located between Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); and 132kV power lines from the switching stations at each renewable energy facility to the new 400/132Kv MTS.

Infrastructure associated with the Ummbila Emoyeni SEF will include:

- PV modules in the range of 330Wp to 450Wp mounted on either a fixed tilt or single axis tracker structure, dependent on optimisation, technology available and cost.
- Inverters and transformers.
- 33kV cabling to connect to the onsite collector substation, to be laid underground where practical.
- 33kV/132kV onsite collector substation (IPP Portion).
- Battery Energy Storage System (BESS).
- Cabling between project components.
- Laydown and O&M hub (approximately 300m x 300m):
    - Construction compound (temporary).
    - Maintenance office.
- Access roads (up to 12m wide) and internal distribution roads (up to 12m wide).

A summary of the details and dimensions of the planned infrastructure associated with the project is provided below in Table 1.

Table 1: Details or dimensions of typical infrastructure required for the 150MW Ummbila Emoyeni SEF.

Infrastructure	Footprint and dimensions
Number of Panels	To be determined
Panel Height	Up to 5m
Technology	Use of fixed-tilt, single-axis tracking, and/or double-axis tracking PV technology. Monofacial or bifacial panels are both considered.
Contracted Capacity	Up to 150MW
Area occupied by the solar array	To be determined in the EIA phase
Area occupied by the on-site facility substation (IPP Portion)	~5ha
Capacity of on-site facility substation (IPP Portion)	33kV/132kV
Underground cabling between the PV array and the onsite substation	Cabling will be installed underground where feasible at a depth of up to 1.5m to connect the PV panels to the on-site facility substation. Where not technically feasible to place cabling underground, this will be installed above-ground. The cabling will have a capacity of up to 33kV.
Laydown and Operations and Maintenance (O&M) hub	~ 300m x 300m, comprising: * Construction compound (temporary) of approximately 6 ha. * O&M office of approximately 1.5ha.
Area occupied by laydown area	~75m x 120m
Access and internal roads	Wherever possible, existing access roads will be utilised to access the project site and development area. It is unlikely that access roads will need to be upgraded as part of the proposed development. Internal roads of up to 12-13m in width will be required to access the PV panels and the on-site substation.
Grid connection	The grid connection infrastructure will include a 400/132kV Main Transmission Substation (MTS), to be located between Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to onsite IPP Substation The grid connection

Infrastructure	Footprint and dimensions
	infrastructure will be assessed as part of a separate Environmental Impact Assessment process in support of an application for Environmental Authorisation.
Temporary infrastructure	Temporary infrastructure, including laydown areas, hardstand areas and a concrete batching plant, will be required during the construction phase. All areas affected by temporary infrastructure will be rehabilitated following the completion of the construction phase, where it is not required for the operation phase.

The Ummbila Emoyeni SEF is proposed in response to the identified objectives of national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Ummbila Emoyeni SEF under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or a similar programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP), with the Ummbila SEF set to inject up to 150MW of electricity into the national grid. Similarly, the location of the new generation in the Mpumalanga Province is important in the context of the Just Energy Transition (JET). The Ummbila Emoyeni SEF will provide valuable jobs and socio-economic benefits that are required in an area where coal fired generation will be phased out over the next 10 years. This will be vitally important if the JET is to be successfully implemented and is a transition for everyone.

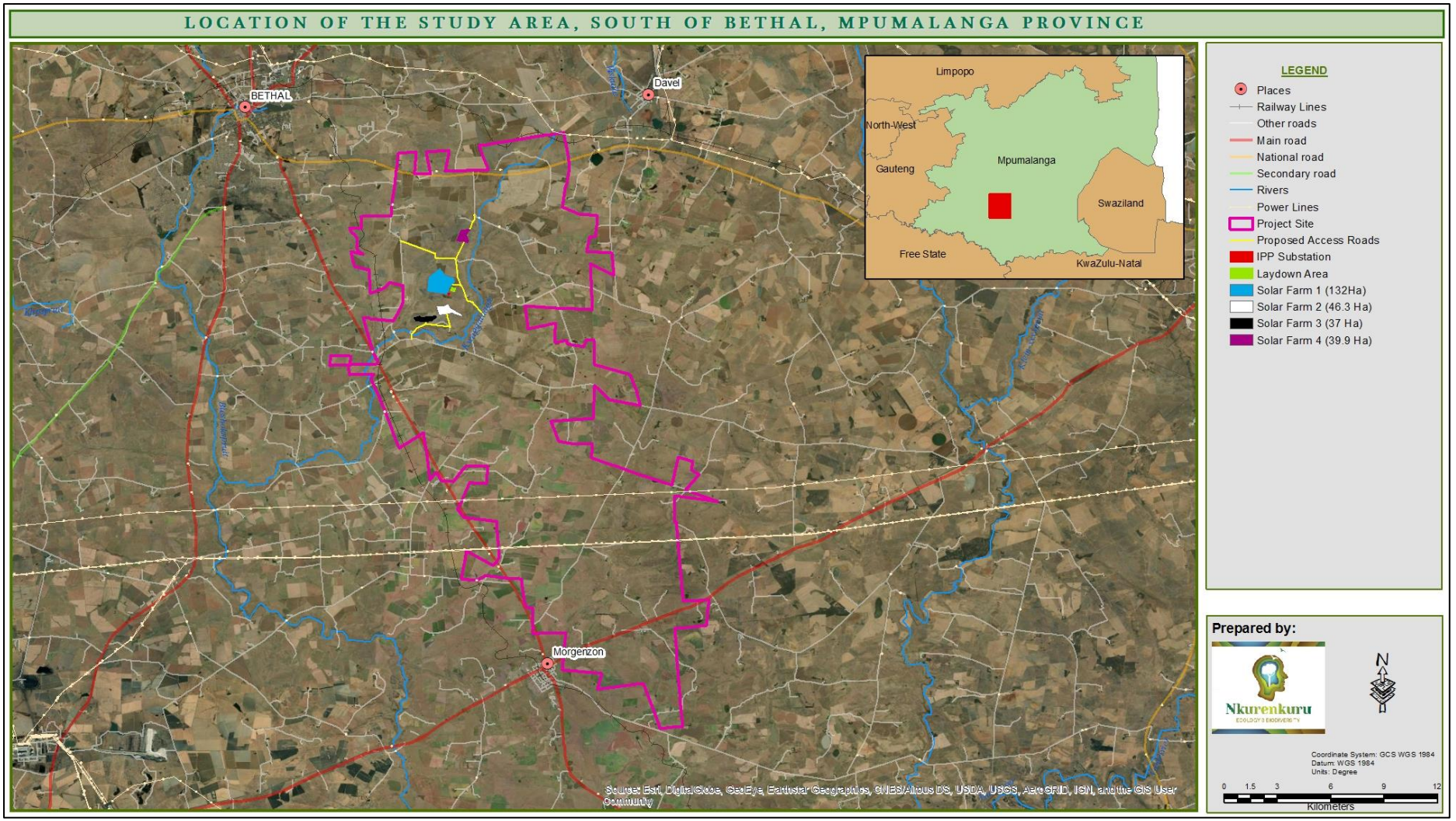

Figure 1: Locality of the study area, south of the town Bethal in the Mpumalanga Province. The inset map shows the main map extent (red square) within Mpumalanga, as well as the broader context of South Africa.

1.4. Terms of Reference (ToR)

To conduct a detailed site terrestrial biodiversity sensitivity and impact assessment, including the following:

- Desktop analysis;
- On-site investigation;
- Detailed compilation of an ecological impact assessment report which adheres to the following (this list is not exhaustive):
    - An Ecological Sensitivity and Impact report meeting the requirements for environmental themes in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA, 2020);
    - Identification of any discrepancies with the environmental sensitivity as identified on the national web based environmental screening tool;
    - Refine / confirm the delineation of the CBA;
    - Identification of sensitive areas to be avoided (including corresponding spatial data);
    - Identification of sensitive species (Species of Conservation Concern and Protected Species) that occur on site;
    - An assessment of all potential impacts associated with the development, including impact significance ratings;
    - Recommendations regarding potential development areas for solar PV within the project site (including acceptable footprint limit); and
    - Recommendations regarding the scope and timeframe for further assessment.

1.5. Conditions of this Report

All findings, recommendations, and conclusions provided in this report are based on the author(s) best scientific and professional knowledge, as well as information available at the time of compilation. This report, or any part or form thereof, may not be amended or extended in any way without the prior written consent of the author(s). Any recommendations, statements, or conclusions drawn from, or based on, this report, must clearly cite or make reference to this report. Whenever such recommendations, statements, or conclusions form part of another report, whether main or other, relating to the current investigation, this report must be included in its entirety.

1.6. Relevant Legislation

The following legislation was taken into account whilst compiling this report:

1.6.1. Provincial

Mpumalanga Nature Conservation Act, No. 10 of 1998, with special reference to:

- Schedule 11: Protected Plants.
- Schedule 12: Specially Protected Plants.

The above-mentioned Act is regarded by Mpumalanga Provincial Legislature, as the legally binding provincial document, providing regulations, guidelines, and procedures for the sustainable utilisation of wild animals, aquatic biota and plants, the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and also, the general conservation of flora and fauna, and the destruction of problematic (vermin and invasive) species.

1.6.2. National

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

1.6.3. International

» Convention on International Trade in Endangered Species of Fauna and Flora (CITES; https://cites.org/eng).
» The Convention on Biological Diversity (CBD; https://www.cbd.int/).
» The Convention on the Conservation of Migratory Species of Wild Animals (CMS; https://www.cms.int/).

2. METHODOLOGY

2.1. Assessment Approach and Philosophy

The assessment was conducted according to the 2014 EIA Regulations, as amended on 7 April 2017, as well as within the best-practice guidelines and principles for biodiversity assessments (Brownlie et al., 2006; de Villiers et al., 2005).

This includes adherence to the following broad principles:

- That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas, namely: Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans, or Bioregional Plans) and Freshwater Ecosystem Priority Areas.
- Demonstrate how the proponent intends on complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should, in order of priority, aim to:
    - Avoid, minimise, or remedy disturbance of ecosystems and loss of biodiversity;
    - Avoid environmental degradation;
    - Avoid jeopardising ecosystem integrity;
    - Pursue the best practical environmental option by means of integrated environmental management;
    - Protect the environment as the people's common heritage;
    - Control and minimise environmental damage; and
    - Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic, or stressed ecosystems.

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

To adhere to the above principles and best-practice guidelines, the basis for the study approach and assessment philosophy included baseline data collection, desktop studies, and site walkovers/field surveys of the property, describing:

- The broad botanical characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of patterns, the following were studied:

Community and ecosystem level:

» The main vegetation types and plant communities (Dayaram et al., 2018; Mucina and Rutherford, 2006), their aerial extents, and interaction with neighbouring types, soils, or topography.
» Threatened or Vulnerable ecosystems (cf. new South African vegetation map/National Spatial Biodiversity Assessment1, fine-scale systematic conservation plans, etc.) (South African National Biodiversity Institute, 2019).

Species-level:

» Species of Conservation Concern (SoCC: Red List and protected species), giving GPS location, if possible (Raimondo et al., 2009).
» Estimated population sizes and viabilities of SoCC present on site (including, if possible, the degree of confidence in prediction based on availability of information and specialist knowledge; i.e., High = 70 – 100% confident, Medium = 40 – 70% confident, Low = 0 – 40% confident).
» Probability of other SoCC occurring in the region of the site (include degree of confidence).

Other pattern issues:

» Any significant landscape features, or rare or important vegetation associations, such as seasonal wetlands, alluviums, seeps, sandstone outcroppings, steep southern aspects, drainage lines, etc., in the vicinity.
» The extent of alien plant cover within the site, and whether any infestations are the result of prior disturbance, for example ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than an infestation of undisturbed sites).
» The condition of the site in terms of current or previous land uses.

In terms of process, the following was studied:

» The key ecological "drivers" of ecosystems in the study area and its vicinity.
» Any mapped spatial components of ecological processes that may occur in the study area or its vicinity (i.e., corridors such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces, or biome boundaries).
» Any possible changes in key processes e.g., increased fire frequency or drainage/artificial recharge of aquatic systems.

If any further studies may be required during or after the EIA process, they will be outlined, together with all relevant legislation, permits, and standards that would apply to the development.

The opportunities and constraints for development is described and shown graphically on an aerial photograph, satellite image, or map delineated at an appropriate level of spatial accuracy.

2.2. Data Exploration and Review

Data sources from the literature and GIS spatial information were consulted and used where necessary, and include the following (see Figure 2 for the area used to compile a plant species list, and Table 2 for a summary):

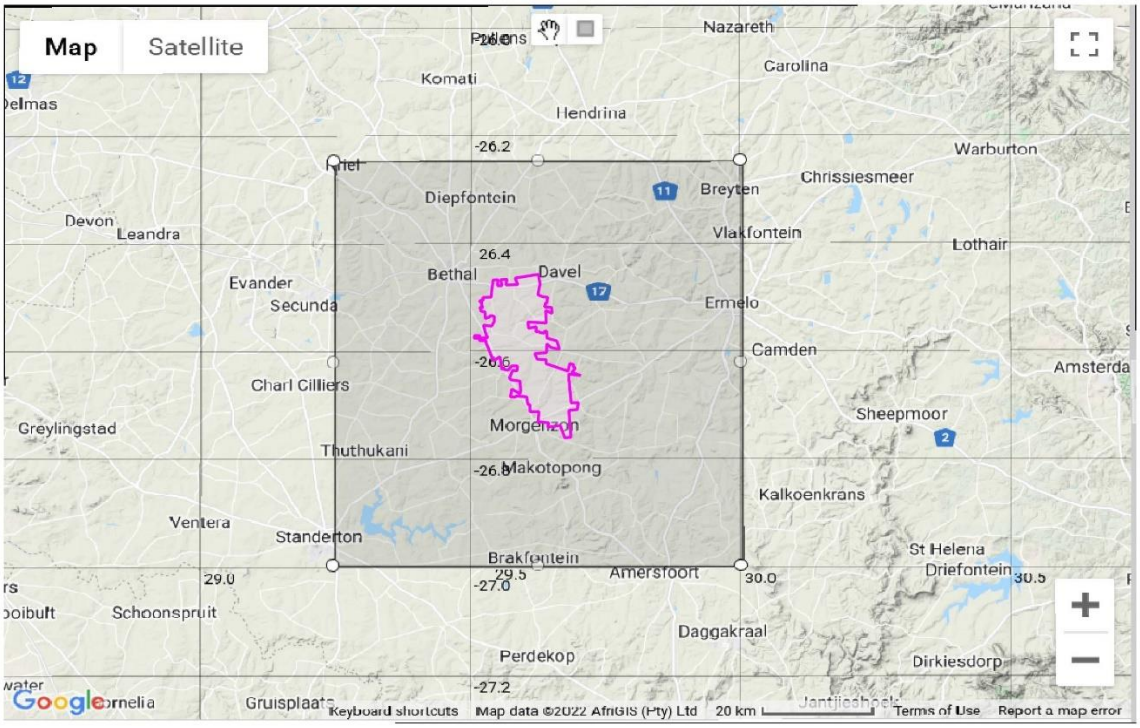

Figure 2: Extent of the study area, as well as the area used to extract data from POSA. Extracted data was used to compile a list of plant species that may potentially occur within the study area, as well as the surrounding area, and provide an indication of potential Species of Conservation Concern that may be found within this area.

Vegetation:

» South African National Vegetation Map (Mucina and Rutherford, 2006) and National List of Threatened Ecosystems (2011): vegetation types and their respective conservation statuses. The latest version of the National Vegetation Map was also consulted to check for any updates of the respective regions (Dayaram et al., 2018; South African National Biodiversity Institute, 2018).

- Botanical Database of Southern Africa (BODATSA), hosted by the South African National Biodiversity Institute (SANBI; https://posa.sanbi.org; also referred as POSA: Plants of Southern Africa): information on plant species recorded for the Quarter Degree Squares 2629AD, 2629BC, 2629BD, 2629CB, 2629D, 2629DB, 2629CD, 2629DC, and 2629DD. This is a much larger area than required and is a conservative approach ensuring that all species possibly occurring within the study area have been represented. It also accounts for the fact that the study area itself might not be well represented in national databases.
- Threatened Species Programme, Red List of South African Plants (Version 2017.1; http://redlist.sanbi.org/): The IUCN conservation statuses of all listed species were extracted from this database.

Ecosystem:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (NFEPA; Nel et al., 2011). This includes rivers, wetlands, and catchments defined in the study area.
- Important catchments and protected area expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES; Government of South Africa, 2008).
- Critical Biodiversity Areas for the site and surroundings (obtained from SANBI Biodiversity GIS (BGIS).

Fauna:

The list of mammal and herpetofauna species predicted to occur in the region, and their respective likelihood of occurrence within the study area, was generated based on known distributions and habitat suitability from online and literature sources such as MammalMap, ReptileMap, FrogMap, and the ReptileAtlas, as well as field guides such as, Skinner & Chimimba (2005), Apps (ed. 2012), Stuart & Stuart (1998), Bates *et al* (2014), Minter *et al*. (2004), Branch (2009), and Du Preez and Carruthers (2009). The literature study focussed on querying online databases to generate species lists for the relevant Quarter Degree Squares (QDS).

The predicted list is typically heavily influenced by factors other than distribution or biome type. Factors such as habitat suitability, current land use, current levels of disturbance, and structural integrity of the habitats all influence the potential for predicted species to occur in the vicinity of the study area. A high likelihood thus exists that not all mammal species known to occur within the region will be located within the study area and surrounding areas. Therefore, a 'Likelihood of Occurrence' (LOO) and a 'Species of Conservation Concern' review will be applied to any potential omissions in the data set. For the LOO analysis, a full summary of Red List faunal species (IUCN, 2021); (SANBI, 2021), as well as other SCC will be tabulated, with a LOO applied.

LOO will be based upon available spatial imagery, and more specifically:

- Habitat suitability;
- Overlap with known distributions;
- Rarity of the species; and
- Current Impacts.

Mammal distribution data were obtained from the following sources:

- The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005);
- The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland (www.ewt.org.za) (EWT, 2016);
- Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) (mammalmap.adu.org.za);
- Stuarts' Field Guide to Mammals of Southern Africa – Including Angola, Zambia & Malawi (Suart & Stuart, 2015)
- A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife (Stuart & Stuart, 2013).
- Smither's Mammals of Southern Africa (Apps, ed. 2012)

Herpetofauna distribution and species data were obtained from the following sources:

- South African Reptile Conservation Assessment (SARCA) (sarca.adu.org);
- A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
- Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
- Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates et al.,
- 2014);
- A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- Animal Demography Unit (ADU) - FrogMAP (frogmap.adu.org.za);
- Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland (Mintner et
- al., 2004); and
- Ensuring a future for South Africa's frogs (Measey, 2011).

Table 2: Information and data coverages used to inform the ecological assessment.

	Data/Coverage Type	Relevance	Source
Biophysical Context	**Colour Aerial Photography**	Desktop mapping of habitat/ecological features	National Geo-Spatial Information (NGI)
	Latest Google Earth™ imagery	To supplement available aerial photography	Google Earth™ On-line
	1:50 000 River Line (GIS Coverage)	Highlight potential on-site and local rivers and wetlands and map local drainage network.	CSIR (2011)
	National Land-Cover	Shows the land-use and disturbances/transformations within and around the impacted zone.	DEA (2015)
	South African Vegetation Map (GIS Coverage)	Classify vegetation types and determination of reference primary vegetation	Mucina & Rutherford (2012; 2018); Dayaram et al., 2018
	NFEPA: river and wetland inventories (GIS Coverage)	Highlight potential on-site and local rivers and wetlands	CSIR (2011)
Conservation and Distribution Context	**National Biodiversity Assessment – Threatened Ecosystems** (GIS Coverage)	Determination of national threat status of local vegetation types	SANBI (2011)
	Mpumalanga Biodiversity Sector Plan: Critical Biodiversity Areas (GIS Coverage)	Determination of provincial terrestrial/freshwater conservation priorities and biodiversity buffers	SANBI (2016)
	SANBI's PRECIS (National Herbarium Pretoria Computerized Information System) electronic database	Determination of plant species composition within the region as well as potential conservation important plants.	http://posa.sanbi.org
	Red Data Books (Red Data Lists of Plants)	Determination of endangered and threatened plants,	Red List of South African Plants (2011); http://redlist.sanbi.org/
	Animal Demography Unit	Compilation of a species list.	Apps (ed.) 2012
	Smither's Mammals of Southern Africa	Compilation of a species list.	Skinner & Chimimba (2005)
	The Mammals of the Southern African Subregion	Compilation of a species list.	Branch (1998)
	Field guide to snakes and other reptiles of southern Africa	Compilation of a species list.	Apps (ed.) 2012

2.3. Botany: Methods Followed during Assessment

The survey period occurred from 24 – 27 April 2022 (autumn). During the inspection the vegetation was not in an optimal survey condition; however, the majority of plants were easily identifiable.

The inspection was conducted by a combination of vehicle surveying (with regular stops) and walking to assess the plant communities present. A Garmin® GPS was used to log any

special features, SoCC, or other important observations. All plants observed at the various stops were recorded, with attention given to observing the potential presence of SoCC.

The aims were to:

- Inspect the various habitats, vegetation, and landscapes present at the study area, and to correlate such observations with the results of the desktop study.
- Identify all observed species recorded within the study area.
- Provide a list of Species of Conservation Concern (SoCC; i.e., protected and Red List species).
- Note the presence of sensitive habitats, for example drainage lines and unique edaphic environments.

Aspects of biodiversity used to guide the interpretation and assessment of the study area are summarized in Table 3.

Table 3: Summary of the different aspects of biodiversity considered in the assessment of the study area.

Intrinsic / Ecological Values
Species-Level Aspects of Biodiversity
» Protected plant species; » Threatened plant species (Red List); » Keystone species performing a key ecological role; » Large or congregatory species populations; » Endemic species or species with restricted ranges; » Previously unknown species.
Community and Ecosystem-Level Aspects of Biodiversity
» Distinct or diverse communities or ecosystems; » Unique ecosystems; » Locally adapted communities or assemblages; » Species-rich or diverse ecosystems; » Communities with a high proportion of endemic species or species with restricted ranges; » Communities with a high proportion of threatened and/or declining species; » The main uses and users of the area and its ecosystem goods and services: important ecosystem services, valued ecosystem goods, valued cultural areas.
Landscape-Level Aspects of Biodiversity
» Key ecological processes (e.g., seed dispersal, pollination, primary production, carbon sequestration); » Areas with large congregations or species and/or breeding grounds; » Migration routes/corridors; » Importance as a link or corridor to other fragments of the same habitat, to protected, or threatened, or valued biodiversity areas; » Importance and role in the landscape with regards to arrangement of spatial components of ecological processes, comprising processes tied to fixed physical features (e.g., soil or vegetation interfaces, river or sand movement corridors, upland-lowland interfaces) and flexible processes (e.g., upland-lowland gradients and macro-climatic gradients), as well as important movement or migration corridor for species.

2.4. Fauna: Methods followed during Field Sampling and Assessment

The project area was inspected over the course of 24 – 27 April 2022 (autumn). Conditions for the faunal survey were regarded as acceptable.

Mammal Assessment:

Likelihood of Occurrence

There is a high likelihood that not all mammal species known to occur within the study area and surrounding areas will be located during the survey. Therefore, a 'Likelihood of Occurrence' (LOO) and a 'Species of Conservation Consideration (SCC)' review was applied to any potential omissions in the data set. For the LOO analysis, a full summary of Red List mammals (IUCN, 2017), as well as other SCC was tabulated, with a LOO applied. The relevant species of special consideration were addressed separately based on the data collected during fieldwork, in the context of development and the effects on the species (both ecologically and spatially).

Likelihood of Occurrences are based upon:

- Habitat suitability;
- Overlap with known distributions;
- Rarity of the species; and
- Current Impacts.

Spoor Tracking

Spoor tracking enabled detailed sampling of mammalian species without the need for trapping or direct observation. All spoor, including footprints, den sites, burrows, hairs, scrapings, and diggings were recorded and documented by detailed geo-referenced photography. Spoor tracking was performed during general fieldwork, during specific timed spoor tracking drives/transects, and at carefully chosen locations such as roads and other areas with highly trackable substrates. In addition, all camera trap sites (see below) were subjected to spoor tracking.

Camera trapping

The use of camera trapping has long been considered as a valuable ecological census tool in the field of African Mammalogy and this method was a primary focus of the fieldwork. Baited cameras were deployed during surveying. Bait stations were chosen based on available cover around the area, the presence of any promising signs (e.g. tracks, scats, tree scrapings), and the likelihood of possible habitats for important species. The baits used consisted of a mixture of pilchards and oats that were pureed to a fine pulp. Cameras

were set to record 3 images per set, with a 40 second delay between sets. Four cameras were deployed.

Nocturnal surveys and daytime observations

Nocturnal Surveys: This technique is an essential tool in mammalian sampling, simply because most of the target species are only active after dark (i.e., they are nocturnal). A high-powered spotlight was used from a vehicle to illuminate such nocturnal species. Some mammal species were located from their vocalisations. Two night drives of 2 hours each were carried out during the study.

Direct Observations: All mammals observed during the sampling period were recorded, as well as their geographic coordinates and surrounding habitat. This data was used to supplement the overall habitat analysis to give context to the area. Animals were encountered through driving, normal routine movement through the study area, active searching of refugia, and finally, through spotlighting at night.

Sherman Trapping

Sherman trapping was done for three trap nights. All traps were placed on the ground and baited with a mixture of peanut butter, olive oil, oats, and marmite. Four trap lines were set out, with each trap line comprising of 20 traps. The distance between each trap varied between 15 and 25 meters and was dependent on the transition between habitats. Each trap line was situated within a single habitat type. Captured animals were moved from the traps into clear plastic bags, identified, photographed, and then released unharmed. The specific period of sampling is regarded as a moderately acceptable period for sampling.

Herpetofaunal Assessment:

Due to the limited time available for the field survey, no trapping was performed in order to maximise prime active searching time by eliminating the need to install, service, and dismantle the traps. Instead, the survey aimed to focus on intensive active searching.

Active Searching

Reptiles were searched for on foot within the study area during the day and night. Specific habitat types were selected, beforehand, where active sampling was intentionally focused (point samples). The habitats of these point samples were also described and photographed. Active searching for reptiles occurred for approximately 30 minutes per point sample and involved:

» Photographing active reptiles from a distance with a telephoto lens (300 m telephoto lens);

- » Lifting up and searching under debris, rocks, or logs (rocks and logs were always returned to their original positions);
- » Scanning for any signs of reptiles such as shed skins, the positive identification of which was taken as an observation of that species; and
- » Catching observed reptiles by hand. All captured reptiles were photographed and released unharmed.

Nocturnal herpetofauna were searched for by driving slowly on the roads during a single night. Amphibians (frogs and toads) are nocturnal and were searched for by torchlight during a single night at and around ephemeral watercourses. Each amphibian encountered at a particular site was identified and photographed where possible. Positive identification of acoustic signals (males call to attract females) was also used as a means of identifying amphibians.

Opportunistic Sampling

Reptiles, especially snakes, are incredibly elusive and difficult to observe. Consequently, all possible opportunities to observe reptiles were taken in order to augment the standard sampling procedures described above. As a result, other participating biodiversity specialists assisted through opportunistically taking photographs of reptiles and amphibians within the study area. These images were copied for proper identification and added to the list of random observations unless a specific location of the observation was provided.

2.5. Assessing Species of Conservation Concern

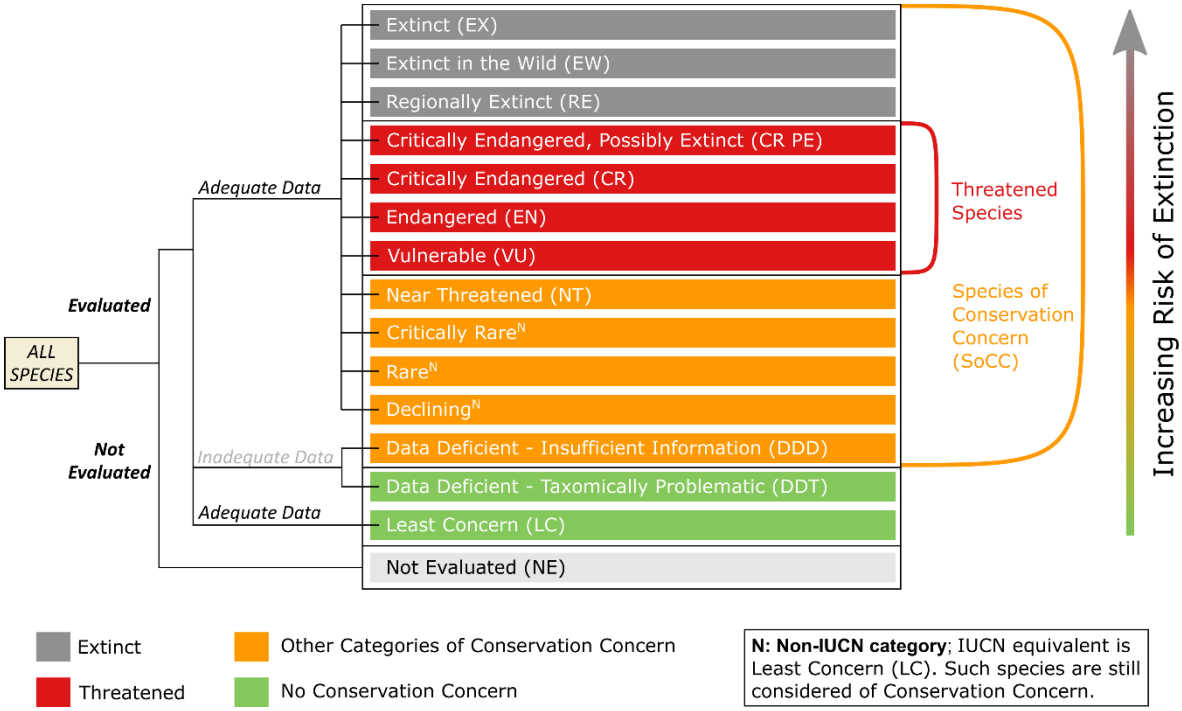

Figure 3: Red List categories used in this report as delineated according to SANBI's Red List of South African Plants (version 2020; http://redlist.sanbi.org/redcat.php).

Species of Conservation Concern (SoCC) are taxa (plants or animals) that have a significant conservation importance in terms of preserving South Africa's high biological diversity.

SoCC include threatened species — i.e., Red List species — that have been classified as "at high risk of extinction in the wild" (i.e., Critically Endangered [CR], Endangered [EN], Vulnerable [VU]), as well as those classified in the categories Near Threatened (NT), Critically Rare, Rare, Declining, and Data Deficient (DD) (Figure 3). Note that SANBI divides the category DD into Data Deficient — Insufficient Information (DDD), and Data Deficient — Taxonomically Problematic (DDT). SoCC also include protected species listed in international conventions, national acts, and provincial ordinances that regulate activities such as the hunting, collecting, and trading of such species.

A population of an SoCC occurring on a proposed development area serves to indicate that the proposed activities could result in significant biodiversity loss. The loss of such subpopulations will either increase the species' extinction risk, or may even contribute to its extinction. A description of the different SANBI Red List categories (http://redlist.sanbi.org/) is provided by Table 4.

Table 4: South African Red List Categories for Species of Conservation Concern (adapted from http://redlist.sanbi.org/redcat.php).

Present State			
Species of Conservation Concern (SoCC)		Extinct (EX)	A species is Extinct when there is no reasonable doubt that the last individual has died. Species are classified as Extinct only after exhaustive surveys throughout the species' known range have failed to record an individual.
		Extinct in the Wild (EW)	A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside of its natural and historical range.
		Regionally Extinct (RE)	A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
	Threatened Species	Critically Endangered, Possibly Extinct (CR PE)	Possibly Extinct is a special tag associated with the category Critically Endangered, for species that are highly likely to be extinct, but exhaustive surveys required for classifying the species as Extinct have not yet been completed. A small chance remains that such species may still be rediscovered.
		Critically Endangered (CR)	A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
		Endangered (EN)	A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
		Vulnerable (VU)	A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
		Near Threatened (NT)	A species is Near Threatened when available evidence indicates that it almost meets any one of the IUCN criteria for Vulnerable, and is, therefore, likely to become at risk of extinction in the near future.
		Critically Rare [non-IUCN]	A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
		Rare [non-IUCN]	A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat, and does not qualify for a category of threat according to one of the five IUCN criteria.
		Declining	A species is Declining when it does not meet or almost meet any one of the five IUCN criteria, and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened, but there are threatening processes causing a continuing decline of the species.
		Data Deficient – Insufficient Information (DDD) [non-IUCN]	A species is DDD when there is inadequate information to make an assessment of its extinction risk, 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.
Other		Data Deficient – Taxonomically Problematic (DDT) [non-IUCN]	A species is DDT when taxonomic problems hinder its distribution range and habitat from being well defined so that an assessment of risk of extinction is not possible.
		Least Concern (LC)	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.
		Not Evaluated	A species is Not Evaluated when it has not been evaluated against the criteria.

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

SoCC likely to occur in the various habitats of the study area were assessed at a desktop level using the outputs of POSA. This information was used to identify potential habitats in the study area that could support these SoCC. Special attention was given to the identification of any Red List species, as well as suitable habitats for Red List species, observed during field investigations.

2.6. Ecological Mapping

Mapping was done via available Google-Earth Satellite Imagery. Due to the intricate mosaics and often gradual mergers of vegetation units, generalisations were made and delineations are therefore approximate. Mapped units thus indicate potential dominant vegetation, but smaller vegetation types invariably exist within dominant units, and could not be mapped separately. The latter would require a supervised classification of georeferenced raw SPOT or similar satellite imagery (with full reflectance data), which was not available for this project due to a limited budget. Maps were created with QGIS (version 3.20).

2.7. Sensitivity Analysis and Criteria

Aspects of biodiversity that were used to guide the interpretation and assessment of the study area are summarized below (Table 5).

Table 5: Summary of the different aspects of biodiversity considered in the assessment of the study site.

Intrinsic / Ecological Values
Species-Level Aspects of Biodiversity
» Protected flora and fauna; » Threatened Species (Red List); » Keystone species performing a key ecological role; » Large or congregatory species populations; » Endemic species or species with restricted ranges; » Previously unknown species.
Community and Ecosystem-Level Aspects of Biodiversity
» Distinct or diverse communities or ecosystems; » Unique ecosystems; » Locally adapted communities or assemblages; » Species-rich or diverse ecosystems; » Communities with a high proportion of endemic species or species with restricted ranges;

» Communities with a high proportion of threatened and/or declining species; » The main uses and users of the area and its ecosystem goods and services: important ecosystem services, valued ecosystem goods, valued cultural areas.
Landscape-Level Aspects of Biodiversity
» Key ecological processes (e.g., seed dispersal, pollination, primary production, carbon sequestration); » Areas with large congregations or species and/or breeding grounds; » Migration routes/corridors; » Importance as a link or corridor to other fragments of the same habitat, to protected or threatened or valued biodiversity areas; » Importance and role in the landscape with regards to arrangement of spatial components of ecological processes, comprising processes tied to fixed physical features (e.g., soil or vegetation interfaces, river or sand movement corridors, upland-lowland interfaces) and flexible processes (e.g., upland-lowland gradients and macro-climatic gradients), as well as important movement or migration corridor for species.

The determination of specific ecosystem services and the sensitivity of ecosystem components, both biotic and abiotic, is complex and no single overarching criterion applies to all habitats studied. The main aspects of an ecosystem that require incorporation into a sensitivity analysis, however, include the following (see Kremen 2005):

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

This implies that, in a sensitivity analysis, aspects that currently prevail in the project area should be taken into consideration. The possibility of fully restoring the original environment and its biota, or at least rehabilitating ecosystem services, after significant disturbance, as close as possible to the original state, should also be considered.

According to the above, sensitivity classes are summarised as follows:

Table 6: Explanation of sensitivity rating

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: » Critical habitat for range restricted species of conservation concern that have a distribution range of less than 10 km^2	» CBA 1 areas » Remaining areas of vegetation types listed in the Draft Ecosystem List of NEM:BA as Critically Endangered,

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
	» Presence of species of conservation concern listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable according to the IUCN Red List 3.1. Categories and Criteria or listed as Nationally Rare » Habitats/Vegetation types with high conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). » Protected habitats (areas protected according to national/provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas, Lake Areas Development Act). These areas/habitats are irreplaceable in terms of Species of Conservation Concern May also be positive for the following: » High intrinsic biodiversity value (high species richness and/or turnover, unique ecosystems) » High value ecological goods and services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) » Low ability to respond to disturbance (low resilience, dominant species very old).	Endangered, or Vulnerable. » Protected forest patches. » Confirmed presence of populations of Species of Conservation Concern (Critically Endangered, Endangered, Vulnerable & Rare)
HIGH	Indigenous natural areas that are positive for any of the following: » High intrinsic biodiversity value (moderate/high species richness and/or turnover). » Confirmed habitat highly suitable for Species of Conservation Concern (Those species listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable according to the IUCN Red List 3.1. Categories and Criteria). » Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). » Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). » Moderate to high value ecological goods & services (e.g. water supply, erosion control,	» CBA 2 "critical biodiversity areas". » Confirmed habitat where Species of Conservation Concern could potentially occur (habitat is suitable, but no confirmed records). » Habitat containing individuals of extreme age. » Habitat with low ability to recover from disturbance. » Habitat with exceptionally high diversity (richness or turnover). » Habitat with unique species composition and narrow distribution.

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
	soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). These areas/habitats are unsuitable for development due to a very likely impact on Species of Conservation Concern May also be positive for the following: » Protected habitats (areas protected according to national/provincial legislation, e.g. National Forests Act, Draft Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)	» Ecosystem providing high value ecosystem goods and services.
Medium	Indigenous natural areas that are positive for: » Suspected habitat for Species of Conservation Concern based either on species records having been collected in the past, prior to 2002, or being a natural area included in a habitat suitability model (Those species listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable according to the IUCN Red List 3.1. Categories and Criteria). Indigenous natural areas that are positive for one or two of the factors listed below, » Moderate intrinsic biodiversity value (moderate species richness and/or turnover). » Moderate to moderately low ability to respond to disturbance (moderate resilience, dominant species of intermediate age). » Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). » Moderate value for ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value).	» CBA 2 "corridor areas", ESA 1 and ESA2. » Habitat with moderate diversity (richness or turnover). » Suspected habitat for Species of Conservation Concern.
Low	Degraded or disturbed indigenous natural vegetation No Natural habitat remaining	

Together with ecological sensitivity mapping, maximum acceptable loss (MAL) limits associated with these sensitivity ratings are used to guide and reduce impacts (Table 7). These acceptable limits are associated with on-site habitat loss. If they are exceeded, significant ecological impacts, that are difficult to mitigate, might occur, and could compromise development. These limits are intended to guide development and provide an impact assessment benchmark. Therefore, development should firstly not exceed these

explicit thresholds, and secondly, should aim to be well below them. Moreover, development should always aim to be in the lowest sensitivity category. For example, if an activity/development is proposed within an area of High or Very High sensitivity, then it is highly recommended that such an activity/development is relocated to the nearest area of Low or Medium sensitivity.

Exceeding either High or Very High sensitivity area thresholds represent an immediate fatal flaw. Low or Medium sensitivity areas could potentially be exceeded only if their combined total footprint does not exceed their overall combined MAL. If their overall combined MAL is indeed exceeded, then there is significant concern regarding developmental suitability. In such a case, the spatial configuration of the development, together with its likely ecological impacts, must be re-evaluated.

Finally, the specialist may identify areas unacceptable for development, irrespective of MAL limits, and any activities/developments within such areas must be moved to other, more suitable, areas.

Table 7: Sensitivities, brief descriptions, actions, and maximum acceptable losses (MAL) associated with the proposed wind energy development.

Sensitivity	MAL	Area Type	Action	Brief Description
Very High	1%	Critically Endangered Ecosystems; Endangered Ecosystems; CBA1: Irreplaceable Areas; and unique areas	No-Go: Avoid at all costs	These areas/habitats are threatened, are refugia for SoCC, or have critical ecological functions. If such areas must be crossed, existing roads or disturbance footprints must be used.
High	2%	Vulnerable Ecosystems; CBA1: Optimal Areas; Natural; or transformed areas (impact will be high)	Avoid if possible	These areas/habitats have a high biodiversity value, are sensitive, or have important ecological functions. Development should be avoided within these areas where possible; if development is necessary, proceed with caution and adequate mitigation. If such areas must be crossed, existing roads or disturbance footprints should preferably be used to reduce impacts.
Medium	5%	Vulnerable Ecosystems; Natural; or transformed areas (impact will be local)	Proceed with adequate mitigation	With appropriate mitigation, developmental impacts (both primary and secondary) will be local and have relatively little ecological impact.
Low-Medium	7%	Secondary Habitats that have been historically disturbed but have since been covered and stabilised by indigenous vegetation.	Proceed with adequate mitigation	With appropriate mitigation, developmental impacts (both primary and secondary) will be local and have relatively little ecological impact.
Low	10%	Mostly transformed areas (impact will be low)	Proceed with adequate mitigation	These areas/habitats have a low sensitivity and are usually highly transformed. With adequate mitigation, developmental impacts will likely be of low significance.

2.8. Impact Assessment Methodology

The impact assessment methodology is in accordance with the recently revised 2014 EIA regulations. The significance of environmental impacts is a function of: the present environmental aspects that are to be impacted on, the probability of an impact occurring, and the consequence of such an impact occurring before, and after, implementation of proposed mitigation measures.

The significance of environmental impacts is to be assessed by means of the criteria of nature (descriptive), extent (scale), duration, magnitude (severity), probability (certainty), and direction (negative, neutral, or positive) (Figure 4). Summarized briefly:

- **Nature**: a description of what causes the effect, what will be affected, and how it will be affected.
- **Extent**: whether the impact will be site specific (limited to the immediate area or development site), local, or regional/provincial. A value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high).
- **Duration**:
  - the lifetime of the impact will be of a very short duration (0 – 1 year) — assigned a score of 1;
  - the lifetime of the impact will be of short duration (1 – 5 years) — assigned a score of 2;
  - medium-term (5 – 15 years) — assigned a score of 3;
  - long term (15 – 30 years) — assigned a score of 4; or
  - permanent (> 30 years) — assigned a score of 5.
- **Magnitude**: quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high and processes are altered to the extent that they temporarily cease, and 10 is very high and results in complete destruction of patterns, and permanent cessation of processes.
- **Probability** (of occurrence): the likelihood of the impact actually occurring. Probability is estimated on a scale of 1 – 5, where 1 is highly improbable (will likely not happen), 2 is improbable (possible, but likelihood still low), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will definitely occur regardless of any prevention measures).
- **Significance**: determined through a synthesis of the characteristics described above and can be assessed as **LOW**, **MEDIUM**, or **HIGH**.
- Direction: either positive, negative, or neutral.

Also implicitly considered is the degree to which the impact:

» can be reversed;
» may cause irreplaceable loss of resources; and
» can be mitigated.

Impact significance is calculated by combining the criteria as follows:

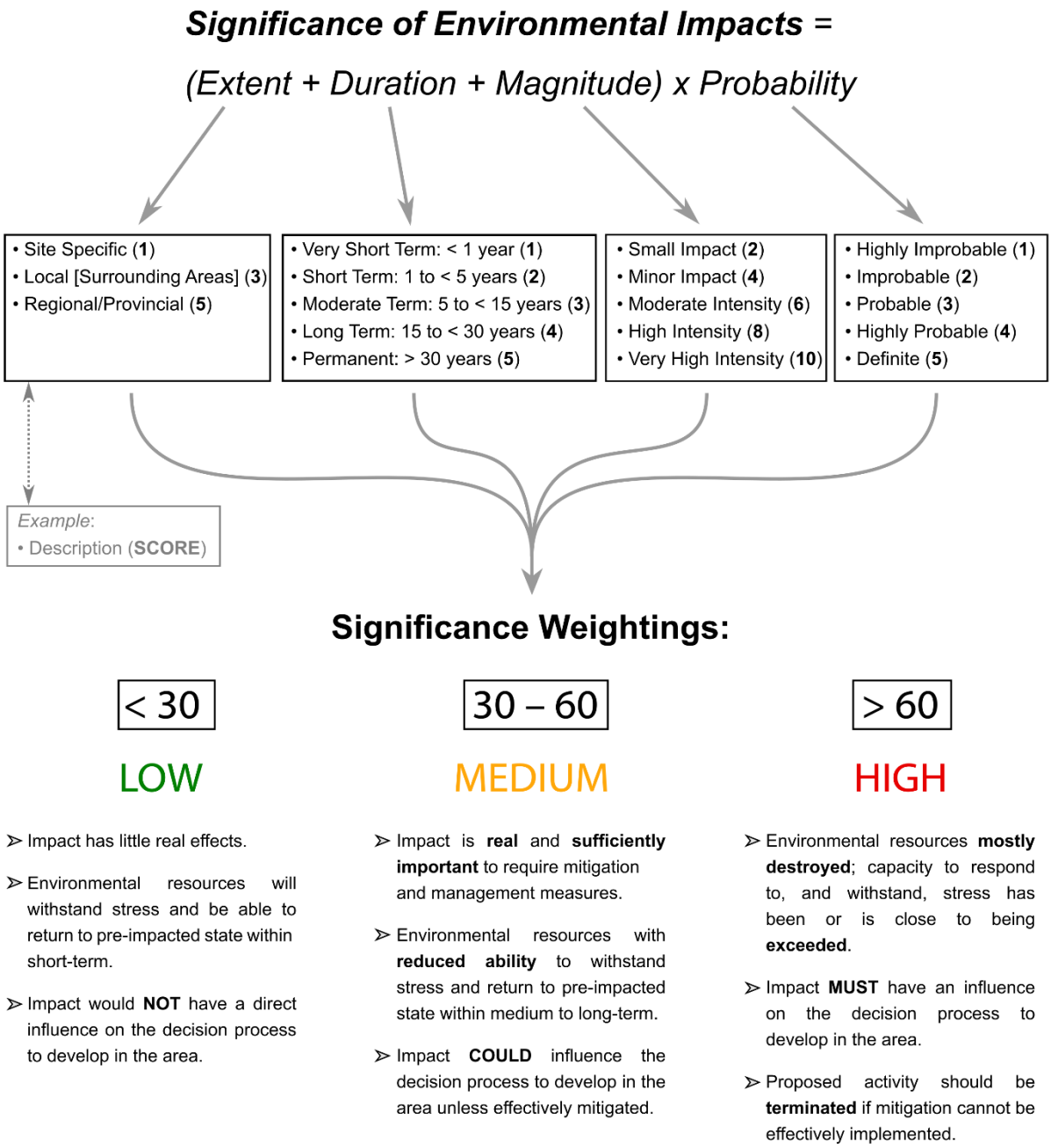

Figure 4: Calculation, description, and summary of Significance Weightings that result from calculating the Significance of Environmental Impacts.

2.9. Assumptions and Limitations

This report deals exclusively with a specifically defined area (the "study area"), and the impacts upon plant biodiversity and natural ecosystems in that area. As such:

- All relevant project information provided by the applicant and/or Environmental Impact Assessment practitioner(s) to the biodiversity specialist(s) was assumed to be correct and valid at the time that it was provided.
- Probably the most significant potential limitation associated with the methodology is the narrow temporal window of sampling.

Temporal variation plays an important role in the structure and patterns of plant biodiversity, communities, and species occurrences. One site visit might, therefore, not fully catalogue plant species diversity in an area (for example, due to seasonal vegetation variation). The site was surveyed in a dry period, and outside of the peak flowering season. However, most plants were easily identifiable. Thus, the vegetation of the area was likely reasonably well documented.

Nevertheless, some annual, short-lived, ephemeral (plants surviving unfavourable conditions as seeds), geophytic (species with underground storage organs), or other cryptic species might not have been observed/detected. For example, some plant species of the families Amaryllidaceae, Colchicaceae, Eriospermaceae, Hyacinthaceae, Hypoxidaceae, Iridaceae, and Orchidaceae, among others, are known to completely die back during certain times of the year, depending on respective life strategies. Thus, during these times such species remain unobservable/undetectable and survive only as dormant bulbs, corms, tubers, or rhizomes below the soil surface. Together with this, rare and threatened plant species are generally uncommon and/or localised, and can easily be overlooked. Even multiple site visits might therefore fail to locate such species.

Furthermore, flowers and fruits are crucial for the complete and accurate identification of plant species, and any absence of such flowers and fruits might prevent the complete and accurate identification of such plant species. Flowering and fruiting times are species specific, and there are invariably always some plant species not flowering and/or fruiting during surveying. This not only impacts identifiability, but also detectability/visibility.

Finally, in principle, it is impossible to survey any area to its full extent, both physically and temporally. The total number of plant species recorded in any area is, therefore, almost always an underestimate of the potential number of species that could occur in such an area.

Considering all of the aforementioned, the author(s) declare a gap in knowledge as to: the potential presence of plant species that might not have been observed/detected on site during the time of surveying, as a result of their potential annual, short-lived, dormant, cryptic, or ephemeral nature, their rare and localised distributions on site, or the incomplete and inaccurate identification of plant species which lacked flowers and/or fruits

and/or other characteristic features. A list of SoCC known to occur in the study area (as per SANBI online databases) was used to supplement the list of species recorded during the survey(s). This final combined list is likely sufficiently conservative and cautious to account for the aforementioned study limitations.

3. THE IMPORTANCE OF BIODIVERSITY AND CONSERVATION

The term "biodiversity" is used to describe the wide variety (richness and abundance) of plant and animal species occurring in their natural environment or "habitat". Biodiversity not only encompasses all living things, but also the series of interactions that sustain them, which are termed "ecological processes".

South Africa's biodiversity provides an important basis for economic growth and development; keeping biodiversity intact is thus vital for ensuring the on-going provision of ecosystem services, for example the production of clean water through comprehensive catchment management practices. The role of biodiversity in combating climate change is also well recognised and further emphasises the key role that biodiversity management plays on a global scale (South African National Biodiversity Institute, 2019).

Typical pressures that natural ecosystems face from human activities include the loss and degradation of natural habitat, invasive alien species, pollution and waste, and climate change (South African National Biodiversity Institute, 2019). High levels of infrastructural and agricultural development typically restrict the connectivity of natural ecosystems, and maintaining connectivity is considered critical for the long-term persistence of both ecosystems and species, in the face of human development and global climate change.

Biodiversity loss places aspects of South Africa's economy and quality of life at risk, and reduces socioeconomic options for future generations. In essence, then, sustainable development is not possible without a healthy biodiversity.

4. STUDY AREA

4.1. Land Use

Land use within the project site is mostly for farming. The study area consists of a mosaic of buildings/structures, active farmland ("agriculture"), fallow land (abandoned farmlands which consist of secondary vegetation; "fallow"), natural grasslands, and freshwater resource features or drainage areas (which is comprised of small streams, wetlands, shallow pans and depressions, and artificial dams).

Farming practices consist a mixture of cultivation (mainly maize with some soya bean cultivation), livestock farming (predominantly cattle on natural to near-natural grasslands and planted pastures), and to lesser extent, game farming.

4.2. Conservation Planning / Context

Understanding the conservation context and importance of the study area and surroundings is important to inform decision making regarding the management of the aquatic resources in the area. In this regard, available national, provincial, and regional conservation planning information was used to obtain an overview of the study site (Table 8).

Table 8: Information and data coverages used to inform the ecological assessment.

NATIONAL LEVEL CONSERVATION PLANNING	**Terrestrial Features**	**National Protected Areas Expansion Strategy**	Focus Area	» Outside of Focus Area: ± 41.6 km north-west of the nearest Focus Area (Moist Escarpment Grassland Focus Area)	Not Classified
		Protected Areas and Conservation Areas (PACA) Database	South African Conservation Area (SACA) and South African Protected Area (SAPA)	Well outside of any SACA and SAPA: » Nearest SACA (Seekoeivlei Nature Reserve) located approximately 88 km to the south. » Nearest SAPA (Rietvlei Private Nature Reserve) located approximately 16 km to the east.	Not Classified
		Vegetation Types	Soweto Highveld Grassland	Vegetation of Study Area	Vulnerable
		Threatened Ecosystems	Soweto Highveld Grassland	Ecosystem of Study Area	Vulnerable

CONSERVATION AND DISTRIBUTION CONTEXT	**Terrestrial Features**	**MPBSP: Terrestrial Critical Biodiversity Areas**	Ecological Support Areas (ESA)	» Local Corridors: ± 1110.1 ha (3.8%) of project site; » Landscape Corridors: ± 754.3 ha (2.6%) of project site	Terrestrial ESA
			Critical Biodiversity Areas (CBA)	» Optimal Areas: ± 6327.8 ha (21.9%) of project site; » Irreplaceable Areas: ± 2419.9 ha (8.4%) of project site	Terrestrial CBA

4.2.1. National Protected Areas Expansion Strategy, Protected Areas, and Conservation Areas

Land-based protected area expansion targets include large, intact, and unfragmented areas of high importance for biodiversity representation and ecological persistence, which are suitable for the creation or expansion of large protected areas. Such areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with a strong emphasis on climate change resilience and requirements for protecting terrestrial and freshwater ecosystems (FEPA: Freshwater Ecosystem Priority Areas). These areas should not be seen as future boundaries of protected areas, since in many cases only a portion of a particular focus area would be required to meet the protected area targets set in NPAES. They are also not a replacement for fine-scale planning, which may identify a range of different priority sites based on local requirements, constraints, and opportunities.

The site is **not** located within any NPAES Areas or any Formal-/Informal Protected Areas (Figure 6). The nearest NPAES Area is located approximately 41.6 km north-west from the nearest focus area (Moist Escarpment Grassland focus area), while the nearest Formal Protected Area is located approximately 88 km south of the site (Seekoeivlei Nature Reserve) and the nearest Informal Protected Area approximately 16 km to the east (Rietvlei Private Nature Reserve).

The proposed development will therefore not have an impact on national ecosystem-specific protected area targets.

4.2.2. National Level of Conservation Priorities (Threatened Ecosystems)

South Africa's vegetation types have been assigned a conservation status according to their respective degrees of transformation and rates of conservation. The conservation status of a habitat or vegetation type is based on the amount of its original area that currently remains intact relative to various thresholds. On a national scale, these thresholds are arranged from Least Threatened to Critically Endangered (Figure 5), as determined by the best available scientific approaches (Driver et al., 2005; South African National Biodiversity Institute, 2019). The level at which an ecosystem becomes Critically Endangered depends on biodiversity targets, and therefore differs from one ecosystem to another, varying from 16% to 36%.

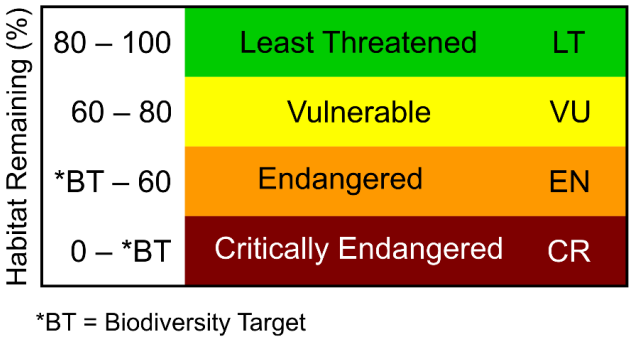

Figure 5: Ecosystem threat status categories (Driver et al., 2005). The biodiversity target represents the minimum conservation requirement.

Nationally, threatened ecosystems that are currently under threat of being transformed by other land uses have been identified and listed. The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (NEM:BA National list of ecosystems that are threatened and in need of protection, G 34809, GoN 1002, 9 December 2011). The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function, and composition of threatened ecosystems (SANBI, 2011). NEM:BA lists threatened or protected ecosystems in one of five categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or protected; Least Threatened ecosystems are not listed. There are four main implications of listing ecosystems:

- Planning related implications which are linked to the requirement in the Biodiversity Act (Act 10 of 2004) for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- Environmental authorisation implications in terms of NEMA and the EIA regulations;
- Proactive management implications in terms of the National Biodiversity Act;
- Monitoring and reporting implications in terms of the Biodiversity Act.

The entire study area is mapped as Soweto Highveld Grassland (Gm 8), as currently mapped by the National Vegetation Map 2018 (Figure 6, Figure 9 and Figure 10).

Soweto Highveld Grassland is listed as Vulnerable (Figure 6), within the National Vegetation Map (SANBI, 2018) as well as within the National Threatened Ecosystems Map (NEM:BA, 2018) (Figure 6).

Soweto Highveld Grassland: The unit is classified as Vulnerable with a target of protection of 24% (Table 9). Only a few patches are statutorily conserved (0.2% of vegetation type) in the Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, and Rolfe's Pan Nature Reserves, or privately conserved in the Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas, and Avalon Nature Reserves, as well as the Heidelberg Natural Heritage Site. Almost half of the area is already transformed (47.3%) by cultivation, urban sprawl, mining, and road infrastructure. Some areas have been flooded by dams, notably the Grootdraai, Leeukuil, Trichardtsfontein, Vaal, and Willem Brummer dams. Erosion is generally very low; only about 93%.

Table 9: Conservation status of the vegetation type occurring in the project site, as well as other vegetation types located within close proximity to the project site.

Vegetation Type	Target (%)	Transformed (%)	Conserved (Statutorily & other reserves)	Conservation Status	
				National Vegetation Map (SAMBI, 2018)	National Ecosystem List (NEMA:BA. 2011)
Soweto Highveld Grassland	24%	47.3%	0.2%	Vulnerable	Vulnerable
Amersfoort Highveld Clay Grassland	27%	24.5%	0%	Least Threatened	Not Listed
Eastern Highveld Grassland	24%	44%	0.3%	Vulnerable	Vulnerable
Wakkerstroom Montane Grassland	27%	6.6%	5.6%	Least Threatened	Endangered

Due to the location of the SEF and associated infrastructure and the nature of the (fairly limited footprint mostly restricted to degraded and transformed areas, minimal use of chemicals, hazardous and toxic materials, and access routes planned largely along existing routes), there is a low-moderate probability that such developments will have a significant impact on the status and conservation target set out for the affected vegetation/ecosystem type.

The most likely/significant impact will be a local loss of, indigenous vegetation, in and around the sections of infrastructure which will be located within natural areas. Furthermore, these disturbed areas may become prone to invasion by Invasive Alien Plants (IAPs) which may spread and establish within the surrounding natural areas (especially aggressive IAPs such as Category 1b IAPs; for example, *Campuloclinium macrocephalum* is regarded as a potentially significant threat). Furthermore, these disturbed areas are vulnerable to erosion, which may potentially spread downslope into natural areas.

These potential impacts associated with the SEF development can, however, be significantly mitigated to acceptable levels, without affecting sensitive and conservation

worthy plant communities (valuable for the overall conservation of the affected vegetation type).

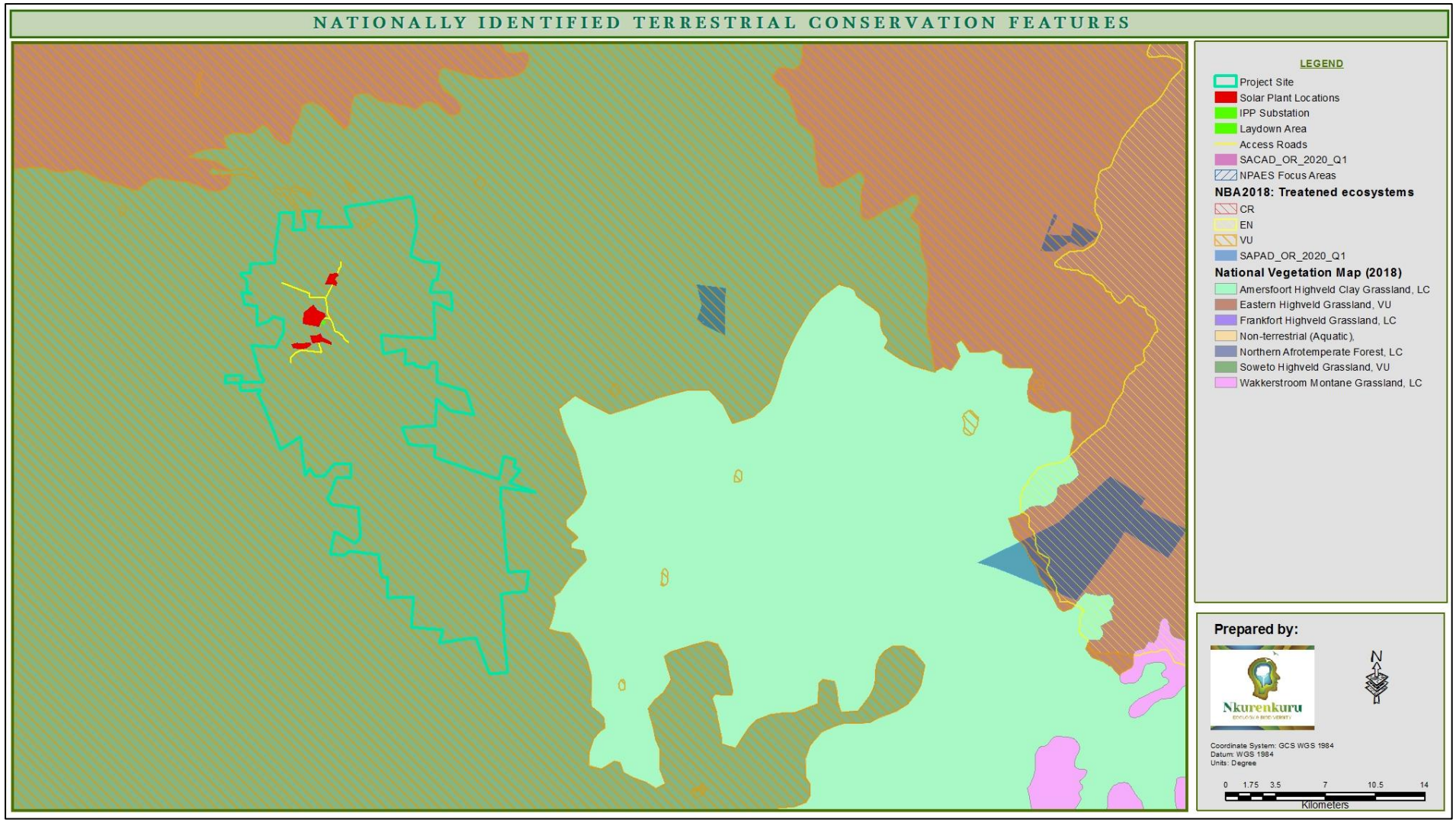

Figure 6: Nationally identified terrestrial conservation priority areas found within the greater surroundings of project site.

4.2.3. Critical Biodiversity Areas and Broad Scale Ecological Processes

The Mpumalanga Biodiversity Conservation Plan (MBCP) was developed jointly by the Mpumalanga Tourism and Parks Agency (MPTA) and the Department of Agriculture and Land Administration (DALA) to guide conservation and land-use decisions in the province in order to support sustainable development.

Terrestrial Critical Biodiversity Areas (CBA) have been identified for the entire Mpumalanga Province and are published by SANBI (http://bgis.sanbi.org/). This biodiversity assessment identifies CBAs representing biodiversity priority areas that should be maintained in a natural to near-natural state. CBA maps show the most efficient selection and classification of land portions to be safeguarded so that ecosystem functioning is maintained and national biodiversity objectives are met (see Table 13 for a summary of the different terrestrial and freshwater features underpinning the various CBA maps, and also refer to

Table 14 for a summary of the land-use guidelines recommended for each feature).

According to Figure 7, **Error! Reference source not found.**, Table 10, Table 11 and Table 12, the majority of the project site is located outside any CBA and ESA (79%), whilst 10% of the project site is located within CBA: Optimal areas, 10% is located within ESA: Landscape corridors and less that 1% is located within CBA: Irreplaceable areas. Furthermore, when taking into account the total coverage of the various CBA subcategories located within the entire project or survey area (total area of 32 822.3 ha), the proposed PV solar development will potentially impact a mere 0.11% of CBA: Irreplaceable areas; and 0.44% of CBA: Optimal areas. This potential impact on CBAs as well as ESA will be even smaller taking into account that the bulk of the access routes are planned along existing routes (fairly broad farm roads, >7m and narrower farm twin tracks) (Table 12). Thus, these roads will be upgraded and impact on natural vegetation will be limited. Only 0.55 km of new road (4% of the planned total road network) will be constructed, with 0.45 km traversing CBA: Optimal areas, and 0.10 km traversing ESA: Landscape corridors. A little more than 10 km of the total 13 km of planned access routes (74%) will be along fairly broad farm roads.

Subsequently, according to this layout, the Ummbila SEF will very slightly impact CBAs, however it is unlikely that this development will have an impact on the conservation targets set out by the province.

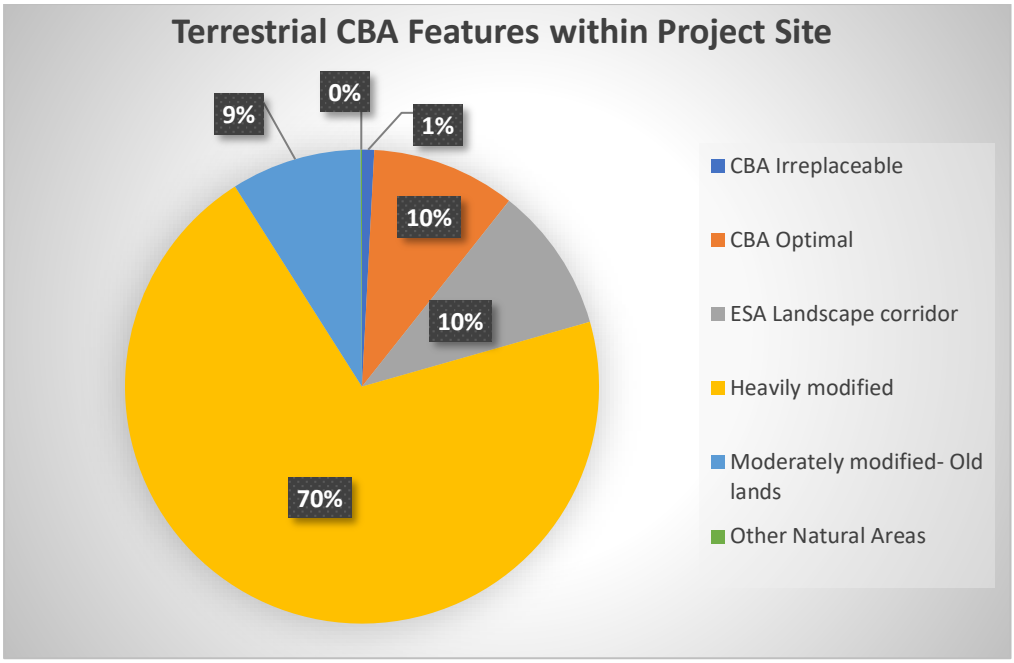

Figure 7: Percentage coverage of Terrestrial CBAs within the project site.

Table 10: Terrestrial CBAs within the proposed project sites earmarked for the proposed development.

MBSP: CBA (Subcategories)	Coverage: Development Site (Ha)	Coverage: Development Site (%)	Coverage: Entire Project Site (Ha)	% of the Project Site's CBAs to be impacted by PV development
CBA Irreplaceable	2.8	1%	2620.2	0.11%
CBA Optimal	33.1	10%	7458.8	0.44%
ESA Landscape corridor	33.5	10%	932.8	3.59%
Heavily modified	237.2	70%	13883.6	1.71%
Moderately modified- Old lands	30.0	9%	3601.3	0.83%
Other Natural Areas	0.3	0%	4325.5	0.01%
Total	336.861392	100%	32822.3	6.69%

Table 11: Breakdown of the coverage of Terrestrial CBAs within each component of the proposed development (excluding access roads, refer to Table 12 below).

MBSP: CBA (Subcategories)	Solar PV Facilities								Laydown Area		IPP Substation	
	Solar Farm 1		Solar Farm 2		Solar Farm 3		Solar Farm 4					
	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)
CBA Irreplaceable	0	0%	0	0%	0	0%	2.25	5%	0	0%	0	0%
CBA Optimal	1.51	1%	20.37	35%	0	0%	5.84	12%	0	0%	0	0%
ESA Landscape corridor	0	0%	30.97	54%	0	0%	34.51	70%	0	0%	0	0%
Heavily modified	144.56	88%	5.31	9%	46.07	100%	7.02	14%	5.00	99%	0.96	77%
Moderately modified- Old lands	18.54	11%	1.08	2%	0	0%	0	0%	0.04	1%	0.29	23%
Other Natural Areas	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

Table 12: The estimated coverage of Terrestrial CBAs that will be impacted by the proposed access roads, as well as the approximate length of the access routes that will traverse the various subqategories.

MBSP: CBA (Subcategories)	All Access Roads			New Access Roads		Narrow Twin Tracks		Fairly Broad Farm Roads	
	Coverage (Ha)	Coverage (%)	Length (Km)	Coverage (Ha)	Length (Km)	Coverage (Ha)	Length (Km)	Coverage (Ha)	Length (Km)
CBA Irreplaceable	0.54	4%	0.47	0	0	0	0	0.54	0.47
CBA Optimal	5.39	43%	6.16	0.40	0.45	0.22	0.24	4.63	5.28
ESA Landscape corridor	2.48	20%	2.70	0.09	0.10	1.06	1.20	1.34	1.40
Heavily modified	0.79	6%	0.75	0	0	0.18	0.08	0.59	0.63
Moderately modified- Old lands	3.03	24%	3.82	0	0	1.27	1.53	1.73	2.07
Other Natural Areas	0.31	2%	0.35	0	0	0.00	0.00	0.31	0.35
Total	12.55	100%	14.25	0.49	0.55	2.74	3.05	9.153	10.206

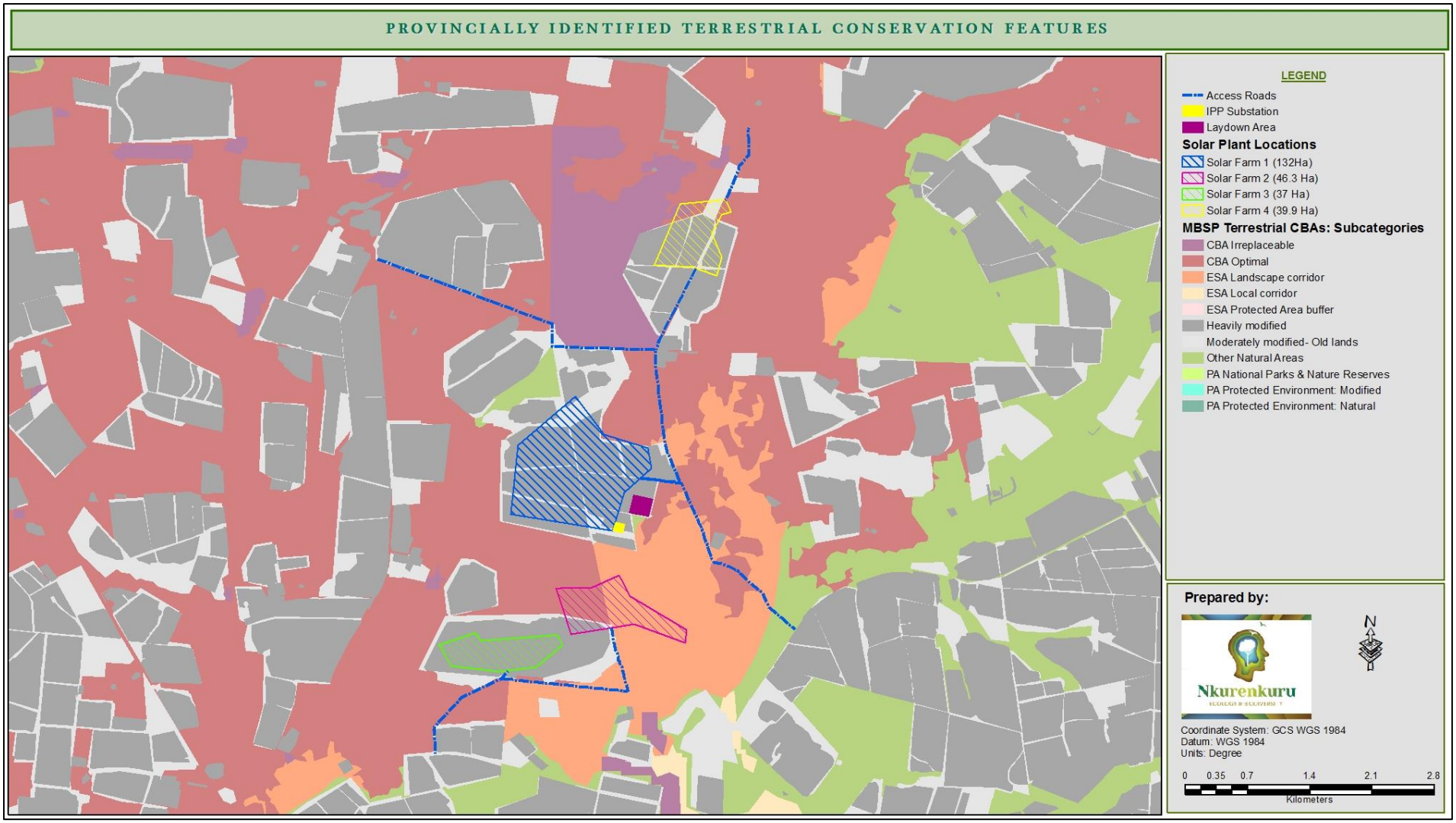

Figure 8: Provincially identified terrestrial conservation priority areas found within the and around the development site.

Table 13: Summary of the different categories occurring within the Mpumalanga Terrestrial and Freshwater CBA maps.

MAP CATEGORY	DESCRIPTION	SUB-CATEGORY	DESCRIPTION
TERRESTRIAL FEATURES			
Protected Areas (PA)	Areas that are formally protected by law and recognized in terms of the Protected Areas Act, including contract protected areas declared through the biodiversity stewardship programme.	National Parks & Nature Reserves	Includes formally proclaimed National Parks, Nature Reserves, Special Nature Reserves, and Forest Nature Reserves.
		Protected Environments: Natural	Includes Protected Environments, declared in terms of Protected Areas Act (Act 57 of 2003, as amended).
		Protected Environments: Modified	Heavily modified areas in formally proclaimed Protected Environments.
Critical Biodiversity Areas (CBAs)	All areas required to meet biodiversity pattern and process targets; Critically Endangered ecosystems, critical linkages (corridor pinch-points) to maintain connectivity; CBAs are areas of high biodiversity value that must be maintained in a natural state.	CBA: Irreplaceable	This category includes: (1) Areas required to meet targets and with irreplaceable values of more than 80%; (2) Critical linkages or pinch-points in the landscape that must remain natural; (3) Critically Endangered Ecosystems.
		CBA: Optimal	The CBA Optimal Areas (previously called 'important and necessary' in the MBCP) are the areas optimally located to meet the various biodiversity targets, as well as other criteria defined in the analysis. Although these areas are not 'irreplaceable', they are nevertheless the most efficient land configuration to meet all biodiversity targets and design criteria.
Ecological Support Areas (ESA)	Areas that are not essential for meeting targets, but which play an important role in supporting the functioning of CBAs and deliver important ecosystem services.	ESA: Landscape Corridor	The best option to support landscape-scale ecological processes, especially allowing for adaptation to the impacts of climate change.
		ESA: Local Corridor	Finer-scale alternative pathways that build resilience into the corridor network by ensuring connectivity between climate change focal areas, thereby reducing reliance on single landscape-scale corridors.
		ESA: Species Specific	Areas required for the persistence of particular species. Although these may be production landscapes, a change in land-use may result in loss of these species from the

			area. (Only one species-specific ESA was included in the analysis – an over-wintering site for blue cranes).
		ESA: Protected Area (PA) Buffers	Areas surrounding PAs that moderate the impacts of undesirable land-uses that may affect the ecological functioning or tourism potential of PAs. Buffer distances vary according to reserve status: National Parks – 10 km; Nature Reserves – 5 km and Protected Environments – 1 km buffer.
Other Natural Areas (ONA)	Areas that have not been identified as a priority in the current systematic biodiversity plan but which retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.		
Moderately or Heavily Modified Areas	Areas in which significant or complete loss of natural habitat and ecological function has taken place due to activities such as ploughing, hardening of surfaces, open-cast mining, cultivation, and so on.	Heavily Modified	All areas currently modified to such an extent that any valuable biodiversity and ecological functions have been lost.
		Moderately Modified: Old lands	Old cultivated lands that have been allowed to recover (within the last 80 years), and which support some natural vegetation. Although biodiversity patterns and ecological functioning may have been compromised, these areas still play a role in supporting biodiversity and providing ecosystem services.

Table 14: Land-use guidelines for the various terrestrial and aquatic categories.

MAP CATEGORY	DESIRED MANAGEMENT OBJECTIVE	GUIDELINES
TERRESTRIAL FEATURES		
PA	Must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.	» All operational aspects of managing these areas must be subject to their main purpose, which is to protect and maintain biodiversity and ecological integrity, and should be governed by a formally approved management plan and land-use activities that support the primary function of these areas as primary sites for biodiversity conservation. » The management plan must identify allowable activities, which should at least be consistent with the CBA Irreplaceable category; the location of these allowable activities should be captured in a zonation plan in the management plan.

	A benchmark for biodiversity.	» Activities relating to the construction of roads, administrative, or tourism infrastructure, and services (such as water reticulation systems, power lines, and similar) that are required to support the primary function of the protected area and its allowable activities, must be subject to at least a basic scoping report, or a full EIA, as specified by NEMA, as well as the protected area management plan. » For Protected Environments, a variety of agricultural land uses may be allowed, such as livestock grazing, afforestation, and some cultivation. The location of these land-use activities must be informed by the CBA maps, and should be specified in the zonation plan of the management plan for the protected environment. All areas of natural habitat that are zoned for conservation use should be subject to implementation of the land-use guidelines for protected areas, CBAs, and ESAs.
CBA: Irreplaceable	Maintain in a natural state with no further loss of natural habitat.	**General Guidelines.** » Biodiversity loss and land-use change in Irreplaceable CBAs should be monitored as a matter of priority, to prevent unauthorised land-use change or degradation by neglect or ignorance. » Where appropriate, these areas should be incorporated into the formal Protected Area system through biodiversity stewardship agreements (contract Nature Reserves or Protected Environments). Ideally, conservation management activities should be the primary land-use in all irreplaceable areas, or they should at least be managed in ways that have no negative impact on species, ecosystems, or ecosystem services. » Extensive (widespread, low-intensity) livestock or game ranching, if well-managed, is compatible with the desired management objectives for these areas. These land-uses are acceptable if they account for the specific biodiversity features (e.g. rare species or vegetation remnants) and vulnerabilities (e.g. infestation by invasive alien plants) at each site, if they comply with recommended stocking rates, and if any associated infrastructure (required to support the ranching activities) is kept to low levels. **Specific Guidelines (for meeting minimum requirements).** » In general, Irreplaceable sites must be avoided in terms of the mitigation hierarchy. » A specialist study must be part of the Scoping and EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert who is approved by the MTPA. » Applications for land use of any kind should be referred to the biodiversity specialists in MTPA and DARDLEA for evaluation. » Degraded areas included in the land parcel, but not the land-use proposal, should be restored to natural ecosystem functioning where possible. » Provision of alternative land as a 'biodiversity offset' in exchange for biodiversity loss in these areas CANNOT be considered except in exceptional circumstances and would need to be considered on a case-by-case basis.

CBA: Optimal	Maintain in a natural state with no further loss of natural habitat.	**General Guidelines.** » Acceptable land uses are those that are least harmful to biodiversity, such as conservation management, or extensive livestock or game farming. Large-scale cultivation, mining, and urban or industrial development are not appropriate. » Extensive (widespread, low-intensity) livestock and game ranching, if well-managed (see above), is compatible with the desired management objectives for these areas. **Specific Guidelines (for meeting minimum requirements).** » If small-scale land-use change is unavoidable, it must be located and designed to be as biodiversity-sensitive as possible. » A specialist study must be part of the scoping and EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert who is SACNASP registered. » Provision for biodiversity offsets in exchange for biodiversity loss should only be considered as a last resort and at a ratio consistent with national policy.
ESA: Landscape and Local-scale Corridor	Maintain ecological functionality in support of biodiversity connectivity by retaining the existing natural vegetation cover in a healthy ecological state, and restore 'critical-linkages' where necessary.	**General Guidelines.** » A greater range of land uses over wider areas are appropriate, subject to an authorisation process that ensures the underlying biodiversity objectives are not compromised. **Specific Guidelines (for meeting minimum requirements).** » Certain activities covered under Listing Notice 3 trigger the EIA process in ESA corridors. » Restoration of corridors is important, particularly in terms of the Working for Water programs. » The impact of land-use proposals on the functionality of ecological corridors must be assessed by the relevant biodiversity specialist as part of the EIA/Scoping report. » Impenetrable fences that restrict animal movement should be discouraged.

ESA: Species Specific	Maintain the prevailing ecological processes that support the specific species, and manage for no further habitat loss.	**General Guidelines.** » Although these areas may be located in production landscapes, and may be heavily modified in parts, a change in land use to anything other than conservation management should be discouraged as it would most likely result in a loss of the target species from the area. **Specific Guidelines (for meeting minimum requirements).** » The impact of any changes in land use on the population viability of listed species, such as blue cranes, should be assessed by a registered specialist. » Restoration of degraded areas and invasive alien plant control is recommended, particularly by clearing small wattle 'jungles' that large birds avoid.
ESA: Protected Area Buffers	To minimise the impacts of surrounding land-uses on the ecological integrity, character, and tourism potential of protected areas.	**General Guidelines.** » When assessing the impacts of proposed land uses in protected area buffers, consideration must be given to both direct (e.g. afforestation that blocks view-sheds and reduces water flow into a Protected Area) and indirect impacts (e.g. light and noise pollution). **Specific Guidelines (for meeting minimum requirements).** » Buffer distances vary according to the nature of the Protected Area, as follows: o National Parks: 10 km buffer as indicated in Listing Notice 3. o Nature Reserves: 5 km buffer as indicated in Listing Notice 3. o Protected Environments: 1 km buffer as these may include production landscapes. » Land-use change applications within the buffer zone may be referred to the protected area manager or ecologist for evaluation. » A viewshed analysis of the potential visual impact of the proposed land-use on adjacent protected areas should be undertaken where necessary.

Other Natural Areas (ONA)	The overall objective should be to ensure ecosystem functionality and minimise loss of natural habitat and species through strategic landscape planning.	» These areas have the greatest flexibility in terms of management objectives and permissible land-uses. » Where possible, avoid modifying any remaining natural habitat by locating land-uses, including cultivation and plantations, in already-modified areas. » Authorisation may be required for high-impact land-uses (such as intensive industry or urban development) and standard application of EIA regulations and other planning procedures is required. Note: These areas may still contain species of conservation concern, but either have not yet been surveyed, or the data were not available for incorporation into the MBSP. The presence or absence of important species should always be established through site visits before proceeding with a land-use change.
Moderately or Heavily Modified Areas	Manage land-use in a biodiversity friendly manner, aiming to maximise ecological functionality. In old lands, stabilise ecosystems and manage them to restore ecological functionality, particularly soil carbon and water-related functionality, using indigenous plant cover. Old lands should be burnt and grazed appropriately.	» Areas with no natural habitat remaining are preferred sites for higher-impact land-uses, and new projects should be located in these areas before modifying any remaining natural habitat. » Restoration and re-vegetation should be prioritised where heavily modified areas occur close to land of high biodiversity value, or are located such that they could potentially serve useful ecological connectivity functions (such as in ecological corridors). » For individual parcels of land identified as having specific actual or potential biodiversity values, develop incentives to restore lost biodiversity and connectivity. » When locating land-uses in these modified areas, consider the potential off-site impacts on neighbouring areas of natural habitat, especially if these are of high biodiversity value. For example, controlling pesticides usage in modified areas due to the impacts on neighbouring areas of natural habitat. » Encourage landowners and developers to use indigenous plants, especially trees, where aesthetic or functional options exist.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT – BASELINE

5.1. Broad-Scale Vegetation Patterns

This section deals with vegetation types as described in the National Vegetation Map of Southern Africa, which will be used interchangeably with the term "VegMap" (Dayaram et al., 2018; Mucina and Rutherford, 2006 and 2018).

Note that the latest VegMap was used, namely 2018. Although vegetation descriptions are as per VegMap 2006, these units were cross-validated with VegMap 2018 to ensure their extents remained the same.

The entire study area is mapped as Soweto Highveld Grassland (Gm 8), but other vegetation types occur nearby, namely Amersfoort Highveld Clay Grassland (Gm 13), Eastern Highveld Grassland (Gm 12) (Figure 9 and Figure 10). These other vegetation types are also described here (see Table 15 for a summary of total area covered by the mapped units as per VegMap).

Table 15: Total area sizes (approximately) for vegetation types occurring within, or near, the study area, as mapped by the National Vegetation Map 2018.

Vegetation Type	Total Area (km^2)	Total Area (ha)	Threat Status
Amersfoort Highveld Clay Grassland (Gm 13)	3 927	392 709	Least Threatened
Eastern Highveld Grassland (Gm 12)	12 772	1 277 243	Vulnerable
Soweto Highveld Grassland (Gm 8)	14 574	1 457 366	Vulnerable

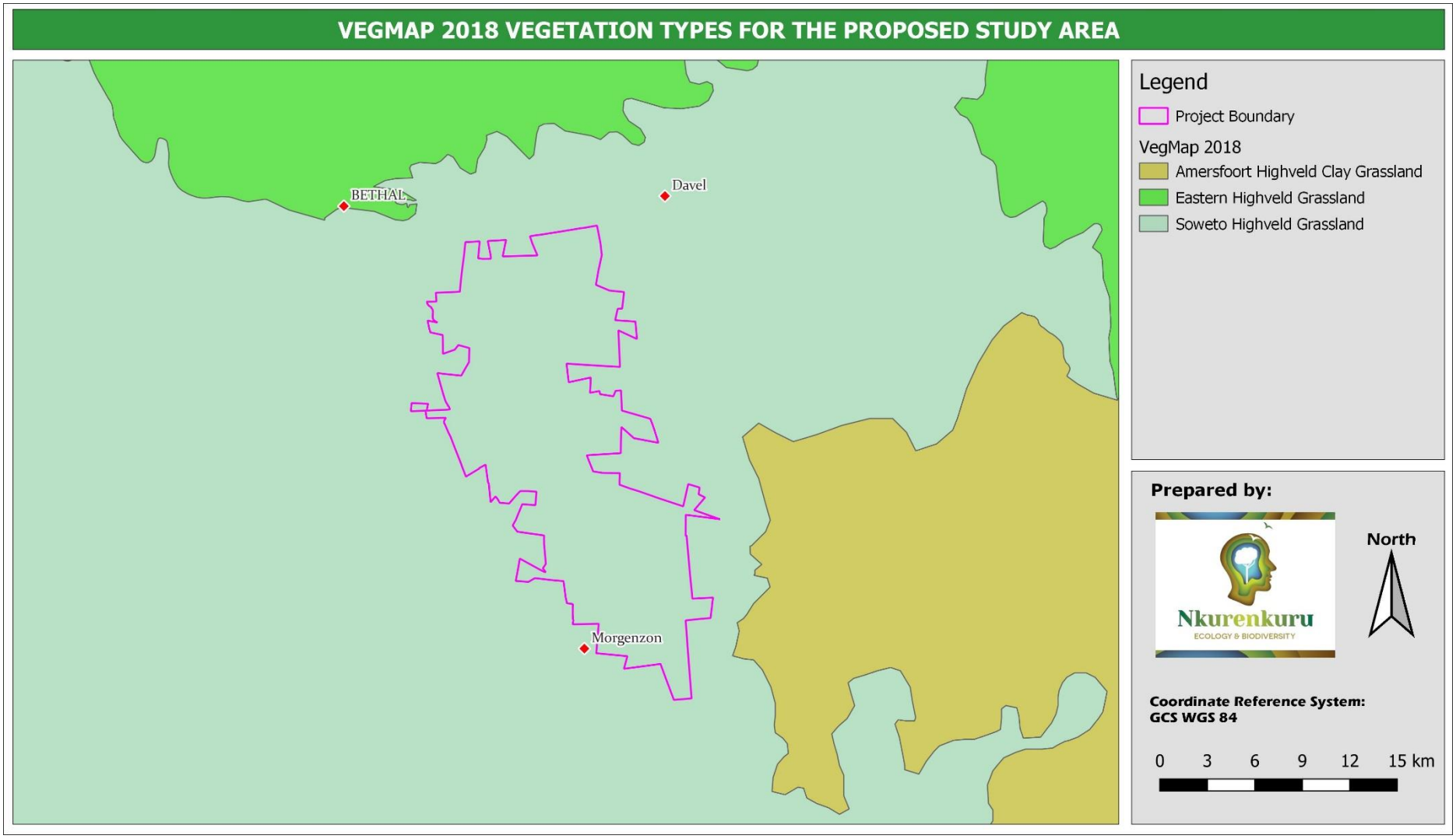

Figure 9: Map illustrating the different vegetation types, according to VegMap 2018, for the study/project area, as well as the general region.

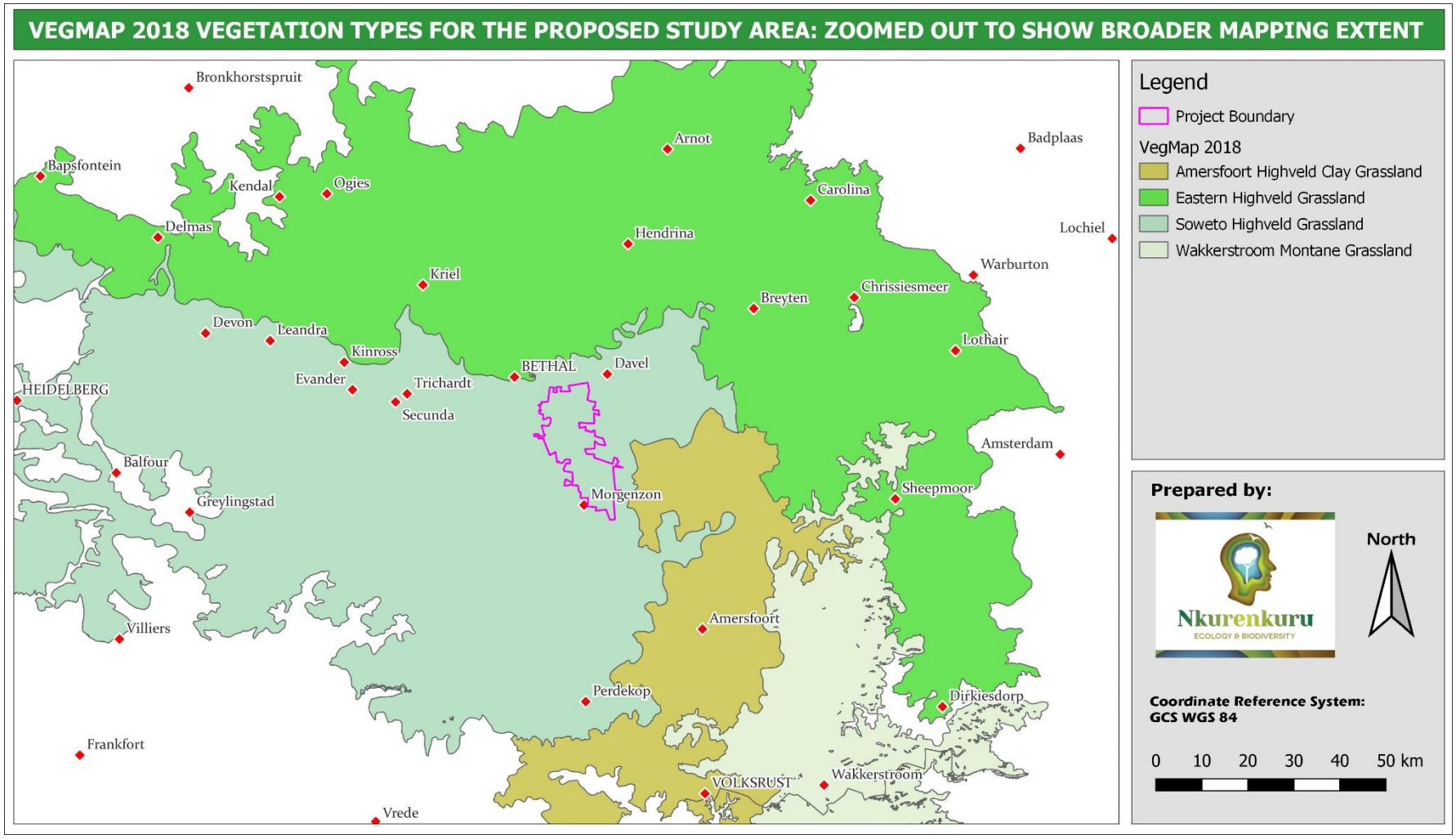

Figure 10: Map illustrating the different vegetation types, according to VegMap 2018, for the study/project area, as well as the general region. This map is zoomed out to show the larger extents of each of the vegetation types.

5.1.1. Soweto Highveld Grassland (Gm 8)

This vegetation type is distributed mainly in Mpumalanga and Gauteng, with small outliers in the Free State and North West Provinces. It has an altitudinal range of 1420 – 1760 m. It is distributed in a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast, and the Vaal River in the south. The vegetation type extends further westwards along the southern edge of the Johannesburg Dome with parts of Soweto, and as far as Randfontein. In southern Gauteng it includes parts of Vanderbijlpark and Vereeniging, as well as Sasolburg in the northern Free State.

The vegetation type is characterised by gentle to moderate undulating landscapes on the Highveld plateau, and supports short to medium-high, dense, tufted grassland, which is dominated by *Themeda triandra* together with a variety of other grasses, such as *Elionurus muticus*, *Eragrostis racemosa*, *Heteropogon contortus*, and *Tristachya leucothrix*. In undisturbed areas, scattered small wetlands, narrow stream alluvia, pans, and occasional ridges or rocky outcrops occur as a mosaic within the grassland.

Shale, sandstone, or mudstone of the Madzaringwe Formation (Karoo Supergroup) or the intrusive Karoo Suite dolerites are characteristic of this vegetation type. The Volksrust Formation (Karoo Supergroup) is found in the south, while rocks of the older Transvaal, Ventersdorp, and Witwatersrand Supergroups are significant in the west. The soils are deep and reddish on flat plains, and are typically of the Ea, Ba, and Bb land types.

The vegetation type receives summer rainfall with a MAP of about 662 mm. It has a cool temperate climate with high extremes between maximum summer and minimum winter temperatures, with a frequent occurrence of frost and large thermic diurnal differences, especially in autumn and spring.

The unit is classified as Endangered with a target of protection of 24%. Only a few patches are statutorily conserved in the Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, and Rolfe's Pan Nature Reserves, or privately conserved in the Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas, and Avalon Nature Reserves, as well as the Heidelberg Natural Heritage Site. Almost half of the area already transformed by cultivation, urban sprawl, mining, and road infrastructure. Some areas have been flooded by dams, notably the Grootdraai, Leeukuil, Trichardtsfontein, Vaal, and Willem Brummer dams. Erosion is generally very low; only about 93%.

Table 16: Key species associated with Soweto Highveld Grassland (Gm 8).

IMPORTANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Graminoids	*Andropogon appendiculatus (d), Brachiaria serrata (d), Cymbopogon pospischilii (d), Cynodon dactylon (d), Elionurus muticus (d), Eragrostis capensis (d), E. chloromelas (d), E. curvula (d), E. plana (d), E. planiculmis (d), E. racemosa (d),*

	Heteropogon contortus (d), Hyparrhenia hirta (d), Setaria nigrirostris (d), S. sphacelata (d), Themeda triandra (d), Tristachya leucothrix (d), Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum.
Herbs	*Hermannia depressa (d), Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Seago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.*
Geophytic Herbs	*Haemanthus humilis subsp. hirsutus, H. montanus.*
Herbaceous Climber	*Rhynchosia totta.*
Low Shrubs	*Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana.*

5.1.2. Eastern Highveld Grassland (Gm 12)

This vegetation type is distributed throughout Mpumalanga and Gauteng Provinces, and occurs as plains between Belfast in the east, and the eastern side of Johannesburg in the west, and extends southwards to Bethal, Ermelo, and west of Piet Retief. The vegetation type has an altitudinal range of 1520 – 1780 m, but some parts are as low as 1300 m.

The vegetation type consists of slight to moderate undulating plains, and includes low hills and pan depressions. The vegetation is short, dense grassland dominated by grasses of the genera *Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*. Small, scattered rocky outcrops have wiry, sour grasses and some woody species, such as *Acacia caffra*, *Celtis africana*, *Diospyros lycioides* subsp. *lycioides*, *Parinari capensis*, *Protea caffra*, *P. welwitschii*, and *Searsia magalismontanum*.

Red to yellow sandy soils of the Ba and Bb land types dominate on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup), and two dominant land types are found, namely Bb (65%) and Ba (30%).

The vegetation type has a strong seasonal summer rainfall, with very dry winters. The MAP ranges from 650 – 900 mm, with an average of 726 mm. Rainfall is relatively uniform across most of this vegetation type, but increases significantly in the extreme southeast, which is evidenced from the MAP coefficient of variation of 25% across most of the unit, which drops to 21% in the east and southeast. Frost incidence ranges from 13 – 42 days, but is higher at higher elevations.

The unit is classified as Endangered with a target of protection of 24%. Only a very small fraction is conserved in statutory reserves such as Nooitgedacht Dam and Jericho Darn Nature Reserves, or in private reserves such as Holkranse, Kransbank, and Morgenstond. About 44% has been transformed primarily by cultivation, plantations, mines,

urbanisation, and by building of dams. Cultivation may have had a more extensive impact, as indicated by landcover data. No serious alien invasions are reported, but *Acacia mearnsii* can become dominant in disturbed sites. Erosion is very low.

Table 17: Key species associated with Eastern Highveld Grassland (Gm 12).

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Graminoids	*Aristida aequiglumis (d), A. congesta (d), A. junciformis subsp. galpinii (d), Brachiaria serrata (d), Cynodon dactylon (d), Digitaria monodactyla (d), D. tricholaenoides (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. curvula (d), E. plana (d), E. racemosa (d), E. sclerantha (d), Heteropogon contortus (d), Loudetia simplex (d), Microchloa caffra (d), Monocymbium ceresiiforme (d), Setaria sphacelata (d), Sporobolus africanus (d), S. pectinatus (d), Themeda triandra (d), Trachypogon spicatus (d), Tristachya leucothrix (d), T. rehmannii (d), Alloteropsis semialata subsp. eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Eragrostis capensis, E. gummiflua, E. patentissima, Harpochloa fax, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides.*
Herbs	*Berkheya setifera (d), Haplocarpha scaposa (d), Justicia anagalloides (d), Pelargonium luridum (d), Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Eryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Seago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.*
Geophytic Herbs	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia.*
Succulent Herb	*Aloe ecklonis.*
Low Shrubs	*Anthospermum rigidum subsp. pumilum, Stoebe plumosa.*

5.1.3. Amersfoort Highveld Clay Grassland (Gm 13)

This vegetation type is distributed throughout Mpumalanga and Kwa-Zulu Natal Provinces, extending in a north-south band from south of Ermelo, down through Amersfoort to the Memel area in south. The vegetation type has an altitudinal range of 1580 – 1860 m.

The vegetation type is comprised of undulating grassland plains, with small scattered patches of dolerite outcrops in some areas. The vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn.

The unit is characterised by vertic clay soils derived from dolerite that is intrusive in the Karoo sediments of the Madzaringwe Formation in the north and the Volksrust Formation and the Adelaide Subgroup in the south. The Dominant land type is Ca, while the Ea land type is of subordinate importance.

The unit receives rainfall mainly in early summer, which ranges from 620 mm in the west to 830 mm in the east, and it has a MAP of 694 mm. Temperatures are higher in the west than the east, and the vegetation type has a MAT of 14°C. Winters are cold and summers are mild, and frost incidence is very high.

The unit is classified as Vulnerable with a target of protection of 27%. None of the vegetation type is protected. About 25% of the vegetation type is transformed, mostly by cultivation (22%). The area is not suited to afforestation. Silver and black wattle (*Acacia*), and *Salix babylonica* invade drainage areas. Erosion potential is very low (57%) and low (40%).

Overgrazing leads to invasion of *Stoebe vulgaris*. Parts of this unit were once cultivated and now lie fallow and have been left to revegetate with pioneer species. These transformed areas are not picked up by satellite for transformation coverage and the percentage of grasslands still in a natural state may be underestimated.

Table 18: Key species associated with Amersfoort Highveld Clay Grassland (Gm 13).

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Graminoids	*Andropogon appendiculatus (d), Brachiaria serrata (d), Digitaria monodactyla (d), D. tricholaenoides (d), Elionurus muticus (d), Eragrostis capensis (d), E. chloromelas (d), E. plana (d), E. racemosa (d), Harpochloa falx (d), Heteropogon contortus (d), Microchloa caffra (d), Panicum natalense (d), Setaria nigrirostris (d), S. sphacelata (d), Themeda triandra (d), Trichoneura grandiglumis (d), Tristachya leucothrix (d), Abildgaardia ovata, Andropogon schirensis, Aristida bipartita, A. congesta, A. junciformis subsp. galpinii, A. stipitata subsp. graciliflora, Bulbostylis contexta, Chloris virgata, Cymbopogon caesius, C. pospischilii, Cynodon dactylon, Digitaria diagonalis, D. ternata, Diheteropogon amplectens, Eragrostis curvula, Koeleria capensis, Panicum coloratum, Setaria incrassata.*
Herbs	*Berkheya setifera (d), Vernonia natalensis, V. oligocephala (d), Acalypha peduncularis, A. wilmsii, Berkheya insignis, B. pinnatifida, Crabbea acaulis, Cynoglossum hispidum, Dicoma anomala, Haplocarpha scaposa, Helichrysum caespititium, H. rugulosum, Hermannia coccocarpa, H. depressa, H. transvaalensis, Ipomoea crassipes, I. oblongata, Jamesbrittenia silenoides, Pelargonium luridum, Pentanisia prunelloides subsp. latifolia, Peucedanum magalismontanum, Pseudognaphalium luteoalbum, Rhynchosia effusa, Salvia repens, Schistostephium crataegifolium, Sonchus nanus, Wahlenbergia undulata.*
Herbaceous Climber	*Rhynchosia totta.*
Geophytic Herbs	*Boophone disticha, Eucomis autumnalis subsp. clavata, Hypoxis villosa var. obliqua, Zantedeschia albomaculata subsp. macrocarpa.*
Tall Shrubs	*Diospyros austroafricana, D. lycioides subsp. guerkei.*
Low Shrubs	*Anthospermum rigidum subsp. pumilum (d), Helichrysum melanacme (d), Chaetacanthus costatus, Euphorbia striata var. cuspidata, Gnidia burchellii, G. capitata, Polygala uncinata, Searsia discolor.*

Succulent Shrub	*Euphorbia clavarioides var. truncata.*

5.2. Broad-Scale Land Unit Types

A map of the study/project area as well as the proposed development area, based on observable land features via Google Earth Satellite Imagery, revealed that it consists primarily of five main functional land types, namely: buildings/structures, active farmlands, fallow land (abandoned farmlands), natural grassland areas, and drainage areas (which is comprised of wetlands, small streams, shallow pans and depressions, and natural or artificial dams, among other things) (Table 19; Figure 11 and Figure 12).

Almost half of the project area consists of natural grasslands (44.5%), while agriculture (38.7%) comprises much of the rest. Natural grasslands have a medium sensitivity rating, since the vegetation type indicated for the study area, as per VegMap 2018, is Soweto Highveld Grassland, which is considered to be Endangered. Additionally, vegetation in pristine condition should be prioritised for conservation purposes. It is therefore preferable that minimal, or if possible, no development, occur within these natural areas so as to maintain the integrity of this vegetation type.

Fallow land seems to comprise close to a tenth (7.5%) of the study area. It has been given a "low-medium" sensitivity rating since, although the areas are degraded and consist of secondary vegetation (see section 6.1.2), they can usually revegetate to form Ecological Support Areas (ESA). Moreover, these areas often serve as habitats for SoCC, as well as other keystone or ecologically important species. Depending on the intensity and time lapse since the last disturbances/activities occurred in these areas, they can often passively restore to a state that closely replicates that of the original, pristine condition (at least functionally). Therefore, these areas could potentially function as buffers and/or corridors, adjacent to natural grasslands and drainage areas, that can be utilized by animal species. These areas could also potentially function as reservoirs for certain native plant species.

Drainage areas (8.5% of the study area) have been given a "very high" sensitivity rating and should be regarded as no-go areas for development, unless an appropriate water use licence can be secured. Lastly, active farmland ("Agriculture") and development ("Structures") comprise the final 40% or so of the study area.

In terms of the proposed development site, a little more than half of the area consist of cultivated areas (Agriculture), whilst 23.5% comprises fallow lands. Subsequently, 73% of the development site falls within "low" to "low-medium" sensitive areas. Natural areas ("medium" sensitivity) cover a little more than 25% of the development site. Drainage areas ("very high" sensitivity) comprises 0.2% of the development site and is associated with three wetland access road crossings. For all wetland crossings, existing crossings will be merely upgraded.

Table 19: Total approximate area sizes for land types occurring within the study/project area as well as within the proposed development site, as mapped based on currently available Google Earth Satellite Imagery.

Land Type	Sensitivity	Total Area (ha)	Total Area (%)
Entire Study/Project Area			
Agriculture	Low	11 170	38.7
Drainage	Very High	2 442	8.5
Fallow Land	Medium	2 194	7.6
Natural Areas	Medium	12 841	44.5
Structures	Low	209	0.7
	Grand Total	**28 856**	100.0
Proposed Development Site (Solar PV Facility and associated infrastructure)			
Agriculture	Low	171.21	50.8%
Drainage	Very High	0.76	0.2%
Fallow Land	Medium	79.04	23.5%
Natural Areas	Medium	85.85	25.5%
Structures	Low	0.003	0.001%
	Grand Total	337	100%

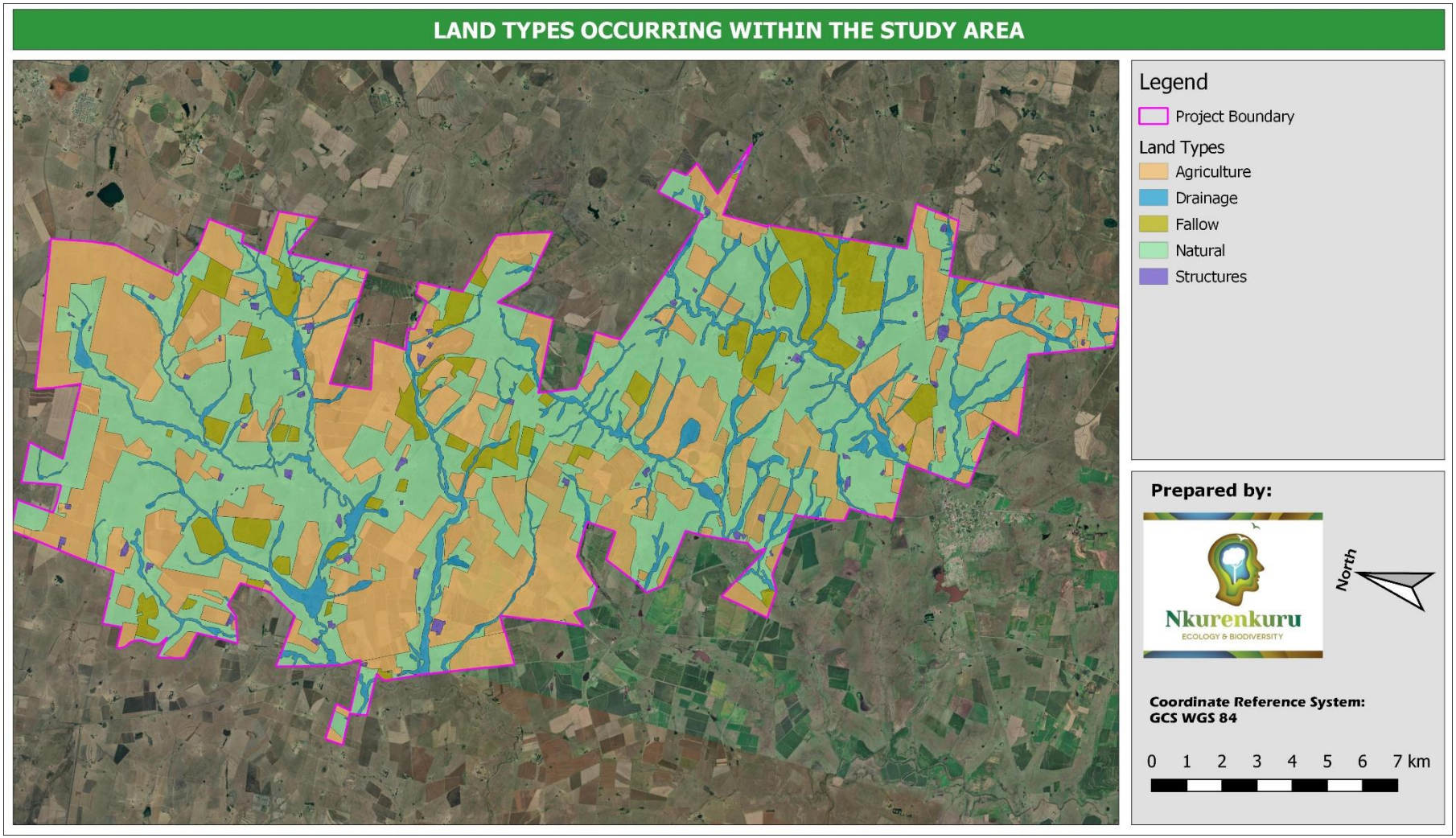

Figure 11: Mapping of the land types occurring within the study area. Note that the map has been rotated sideways to optimize space (specifically see the north arrow direction).

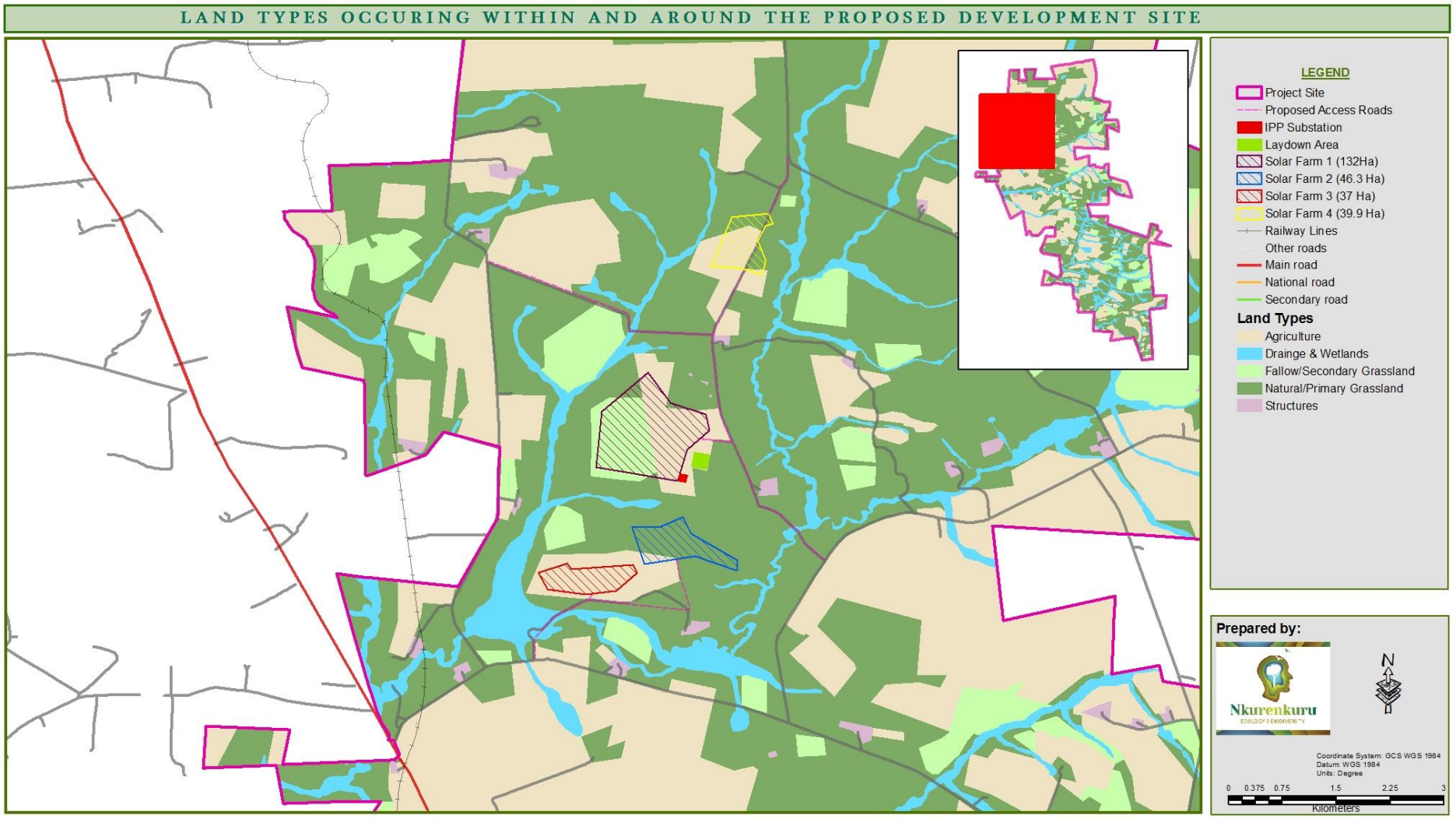

Figure 12: Mapping of the land types occurring within and around the development site with proposed infrastructure added. Compare with Figure 11.

5.3. POSA Plant Species Observations

A list was obtained from the SANBI database (POSA — Plants of southern Africa; http://posa.sanbi.org/) containing all plant species that have been recorded to date from the surroundings of the study area (see section 2.2 for the extent of the area used for gathering records). POSA generated species lists also contain updated Red List information according to the Red List of South African Plants (Raimondo et al., 2009; updated online version: http://redlist.sanbi.org/). Species listed as protected were also identified in the list. Therefore, only SoCC that may potentially occur in the study area, and the broader surrounds, have been listed within the baseline study section of this report. The field survey(s) aimed to validate which of these species occur within the study area, and whether any additional species that may not yet have been recorded in official databases, are present.

A total of 1 076 species have been recorded within the broader area based on the online plant search (see Appendix 1 for the full list). Of this, the top three representative families were Poaceae (148 spp., 14%), Asteraceae (140 spp., 13%), and Fabaceae (97 spp., 9%).

Furthermore, this list included a total of 102 SoCC, namely 19 Red List and 88 protected species (note that some of the Red List species are also protected; thus some overlap occurs between these numbers) (Table 20). The protected species are listed under Schedule 11 (Protected Plants) of the Mpumalanga Nature Conservation Act, no. 10 of 1998.

The initial screening report also revealed the potential presence of an additional three Medium Sensitive species, namely species 851, 691, and 1252 (for their protection, the identities of these species will not made public).

Finally, 82 alien plant species are recorded within the extracted area, with 13 of them being listed invasive species within NEM:BA Act No. 10 of 2004 (Alien and Invasive Species List, 2016) namely:

- *Acacia dealbata* (Silver wattle; Category 2)
- *Cestrum parqui* (Chilean cestrum; Category 1b)
- *Convolvulus arvensis* (Field bindweed, Wild morning-glory; Category 1b)
- *Datura stramonium* (Common thorn apple; Category 1b)
- *Echium plantagineum* (Patterson's curse; Category 1b)
- *Eucalyptus camaldulensis* (River red gum; Category 1b)
- *Ligustrum vulgare* (Common privet; Category 3)
- *Linaria vulgaris* (Common toadflax, Butter-and-eggs; Category 1b)
- *Mirabilis jalapa* (Four-o'clock, Marvel-of -Peru; Category 1b)
- *Nasturtium officinale* (Watercress; Category 2)
- *Verbena brasiliensis* (Brazilian verbena; Category 1b)
- *Verbena rigida* (Veined verbena; Category 1b)
- *Xanthium spinosum* (Spiny cocklebur; Category 1b)

Table 20: Species of Conservation Concern that have been recorded within the broader region surrounding the study area, as per the SANBI POSA online database.

Family	Species	IUCN	Protection Schedule
Apocynaceae	*Schizoglossum peglerae*	EN	
Asparagaceae	*Asparagus fractiflexus*	EN	
Aizoaceae	*Khadia carolinensis*	VU	
Amaryllidaceae	*Nerine gracilis*	VU	
Apocynaceae	*Aspidoglossum xanthosphaerum*	VU	
Apocynaceae	*Miraglossum davyi*	VU	
Apocynaceae	*Pachycarpus suaveolens*	VU	
Asphodelaceae	*Aloe hlangapies*	VU	11
Iridaceae	*Gladiolus paludosus*	VU	11
Apocynaceae	*Stenostelma umbelluliferum*	NT	
Asphodelaceae	*Kniphofia typhoides*	NT	11
Asteraceae	*Cineraria austrotransvaalensis*	NT	
Fabaceae	*Argyrolobium campicola*	NT	
Hyacinthaceae	*Merwilla plumbea*	NT	
Iridaceae	*Gladiolus robertsoniae*	NT	11
Orchidaceae	*Habenaria barbertoni*	NT	11
Euphorbiaceae	*Acalypha caperonioides var. caperonioides*	DD	
Hyacinthaceae	*Drimia elata*	DD	
Iridaceae	*Hesperantha rupestris*	DD	
Agapanthaceae	*Agapanthus inapertus subsp. intermedius*	LC	11
Amaryllidaceae	*Boophone disticha*	LC	11
Amaryllidaceae	*Brunsvigia natalensis*	LC	11
Amaryllidaceae	*Brunsvigia radulosa*	LC	11
Amaryllidaceae	*Crinum bulbispermum*	LC	11
Amaryllidaceae	*Crinum graminicola*	LC	11
Amaryllidaceae	*Cyrtanthus breviflorus*	LC	11
Amaryllidaceae	*Cyrtanthus stenanthus*	LC	11
Amaryllidaceae	*Cyrtanthus tuckii*	LC	11
Amaryllidaceae	*Haemanthus humilis subsp. hirsutus*	LC	11
Amaryllidaceae	*Haemanthus montanus*	LC	11
Amaryllidaceae	*Scadoxus puniceus*	LC	11
Araceae	*Zantedeschia albomaculata subsp. albomaculata*	LC	11
Araceae	*Zantedeschia albomaculata subsp. macrocarpa*	LC	11
Araceae	*Zantedeschia rehmannii*	LC	11
Asphodelaceae	*Aloe boylei*	LC	11
Asphodelaceae	*Aloe davyana*	LC	11
Asphodelaceae	*Aloe ecklonis*	LC	11
Asphodelaceae	*Aloe graciliflora*	LC	11
Asphodelaceae	*Aloe jeppeae*	LC	11
Asphodelaceae	*Aloe maculata subsp. maculata*	LC	11
Asphodelaceae	*Kniphofia albescens*	LC	11
Asphodelaceae	*Kniphofia porphyrantha*	LC	11
Dioscoreaceae	*Dioscorea dregeana*	LC	11
Hyacinthaceae	*Eucomis montana*	LC	11

Hyacinthaceae	*Eucomis pallidiflora subsp. pallidiflora*	LC	11
Iridaceae	*Gladiolus crassifolius*	LC	11
Iridaceae	*Gladiolus dalenii subsp. dalenii*	LC	11
Iridaceae	*Gladiolus ecklonii*	LC	11
Iridaceae	*Gladiolus elliotii*	LC	11
Iridaceae	*Gladiolus longicollis subsp. longicollis*	LC	11
Iridaceae	*Gladiolus longicollis subsp. platypetalus*	LC	11
Iridaceae	*Gladiolus papilio*	LC	11
Iridaceae	*Gladiolus sericeovillosus subsp. calvatus*	LC	11
Iridaceae	*Gladiolus sericeovillosus subsp. sericeovillosus*	LC	11
Iridaceae	*Gladiolus vinosomaculatus*	LC	11
Iridaceae	*Gladiolus woodii*	LC	11
Iridaceae	*Hesperantha coccinea*	LC	11
Iridaceae	*Watsonia bella*	LC	11
Iridaceae	*Watsonia pulchra*	LC	11
Orchidaceae	*Brachycorythis ovata subsp. ovata*	LC	11
Orchidaceae	*Brachycorythis pubescens*	LC	11
Orchidaceae	*Brownleea parviflora*	LC	11
Orchidaceae	*Disa aconitoides subsp. aconitoides*	LC	11
Orchidaceae	*Disa cooperi*	LC	11
Orchidaceae	*Disa nervosa*	LC	11
Orchidaceae	*Disa patula var. transvaalensis*	LC	11
Orchidaceae	*Disa stachyoides*	LC	11
Orchidaceae	*Disa versicolor*	LC	11
Orchidaceae	*Disperis cooperi*	LC	11
Orchidaceae	*Disperis fanniniae*	LC	11
Orchidaceae	*Eulophia cooperi*	LC	11
Orchidaceae	*Eulophia hians var. hians*	LC	11
Orchidaceae	*Eulophia hians var. inaequalis*	LC	11
Orchidaceae	*Eulophia hians var. nutans*	LC	11
Orchidaceae	*Eulophia ovalis var. bainesii*	LC	11
Orchidaceae	*Eulophia ovalis var. ovalis*	LC	11
Orchidaceae	*Eulophia parvilabris*	LC	11
Orchidaceae	*Habenaria clavata*	LC	11
Orchidaceae	*Habenaria dives*	LC	11
Orchidaceae	*Habenaria epipactidea*	LC	11
Orchidaceae	*Habenaria falcicornis subsp. caffra*	LC	11
Orchidaceae	*Habenaria lithophila*	LC	11
Orchidaceae	*Neobolusia tysonii*	LC	11
Orchidaceae	*Orthochilus foliosus*	LC	11
Orchidaceae	*Orthochilus leontoglossus*	LC	11
Orchidaceae	*Orthochilus welwitschii*	LC	11
Orchidaceae	*Pterygodium dracomontanum*	LC	11
Orchidaceae	*Pterygodium nigrescens*	LC	11
Orchidaceae	*Satyrium hallackii subsp. ocellatum*	LC	11
Orchidaceae	*Satyrium neglectum subsp. neglectum var. neglectum*	LC	11
Orchidaceae	*Satyrium parviflorum*	LC	11

Orchidaceae	*Satyrium trinerve*	LC	11
Orchidaceae	*Schizochilus zeyheri*	LC	11
Proteaceae	*Protea roupelliae subsp. roupelliae*	LC	11
Hyacinthaceae	*Eucomis autumnalis subsp. clavata*	NE	11
Orchidaceae	*Satyrium longicauda var. longicauda*	NE	11
Apocynaceae	*Ceropegia breviflora*		11
Apocynaceae	*Ceropegia rehmannii*		11
Iridaceae	*Gladiolus sp.*		11
Orchidaceae	*Eulophia sp.*		11
Orchidaceae	*Orthochilus sp.*		11
Orchidaceae	*Orthochilus vinosus*		11

5.4. Faunal Screening Assessment

5.4.1. Mammal Diversity and Habitats

The IUCN Red List Spatial Data lists 85 mammal species that could be expected to occur within the vicinity of the study area. This is regarded as a moderately-low species diversity.

Of these species, sixteen are medium to large conservation dependant species, or species that had a historical range that included the project area, but with natural populations since becoming locally "extinct" in these areas. These species are now generally restricted to game reserves, game farms, and protected areas, with most of these species having been re-introduced within these areas.

Examples of such species are:

- African Wild Dog – *Lycaon pictus* (Endangered);
- Spotted Hyaena – *Crocuta crocuta* (Near Threatened);
- Lion – *Panthera leo* (Vulnerable);
- Cheetah – *Acinonyx jubatus* (Vulnerable);
- Hook-lipped Rhinoceros – *Diceros bicornis bicornis* (Endangered);
- Red Hartebeest – *Alcelaphus caama* (Not Evaluated);
- African Savanna Buffalo – *Syncerus caffer* (Least Concern); and

These species are not expected to occur in the study area and were removed from the expected Species of Conservation Concern (SCC) list.

Of the 69 remaining mammals, two are introduced/exotic mammals (House Mouse – *Mus musculus* and Brown Rat – *Rattus norvegicus*). The remaining 67 mammals are regarded as indigenous species that contain, or may contain, natural populations within the study area. Of these naturally occurring mammals, thirty-five species been previously recorded within the larger survey area (Quarter Degree Grids: 2629DA, 2629CB, 2629AD, 2629BC) according to the Animal Demographic Unit (ADU) database, indicating a significant undersupplying within the area (https://vmus.adu.org.za/vm_sp_list.php). The most often recorded species were;

- Four Striped Grass Mouse– *Rhabdomys pumilio* (No. of Records: 28)
- South African Hedgehog – *Atelerix frontalis* (No. of Records: 16);
- Natal Multimammate Mouse – *Mastomys natalensis* (No. of Records: 1);
- Highveld Gerbil – *Gerbilliscus brantsii* (No. of Records: 10);
- Striped Polecat – *Ictonyx striatus* (No. of Records: 8);
- Cape Hare – Lepus capensis (No. of Records: 6); and
- Yellow Mongoose – *Cynictis Penicillata* (No. of Records: 5);

5.4.2. Mammal Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional (2016) and Global (2015) Red Data Lists, and indicate severe recent population declines, as well as those species, or populations of species, that are highly range restricted.

Of the remaining 67 small- to medium sized mammal species, that have a natural distribution range that include the project site and have a likelihood of occurring within the project site, fourteen (14) are listed as being of conservation concern on a regional or global basis (Table 21).

The list of potential species includes:

- One species listed as Endangered (EN) on a regional basis;
- Five (5) that are listed as Vulnerable (VU) on a regional basis; and
- Eight (8) that are listed as Near Threatened (NT) on a regional scale.

Table 21: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

Species	Common Name	Conservation Status			Likelihood of Occurrence
		Red Data	IUCN	TOPS	
Redunca fulvorufula	Mountain Reedbuck	NT	LC		Moderate
Panthera pardus	Leopard	NT	NT	Protected	High
Poecilogale albinucha	African Striped Weasel	EN	LC		High

Species	Common Name	Conservation Status			Likelihood of Occurrence
		Red Data	IUCN	TOPS	
Crocidura mariquensis	Swamp Musk Shrew	LC	VU	VU	Low
Dasymys incomtus	African Marsh Rat	NT	LC		Moderate
Otomys auratus	Southern African Vlei Rat	NT	LC		Moderate
Aonyx capensis	Cape Clawless Otter	NT	LC		Low
Parahyaena brunnea	Brown Hyaena	NT	LC		High
Leptailurus serval	Serval	NT	NT	Protected	High
Ambysomus septentrionalis	Highveld Golden Mole	NT	NT	Protected	Moderate
Crocidura maquassiensis	Maquassie Musk Shrew	NT	NT	Protected	High
Mystromys albicaudatus	White-tailed Mouse	NT	NT		Moderate
Hydrictis maculicollis	Spotted -necked Otter	VU	LC		Moderate
Chrysochloris villosus	Rough-haired Golden Mole	VU	LC		Moderate

5.4.3. Protected Mammal Species

Protected mammal species are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule II, III and V of the Mpumalanga Province Nature Conservation Act No 10 of 1998 (MPNCA).

TOPS Regulations:

- The Threatened or Protected Species (TOPS) regulations, 2007, provide a national approach to the sustainable use of species threatened with extinction, or in need of national protection, while ensuring the survival of the species in the wild, thus ensuring the conservation of the species.
- The TOPS regulations address multiple issues including: unethical hunting practices such as hunting in confined spaces, or hunting of tranquilised animals or by means of bait; activities related to the management of damage-causing animals; hybridisation and spreading diseases as a result of translocation; activities threatening cycad populations; and registration of captive breeding and keeping facilities.
- NEMBA enables the Minister to prohibit activities that may impact on the survival of species in the wild, and to regulate activities to ensure the sustainable use of indigenous biological resources.
- According to the definitions provided within the TOPS regulations (Section 56 (1)):
    - a Protected Species (56(1)(d)) is any indigenous species which is of high conservation value or national importance, or requires regulation in order to ensure that the species is managed in an ecologically sustainable manner. Furthermore, all indigenous species listed within CITES (Conservation on International Trade in Endangered Species of Wild Fauna and Flora) are also automatically listed as Protected Species within TOPS.

Schedule 2, 3, and 4 of the Mpumalanga Province Nature Conservation Act No 10 of 1998 (MPNCA):

- The aim/purpose of the Act is to provide for;
  - the sustainable utilisation of wild animals, aquatic biota, and plants;
  - to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora;
  - to provide for offences and penalties for contravention of the Act;
  - to provide for the appointment of nature conservators to implement the provisions of the Act;
  - to provide for the issuing of permits and other authorisations; and
  - to provide for matters connected therewith.

Table 22: List of Protected mammal species (according to national provincial regulations) that have a distribution that include the study area.

Species	Common Name	TOPS (NEM:BA)	CITES	MPNCA Schedule 1	MPNCA Schedule 4	Likelihood of Occurrence
Aonyx capensis	Cape Clawless Otter	Protected	II	2		High
Hydrictis maculicollis	Spotted -necked Otter	Protected	II	2		Moderate
Mellovora capensis	Honey Badger	Protected		2		High
Parahyaena brunnea	Brown Hyaena	Protected		2		Moderate
Orycteropus afer	Aardvark	Protected		2		High
Proteles cristatus	Aardwolf		II	2		High
Redunca fulvorufula	Mountain Reedbuck			2		High
Raphicerus campestris	Steenbok			2		High
Atelerix frontalis	Southern African Hedgehog			2		High
Panthera pardus	Leopard	VU	I		4	Low
Leptailurus serval	Serval	Protected	II			High
Vulpes chama	Cape Fox	Protected				Moderate

5.4.4. Reptile Diversity

The IUCN Red List Spatial Data lists 66 reptile species that could be expected to occur within the vicinity of the study area. This is comparatively moderate-low suggesting that reptile diversity at the site is likely to be fairly moderate.

Of these 66 reptile species, 24 have been previously recorded within the larger survey area (Quarter Degree Grids: 2629DA, 2629CB, 2629AD, 2629BC) according to the Animal Demographic Unit (ADU) database, indicating under sampling within the region. Species that has been frequently observed within the these QDGs are:

- Speckled Rock Skink – *Trachylepis punctatissima* (No. of Records: 15);
- Eastern Thread Snake – *Leptotyphlops scutifrons conjunctus* (No. of Records: 14);
- Bibron's Blind Snake – *Afrotyphlops bibronii* (No. of Records: 10);
- Distant's Ground Agama – *Agama aculeata distanti* (No. of Records: 7);

» Black-headed Centipede-eater – *Aparallactus capensis* (No. of Records: 7); and
» Rhombic Egg-eater – *Dasypeltis scabra* (No. of Records: 7).

5.4.5. Reptile Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2017), Global Red Data List (2015), that have experienced severe recent population declines, as well as those species, or populations of species, that are highly range restricted.

Of the 66 reptile species that have a natural distribution range that include the project site, and have a likelihood of occurring within the project site, only one is listed as being of conservation concern on a regional or global basis namely: Coppery Grass Lizard – *Chamaesaura aenea* (Near Threatened and Endemic). This species has a moderate likelihood of occurrence.

5.4.6. Protected Reptile Species

These are species that are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule 2, 3, and 4 of the Mpumalanga Province Nature Conservation Act No 10 of 1998.

All of the reptilian species, apart from the water leguaan (*Varanus niloticus*) and rock leguaan (*Varanus exanthematicus*), as well as all species of snakes (Order Serpentes), are regarded as Schedule 2 Protected Species.

Apart from the above mentioned provincially protected species, no TOPS species are likely to occur within the study area.

5.4.7. Amphibian Diversity

The IUCN Red List Spatial Data lists nineteen (19) amphibian species that occur within the region.

Of these nineteen amphibian species, thirteen species have been previously recorded within the larger survey area (Quarter Degree Grids: 2629DA, 2629CB, 2629AD, 2629BC) according to the Animal Demographic Unit (ADU) database. The most frequently recorded species are:

» Rattling Frog – *Semnodactylus wealii* (No. of Records: 10);
» Cape River Frog – *Amietia fuscigula* (No. of Records: 8);
» Common Caco – *Cacosternum boettgeri* (No. of Records: 8);
» Natal Sand Frog – *Tomopterna natalensis* (No. of Records: 7); and
» Raucous Toad – *Sclerophrys capensis* (No. of Records: 7)

5.4.8. Amphibian Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2017), Global Red Data List (2015), that have experienced severe recent population declines, as well as those species, or populations of species, that are highly range restricted.

Of the nineteen amphibian species that have a natural distribution range that include the project site, none are listed as being of conservation concern on a regional or global basis.

5.4.9. Protected Amphibian Species

These are species that are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Mpumalanga Province Nature Conservation Act No 10 of 1998 (MPNCA).

Only one protected species has a distribution range that include the study area, namely African Bull Frog (*Pyxicephalus adspersus*). This specie has a moderate likelihood of occurrence.

6. FINDINGS OF THE BOTANICAL ASSESSMENT

6.1. Site Specific Vegetation Description – Fine Scale Vegetation Patterns

This section describes the different habitats and vegetation patterns observed within the study area, as well as the proposed development site. As these are field-based observations taken directly from the study area, they are of greater reliability and pertinence than the coarsely mapped results of the National Vegetation Map, which does not adequately represent such finer details.

According to the National Vegetation Map 2018, only Soweto Highveld Grassland (Gm 8), is mapped for the study area (see Figure 9 and section 5.1). However, ground truthing indicated that other vegetation types, or variations/subsets thereof, are found within the study area. Representative photos of these types/variations are given by Figure 13 – Figure 15, and approximate area sizes are given by Table 19 in section 5.2.

Briefly: a total of 198 plant species were found within the study area, which consisted of 158 native, 0 Red List, 6 protected, 0 Mpumalanga endemic, 39 alien, and 11 NEM:BA listed invasive species. Photos of a selection of some of these species are given by Figure 16 – Figure 18. Furthermore, a total of 61 species were recorded within the study area that were not recorded within POSA, 6 of which were SoCC (*Boophone disticha*, *Crinum bulbispermum*, *Haemanthus humilis* subsp. *hirsutus*, *Aloe ecklonis*, *Gladiolus ecklonii*, and *Gladiolus woodii*), as well as 24 alien species. A summary of species according to the various classifications is given by Table 23.

Table 23: Plant species summary statistics for the vegetation/land types of the study area. "Unique" species were only found in the specific type in question, and not in the others. "Shared" species were shared with one or more of the other types. "Disturbed" includes disturbed areas (e.g., manmade dams, kraals, ruins/murals, roadsides, etc.) that did not conform to specific types. Type = Vegetation or Land Type (see text for type names); SoCC = Species of Conservation Concern; MPE = Mpumalanga Endemic; NEM:BA = Species listed under NEM:BA Alien and Invasive Species Regulations; N/A = Not Applicable.

	Total	Shared	Unique	%Unique	SoCC	Red List	Protected	MPE	Native	Alien	NEM:BA
Type											
Disturbed	7	0	7	100	0	0	0	0	0	7	3
Drainage	77	29	48	62	1	0	1	0	63	14	3
Fallow Land	39	23	16	41	0	0	0	0	30	9	1
Natural Clay	30	23	7	23	0	0	0	0	24	6	2
Natural Dolerite	62	36	26	42	1	0	1	0	52	10	2
Natural Loam Soil	28	13	15	54	2	0	3	0	26	2	0
Natural Rock Turf	18	13	5	28	1	0	1	0	17	1	0
Natural Sandstone	36	21	15	42	2	0	2	0	32	4	2
Overall Total											
	198	**N/A**	**N/A**	**N/A**	**6**	**0**	**6**	**0**	**158**	**40**	**11**

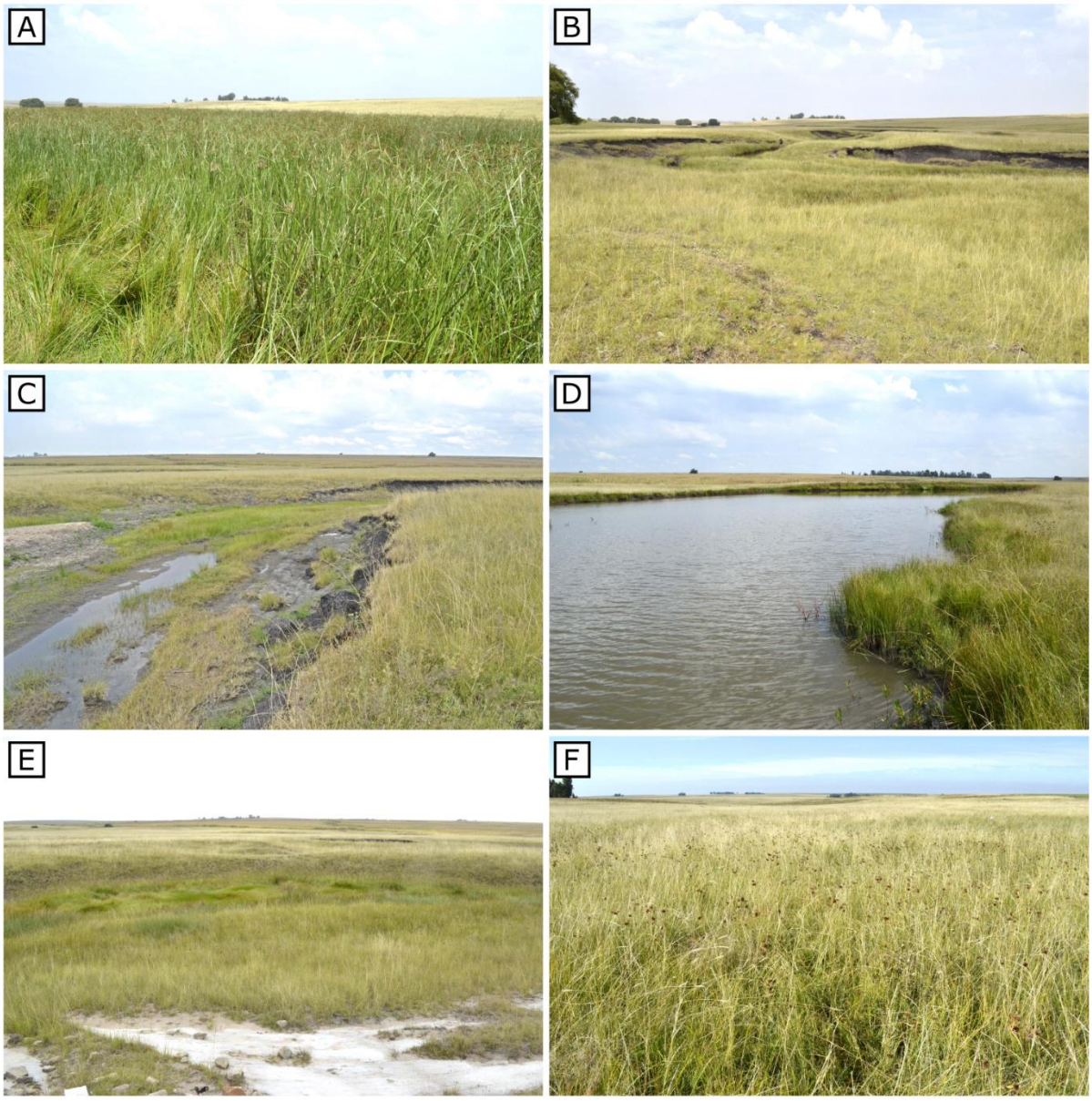

Figure 13: Representative photos of drainage areas found within the study area. A) Thriving community of *Cyperus rigidifolius* in a large floodplain, B) undulating walls of a valley bottom channel, C – E) water filled channels of a floodplain, with E showing an exposed underlying sandstone bank, and F) seepage wetland arising on a hillslope.

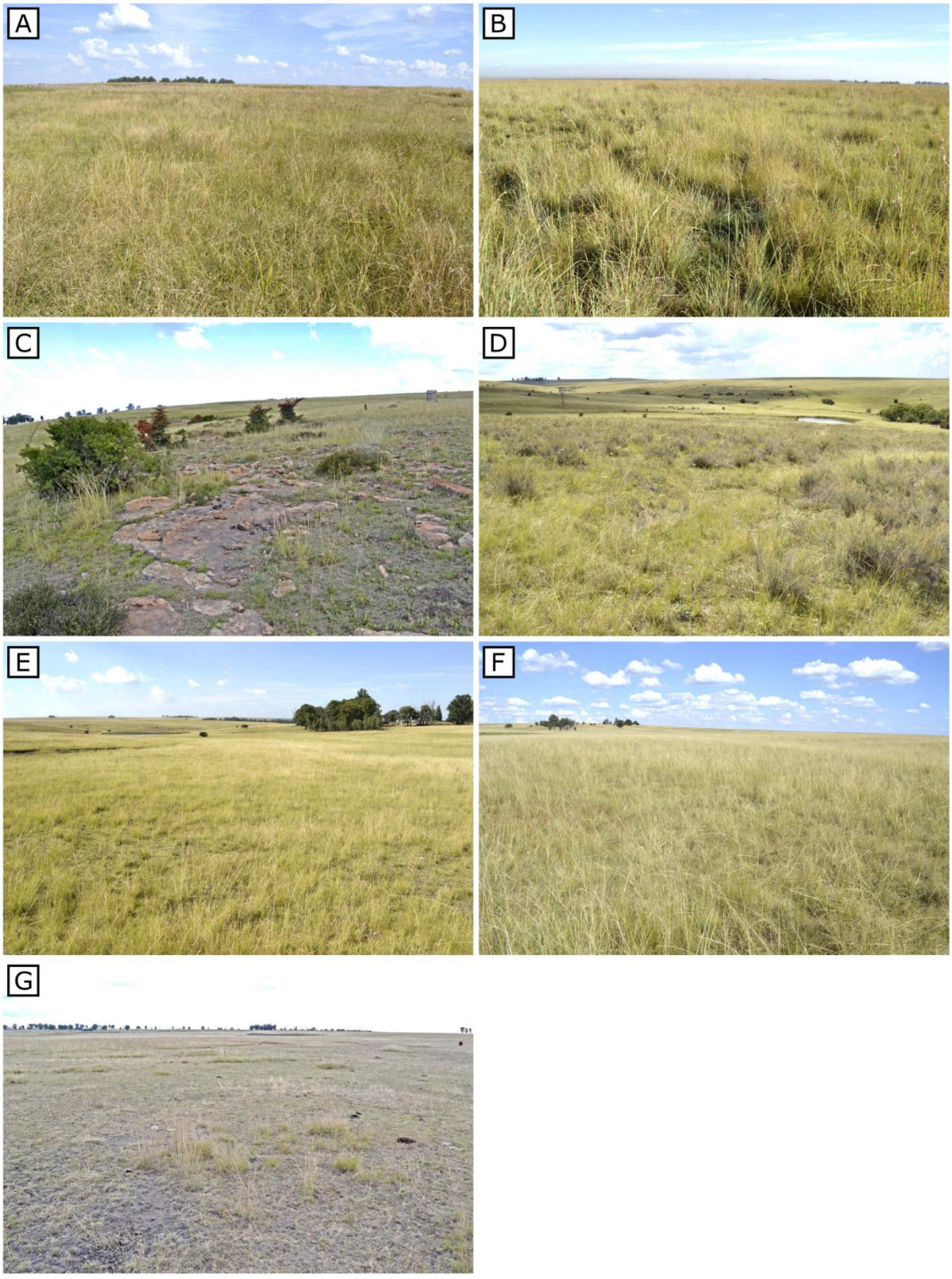

Figure 14: Representative study area photos of A) natural dolerite grassland to the extreme south, B) fallow lands with dominant *Hyparrhenia tamba*, C) exposed sandstone ridge, D) variation of C in which soils are sandy and derived from sandstone, E – F) natural clayey grassland, and G) shallow rock turf grassland with islands of various grasses where soils are somewhat deeper than the surroundings.

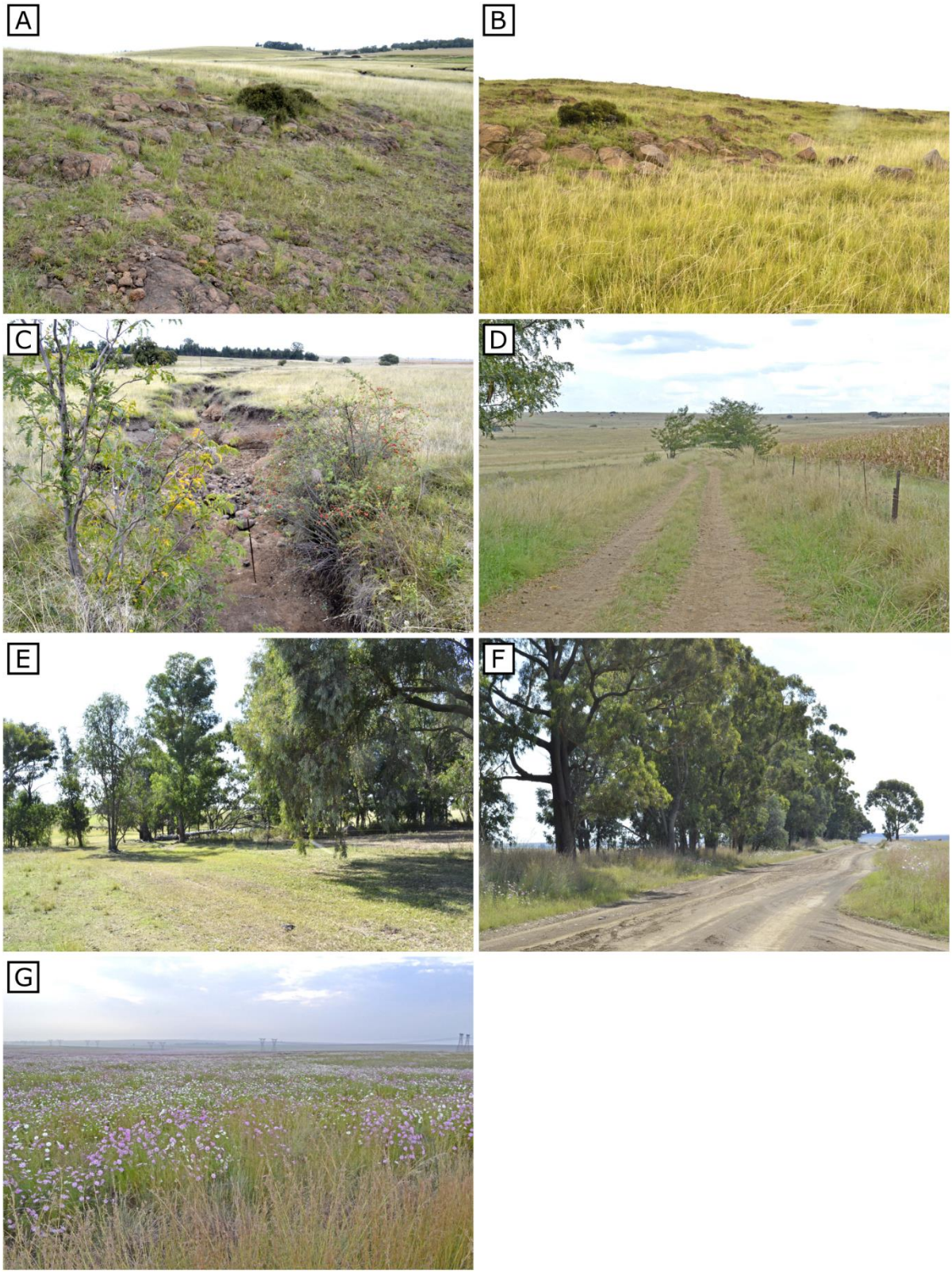

Figure 15: Representative study area photos of A – B) natural dolerite ridges, and C – G) disturbed areas, which include roadsides (D – F), donga erosion next to a road (C), and recently abandoned agricultural lands (G) with *Cosmos bipinnatus* dominating and growing in mass.

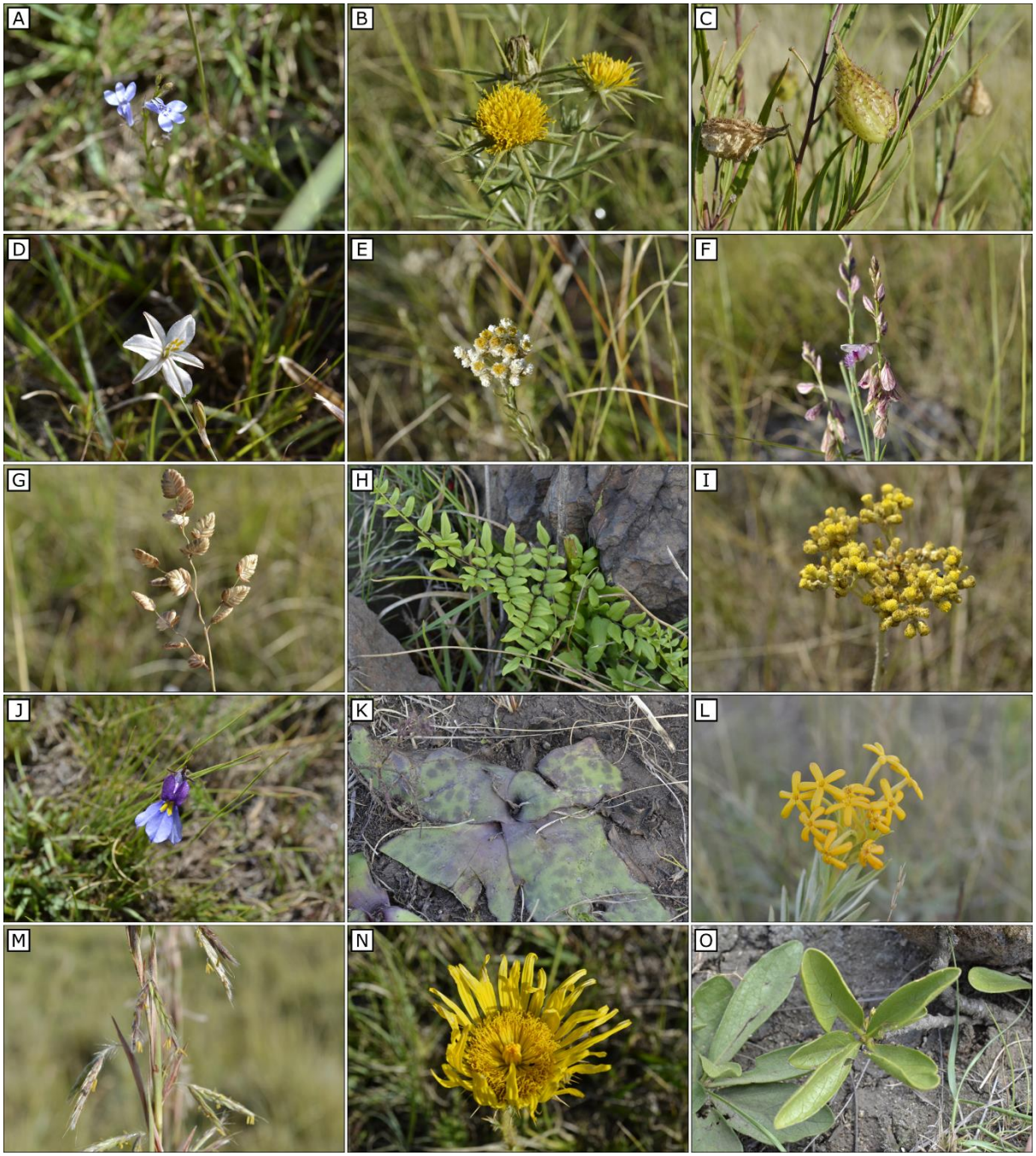

Figure 16: Photos of some of the native plant species that were found within the study area. Species names: A) Lobelia flaccida subsp. flaccida, B) *Berkheya rigida*, C) *Gomphocarpus fruticosus*, D) *Chlorophytum cooperi*, E) *Helichrysum rugulosum*, F) *Polygala hottentota*, G) *Eragrostis capensis*, H) *Cheilanthes viridis* var. *viridis*, I) *Helichrysum nudifolium* var. *nudifolium*, J) *Monopsis decipiens*, K) *Ledebouria ovatifolia* subsp. *ovatifolia*, L) *Lasiosiphon capitatus*, M) *Hyparrhenia tamba*, N) *Berkheya radula*, and O) *Pygmaeothamnus zeyheri* var. *zeyheri*.

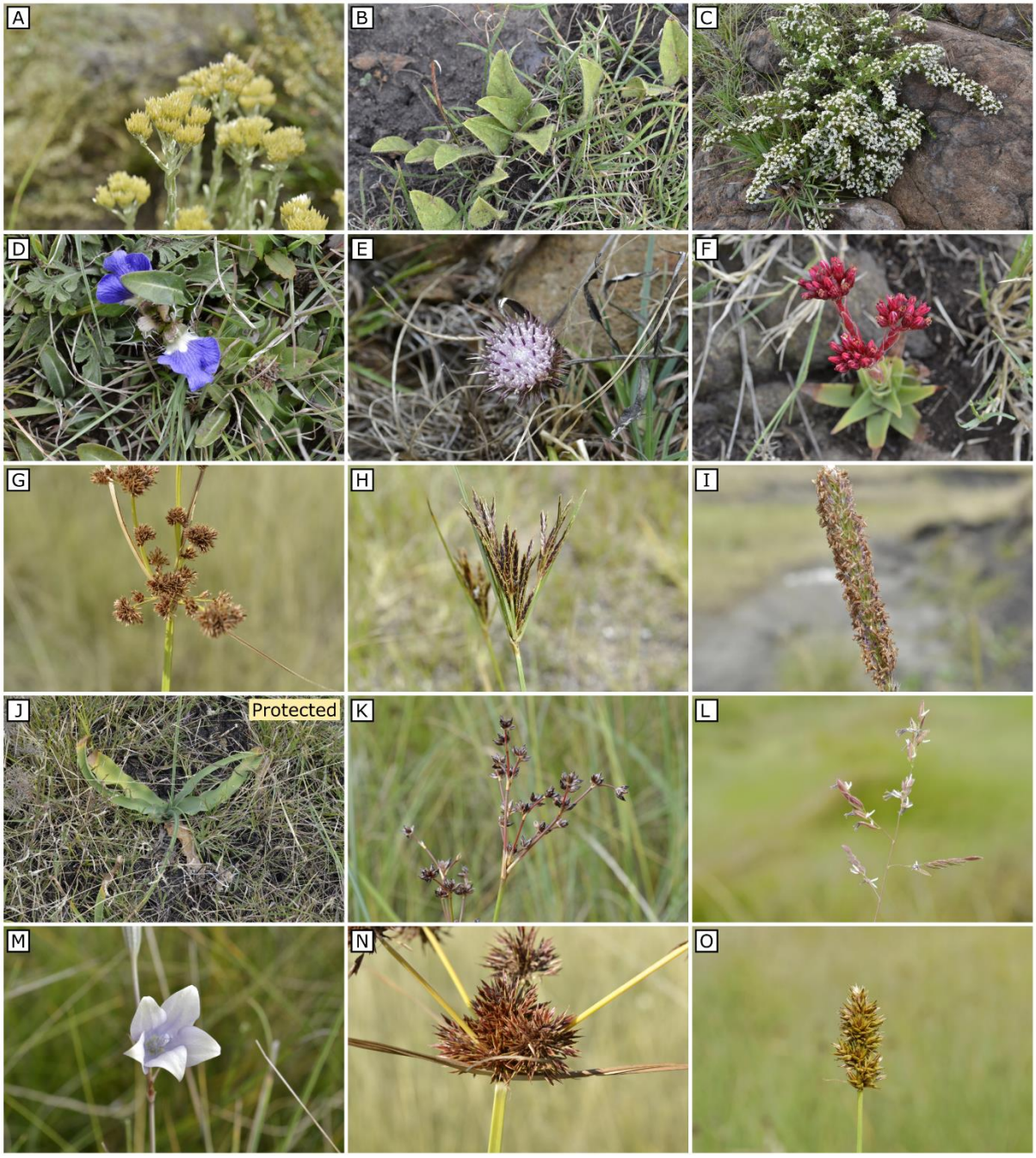

Figure 17: Photos of some of the native plant species that were found within the study area. Species names: A) *Helichrysum callicomum*, B) *Ipomoea crassipes* var. *crassipes*, C) *Selago densiflora*, D) *Blepharis obermeyerae*, E) *Dicoma anomala* subsp. *anomala*, F) *Crassula alba*, G) *Cyperus haematocephalus*, H) *Cyperus rigidifolius*, I) *Setaria nigrirostris*, J) *Crinum bulbispermum*, K) *Juncus exsertus*, L) *Leersia hexandra*, M) *Wahlenbergia undulata*, N) *Cyperus congestus*, and O) *Carex glomerabilis*.

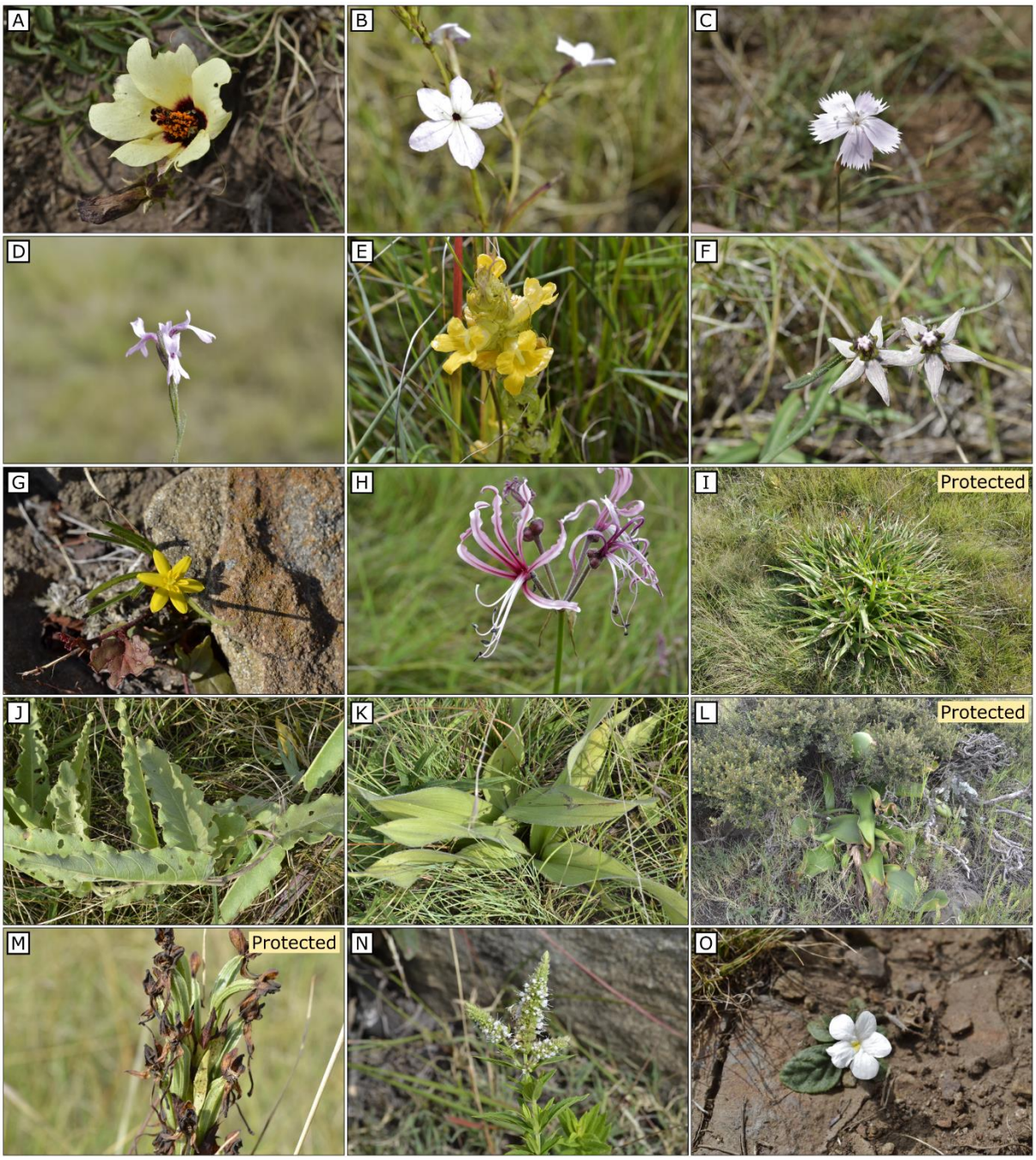

Figure 18: Photos of some of the native plant species that were found within the study area. Species names: A) *Hibiscus microcarpus*, B) *Cycnium tubulosum* subsp. *tubulosum*, C) *Dianthus mooiensis*, D) *Striga bilabiata* subsp. *bilabiata*, E) *Alectra sessiliflora*, F) *Asclepias gibba* var. *gibba*, G) *Hypoxis argentea* var. *argentea*, H) *Nerine angustifolia*, I) *Aloe ecklonis*, J) *Ipomoea ommanneyi*, K) *Hypoxis colchicifolia*, L) *Haemanthus humilis* subsp. *hirsutus*, M) *Habenaria* sp., N) *Mentha longifolia* subsp. *capensis*, and O) *Crabbea acaulis*.

6.1.1. Drainage Areas

Drainage areas, such as wetlands, temporary seepages, and ephemeral rivers, among others, comprised an approximate total of 9% (± 2 442 ha out of 28 856 ha) of the entire project/study area. Within the proposed development site, drainage areas comprise an

approximate total of 0.2% (0.76 ha out of 337 ha). These drainage areas are wetlands (channelled valley-bottom, seepage and floodplain wetlands) that will be crossed by the proposed access routes at two sites. All three of these wetland crossings will occur along existing crossings, which will merely be upgraded, subsequently limiting the impact on these wetland areas. The vegetation receives full sun and is characterised by 75 – 100% cover. It is relatively flat in topography, except for seepages arising on hillslopes, and generally with southern to western aspects. Since much of these areas are seasonally waterlogged, they are characterised by heavy, black clay soils without many rocks. Some areas have exposed underlying sandstone banks. The type did not have any native trees, except for scattered individuals of *Salix babylonica* along larger river channels. The shrub layer was approximately 50 cm in height, with the forb layer being 50 cm and the graminoid layer 90 cm.

A total of 77 plant species (63 native and 14 alien) were recorded within this type. Due to the unique characteristics of this habit type, it contained the highest number (62%) of unique species (i.e., those species that were not found in any of the other types). No endemic species were found is unit; however, one protected species was found, namely *Crinum bulbispermum*. The unit did not contain any Red List species.

Some of the dominant species were *Cyperus congestus*, *C. fastigiatus*, *C. rigidifolius*, *Eleocharis dregeana*, *Fingerhuthia sesleriiformis*, *Fuirena coerulescens*, *Leersia hexandra*, *Pennisetum thunbergii*, and *Setaria nigrirostris*. The following native species were unique to this type:

- *Agrostis eriantha var. eriantha*
- *Alectra sessiliflora*
- *Aristida bipartita*
- *Brachiaria eruciformis*
- *Carex glomerabilis*
- *Crinum bulbispermum*
- *Cycnium tubulosum subsp. tubulosum*
- *Cyperus congestus*
- *Cyperus fastigiatus*
- *Cyperus haematocephalus*
- *Cyperus rigidifolius*
- *Denekia capensis*
- *Diclis rotundifolia*
- *Eleocharis dregeana*
- *Falkia oblonga*
- *Fingerhuthia sesleriiformis*
- *Fuirena coerulescens*
- *Gomphostigma virgatum*
- *Hemarthria altissima*
- *Hermannia erodioides*
- *Imperata cylindrica*
- *Jamesbrittenia aurantiaca*
- *Juncus exsertus*
- *Leersia hexandra*
- *Lobelia acutangula*
- *Lobelia sonderiana*
- *Mentha longifolia subsp. capensis*
- *Moraea pallida*
- *Nerine angustifolia*
- *Panicum coloratum*
- *Pelargonium minimum*
- *Pennisetum thunbergii*
- *Schoenoplectus decipiens*
- *Scirpoides burkei*
- *Sebaea leiostyla*
- *Setaria nigrirostris*
- *Trifolium africanum*

- *Wahlenbergia undulata*

All drainage areas that were inspected were in a pristine condition (no transformation, no secondary vegetation) and relatively free from any alien species, except for scattered individuals of *Cosmos bipinnatus*, *Oenothera rosea*, *Paspalum dilatatum*, *Physalis peruviana*, and *Schkuhria pinnata*. Three NEM:BA listed invasive species were also occasionally recorded, namely *Cirsium vulgare*, *Verbena bonariensis*, and *Xanthium spinosum*.

6.1.2. Fallow Land

Fallow land refers to areas that were historically used for agriculture, but have subsequently been left to restore passively. It comprised an approximate total of 8% (± 2 190 ha out of 28 856 ha) of the entire project/study area. Fallow land condition depend on variety of factors, such as the history, intensity, and type of agricultural activities, as well as the time since cessation of activities, among other things. Therefore, although fallow lands are usually degraded and consist of secondary vegetation, they often revegetate to form important zones that support various types of biodiversity. Fallow lands can often be considered as Ecological Support Areas (ESA). These areas serve as habitats for SoCC, as well as other keystone or ecologically important species. Although it would take considerable time for fallow lands to restore to previous natural conditions (this might even have to involve some measure of active restoration), such areas often passively restore to a state that closely replicates that of the original, pristine conditions, even if only functionally. Such areas can function as buffer zones and/or corridors, adjacent to natural grasslands and drainage areas, that can be utilized by animal species, and could also function as reservoirs for certain native plant species. Indeed, numerous native species, shared with other natural types, were found in the fallow lands of the study area.

Within the proposed development site, fallow lands comprise an approximate 24% (± 79.04 ha out of 337 ha).

The vegetation of fallow lands in the study area receives full sun and is characterised by 75 – 100% cover. The fallow lands in the study area is mostly used for haymaking, and therefore have various types of topography depending on where the activities take place; this generally ranges from relatively flat to moderate slopes with various aspects. These areas were well-drained and characterised by clayey soils with small-sized rocks (about 0.06 – 2 mm diameter). This type did not have any trees or shrubs, and were characterised by a forb layer of approximately 30 cm in height, and a graminoid layer varying between 50 – 180 cm.

A total of 39 plant species (30 native and 9 alien) were recorded within this type. Interestingly, it contained a relatively moderate number (41%) of unique species. No endemic, protected, or Red List species were found is type. Some of the dominant species

were *Berkheya radula*, *B. rigida*, *Eragrostis capensis*, *E. chloromelas*, *E. plana*, and *Hyparrhenia tamba*. The following native species were unique to this type:

- *Berkheya setifera*
- *Chlorophytum cooperi*
- *Cynoglossum hispidum*
- *Cyperus esculentus var. esculentus*
- *Eragrostis capensis*
- *Indigofera hilaris var. hilaris*
- *Lactuca inermis*
- *Rhynchosia adenodes*
- *Rhynchosia nervosa*
- *Setaria pumila*
- *Tristachya leucothrix*

Although the fallow land areas that were inspected were essentially comprised of transformed, secondary vegetation, they were relatively free from alien species, which were never dominant. Some of these species included *Agave americana*, *Bidens pilosa*, *Erigeron primulifolius*, *Paspalum dilatatum*, *Schkuhria pinnata*, and *Tagetes minuta*. One NEM:BA listed species was recorded, namely *Cirsium vulgare*.

6.1.3. Natural Areas

Natural areas comprised the largest part of the project/study area, with an approximate total of 45% (± 12 814 ha out of 28 856 ha). However, natural areas cover only a total approximate 26% of the development site (± 85.85 ha out of 337 ha). A couple of variations were found within the broader scope of these natural areas, including areas of natural clay, dolerite, loam soil, shallow rock turf, and sandstone, all of which are grassland variations. By far the most abundant of these areas were natural clayey grassland. The other areas often integrate seamlessly with such clayey grasslands, and as such are difficult to map with accuracy on a fine scale. Therefore, although all of these areas are discussed below in detail, they were not mapped (and are all included under "Natural Areas"; see also section 5.2), and field referencing should instead be made to the descriptions below.

6.1.3.1. Natural Clayey Grasslands

The vegetation of the clayey grasslands receives full sun and is characterised by 75 – 100% cover. These areas had considerable variation in topography, ranging from relatively flat to moderate slopes with various aspects. Although these areas are well-drained, they are characterised by clayey, yet stony, soils with medium-sized rocks (about 4 – 64 mm diameter). This type was generally devoid of any trees. The shrub layer height is approximately 30 cm, while the forb layer is 50 cm and the graminoid layer about 150 cm.

A total of 30 plant species (24 native and 6 alien) were recorded within this type. This type only had about 23% of its species unique to it, and many of the species were thus shared with one or more of the other types. No endemic, protected, or Red List species were found in this type.

Eragrostis plana was by far the most dominant species of this type. Some of the other dominant species included *Berkheya radula*, *Cynodon dactylon*, *Eragrostis racemosa*, and *Helichrysum rugulosum*. The following native species were unique to this type:

- *Argyrolobium pauciflorum*
- *Lasiosiphon capitatus*
- *Oldenlandia herbacea var. herbacea*

Most of the natural clay areas that were inspected were in a pristine condition (no transformation, no secondary vegetation) and relatively free from alien species, except for *Bidens pilosa* and *Richardia humistrata*, the latter of which sometimes formed dense mats at certain places, as well as scattered individuals of some other species. However, some of these areas were clearly overgrazed as witnessed by the dominant presence of *E. plana*, as well as large herds of game and/or cattle. Four NEM:BA listed invasive species were also occasionally recorded, namely *Pyracantha angustifolia*, *P. crenulata*, *Verbena brasiliensis*, and *V. rigida*.

6.1.3.2. Natural Dolerite

Two types of exposed ridges were found scattered within the natural clayey grassland matrix, namely dolerite and sandstone (the latter is discussed in 6.1.3.3). Specifically, the vegetation of dolerite ridges receives full sun and is characterised by 50 – 75% cover, but this was lower on more exposed sheets. These areas had considerable variation in aspect, but were usually characterised by moderate slopes, since they occur on the exposed hillsides. These areas are well-drained and are characterised by very shallow, rocky soils with medium-sized rocks (about 4 – 64 mm diameter). They also often have large exposed rock sheets. These ridges did not have any trees. The shrub layer height is approximately 40 cm, while the forb layer was 30 cm and the graminoid layer about 50 cm.

A total of 62 plant species (52 native and 10 alien) were recorded within this type. This type had about 42% of its species unique to it. No endemic species were found is unit; however, one protected species was found, namely *Haemanthus humilis* subsp. *hirsutus*. No Red List species were found. The dominant species for this type included *Aristida junciformis* subsp. *junciformis*, *Berkheya rigida*, *Eragrostis plana*, *Helichrysum rugulosum*, and *Richardia humistrata*. The following species were unique to this type:

- *Asclepias gibba var. gibba*
- *Blepharis obermeyerae*
- *Cineraria aspera*
- *Commelina africana var. africana*
- *Crassula alba*
- *Crassula lanceolata subsp. transvaalensis*
- *Crassula setulosa*
- *Cucumis zeyheri*
- *Cyanotis speciosa*
- *Cyperus turbatus*
- *Dianthus mooiensis*
- *Helichrysum nudifolium var. pilosellum*
- *Hibiscus microcarpus*
- *Ledebouria apertiflora*
- *Lepidium africanum subsp. africanum*

- *Melolobium microphyllum*
- *Selago densiflora*
- *Senecio affinis*
- *Setaria sphacelata var. torta*
- *Silene burchellii*
- *Striga bilabiata subsp. bilabiata*
- *Trichoneura grandiglumis*

All natural dolerite areas that were inspected were in a pristine condition (no transformation, no secondary vegetation) and relatively free from alien species, except for a few scattered individuals of certain species. Two NEM:BA listed invasive species were also occasionally recorded, namely *Datura stramonium* and *Xanthium spinosum*.

6.1.3.3. Natural Sandstone

The other type of exposed ridge, together with natural dolerite, that was found scattered within the natural clayey grassland matrix, was sandstone. This type essentially shared the same characteristics as Natural Dolerite in terms of topography, slope, and vegetation cover, although a minor variation occurred where soils were somewhat deeper, and thus sandier. However, the species composition was similar between sandstone types. The shrub layer height is approximately 40 cm (except for alien *Pyracantha angustifolia* and *P. crenulata*), while the forb layer was 40 cm and the graminoid layer about 100 cm.

A total of 36 plant species (32 native and 4 alien) were recorded within this type. This type had about 42% of its species unique to it. No endemic species were found is unit; however, two protected species were found, namely *Aloe ecklonis* and *Haemanthus humilis* subsp. *hirsutus*. No Red List species were found. The dominant species for this type included *Helichrysum nudifolium* var. *nudifolium*, *Richardia humistrata*, and *Seriphium plumosum*. The following species were found only in this type:

- *Argyrolobium pseudotuberosum*
- *Asparagus setaceus*
- *Crassula vaginata subsp. vaginata*
- *Helichrysum callicomum*
- *Hypoxis argentea var. argentea*
- *Indigofera sanguinea*
- *Lobelia flaccida subsp. flaccida*
- *Ophioglossum reticulatum*
- *Pygmaeothamnus zeyheri var. zeyheri*
- *Searsia discolor*
- *Searsia pyroides var. pyroides*

All natural areas that were inspected were in a relatively pristine condition (no transformation, no secondary vegetation). However, parts of these areas were prone to invasion by *Pyracantha angustifolia*, *P. crenulata*, and *Richardia humistrata*. The latter two species are NEM:BA listed invasives.

6.1.3.4. Natural Loam Soil

Natural loam soil vegetation was found to the extreme southern parts of the study area, and likely occur as a minority type only throughout the lower parts of the study area. The vegetation of this type receives full sun and is characterised by 75 – 100% cover. It is relatively flat in topography, generally with a north-western aspect. These areas were well-drained and characterised by red, loamy soils with small to medium-sized rocks (about 2

– 4 mm diameter). No trees or shrubs were observed in this type, and it is characterised by a forb layer of approximately 40 cm in height, and a graminoid layer of about 200 cm.

A total of 28 plant species (26 native and 2 alien) were recorded within this type. Due to the unique characteristics of this habit type, it contained the second highest number (54%) of unique species (apart from disturbed vegetation), even though it had relatively low species richness. No endemic species were found is type; however, three protected species were found, namely *Aloe ecklonis*, *Boophone disticha*, and *Gladiolus ecklonii*. The type did not contain any Red List species.

Some of the dominant species were *Diheteropogon amplectens* var. *amplectens*, *Setaria incrassata*, and *Themeda triandra*. The following native species were unique to this type:

- *Diheteropogon amplectens var. amplectens*
- *Eriosema salignum*
- *Gladiolus ecklonii*
- *Habenaria*
- *Hermannia transvaalensis*
- *Hilliardiella elaeagnoides*
- *Hypoxis colchicifolia*
- *Hypoxis rigidula var. rigidula*
- *Ipomoea ommanneyi*
- *Schistostephium crataegifolium*
- *Senecio inornatus*
- *Striga gesnerioides*
- *Trachypogon spicatus*
- *Vigna vexillata var. vexillata*

All natural loam areas that were inspected were in a pristine condition (no transformation, no secondary vegetation), and only two alien species were recorded in this type, namely *Bidens pilosa* and *Erigeron bonariensis*. No NEM:BA listed invasive species were observed.

6.1.3.5. Natural Rock Turf

Natural rock turf was found to the extreme northern parts of the study area, and likely occur as a minority type throughout the study area. The vegetation of this type receives full sun and is characterised by 75 – 100% cover. It is relatively flat in topography, generally with a southern aspect. This interesting type was characterised by very shallow, rocky soils with medium to large-sized rocks (about 64 – 256 mm diameter). The area had islands of tall grass (with mostly *Eragrostis chloromelas* and *E. plana*) scattered within a mosaic of shallow rocky soils and exposed rock sheets. No trees or shrubs were observed in this type, and it is characterised by a forb layer of approximately 50 cm in height, and a graminoid layer of about 150 cm.

A total of 18 plant species (17 native and 1 alien) were recorded within this type. This type had a low number (28%) of unique species. No endemic species were found is unit; however, one protected species was found, namely *Gladiolus woodii*. The unit did not contain any Red List species.

Some of the other dominant species, apart from *E. chloromelas* and *E. plana*, were *Bulbine capitata* and *Sporobolus albicans*. The following native species were unique to this type:

- *Aristida congesta subsp. congesta*
- *Bulbine capitata*
- *Chloris virgata*
- *Digitaria eriantha*
- *Gladiolus woodii*

The natural rock turf area that was inspected did not have any transformation or secondary vegetation; however, it seemed to be well grazed by cattle. Only one alien species was recorded in this type, namely *Tagetes minuta*.

6.1.4. Disturbed areas

Disturbed areas are those that experience, or have recently experienced, considerable anthropogenic disturbance (apart from the fallow lands discussed in 6.1.2, which have generally been abandoned for quite some time). These areas include, but are not limited to, manmade dams, kraals, ruins/murals, roadsides, housing areas, etc. Although these areas are small in size compared to the other types, they often serve as reservoirs for weedy species. They can also serve as corridors through which alien species spread, which is especially true for roadsides. Additionally, alien species are often specifically planted in these areas, and can even include NEM:BA listed species. The disturbed areas in the study

area were characterised by a wide range of vegetation cover, topography, aspect, and soil types.

The following species were specifically recorded in the disturbed areas:

- *Cupressus arizonica var. arizonica*
- *Eucalyptus camaldulensis*
- *Eucalyptus cinerea*
- *Eucalyptus sideroxylon*
- *Gleditsia triacanthos* (NEM:BA listed)
- *Rosa rubiginosa* (NEM:BA listed)
- *Yucca gloriosa*

6.2. Species of Conservation Concern

As mentioned in sections 2.2, 2.4, and 5.3, a species list was obtained from the SANBI database (POSA) for the study area and surrounding environment. According to this list a total of 102 plant Species of Conservation Concern occur within the area. This included 19 Red List and 88 protected species. Together with this, the online screening report revealed the occurrence of additional Species of Conservation Concern, namely *Miraglossum davyi*, *Aspidoglossum xanthosphaerum*, and *Pachycarpus suaveolens*, as well as three sensitive species (1252, 691, 851; these species will not be made public in order to protect them from illegal activities).

Ground truthing confirmed 6 Species of Conservation Concern to be present within the study area (Table 24; see also Table 23). These were exclusively protected species, and none of them are Red List species. All of these species were present in the list obtained online (POSA) during the desktop phase.

Table 24: Plant Species of Conservation Concern recorded within the study area. "MNCA" = Mpumalanga Nature Conservation Act.

Family	Species	Conservation Status	
		IUCN Red List	MNCA Schedule
Asphodelaceae	*Aloe ecklonis*	LC	11
Amaryllidaceae	*Boophone disticha*	LC	11
Amaryllidaceae	*Crinum bulbispermum*	LC	11
Iridaceae	*Gladiolus ecklonii*	LC	11
Iridaceae	*Gladiolus woodii*	LC	11
Amaryllidaceae	*Haemanthus humilis* subsp. *hirsutus*	LC	11

6.3. Alien Plant Species

A total of 40 alien plant species were found within the study area, 11 of which were NEM:BA listed invasive species (Table 25). A photo selection of some of the alien species are given by Figure 19 and Figure 20. All of the land types that were inspected contained alien

species; however, the number of alien species varied across the types, and these alien species were never dominant to any degree. In other words, none of the types were dominated by alien species. Only some of the recently abandoned agricultural lands were dominated by *Cosmos bipinnatus* (see Figure 15G). However, these areas are likely very recently abandoned, and do not resemble the description of fallow land given in section 6.1.2.

Table 25: All alien plant species recorded within the study area.

Family	Species	NEM:BA Category
Agavaceae	*Agave americana*	
Asteraceae	*Bidens pilosa*	
Asteraceae	*Cirsium vulgare*	1b
Asteraceae	*Cosmos bipinnatus*	
Cupressaceae	*Cupressus arizonica* var. *arizonica*	
Solanaceae	*Datura stramonium*	1b
Asteraceae	*Erigeron bonariensis*	
Asteraceae	*Erigeron primulifolius*	
Myrtaceae	*Eucalyptus camaldulensis*	1b
Myrtaceae	*Eucalyptus cinerea*	
Myrtaceae	*Eucalyptus sideroxylon*	
Euphorbiaceae	*Euphorbia serpens*	
Fabaceae	*Gleditsia triacanthos*	1b
Amaranthaceae	*Gomphrena celosioides*	
Malvaceae	*Hibiscus trionum*	
Asteraceae	*Hypochaeris radicata*	
Fabaceae	*Medicago polymorpha*	
Onagraceae	*Oenothera rosea*	
Poaceae	*Paspalum dilatatum*	
Polygonaceae	*Persicaria lapathifolia*	
Solanaceae	*Physalis peruviana*	
Plantaginaceae	*Plantago rhodosperma*	
Polygonaceae	*Polygonum aviculare*	
Portulacaceae	*Portulaca oleracea*	
Asteraceae	*Pseudognaphalium luteoalbum*	
Rosaceae	*Pyracantha angustifolia*	1b
Rosaceae	*Pyracantha crenulata*	1b
Rubiaceae	*Richardia humistrata*	
Rosaceae	*Rosa*	
Rosaceae	*Rosa rubiginosa*	1b
Salicaceae	*Salix babylonica*	
Asteraceae	*Schkuhria pinnata*	
Solanaceae	*Solanum nigrum*	
Asteraceae	*Tagetes minuta*	
Verbenaceae	*Verbena bonariensis*	1b
Verbenaceae	*Verbena brasiliensis*	1b
Verbenaceae	*Verbena litoralis*	

Verbenaceae	*Verbena rigida*	1b
Asteraceae	*Xanthium spinosum*	1b
Asparagaceae	*Yucca gloriosa*	

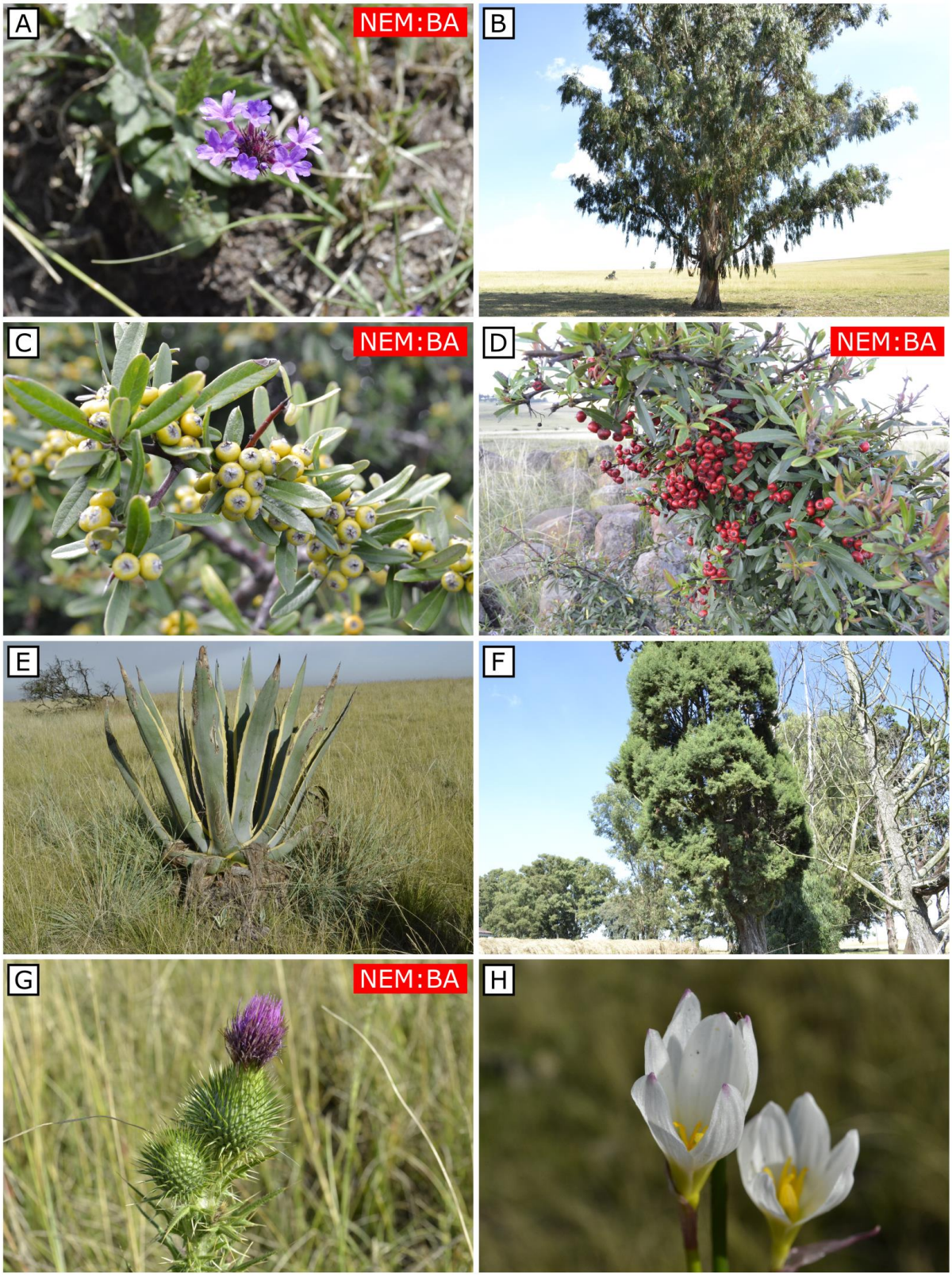

Figure 19: Alien plant species that were found within the study area. NEM:BA listed invasive species are indicated where applicable. A) *Verbena rigida*, B) *Eucalyptus camaldulensis*, C) *Pyracantha angustifolia*, D) *Pyracantha crenulata*, E) *Agave americana*, F) *Cupressus arizonica* var. *arizonica*, G) *Cirsium vulgare*, and H) *Zephyranthes candida*.

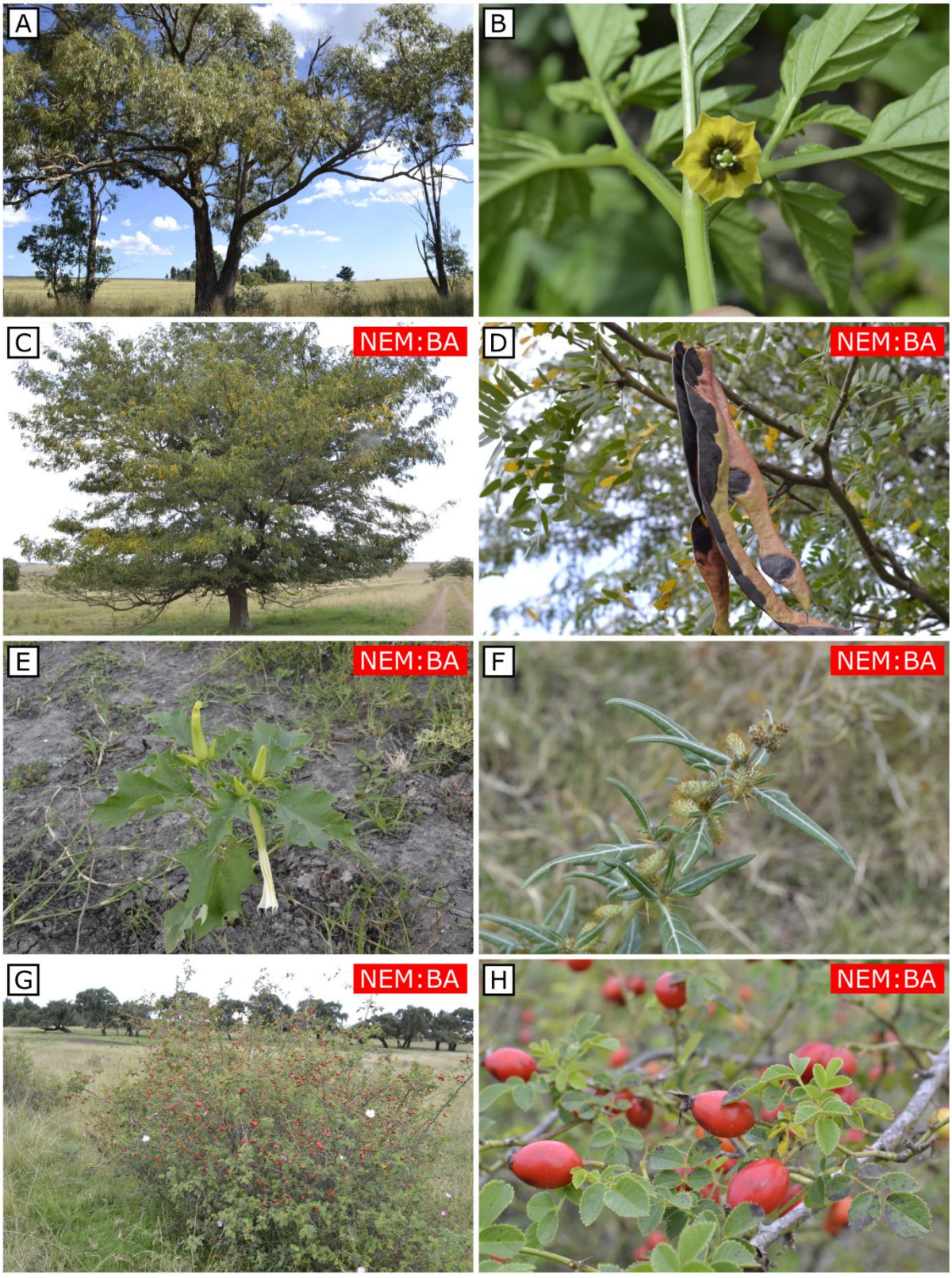

Figure 20: Alien plant species that were found within the study area. NEM:BA listed invasive species are indicated where applicable. A) *Eucalyptus sideroxylon*, B) *Physalis peruviana*, C) *Gleditsia triacanthos*, D) fruits of *Gleditsia triacanthos*, E) *Datura stramonium*, F) *Xanthium spinosum*, G) *Rosa rubiginosa*, and H) fruits of *Rosa rubiginosa*.

6.4. Plant Habitat Sensitivity

Most of the development site is either of "low" (171.21 ha; 50.8%) or "moderate-low" (79.04 ha; 23.5%) sensitivity (Table 26; see also Figure 25). Drainage areas, which include, but are not limited to, wetlands, temporary seepages, and ephemeral rivers and streams, should be considered as no-go areas for all infrastructure apart from the proposed wetland access road crossings (along existing crossings). Drainage areas are all classified as "Very High". However, these drainage systems can be locally regarded as "Moderate Sensitive" where existing crossings/road or impacts are already present (such as the areas earmarked for the access road crossings). The developer aims to incorporate these existing watercourse crossings into the final design layout. Apart from these two watercourse/wetland crossings, the developer should, and have, avoided any new watercourse crossings. As mentioned, based on the current layout, two existing wetland crossings have been identified to be upgraded and utilised. Apart from these watercourse/wetland crossings, no other drainage features will be impacted by the proposed PV solar development.

As for the other terrestrial Natural areas (classified as "medium" sensitivity), a couple of variations were found (see section 6.1.3). In order of descending number of unique species found in each type (Table 23), they were: Natural Loam Soil (54%), Natural Dolerite (42%), Natural Sandstone (42%), Natural Rock Turf (28%), and Natural Clay (23%). Thus, natural rock turf and natural clay areas had the lowest number of species that occurred only in those types, and most of their species were therefore shared with the other types. The concept of "unique species" relates directly to community compositional changes — that is, beta diversity — and is important for conservation purposes. Specifically, the beta diversity of specific areas can differ between each other in the components of turnover and nestedness (Baselga, 2013, 2010a, 2010b). A high species turnover would indicate that species are replaced on going from one area to another, whereas a low turnover (also termed high nestedness) would indicate that species form subsets of a larger community when going from one area to another. The implication of this is that conservation efforts should ideally prioritise areas with a high number of unique biodiversity (thus representing high turnover compared to other areas); in other words, areas with a high number of unique species should be prioritised. This maximizes and optimizes conservation efforts. Although genetic diversity is still lost whenever an area is destroyed, conserving areas of highest turnover is a step towards minimizing the potential for local species extinction.

In light of the above, any developmental activities within the study area should aim to target areas of natural rock turf and natural clay, and avoid, where possible, areas of loam soil, dolerite, and sandstone. This would preserve a higher number of unique biodiversity, and would impact the lowest number of species. Incidentally, not only were areas of natural clay the most abundant, they also had a medium species richness compared to the other areas. Moreover, areas of natural clay were not observed to have any Species of Conservation Concern; however, this is likely not truly the case, since it is likely that such species were just overlooked (as described in section 2.9 on the study limitations).

Nevertheless, given the data gathered on the differences between these types, development should ideally occur only in natural rock turf and natural clay. Furthermore, in order to reduce impacts on the natural grassland habitats, disturbances and transformation of land should be limited to a small as possible footprint, infrastructure should be located near the margins of these habitats (fringing lower sensitive areas), infrastructure should be clustered where possible and the shortest routes from existing roads should be taken. According to the current layout, natural, primary grassland that fall within the proposed development area are consistent with the descriptions for natural rock turf and natural clay grasslands, whilst loamy soils, and exposed dolerite and sandstones areas will be avoided.

As mentioned apart from the three wetland crossings, no other infrastructure associated with this development will occur within or near drainage areas ("very high" sensitivity). Natural primary grasslands classified as CBA Optimal Areas have been classified as "high" sensitivity, whilst natural primary grassland classified as CBA Irreplaceable Areas are classified as "very high" sensitivity. According to Table 26 and Figure 21, the proposed development will impact very limited areas of "very high" (2.75 ha) and "high" (31.71 ha) sensitivity. These areas that will be impacted are typically located at the edge of the boundary of these features and as such the development will not result in the fracturing of these sensitive features. Furthermore, as mentioned earlier (Section 4.2.3) the potential impact on "very high" and "high" sensitivities will likely be smaller than the 2.45 and 31.71 ha, when taking into account that the bulk of the access routes are planned along existing routes (fairly broad farm roads, >7m and narrower farm twin tracks). Thus, these roads will be merely upgraded and impacts on natural vegetation will be limited. Only 0.55 km of new road (4% of the planned total road network) will be constructed.

The bulk of the development is planned within cultivated areas (51%, 171.21 ha) and secondary grassland (23%, 79.04 ha), these areas are irrespectively classified as "low" and "low-medium" sensitive areas. Furthermore, 15% (51.39 ha) of the proposed development footprint is planned within primary grassland that fall outside of any CBAs ("medium" sensitivity).

The overall score that was allocated to PV solar infrastructure was based on a combination of CBA status and site sensitivity (Table 26 and Figure 21), and can be summarised as follow:

- Infrastructure occurring in Irreplaceable CBAs and "Medium" site sensitivity, natural primary grassland areas, are classified as overall "Very High" sensitivity.
- Infrastructure occurring in Optimal CBAs and "Medium" site sensitivity, natural primary grassland areas, are classified as overall "High" sensitivity.
- Infrastructure occurring in Ecological Support Areas and "Medium" site sensitivity, natural primary grassland areas, are classified as overall "Medium" sensitivity.
- Infrastructure occurring in any Critical Biodiversity Areas as well as Ecological Support Areas, which have been found "on-site", to be, in fact, located within historically disturbed areas that have since been covered by a stable indigenous

vegetation cover (secondary grasslands), are classified as overall "Low-Medium" sensitivity.

» Infrastructure occurring in any Critical Biodiversity Areas as well as Ecological Support Areas, which have been found "on-site", to be, in fact, located within disturbed/transformed/degraded areas, are classified as overall "Low" sensitivity.

These scores aim to represent a combination of CBA status and site sensitivity rating to classify proposed infrastructure that are most likely to have a high impact on biodiversity.

According to the current layout, most of the sensitive areas will be avoided and the Ummbila SEF will not significantly impact sensitive areas or impact conservation targets set out by the province (**Error! Reference source not found.**, Table 26, Table 27, and Table 28).

Table 26: The extent of the various overall sensitivity categories (based on the combined CBA and Site Sensitivity classifications) within the study area, together with maximum acceptable losses of each type.

	Entire Study/Project Area Extent	**Development Site Extent**		**Maximum Acceptable Loss**	
Sensitivity	**ha; % of total**	**ha; % of total project site**	**% of entire project area**	**%**	**ha**
Very High	5569 (15.2%)	2.75 (1%)	0.008%	1%	56
High	6131 (16.8%)	31.71 (9%)	0.087%	2%	123
Medium	7549 (20.7%)	51.39 (15%)	0.141%	5%	377
Low-Medium	2779 (7.6)	79.04 (23%)	0.216%	8%	222
Low	14496 (39.7%)	171.22 (51%)	0.469%	10%	1138
Total	**36524 (100%)**	**337 (100%)**	**-**	**-**	**1529**

Table 27: Breakdown of the coverage of ecological sensitivities within each component of the proposed development (excluding access roads, refer to Table 28below).

Sensitivities	Solar PV Facilities								Laydown Area		IPP Substation	
	Solar Farm 1		Solar Farm 2		Solar Farm 3		Solar Farm 4					
	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)	Coverage (Ha)	Coverage (%)
Very High: Primary Grassland & CBA1 Irreplaceable	0	0%	0	0%	0	0%	2.25	5%	0	0%	0	0%
High: Primary Grassland & CBA1 Optimal	1.28	1%	20.37	35%	0	0%	5.66	11%	0	0%	0	0%
Medium: Primary Grassland	4.88	3%	32.21	56%	0	0%	10.03	20%	0	0%	0	0%
Low-Medium: Secondary Grassland	79.04	48%	0	0%	0	0%	0	0%	0	0%	0	0%
Low: Cultivated Areas	79.41	48%	5.14	9%	46.07	100%	31.69	64%	5.03	100%	1.25	100%
Low: Infrastructure	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Total	**164.62**	**100**	**57.73**	**100**	**46.07**	**100**	**49.62**	**100**	**5.03**	**100**	**1.25**	**100**

Table 28: The estimated coverage of the various sensitivity categories that will be impacted by the proposed access roads, as well as the approximate length of the access routes that will traverse the various sensitivity categories.

Sensitivities	All Access Roads		New Access Roads		Narrow Twin Tracks (Upgrade)		Fairly Broad Farm Roads (Upgrade)	
	Length (km)	Length (%)	Length (km)	Length (%)	Length (km)	Length (%)	Length (km)	Length (%)
Very High: Primary Grassland & CBA1 Irreplaceable	0.42	3%	0	0%	0	0%	0.42	4%
Very High: Freshwater Resources/Drainage	0.85	6%	0	0%	0	0%	0.85	8%
High: Primary Grassland & CBA1 Optimal	5.12	36%	0.45	82%	0.23	7%	4.25	42%
Medium: Primary Grassland	4.74	33%	0.10	18%	1.54	51%	3.03	30%
Low-Medium: Secondary Grassland	0	0%	0	0%	0	0%	0	0%
Low: Cultivated Areas	3.11	22%	0	0%	1.28	42%	1.65	16%
Low: Infrastructure	0	0%	0	0%	0	0%	0	0%
Total	**14.25**	**100**	**0.55**	**100**	**3.05**	**100**	**10.21**	**100**

PROPOSED PV SOLAR FACILITY AND SUPPORTING INFRASTRUCTURE LAYOUT CLASSIFIED BY THE COMBINED CBA STATUS AND SITE SENSTIVITY OF THE PROJECT SITE

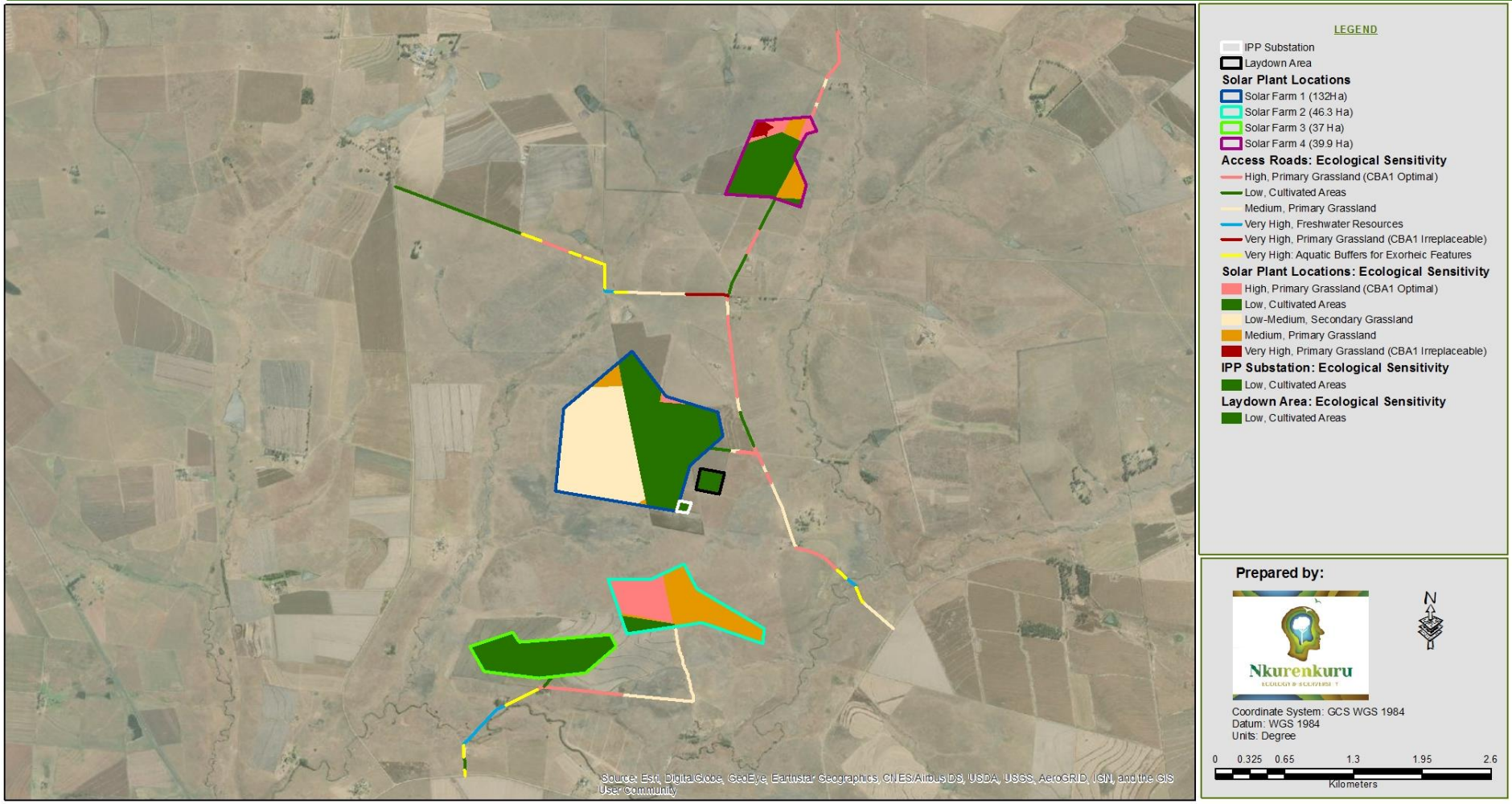

Figure 21: Layout: PV solar facilities and supporting infrastructure classified by the combined CBA status and Site Sensitivity (see **Error! Reference source not found.**).

7. FINDINGS OF THE FAUNAL ASSESSMENT

7.1. Mammals

7.1.1. Overall Diversity

A total of thirty-two (32) mammal species were observed (refer to Table 29) through direct observations, camera trap photographs, Sherman traps, and/or the presence of visual tracks & signs, within the study area. A number of antelope species were recorded within the project site. Most of these antelope species are confined by fences, within game camps, and thus only occur where farmers have introduced them or allow them to persist, and should be considered as part of the farming system rather than as wildlife *per se*. Some of these South African indigenous antelope species do not have a natural distribution within the specific region, but as mentioned have been introduced by farmers. Such antelope species confirmed in the study area include: Springbok, African savanna buffalo, Sable antelope, Common reedbuck, Back Wildebeest, and Blesbok. Furthermore, some of the farmers have introduced exotic game such as European Fallow Deer and Lechwe into their game camps. Populations of smaller antelope species such as Steenbok and Common duiker occur naturally within the study area and region.

This data represents strong evidence as to a potential moderately diverse and functional mammal assemblage, populating the study area.

Based on the various sampling techniques, the following mammals were the most frequently observed within the project site:

- Scrub hare (*Lepus saxatilis*): Numerous records (>30 records);
- Cape Porcupine (*Hystrix africaeaustralis*): No of Records 3 (and few feeding/gnawing signs);
- Four-striped grass mouse (*Rhabdomys pumilio*): No of Records 3 (all three trapped);
- Yellow mongoose: No of Records 4;
- Highveld Gerbil (*Gerbilliscus brantsii*): No of records 1 (trapped) however numerous burrows were recorded in and around the cultivated areas);

Table 29: List of Mammalian species that were observed within the study area.

Scientific Name	Common Name	Regional Status (2016)	Global Status (2015)	TOPS (NEMBA)	MPNCA	Remarks
Antidorcas marsupialis	Springbok	LC	LC			Introduced game
Connochaetes gnou	Back Wildebeest	LC	LC		II	Introduced game
Damaliscus pygargus phillipsi	Blesbok	LC	LC			Introduced game
Hippotragus niger	Sable antelope	LC	LC		II	Introduced game

Scientific Name	Common Name	Regional Status (2016)	Global Status (2015)	TOPS (NEMBA)	MPNCA	Remarks
Kobus leche	Lechwe	LC	LC			Introduced exotic game
Raphicerus campestris	Steenbok	LC	LC		2	
Redunca arundinum	Common reedbuck	LC	LC		2	Introduced game
Sylvicapra grimmia	Common duiker	LC	LC			
Syncerus caffer	African savanna buffalo	LC	LC		4	Introduced game
Canis mesomelas	Black-backed jackal	LC	LC			
Cervus dama	European Fallow Deer	LC	LC			Introduced exotic game
Equus quagga	Plains zebra	LC	LC			Introduced game
Caracal caracal	Caracal	LC	LC			
Leptailurus serval	Serval	NT	NT	Protected	5	Observed by multiple farmers
Atilax paludinosus	Marsh mongoose	LC	LC		5	
Cynictis penicillata	Yellow mongoose	LC	LC		5	
Galerella sanguinea	Slender mongoose	LC	LC		5	
Parahyaena brunnea	Brown hyena	NT	NT	Protected	2	Observed by farmer
Hystrix africaeaustralis	Cape porcupine	LC	LC			
Lepus saxatilis	Scrub Hare	LC	LC			
Dendromus melanotis	Grey pygmy climbing mouse	LC	LC			
Gerbilliscus brantsii	Highveld gerbil	LC	LC			
Mastomys natalensis	Natal multimammate mouse	LC	LC			
Otomys irroratus	Vlei rat	NT	LC			
Rhabdomys pumilio	Four-striped grass mouse	LC	LC			
Saccostomus campestris	Pouched mouse	LC	LC			
Aonyx capensis	Cape clawless otter	LC	LC	Protected	2	
Orycteropus afer	Aardvark	LC	LC	Protected	2	
Crocidura fuscomurina	Tiny Musk Shrew	LC	LC			
Crocidura hirta	Lesser red musk shrew	LC	LC			
Atelerix frontalis	Southern african hedgehog	NT	LC		2	

However, it must be reiterated that the poor trapping success (± 1% trapping success rate) is most likely a biased reflection of the predicted total diversity; that is, it would seem that the overall diversity is low, but this is likely not the case. This is likely due to the very high rainfall prior to the sampling period (and thus very high productivity of vegetation, insects, and fruits/seeds), which resulted in an abundance of resources, thereby negating the need for small mammals to forage within traps, and thus lowering the overall trapping success. As such, although the extremely low trap success rate was somewhat unusual, it does not diminish the reliability of the data gathered. A stable and healthy small mammalian populations is crucial as these species, along with invertebrates, form the base of the trophic chain within this region. From the number of small meso-predators observed within the study area it is clear that these populations of small

mammals and invertebrates, as well as small terrestrial/ground dwelling bird populations, are still strong enough to sustain these mesopredators (Black-backed jackal, Serval, Marsh mongoose, Yellow mongoose, Slender mongoose, Small-spotted genet, and Cape clawless otter).

The structural and compositional habitat/vegetation unit diversity can be described as moderately diverse within the project site. The most significant habitats within the project site are the wetland and natural grassland habitats. These habitat types are fairly diverse in terms of its structural geomorphological diversity.

7.1.2. Mammal Species of Conservation Concern (SCC)

During the site visit four (4) Mammal SCC were recorded through active searching (diurnal and nocturnal surveys), camera trapping, Sherman trapping, and through random observations, namely: Serval (Near Threatened), Brown hyena (Near Threatened); Vlei rat (Near Threatened), Cape clawless otter (Near Threatened), and South African hedgehog (Near Threatened).

In terms of the likely impacts of the development on Serval, Brown hyena, and South African hedgehog, habitat loss is not likely to be highly significant as the direct footprint of the development is not likely to exceed a few hundred hectares. This would therefore not be significant in context of the relatively homogenous and intact surrounding landscape.

- Serval is a relatively common wetland associated species in grassland areas, and although the NT status warrants due consideration, the species' presence is not considered to be a fatal flaw given that wetland areas will not be significantly impacted (almost all of the wetland features have been excluded from the development footprint, apart from a few road crossings). Moreover, connectivity between wetland features (linear connectivity), as well as between the wetland features and the fringing terrestrial grassland (lateral connectivity), will remain largely unchanged.
- Brown Hyaena are essential components of the ecosystem and act as important scavengers in the region, clearing carcases that can potentially spread diseases to wild mammal populations. Brown Hyaena are listed as NT, and although they are present in high densities within Bankenveld (savanna/grassland ecotones), pure grassland (even with some rocky outcrops) does not represent the cornerstone of their distribution. These species likely only utilise the area as a migratory corridor. As mentioned, landscape connectivity will not be significantly impacted by the proposed development.
- Hedgehogs are listed as NT, and the species can be found in grasslands of varying degrees of degradation (from pristine to semi-degraded), especially in the absence of dogs and other feral predators. With a loss of grassland habitat, it is likely that local hedgehog populations will be displaced or eradicated. The best course of

action will be to allow for worker induction, which will report hedgehog presence and allow individuals to be safely relocated to more undisturbed areas.

In terms of the likely impacts of the development on Vlei rat and Cape clawless otter, both of these species are restricted to aquatic environments and their surrounding grasslands, and although the NT status (for both species) warrants due consideration, the species' presence is not considered to be a fatal flaw given that wetland areas will not be significantly impacted (almost all of the wetland features have been excluded from the development footprint apart from a few road crossings). Moreover, connectivity between wetland features (linear connectivity), as well as between the wetland features and the fringing terrestrial grassland (lateral connectivity), will remain largely unchanged.

Figure 22: Photographic evidence of a selection of mammal species observed within the project site.

7.2. Amphibians

7.2.1. Overall Diversity

A total of six (6) amphibian species were observed (refer to Table 30) through direct observations within the study area. None of these observed species are SCC and all are considered to be fairly common.

All of the amphibian species were observed within or in close proximity to wetland features. Several observations of both Common river frog and Poynton's river frog were made in the study area. Both of the river frogs have a very similar ecology and are expected to respond similarly to external influences. Indeed, they are both regarded as relatively tolerant to disturbance and are therefore poor bio-indicators. These species were frequently observed around inundated, narrow drainage channels and pools located within the valley-bottom wetlands and floodplains, as well as within artificial impoundments/dams. The fairly dense grass, sedge, and bulrush vegetation surrounding these areas provide excellent refugia and habitat for amphibian species. A few rocks are also present within some of the wetland habitats and also provide valuable refuge. Most of the amphibian species that were recorded within the study area, were also recorded within the dams, as well as the seepage areas below the dam features.

In terms of the likely impacts of the development on these species, these species are restricted to aquatic environments and their surrounding grasslands, and impacts on amphibian populations are not likely to be significant given that:

- Almost all of the wetland features have been excluded from the development footprint apart from a few road crossings.
- Connectivity between wetland features (linear connectivity), as well as between the wetland features and the fringing terrestrial grassland (lateral connectivity), will remain largely unchanged.
- Potential water pollution risk is fairly low.

Table 30: List of Amphibian species that were observed within the study area.

Scientific Name	Common Name	Regional Status (2016)	Global Status (2015)	TOPS (NEMBA)	MPNCA
Kassina senegalensis	Bubbling kassina	LC	LC		
Semnodactylus wealii	Rattling frog	LC	LC		
Amietia delalandii	Common river frog	LC	LC		
Amietia poyntoni	Poynton's river frog	LC	LC		
Cacosternum boettgeri	Boettger's Caco	LC	LC		
Strongylopus fasciatus	Striped stream frog	LC	LC		

The structural and compositional habitat/vegetation unit diversity can be described as moderately-low diverse within the study area. The most significant habitats within the

study area are the wetland habitats. These habitats are fairly diverse in terms of structural and geomorphological diversity.

7.2.2. Amphibian Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2017), Global Red Data List (2015), that have experienced severe recent population declines, as well as those species, or populations of species, that are highly range restricted.

Of the six amphibian species that were recorded within the study area, none are listed as being of conservation concern on a regional or global basis.

7.3. Reptiles

7.3.1. Overall Diversity

A total of ten (10) reptile species were observed (refer to Table 31) through direct observations within the study area. None of these observed species are SCC and all are considered to be fairly common within the region. Furthermore, two of the observed reptile species are South African endemics (Transvaal thick-toed gecko and Short-headed legless skink), whilst one species is near endemic (Rinkhals).

The structural and compositional habitat/vegetation unit diversity can be described as moderately-low diverse within the study area. The most significant habitats within the study area are the rocky grassland habitats. These habitats provide good refugia for potential reptile species.

Table 31: List of Reptile species that were observed within the study area.

Scientific Name	Common Name	Regional Status (2016)	Global Status (2015)	TOPS (NEMBA)	MPNCA
Pachydactylus affinis	Transvaal thick-toed gecko	LC	LC		II
Hemidactylus mabouia	Common tropical house gecko	LC	LC		II
Monopeltis infuscata	Dusky spade-snouted worm lizard	LC	LC		II
Gerrhosaurus flavigularis	Yellow-throated plated lizard	LC	LC		II
Acontias breviceps	Short-headed legless skink	LC	LC		II
Trachylepis varia	Variable Skink	LC	LC		II
Leptotyphlops scutifrons	Peters' thread snake	LC	LC		
Lycphidion capense capense	Cape wolf snake	LC	LC		
Hemachatus haemachatus	Rinkhals	LC	LC		
Daypeltis scabra	Rhombic egg-eater	LC	LC		

7.3.2. Reptile Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2017), Global Red Data List (2015), that have experienced severe recent population declines, as well as those species, or populations of species, that are highly range restricted.

Of the ten reptile species that were recorded within the study area, none are listed as being of conservation concern on a regional or global basis.

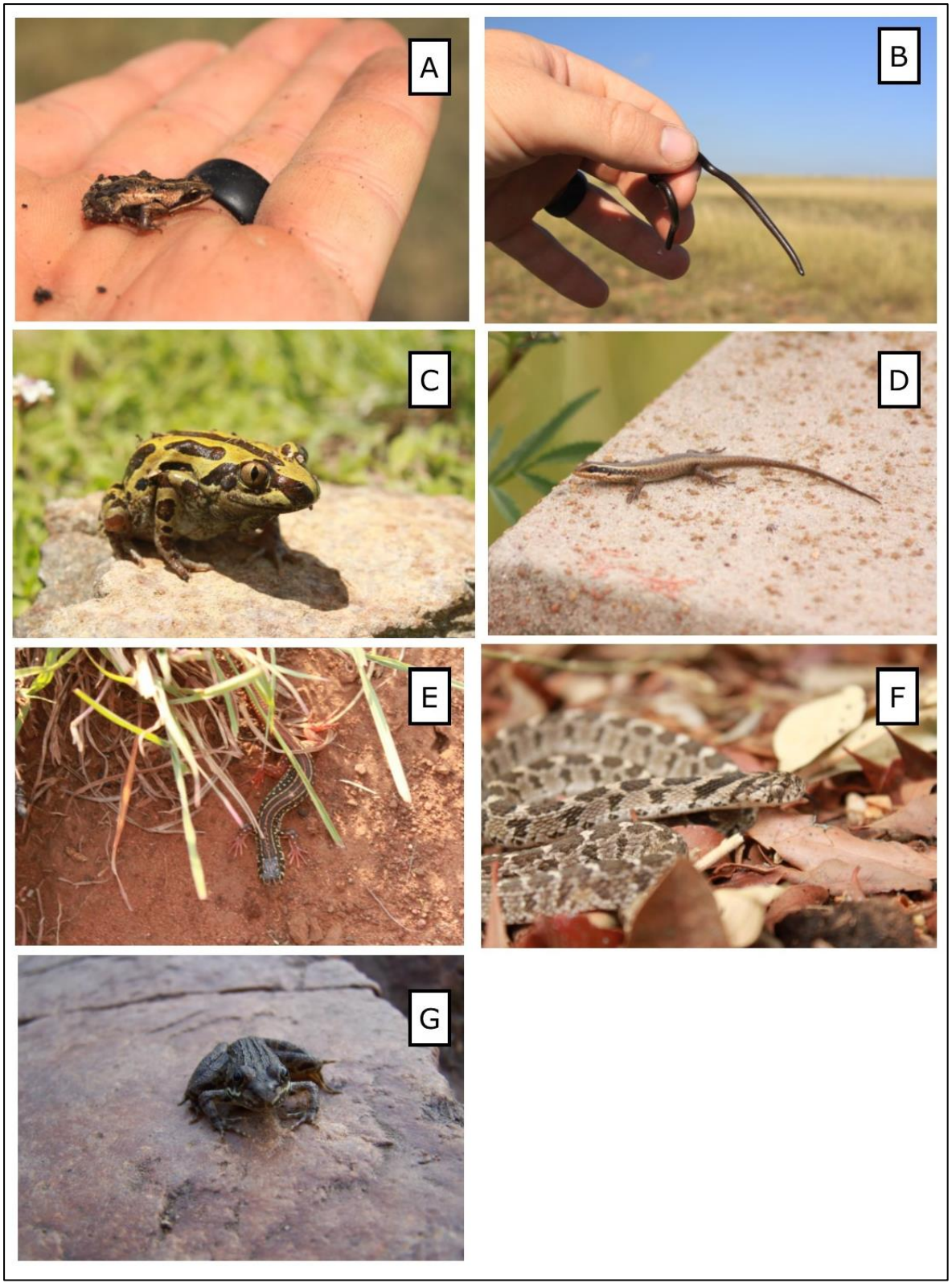

Figure 23: Photographic evidence of a selection of mammal species observed within the study area.

7.4. Faunal Habitat Analysis

7.4.1. Primary Grassland

The primary grassland found within the project site is regarded as structurally, moderate-high diverse/complex, with edaphic (soil) geological factors being the primary contributors to the complexity of the area. As mentioned within the botanical section (section 6.1.3), the variations found within this grassland included areas of natural clay, dolerite, loam soil, shallow rock turf, and sandstone outcrops. However, the most abundant of these areas were natural clayey grassland. These habitats generally provide good refugia and forage for faunal species, especially small mammal species, which in turn form the basis for the trophic food chain. These grasslands are also regarded as important breeding and foraging sites, especially for mammal species. Within the study area, these habitats represent, combined, the largest faunal habitat. The grasses in these habitats are very dense and of fair forage value. The moderate-high structural complexity (habitat and niche diversity) and strong foraging potential allows for a moderate species diversity for these areas, with species from most trophic levels being present. However, it must be reiterated that the poor and unusually low small mammal trapping success is likely an underestimated of the habitat's predicted total diversity. This is especially true for the rocky grasslands (sandstone and dolerite grassland), usually associated with higher points in the landscape, which showed excellent potential for mammal species. These rocky outcrops are mixed with rocky refugia (which provide structural complexity) to provide a slightly more sensitive habitat, especially for small mammals and reptile species. Thus, the species diversity within the rocky grasslands was still regarded as moderate.

The overall diversity, connectivity, and sensitivity of these areas can be regarded as **Moderate** (refer to Table 32).

7.4.2. Secondary Grassland

These are old cultivated lands that have either been anthropogenically re-seeded to serve as forage (pastures) for livestock, or have passively/"naturally" rehabilitated over time, with a fairly dense, natural vegetation cover. Although the grass layer was moderate to excellent, the fairly species poor nature of the habitat reduces habitat and foraging potential in comparison with the above-described natural habitats. The softer substrate is, however, more optimal for fossorial or burrowing species such as mole rats, mongooses, and porcupines.

The overall diversity, connectivity, and sensitivity of these areas were **Low** (refer to Table 32).

7.4.3. Agricultural fields

As discussed in the botanical section (section 6.1.4), this habitat type represents a fairly large habitat type within the study area and is mostly cultivated with maize, beans, and soya. Crop agriculture will be carried out on areas within the study area in order to maximise the land use potential of the land, and will seasonally provide structural refugia and some forage potential. This habitat type is almost completely transformed, although it provides temporary foraging habitat for granivorous rodent species as well as meso and small carnivores (due to the presence of rodents and other small to medium sized mammals). Finally, due to their optimal substrate, these areas are ideal for fossorial species.

The overall diversity, connectivity, and sensitivity of these areas were **Low** (refer to Table 32).

7.4.4. Disturbed Areas

As discussed in the botanical section (section 6.1.4), this habitat type represents fire breaks, farm tracks, access roads, and severely trampled areas. The vegetation cover within these areas are either sparse, or frequently mowed and/or removed. The soils within these areas are also usually hard and compacted. These hard and compacted areas, with a sparse vegetation cover, is a preferred habitat for small borrowing mammals such as the White-tailed Mongoose. The almost completely transformed habitat may also provide temporary foraging habitat for meso and small carnivores due to the presence of rodents and other small to medium sized mammals.

The overall diversity, connectivity, and sensitivity of these areas were **Low** (refer to Table 32).

7.4.5. Wetland Habitats

Wetlands and dams occur naturally or have been somewhat modified throughout the study area, and support surrounding agricultural practices. The wetland habitats found within the study area are regarded as structurally, moderate-high diverse/complex, with hydrological factors such as periods of soil saturation and inundation being the primary drivers and contributors to the complexity, especially in terms of vegetation structure and variation within these areas. Furthermore, the instream dams also contribute to the complexity of the area as these areas provide habitats which tend to be inundated for prolonged periods of time and contain areas which are densely covered by bulrushes and reeds. These wetland areas provide structural complexity and potential breeding/foraging habitat for various mammal and herpetofaunal species (especially amphibians) species.

The overall diversity, connectivity, and sensitivity of these areas were **High to Very-High** (refer to Table 32).

Table 32: Summary of the results of the faunal habitat sensitivity assessment.

Sensitivity Summary	Faunal Habitats				
	Undulating Grassland	**Rocky outcrop grassland**	**Fallow Lands**	**Agricultural Lands**	**Wetlands**
Observed Species Diversity	3 Reptiles; 24 Mammals 1 Amphibians	5 Reptiles; 7 Mammals 0 Amphibians	0 Reptiles; 5 Mammals 0 Amphibians	0 Reptiles; 2 Mammals 0 Amphibians	2 Reptiles 11 Mammals 6 Amphibians
Potential Species Diversity	Moderate-high	Low to Moderate	Low	Low	Moderate
Habitat Specialist	Mainly generalists	A combinations of habitat specialists and generalists	Mainly generalists	Mainly generalists	Mainly Habitat specialists
Observed Species of Conservation Concern	3 Southern African hedgehog, Serval, Brown hyena	1 Southern African hedgehog	0	0	2 Cape clawless otter, Vei rat
Protected Species	7 Mammals; 2 Reptiles	2 Mammals; 4 Reptiles	1 Mammal; 0 Reptile;	0 Mammal; 0 Reptile	3 Mammals; 1 Reptile
Structural Complexity (micro-habitat and niche space)	Moderate	Moderate to High	Low	Low	High
Habitat Integrity	Moderate	Moderate-High	Low	Low	High
Present Ecological Status	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	Unmodified, natural	Serious Modifications The change in ecosystem processes and loss of natural habitat and biota was great during the initial disturbance/ transformation, however some natural habitat features have returned and are now recognizable.	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	Largely to moderately modified A slight to moderate change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.
Food Availability	High	Moderate	Moderate to Low	Low	High
Connectivity	Moderate to High	Moderate to High	Moderate - Low	Low	Very High

Sensitivity Summary	Faunal Habitats				
	Undulating Grassland	**Rocky outcrop grassland**	**Fallow Lands**	**Agricultural Lands**	**Wetlands**
Important Structural and Landscape Elements	Natural areas fringing wetlands: Important migration and movement corridors				Important migration and movement corridors
Climate Resilience	Low	Moderate	Low	Low	Moderate
RATING	**Medium**	**Medium**	**Low**	**Low**	**Very High**

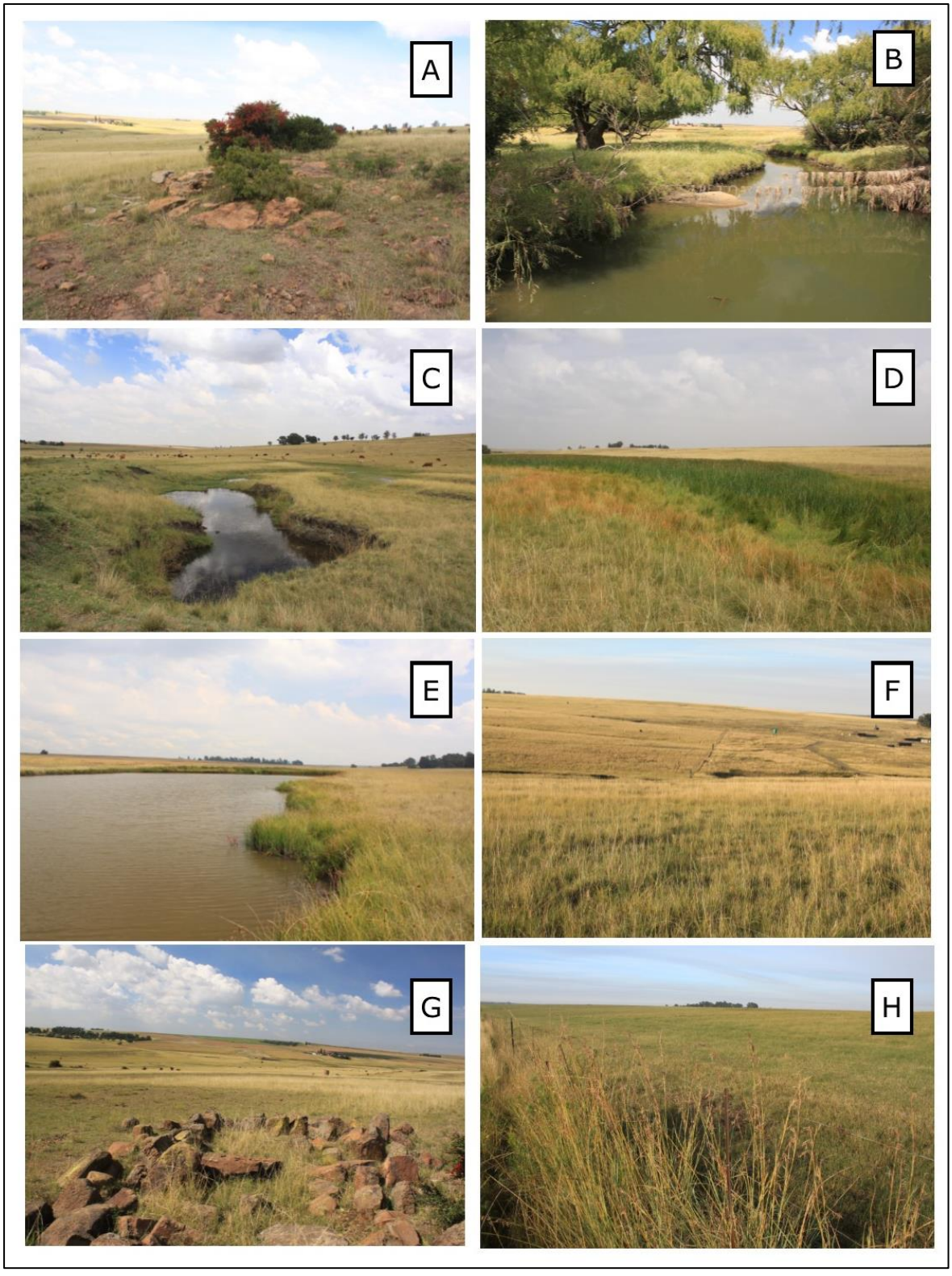

Figure 24: Faunal habitats A & G) Mid- and low slope rocky outcrops with many loose small rocks and few flakes and cracks. Outcrops are surrounded by undulating grassland. B) Fairly large pool within a valley-bottom wetland. Fringes are densely vegetated with grasses and sedges. C) Narrow and deep drainage channel with few rocks and fairly steep channel bank. Edges are well vegetated. D) Seepage Wetland densely vegetated with grass and sedge species. E) Artificial impoundment (Dam) with edges densely vegetated with grasses and sedges. F) Undulating grassland. H) Pasture that has recently been baled.

8. COMBINED SENSITIVITY (PLANT, ANIMAL AND TERRESTRIAL BIODIVERSITY THEMES)

The maps below (Figure 25, Figure 26) illustrate the sensitivities identified within the faunal, floral, and terrestrial biodiversity assessments.

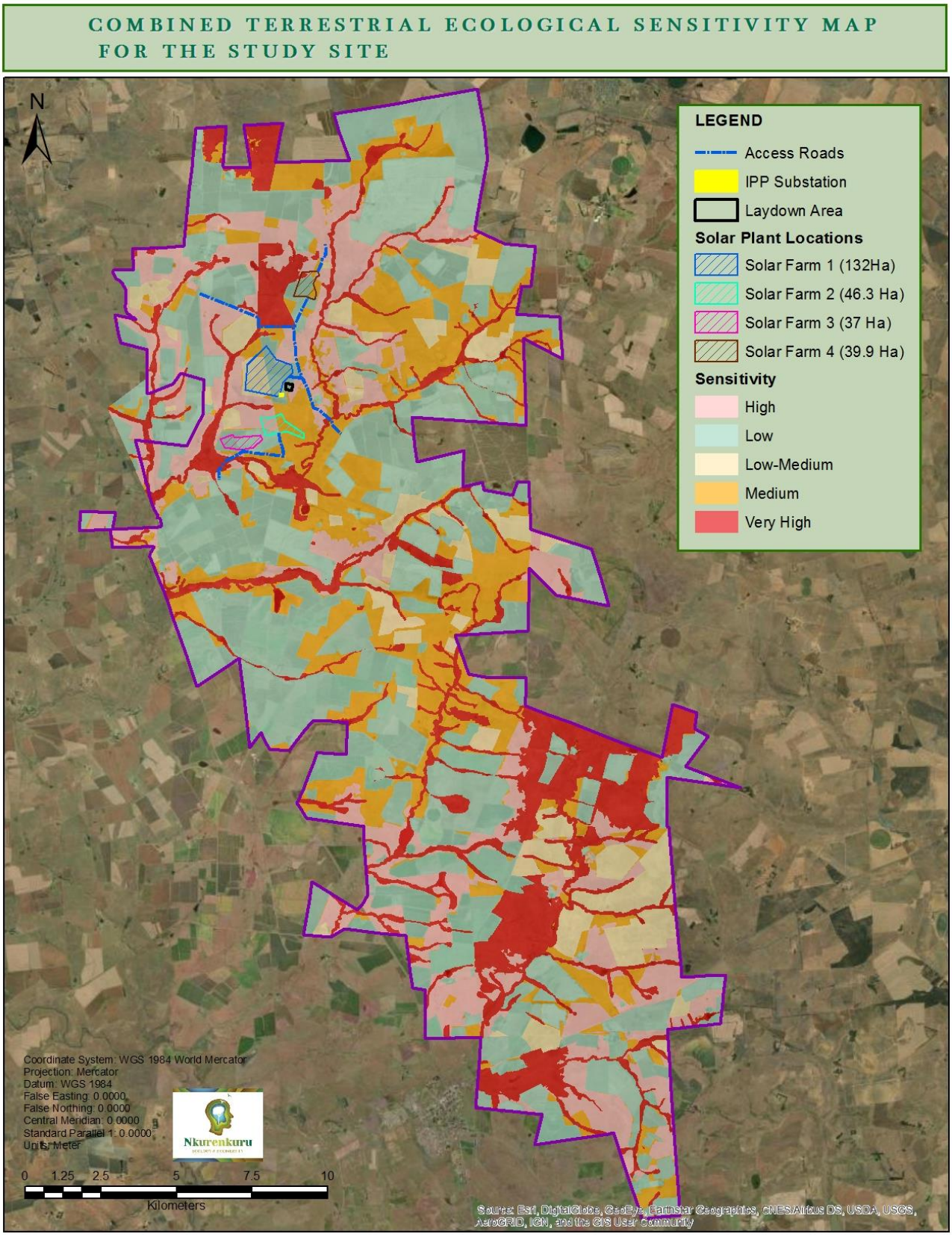

Figure 25: Mapping of the site sensitivity for the entire project/study area.

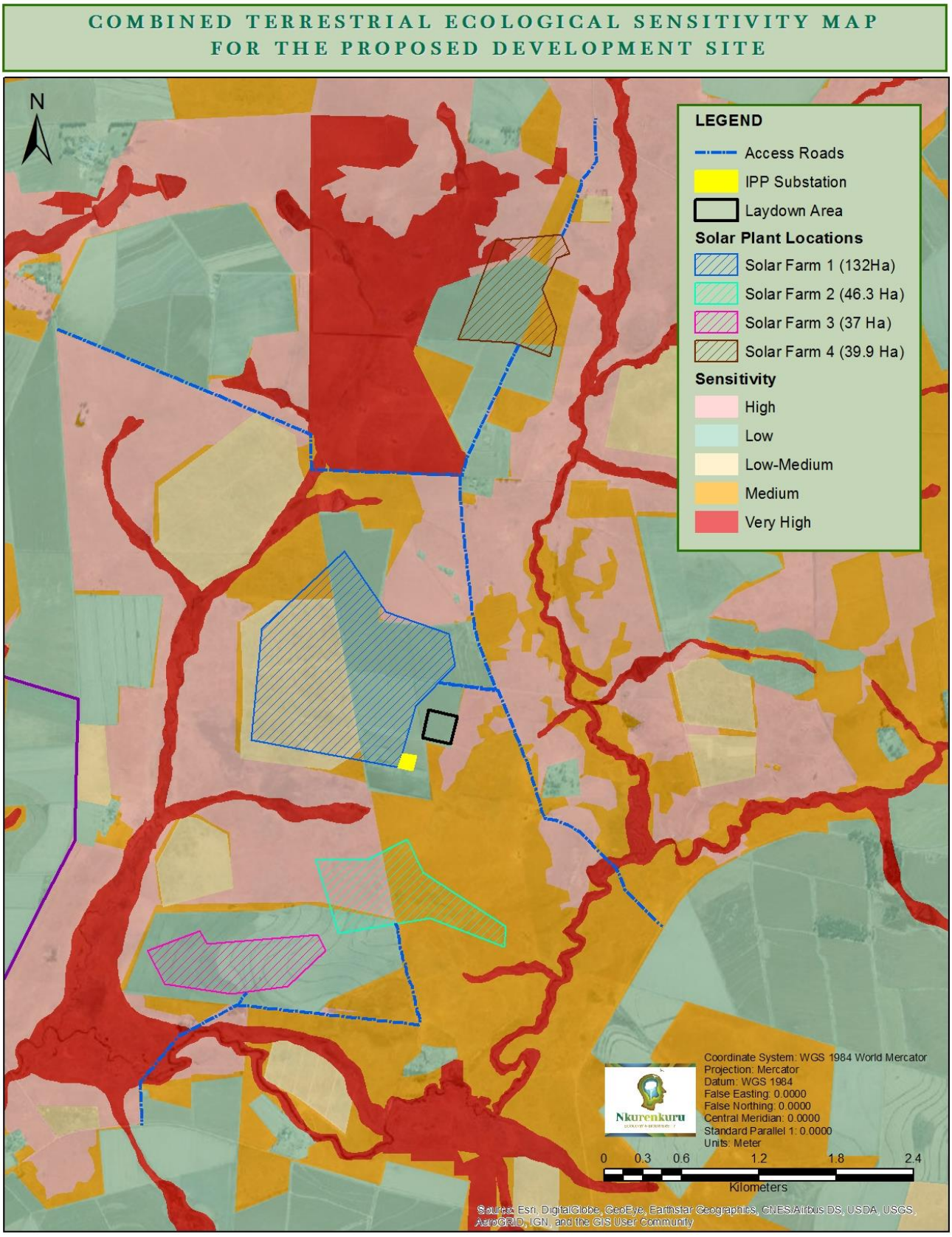

Figure 26: Mapping of the site sensitivity for the proposed development site and immediate surroundings.

9. ASSESSMENT OF PROPOSED IMPACTS

9.1. Assumptions

The following is assumed and/or known:

- A thorough ecological walkthrough of all footprint areas will be conducted to detect and map all protected species. These results should then be used during the permit application process for the removal/relocation, destruction, and disturbance of these protected species.
    - Such an investigation should be carried out by a suitably qualified botanist prior to commencement of construction, and
    - must be carried out at a time when the maximum number of species is actively growing and thus visible (preferably between November and February)
- Prior to development, and after construction, the development footprint will be routinely cleared of all alien invasive plants if detected.
- The construction phase itself will be associated with clearing of vegetation within the development footprint only.
- Where practically possible, the need for grading is expected to be minimal, limited mostly to contour buffer strips and/or small-scale levelling where necessary.
- All removal of vegetation for construction purposes will be done mechanically, without the use of herbicides for indigenous species and in the case of Invasive Alien Species only where deemed absolutely necessary and with the authorisation of the EO.
- A continuous vegetation layer is the most important aspect of ecosystem functionality within and beyond the project site.
    - A weakened or absent vegetation layer not only exposes the soil surface, but also lacks the binding and absorption capacity that creates the buffering functionality of vegetation to prevent or lessen erosion as a result of floods.
- All existing access and service roads will be used as far as possible.

9.2. Localised vs. cumulative impacts: some explanatory notes.

Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type, and abundance of species they contain. At the periphery of patches, influences of neighbouring patches become apparent, known as the 'edge effect'. Patch edges may be subjected to increased levels of heat, dust, desiccation, disturbance, invasion of exotic species, and other factors. Edges seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat.

Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts greater pressure on the dynamics and functionality of ecosystems (Perlman & Milder 2005).

Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. Thus, new power lines should follow routes of existing servitudes if such exist. Renewable energy facilities should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within close proximity, these developments should be situated as close together as possible, not scattered throughout the landscape.

Existing renewable energy projects that were considered in terms of their potential cumulative terrestrial ecological impacts, that are in an approximate 30 km radius of the Ummbila Emoyeni SEF, are illustrated below in Figure 27. Apart from the planned 666 MW Ummbila Emoyeni Wind Energy Facility, only four other renewable facilities are located within the 30 km radius namely:

- The proposed 9.5 MW Forzando North Coal Mine PV Solar Facility to the north; and
- the 95.9 MW Tutuka PV Solar Facility to the west;
- the proposed 200 MW Hendrina North WEF; and
- the proposed 200 MW Hendrina South WEF

The combined, cumulative footprint of all renewable energy projects (located within the 30 km radius) is approximately 1 418 ha, covering only 0.2% of the area within the 30 km radius. Of the 0.2%, the Ummbila SEF will contribute 17.98%.

Conclusion on cumulative impacts due to this and the surrounding developments:

- These renewable energy facilities (REFs) will impact a very small area of the 30 km area and will subsequently result in minimal transformation of intact habitats. Subsequently, the cumulative threat posed by these developments on the ecological functioning of these habitats are very small to insignificant, and it is unlikely that these REFS will result in significant habitat fragmentation, disruption of landscape connectivity, and impair the ability of these habitat types to respond to environmental fluctuations.
- The proposed Forzando North Coal Mine PV Solar Facility as well as the two Hendrina WEFs (200 MW South and 200 MW North) are located within another vegetation type (Eastern Highveld Grassland) and will subsequently not contribute to the cumulative impact on the Soweto Highveld Grassland.
- Even though the other REF developments are restricted to the vulnerable Soweto Highveld Grassland, sensitive habitats have been largely avoided, with most of the developments occurring within secondary and/or modified grasslands. As such, the

cumulative impact on such habitat types and the biodiversity they sustain will be very small.

» Excessive clearing of vegetation can, and will, influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, and this could also have detrimental effects on downslope freshwater resource systems.

  - Rehabilitation and revegetation of all surfaces disturbed or altered during construction is desirable.
  - Runoff from sealed surfaces, or surfaces that need to be kept clear of vegetation to facilitate operation of a development, must be monitored regularly to ensure that erosion control and stormwater management measures are adequate to prevent the degradation of the surrounding environment.

» Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.

  - A regular monitoring and eradication protocol must be part of all the developments' long term management plans.

» The loss of and transformation of intact habitats could compromise the status and ecological functioning of provincially identified CBAs. As already mentioned, all of the proposed REF developments are largely located in areas that have been classified as Moderately Modified, Heavily Modified, and Other Natural Areas, with very limited impacts on CBA and ESAs. In terms of the Ummbila SEF, most of the infrastructure located within Other Natural, Heavily Modified, and Moderately Modified Areas, with very minimal development within CBAs (Optimal and Irreplaceable Areas. Subsequently, according to the current layout, the Ummbila SEF will very slightly contribute to cumulative impacts on CBAs, but should not impact the conservation targets set out by the province.

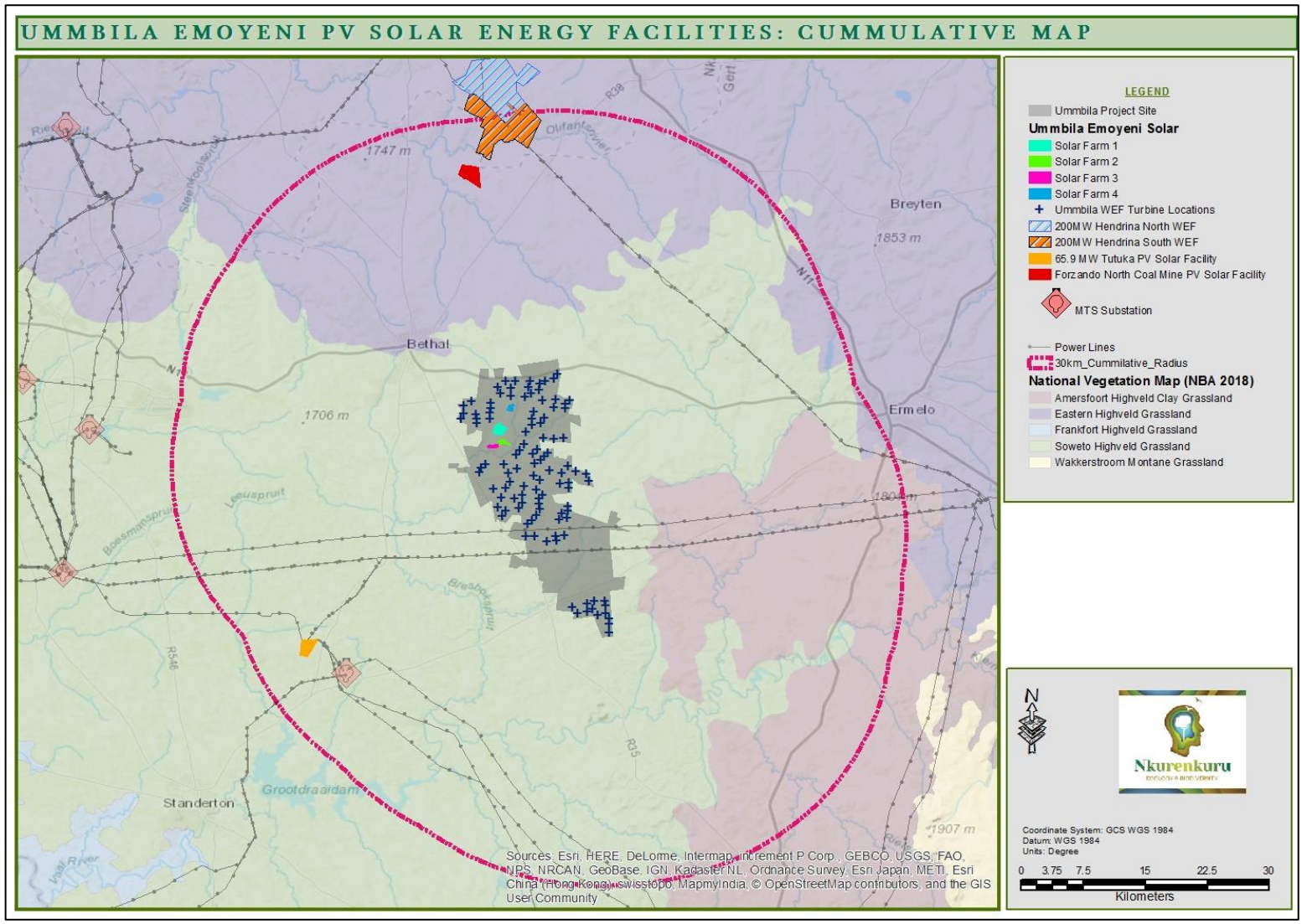

Figure 27: Location Map of the proposed Ummbila SEF relative to the other renewable facilities planned within a 30 km radius.

9.3. Identification of Potential Terrestrial Ecological Impacts and Associated Activities.

Potential ecological impacts resulting from the proposed development would stem from a variety of different activities and risk factors associated with the construction and operation phases of the project, and include the following:

Construction Phase

SEFs require an initial high intensity disturbance of a fairly large surface area including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary and the compaction of local soil within the development footprint. Concrete foundations for the framework on which the PV panels will be mounted. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with the construction of access and internal roads within the PV solar facility. The internal substation would also need to be constructed within the site. Temporary laydown and storage areas would need to be placed within the site for the construction works.

- Human presence and uncontrolled access to the site may result in negative impacts on fauna and flora through poaching of fauna and uncontrolled collection of plants for traditional medicine or other purpose.
- Site clearing and exploration activities for site establishment.
- Vegetation clearing could impact listed plant species. Vegetation clearing would also lead to the loss of vegetation communities and habitats for fauna and avifauna and potentially the loss of faunal as well as avifaunal species, habitats, and ecosystems. On a larger and cumulative scale (if numerous and uncontrolled developments are allowed to occur in the future) the loss of these vegetation communities and habitats may potentially lead to a change in the conservation status of the affected vegetation type, as well as the ability of this vegetation type and associated features to fulfil its ecological responsibilities (functions). The above impact is most likely to be low due to the fact that most of the development area is situated within an area which has been somewhat degraded due to long term overgrazing.
- Soil compaction and increased erosion risk would occur due to the loss of plant cover and soil disturbance created during the construction phase. This may potentially impact the downstream watercourses, wetlands, and aquatic habitats, mainly due to an increase of surface water and silt inflow from the surrounding disturbed areas (these potential impacts on downslope wetland features have been assessed within the freshwater resource study and assessment). These potential impacts may result in a reduction in the buffering capacities of the landscape during extreme weather events.
- Movement of construction vehicles and placement of infrastructure within the boundary of the drainage line may lead to the disturbance of these habitats, removal

of vegetation cover and a potential increase in erosion, which may eventually spread into downstream areas.

- Invasion by alien plants may be attributed to excessive disturbance to vegetation, creating a window of opportunity for the establishment of these alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the study area by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species.
- Presence and operation of construction machinery in the study area. This will create a physical impact as well as generate noise, potential pollution, and other forms of disturbance in the study area.
- Increased human presence can lead to poaching, illegal plant harvesting, and other forms of disturbance such as fire.

Operation Phase

During the operation phase the facilities will operate continuously, mostly unattended and with low maintenance required for the duration of the SEFs lives (±20 years). The SEFs is likely to be monitored and controlled remotely, with maintenance only taking place when required.

The PV panels as well as the hard surfaces created by the development may lead to increased runoff (reduction in infiltration) and the potential interception and channelling of surface runoff, particular on surfaces with a steeper gradient. This may potentially lead to:

- A modification to the surface runoff and infiltration patterns;
- Increased erosion;
- Sedimentation of the downslope areas; and
- Impairment of nearby located freshwater resource features' functions and services

Subsequently, a localised long-term impact (more than 20 years) of moderate to low intensity could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

Decommission Phase

- During decommissioning, the potential impacts will be very similar to that of the Construction Phase, although with slightly lower significance.

Cumulative Impacts

- The loss of vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets.
- Transformation of intact, sensitive habitats could compromise the ecological functioning of these habitats and may contribute to the fragmentation of the landscape, and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.
- The loss of biodiversity may be exacerbated.
- Invasion of exotics and invasive species into the broader area may also potentially be exacerbated.
- The loss of and transformation of the Ecological Support Areas could impact the Province's ability to meet its conservation targets.

The impacts identified above are assessed below, during the construction, operation, and decommissioning phases of the facility, as well as before and after mitigation.

The majority of impacts associated with the development would occur during the construction phase as a result of the disturbance associated with the operation of heavy machinery in the study area and the presence of construction personnel. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarised below before the impacts are assessed. These are not necessarily a reflection of the impacts that would occur, but rather a discussion on overall potential impacts and/or extent of these potential impacts that would occur if mitigation measures are not considered and/ or sensitive areas not avoided. The assessment of these impacts is outlined in the following section.

Impact 1. Potential impacts on vegetation and listed or protected plant species

As already mentioned, the most likely and significant impact will be on the vegetation located within the development area and development footprint of the proposed facility. The proposed development may lead to a direct loss of vegetation. Some loss of vegetation is an inevitable consequence of the development.

At Vegetation Level:

Consequences of the impact occurring may include:

- general loss of habitat for sensitive species;
- loss in variation within sensitive habitats due to loss of portions of it;
- general reduction in biodiversity;
- increased fragmentation (depending on location of impact);
- disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- loss of ecosystem goods and services.

Although the development will impact the described vulnerable vegetation type (Soweto Highveld Grassland), at a relative, local scale, it is highly unlikely that this development will impact on the status of this vegetation type (impact on a regional scale) due to the fact that most of the infrastructure will be located outside of natural, intact grassland (within secondary grasslands, old cultivated areas, and degraded areas).

At species level:

No Red Data or highly range restricted plant species (plant SCC) were observed within the study area; however, the following protected species were observed within the study area;

- *Aloe ecklonis*
- *Boophone disticha*
- *Crinum bulbispermum*
- *Gladiolus ecklonii*
- *Gladiolus woodii*
- *Haemanthus humilis subsp. hirsutus*

Red data, declining, and highly range restricted species (Species of Conservation Concern or SCC) are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Due to the fact that no such plant SCC were recorded within the study area, any impacts on such species/populations will be avoided.

The protected species recorded within the study area are fairly abundant within the region, and some loss of these species are regarded as acceptable, and will not threaten important populations of these species. Furthermore, the nature and extent of impacts on these species can be evaluated, and the impacts can be mitigated to an extent through avoidance of identified sensitive areas, and the search-and-rescue of some of these protected species, that have the potential to establish successfully after relocation.

Impact 2. Direct Faunal impacts

Faunal species will primarily be affected by the overall loss of habitat. Increased levels of noise, disturbance, potential pollution, and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species and species confined and dependent on specified habitats would not be able to avoid the construction activities and might be at risk. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the

large number of construction personnel that are likely to be present. This impact is highly likely to occur during the construction phase and could also potentially occur with resident fauna within the facility after construction.

Threatened species (red data species) include those listed as Critically Endangered, Endangered, or Vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species and possible extinction. This may arise if the proposed infrastructure is located where it will impact on such individual or populations. Consequences may include:

» fragmentation of populations of affected species;
» reduction in the area of occupancy of affected species; and
» loss of genetic variation within the affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival.

As already mentioned, faunal diversity within the study area, and also within the surrounding environment, is moderate to low.

» Only three animal SCC were recorded within the study area, namely *Parahyaena brunnea* – Brown hyena (Near Threatened), *Leptailurus serval* – Serval (Near Threatened) and *Aonyx capensis* – Cape clawless otter (Near Threatened). Even though these species are fairly rare within the area, all of these species have a fairly widespread distribution within their distribution region. In terms of the likely impacts of the development on these species, habitat loss is not likely to be highly significant as the direct footprint of the development is not likely to exceed a few hundred hectares and this would not be significant in context of the relatively homogenous and intact surrounding landscape. Furthermore, development within the freshwater resource features, as well as buffer areas, will be largely avoided, and is restricted to minimal access road construction. As such the preferred habitat for Cape clawless otter, and to some extent for Serval, will be avoided, with ample foraging available. Subsequently, it is highly unlikely that this development will threaten local individuals and populations of animal SCC.
» Furthermore, impacts on the general animal populations are likely to be low due to a fairly small development footprint, the vast extent of available natural habitats, and the fact that very limited development will occur within "sensitive" faunal habitats. The extent of development that will occur within these habitats are regarded as acceptable (within the implementation of mitigation measures) and will not result in a reduction in local faunal biodiversity and the fragmentation of important faunal populations.

During the construction phase noise generated may cause some temporary disturbances although it is expected that this will not deter these species.

Disturbance of faunal species can be maintained to a minimum and low significance by implementing effective mitigation measures. Most of the naturally occurring species are mobile and will most likely move away from the development area during the construction phase. The observation of less mobile species such as tortoises, snakes, and potential amphibian species should be prioritised, and where encountered should either be relocated as recommended by the ECO or be left undisturbed if the development will not affect the species (e.g. toads and frogs of nearby wetland habitats).

Impact 3. Soil erosion and associated degradation of ecosystems

This impact, along with the loss of vegetation, is probably the most significant impact that may occur due to the proposed development. Soil erosion is a frequent risk associated with SEFs on account of the vegetation clearing and disturbance associated with the construction phase of the development and will continue occurring throughout the operation phase. Service roads and installed infrastructure will generate increased direct runoff during intense rainfall events and may exacerbate the loss of topsoil and the effects of erosion. These eroded materials may enter nearby watercourses and may potentially impact these systems through siltation and changes in water chemistry and turbidity. Current erosion patterns observed within the affected farm properties were moderate.

With effective mitigation measures in place, including regular monitoring of the occurrence, spread and potential cumulative effects of erosion, may be limited to an absolute minimum.

Impact 4. Alien Plant Invasions

Major factors contributing to invasion by alien invader plants include habitat disturbance and associated destruction of indigenous vegetation. Consequences of this may include:

- change in the vegetation structure leading to change in various habitat characteristics and loss of indigenous vegetation;
- replacement of palatable species with unpalatable species therefore reducing the grazing capacity of the area;
- change in the plant species composition;
- change in soil chemistry properties;
- loss of sensitive habitats (e.g. downstream watercourses and wetlands);
- loss or disturbance to individuals of rare, endangered, endemic, and/or protected species;
- fragmentation of sensitive habitats;
- change in vegetation flammability, depending on alien species; and
- impairment of wetland function.

The affected farm properties mostly contain fairly low levels of IAPs. These IAPs may be a threat during the construction phase and throughout the operation phase, and will require regular and careful monitoring. With effective and meticulous mitigation measures in place this can be achieved.

Impact 7. Impacts on broad-scale ecological processes

Ecological processes generally occupy larger areas than biodiversity pattern features. They are also more difficult to measure and map. For current purposes, inferred ecological processes are associated with whole habitats, specific habitat patches, or any other part of the landscape that can be spatially defined and mapped.

Important ecological processes operating at the site include:

» Climate-change refuge habitats: These are areas or habitats that have moderated microclimates relative to the broader landscape and allow species to persist in a landscape that has an otherwise incompatible climate. At the site such habitats include:

    - Larger aquatic ecosystems

» Climate resilience and the provision of ecological infrastructure and services: Natural grasslands are regarded as remarkable and irreplaceable biodiversity assets of global significance. In South Africa, grassland plant diversity is second only to that of the Fynbos Biome, and grassland ecosystems are home to a large number of the country's rare, endangered, and endemic animal species. Grasslands are critically important water production landscapes and also provide the natural resources and ecological infrastructure that supports most of South Africa's important economic activities, and millions of rural livelihoods. Ecological infrastructure is the stock of functioning ecosystems that provides a flow of essential system services to human communities — services such as the provision of fresh water, climate regulation, and soil formation. Ecological infrastructure includes features such as healthy mountain catchments, rivers, wetlands, and nodes and corridors of natural grassland habitat which together form a network of interconnected structural elements within the landscape. If this ecological infrastructure is degraded or lost, the flow of ecosystem services will diminish and ecosystems will become vulnerable to shocks and disturbances, such as the impacts of climate change, unsustainable land use change, and natural disasters like floods and droughts. It is important to note that when ecological infrastructure is degraded or fails, the direct monetary cost to society and government is often very high. Ecological infrastructure is, therefore, the nature-based equivalent of hard infrastructure, and is just as important for providing the vital services that underpin social development and economic activity.

Grassland ecosystems provide many essential ecosystem services, underpinned by a rich biodiversity and diverse ecosystem processes. Important local and large-scale ecosystem services provided by grasslands include:

- Water production, water purification, and flood attenuation.
- Good quality forage for animal production.
- Nutrient-cycling and carbon sequestration and storage.
- Pollination services.
- Support for livelihoods such as thatching and weaving.
- Medicinal and food plants.
- Cultural, heritage, and recreational amenities, often with significant tourism value.
- Deep, nutrient-rich soils.

» Water production landscapes: Grasslands are critically important water production landscapes, playing a vital role in maintaining the quality and quantity of water entering rivers, streams, and aquifers. The nature of the herbaceous vegetation in grasslands, both above and below ground, forms an effective substrate for capturing water, maximising infiltration, limiting erosive run-off, and reducing soil loss. In this way, these ecosystems play a role in augmenting and regulating stream flow by holding water in the soil profile, or within wetlands, and slowly releasing it into rivers and streams, thereby maintaining vital base flows in the dry seasons. Grasslands account for more than half of the Strategic Water Source Areas of the country — areas that cover less than 5% of South Africa's land surface, but that receive the majority of its rainfall, and yield more than 80% of all water run-off. At least five major river systems have their headwaters in grasslands, and 34% of the country's remaining wetlands occur in grassland landscapes.

The study area itself is characterized by numerous wetland features and upper foothill/transitional watercourses, forming part of the headwater catchment of economically and ecologically important Vaal River. These freshwater resource features provide valuable ecological services and functions, locally as well as downstream (refer to Table 33 below).

Table 33: Important local and large-scale ecological functions and services provided by freshwater resource features.

Wetland Benefits (goods and services)	Indirect Benefits	
	Hydrological Benefits	Water purification Flood attenuation Stream flow augmentation Sustained stream flow Ground water recharge/discharge Erosion control
	Biodiversity conservation – integrity and irreplaceability	

		Chemical cycling
	Direct Benefits	Water supply
		Provision of harvestable resources
		Socia-cultural significance
		Tourism and recreation
		Education and research

» Island biogeography. In nature, size matters and larger patches of habitat support more species and are more resilient to ecological perturbation. Within the Mesic Highveld Grassland large tracts of natural vegetation have been transformed through cultivation, plantation forestry, mining, and urban settlement and have contributed to landscape fracturing. Within the study area and surrounding area, especially cultivation practices, and to some extent habitat degradation due to overgrazing, have resulted in the cumulative transformation of large tracts of natural grassland. Natural grassland currently has a somewhat patchy distribution within the landscape. Landscape connectivity within the study area is, however, still regarded as fairly acceptable with fairly large continuous grassland tracts still present. The persistence/survival of these natural continuous grassland areas are mainly due to the numerous wetlands and watercourses, as well as the hillier areas, as these areas are not deemed arable.

» Species movement. The numerous interconnected wetland and watercourse features potentially function as important corridors for the movement of fauna as well as flora. Activities that reduce the ability of these habitats to facilitate species movement will have a potentially disproportionately large regional impact on species movement.

The contribution of this development to the impacts on the above described broad-scale ecological processes is regarded as very small, due to:

» the relatively small development footprint;
» the fact that the bulk of the development will be restricted to disturbed/transformed/degraded areas with minimal development within primary natural grassland. Furthermore, most of the infrastructure, planned within the natural areas, are located near the edge of these natural areas.

9.4. Assessment of Impacts

CONSTRUCTION PHASE	
Impact 1: Potential impacts on vegetation and listed or protected plant species.	
Environmental Parameter	Vegetation and protected plant species
Issue/Impact/Environmental Effect/Nature	Vegetation clearing for access roads, turbines and their service areas, and other infrastructure will impact on vegetation and protected plant species.

	Impacts on vegetation and protected plant species would occur due to the construction of the facility and associated infrastructure. This impact is regarded as the most likely and significant impact and will lead to direct loss of vegetation, including protected species. The most likely consequences include: » local loss of habitat (to an extent as a natural ground covering will be maintained where possible); » very small and local disturbance to processes maintaining local biodiversity and ecosystem goods and services; and » a potential loss of a few local protected species.

	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Whole Site (2)	Whole Site (2)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (4)
Probability	Definite (5)	Highly Probable (4)
Significance	**High (65)**	**Medium (40)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes, to a large extent	

Mitigation Measures	» Preconstruction walk-through of the final development footprint for protected species that would be affected and that can be translocated. » Since a large proportion of the identified protected species at the site are geophytes, the potential for successful translocation is high. Before construction commences individuals of listed species within the development footprint that would be affected, should be counted, and marked and translocated where deemed necessary by the ecologist conducting the pre-construction walk-through survey, and according to the recommended ratios. Permits from the relevant provincial authorities will be required to relocate and/or disturb listed plant species. » Any individuals of protected species affected by, and observed within, the development footprint during construction should be translocated under the supervision of the ECO and/or Contractor's Environmental Officer (EO). » Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas, etc. » Demarcate all areas to be cleared with construction tape or similar material where practical. However, caution should be exercised to avoid using material that might entangle fauna.

	» ECO and/or Contractor's EO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority vegetation clearance is taking place. » Ensure that laydown areas, construction camps and other temporary use areas are located in areas of low and medium sensitivity and are properly fenced or demarcated as appropriate and practically possible. » All vehicles to remain on demarcated roads and no unnecessary driving in the veld outside these areas should be allowed. » Regular dust suppression during construction, if deemed necessary, especially along access roads. » No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purpose without express permission from the ECO and or Contractor's EO. » No fires should be allowed on-site.
Residual Impacts	Due to the shade effect of the solar panels some transformation of vegetation is likely to occur underneath the panels. As this area is already, to some extent, in a transformed state, further transformation due to the shading effect is **not likely to be significant**. However, any transformations caused by the development will take a very long time to restore and as such is regarded as a residual impact.
Impact 2: Direct Faunal Impacts.	
Environmental Parameter	Faunal impacts due to construction activities
Issue/Impact/Environmental Effect/Nature	Increased levels of noise, pollution, disturbance, and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.

	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Whole Site (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (24)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Noise and disturbance during the construction, decommission and during maintenance phases cannot be avoided but would be transient in nature, and with appropriate mitigation no long-term impacts from the construction phase can be expected.	

Mitigation Measures	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person. » The collection, hunting, or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site. » Fires should not be allowed on site. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel, and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All construction vehicles should adhere to a low speed limit (30 km/h) to avoid collisions with susceptible species such as snakes and tortoises. » Construction vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).	
Residual Impacts	The altered development area will contain a lower diversity of habitat types and niches for faunal species; however, faunal diversity was in any case confirmed to be limited and as such this potential residual impact can be regarded as low.	
OPERATIONAL PHASE		
Impact 3: Soil erosion and associated degradation of ecosystems.		
Environmental Parameter	Ecosystem integrity and the delivery of ecosystem services such as grazing and clean water.	
Issue/Impact/Environmental Effect/Nature	Following construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Erosion is one of the greater risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Very Short Duration (1)
Magnitude	Moderate (7)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (60)**	**Low (15)**
Status	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily	High
Irreplaceable loss of resources	Potential loss of important resources.	No
Can impacts be mitigated?	Yes, to a large extent	

Mitigation Measures	» Any erosion problems observed along access roads or any hardened/engineered surface should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » All bare areas (excluding agricultural land and the development footprint), affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible » Roads and other disturbed areas should be regularly monitored for erosion problems, and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation. » Topsoil must be removed and stored separately from subsoil. Topsoil must be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. » Practical phased development and vegetation clearing must be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.
Residual Impacts	The loss of fertile soil and soil capping resulting in areas which cannot fully rehabilitate itself with a good vegetation cover. With appropriate avoidance and mitigation residual impacts will be very low.

Impact 4: Alien Plant Invasion.		
Environmental Parameter	Biodiversity, ecosystem integrity, and the delivery of ecosystem services such as forage.	
Issue/Impact/Environmental Effect/Nature	Increased alien plant invasion is one of the greatest risk factors associated with this development following the construction phase. The disturbed and bare ground that is likely to be present at the site during and after construction would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Very Short Duration (1)
Magnitude	Moderate (6)	Small (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (12)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Potential loss of important resources due to the replacement of natural vegetation by invading alien plants	No

Can impacts be mitigated?	Yes
Mitigation Measures	» The successful reduction in the treat (significance) posed by Alien Invasive Plants relies on a detailed; o Site-specific eradication and management programme for alien invasive plants; o Site-specific Vegetation Rehabilitation Management Plan; and o The meticulous implementation of this Management Plan. » Such an Alien Invasive and Vegetation Rehabilitation Management Plan must subsequently be included in the Environmental Management Programme (EMPr). » Regular monitoring by the operation and maintenance team for alien plants must occur and could be conducted simultaneously with erosion monitoring. » When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels. » Clearing methods must aim to keep disturbance to a minimum. » No planting or importing any listed invasive alien plant species (all Category 1a, 1b, 2, and 3 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.
Residual Impacts	If the above recommended mitigation measures are strictly implemented, and some re-establishment and rehabilitation of natural vegetation is allowed, the residual impact will be very low.
DECOMMISSIONING PHASE	
Impact 5: Direct Faunal Impacts.	
Environmental Parameter	Faunal impacts due to decommissioning activities
Issue/Impact/Environmental Effect/Nature	Increased levels of noise, pollution, disturbance, and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna would move away from the area during this phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Whole Site (2)	Local (1)
Duration	Short Duration (2)	Short Duration (2)
Magnitude	Minor (3)	Minor (3)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (28)**	**Low (12)**
Status	Negative	Negative
Reversibility	High	High

Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Noise and disturbance during the decommission and during maintenance phases cannot be avoided, but would be transient in nature and with appropriate mitigation no long-term impacts from the construction phase can be expected.	
Mitigation Measures	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site. » Fires should not be allowed on site. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel, and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises. » Vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).	
Impact 6: Soil erosion and associated degradation of ecosystems.		
Environmental Parameter	Ecosystem integrity and the delivery of ecosystem services such as grazing and clean water.	
Issue/Impact/Environmental Effect/Nature	Following decommission, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Very Short Duration (1)
Magnitude	Moderate (6)	Small (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily	High
Irreplaceable loss of resources	Potential loss of important resources.	No
Can impacts be mitigated?	Yes, to a large extent	
Mitigation Measures	» Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur.	

	» There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures. » All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible.
Impact 7: Alien Plant Invasion.	
Environmental Parameter	Biodiversity, ecosystem integrity, and the delivery of ecosystem services such as forage.
Issue/Impact/Environmental Effect/Nature	Increased alien plant invasion is one of the greatest risk factors associated with this development following the decommission phase. The disturbed and bare ground that is likely to be present at the site during and after decommission would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Very Short Duration (1)
Magnitude	Moderate (6)	Small (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (12)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Potential loss of important resources due to the replacement of natural vegetation by invading alien plants	No
Can impacts be mitigated?	Yes	

Mitigation Measures	» The successful reduction in the threat (significance) posed by Alien Invasive Plants relies on a detailed; o Site-specific eradication and management programme for alien invasive plants; o Site-specific Vegetation Rehabilitation Management Plan; and o The meticulous implementation of this Management Plan. » Such an Alien Invasive and Vegetation Rehabilitation Management Plans must subsequently be included in the Environmental Management Programme (EMPr). » Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular

	control must be implemented until a cover of indigenous species (ideally climax species) has returned. » When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels. » Clearing methods must aim to keep disturbance to a minimum. » No planting or importing of any listed invasive alien plant species (all Category 1a, 1b, 2, and 3 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.

CUMULATIVE IMPACTS		
Impact 8: Impact on Critical Biodiversity Areas and broad-scale ecological processes.		
Environmental Parameter	Broad-scale ecological processes, especially habitat fragmentation.	
Issue/Impact/Environmental Effect/Nature	Transformation of intact habitats could potentially compromise ecological processes, as well as ecological functioning of important habitats, and would contribute to the fragmentation of the landscape and potentially disrupt the connectivity of the landscape for fauna and flora, and impair their ability to respond to environmental fluctuations.	
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects within the area**
Extent	Local (1)	Regional (4)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (4)	Minor (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (20)**	**Medium (39)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation Measures	» The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. » An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland. » Reduce the footprint of the facility within sensitive habitat types as much as possible. » All disturbed areas that are not used, such as excess road widths, should be rehabilitated with locally occurring plant species after construction to reduce the overall footprint of the development.	

Impact 9: Cumulative loss of natural grassland and wetland/watercourse habitats (associated with Soweto Highveld Grassland).		
Environmental Parameter	The ecosystem has been classified as Endangered with a conservation target of 24%. Currently only 0.2% is conserved (statutorily or other reserves) whilst 52.7% of the ecosystem have already been transformed	
Issue/Impact/Environmental Effect/Nature	Cumulative loss of natural Soweto Highveld Grassland and further increase in the fractured nature of the landscape may lead to the loss of features responsible for maintaining biodiversity and providing ecosystem goods and services and may potentially lead to; » A change in the status of the Grassland, subsequently also reducing the ability to meet national conservation obligations and targets; » A reduction in biodiversity and even the loss of some species from the area; » Fracturing and isolation of landscapes may cut off important migration routes and prevent genetic variability, thus reducing "genetic health", which may in turn lead to weaker species incapable to adapt and react to potential environmental changes, and consequently also to a reduction in biodiversity and the extinction of some species from certain areas. » The loss of important corridors essential for some species to allow for movement between important habitat types crucial for the survival of these species.	
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects within the area**
Extent	Local (1)	Regional (4)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small (2)	Minor (3)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (24)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation Measures	» The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. » An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as in the adjacent rangeland. » Reduce the footprint of the facility within sensitive habitat types as much as possible.	

	» All disturbed areas that are not used, such as excess road widths, should be rehabilitated with locally occurring grasses after construction to reduce the overall footprint of the development. » Small to medium sized mammals can be allowed to move between the development area and surrounding areas by creating artificial passageways underneath boundary fences (this is optional and may be implemented by developer if deemed necessary).

10. CONCLUSION

Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of a commercial Solar Energy Facility and associated infrastructure on a site located ~6km south-east of Bethal and 1km east of Morgenzon, within the Mpumalanga Province.

From a botanical and ecological perspective, it was found that the development area mostly comprised of either "low" (171.21 ha; 50.8%) or "moderate-low" (79.04 ha; 23.5%).

Apart from the three wetland crossings, no other infrastructure associated with this development will occur within or near drainage areas ("very high" sensitivity). Natural primary grasslands classified as CBA Optimal Areas have been classified as "high" sensitivity, whilst natural primary grassland classified as CBA Irreplaceable Areas are classified as "very high" sensitivity. The proposed development will impact very limited areas of "very high" (2.75 ha) and "high" (31.71 ha) sensitivity. These areas that will be impacted are typically located at the edge of the boundary of these features and as such the development will not result in the fracturing of these sensitive features. Furthermore, the potential impact on "very high" and "high" sensitivities will likely be smaller than the 2.45 and 31.71 ha, when taking into account that the bulk of the access routes are planned along existing routes (fairly broad farm roads, >7m and narrower farm twin tracks). Thus, these roads will be merely upgraded and impacts on natural vegetation will be limited. Only 0.55 km of new road (4% of the planned total road network) will be constructed. sensitivity. The bulk of the development is however, planned within cultivated areas (51%, 171.21 ha) and secondary grassland (23%, 79.04 ha), these areas are irrespectively classified as "low" and "low-medium" sensitive areas. Furthermore, 15% (51.39 ha) of the proposed development footprint is planned within primary grassland that fall outside of any CBAs ("medium" sensitivity).

A total of 198 plant species were found within the project/study area, which consisted of 158 native, 0 Red List, 6 protected, 0 Mpumalanga endemic, 39 alien, and 11 NEM:BA listed invasive species.

A total of 32 mammal, 6 amphibian, and 10 reptile species were recorded within the project/study area. No amphibian or reptile SCC were recorded within the study area; however, 4 mammal SoCC were recorded, namely: Serval (Near Threatened), Brown hyena (Near Threatened), Vlei rat (Near Threatened), Cape clawless otter (Near Threatened), and South African hedgehog (Near Threatened). It was determined that the development will not detrimentally impact these populations/individual SCC.

There are no impacts associated with the proposed PV solar energy development that cannot be mitigated to a low level. Its local environmental impact can be reduced to an acceptable magnitude. Likewise, the contribution of the proposed PV solar energy development to the cumulative impact in the area would be low and is acceptable. As such, there are no fatal flaws associated with the development and no terrestrial ecological

considerations that should prevent it from proceeding. Therefore, it is the opinion of the specialists that the development may be authorised within the specified area, subject to the implementation of the recommended mitigation measures.

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12. APPENDICES

Appendix 1 Plant Species List (Site and POSA Generated List)

The species list presented here is a combination of online (POSA) and study area survey data. Descriptions of colours and symbols are given below:

Species in **bold**:	Species that were found in the study area.
Species marked with "*":	Protected species.
Species marked with "†":	Red List species.
Species highlighted in blue:	Alien species.
Species marked with NEM:BA:	Alien species listed in the NEM:BA Alien and Invasive Species Regulations.
Species marked with MPE:	Mpumalanga Endemic.
Small letters in []:	Vegetation/land type in which the species was found:

- a: Disturbed
- b: Drainage
- c: Fallow Land
- d: Natural Clay
- e: Natural Dolerite
- f: Natural Loam Soil
- g: Natural Rock Turf
- h: Natural Sandstone

Family	Species	IUCN	Family	Species	IUCN	Family	Species	IUCN
Cyperaceae	*Abildgaardia ovata*	LC	Poaceae	*Eleusine coracana* subsp. *africana*	LC	**Ophioglossaceae**	***Ophioglossum reticulatum*[d]**	**LC**
Fabaceae	*Acacia dealbata*(NEM:BA)	NE	Poaceae	*Elionurus muticus*	LC	Hyacinthaceae	*Ornithogalum candicans*	LC
Euphorbiaceae	*Acalypha angustata*	LC	Hypoxidaceae	*Empodium elongatum*	LC	Hyacinthaceae	*Ornithogalum capillare*	LC
Euphorbiaceae	*†Acalypha caperonioides* var. *caperonioides*	DD	Poaceae	*Enneapogon scoparius*	LC	Hyacinthaceae	*Ornithogalum flexuosum*	LC
Euphorbiaceae	*Acalypha depressinervia*	LC	Onagraceae	*Epilobium capense*	LC	Hyacinthaceae	*Ornithogalum juncifolium* var. *juncifolium*	NE
Euphorbiaceae	*Acalypha* sp.		Poaceae	*Eragrostis caesia*	LC	Orchidaceae	**Orthochilus foliosus*	LC
Euphorbiaceae	*Acalypha wilmsii*	LC	**Poaceae**	***Eragrostis capensis*[c]**	**LC**	Orchidaceae	**Orthochilus leontoglossus*	LC
Asteraceae	*Acanthospermum glabratum*	NE	**Poaceae**	***Eragrostis chloromelas*[cefg]**	**LC**	Orchidaceae	**Orthochilus* sp.	
Amaranthaceae	***Achyranthes aspera*[d]**	**NE**	Poaceae	*Eragrostis cilianensis*	LC	Orchidaceae	**Orthochilus vinosus*	
Amaranthaceae	*Achyranthes aspera* var. *aspera*	NE	Poaceae	*Eragrostis curvula*	LC	Orchidaceae	**Orthochilus welwitschii*	LC
Lamiaceae	*Acrotome hispida*	LC	**Poaceae**	***Eragrostis gummiflua*[dh]**	**LC**	Orthotrichaceae	*Orthotrichum diaphanum*	
Lamiaceae	*Acrotome inflata*	LC	Poaceae	*Eragrostis lehmanniana* var. *chaunantha*	LC	Asteraceae	*Osteospermum moniliferum* subsp. *canescens*	LC
Asteraceae	*Adenanthellum osmitoides*	LC	Poaceae	*Eragrostis lehmanniana* var. *lehmanniana*	LC	Asteraceae	*Osteospermum scariosum* var. *scariosum*	NE
Lamiaceae	*Aeollanthus buchnerianus*	LC	Poaceae	*Eragrostis mexicana* subsp. *virescens*	NE	Asteraceae	*Othonna natalensis*	LC
Fabaceae	*Aeschynomene rehmannii* var. *leptobotrya*	LC	**Poaceae**	***Eragrostis micrantha*[bc]**	**LC**	Oxalidaceae	*Oxalis convexula*	LC
Fabaceae	*Aeschynomene rehmannii* var. *rehmannii*	LC	Poaceae	*Eragrostis obtusa*	LC	Oxalidaceae	*Oxalis corniculata*	NE
Asteraceae	*Afroaster hispidus*	LC	Poaceae	*Eragrostis patentissima*	LC	Oxalidaceae	*Oxalis obliquifolia*	LC
Asteraceae	*Afroaster serrulatus*	LC	**Poaceae**	***Eragrostis plana*[bcdeg]**	**LC**	Oxalidaceae	*Oxalis smithiana*	LC
Apiaceae	*Afrosciadium magalismontanum*	LC	Poaceae	*Eragrostis planiculmis*	LC	Polygonaceae	*Oxygonum dregeanum* subsp. *canescens* var. *canescens*	NE
Agapanthaceae	**Agapanthus inapertus* subsp. *intermedius*	LC	**Poaceae**	***Eragrostis racemosa*[cdef]**	**LC**	Polygonaceae	*Oxygonum dregeanum* subsp. *swazicum*	LC
Agavaceae	***Agave americana*[c]**	**NE**	Poaceae	*Eragrostis remotiflora*	LC	Anacardiaceae	*Ozoroa engleri*	LC

Rosaceae	*Agrimonia bracteata*	LC	Poaceae	*Eragrostis sclerantha* subsp. *sclerantha*	LC	Apocynaceae	*Pachycarpus campanulatus* var. *sutherlandii*	LC
Poaceae	*Agrostis continuata*	LC	Poaceae	*Eragrostis* sp.		Apocynaceae	*Pachycarpus dealbatus*	LC
Poaceae	***Agrostis eriantha* var. *eriantha*[b]**	**LC**	Poaceae	*Eragrostis tef*	NE	Apocynaceae	*Pachycarpus grandiflorus* subsp. *grandiflorus*	LC
Poaceae	*Agrostis gigantea*(NEM:BA)		Ericaceae	*Erica alopecurus* var. *alopecurus*	LC	Apocynaceae	*Pachycarpus macrochilus*	LC
Poaceae	*Agrostis lachnantha* var. *lachnantha*	LC	Ericaceae	*Erica cerinthoides* var. *cerinthoides*	NE	Apocynaceae	*Pachycarpus plicatus*	LC
Poaceae	*Agrostis* sp.		Ericaceae	*Erica drakensbergensis*	LC	Apocynaceae	*Pachycarpus scaber*	LC
Lamiaceae	*Ajuga ophrydis*	LC	Ericaceae	*Erica oatesii*		Apocynaceae	*Pachycarpus schinzianus*	LC
Hyacinthaceae	*Albuca baurii*	LC	**Asteraceae**	***Erigeron bonariensis*[ef]**	**NE**	Apocynaceae	*†Pachycarpus suaveolens*	VU
Hyacinthaceae	*Albuca setosa*	LC	Asteraceae	*Erigeron canadensis*	NE	**Poaceae**	***Panicum coloratum*[b]**	**LC**
Hyacinthaceae	*Albuca shawii*	LC	**Asteraceae**	***Erigeron primulifolius*[c]**	**NE**	Poaceae	*Panicum ecklonii*	LC
Hyacinthaceae	*Albuca* sp.		Eriocaulaceae	*Eriocaulon sonderianum*	LC	Poaceae	*Panicum natalense*	LC
Hyacinthaceae	*Albuca virens* subsp. *virens*	LC	Poaceae	*Eriochrysis brachypogon*	LC	Poaceae	*Panicum schinzii*	LC
Rosaceae	*Alchemilla capensis*	LC	Fabaceae	*Eriosema cordatum*	LC	Poaceae	*Panicum* sp.	
Rosaceae	*Alchemilla woodii*	LC	Fabaceae	*Eriosema kraussianum*	LC	Poaceae	*Panicum volutans*	LC
Orobanchaceae	*Alectra capensis*	LC	Fabaceae	*Eriosema nutans*	LC	Papaveraceae	*Papaver aculeatum*	LC
Orobanchaceae	***Alectra sessiliflora*[b]**	**LC**	**Fabaceae**	***Eriosema salignum*[f]**	**LC**	Apocynaceae	*Parapodium costatum*	LC
Alliaceae	*Allium* sp.		Fabaceae	*Eriosema simulans*	LC	Asteraceae	*Parapolydora fastigiata*	LC
Poaceae	*Alloteropsis semialata* subsp. *eckloniana*	LC	Fabaceae	*Eriosema* sp.		**Poaceae**	***Paspalum dilatatum*[bc]**	**NE**
Poaceae	*Alloteropsis semialata* subsp. *semialata*	LC	Ruscaceae	*Eriospermum abyssinicum*	LC	Poaceae	*Paspalum distichum*	LC
Asphodelaceae	**Aloe boylei*	LC	Ruscaceae	*Eriospermum cooperi* var. *cooperi*	LC	Malvaceae	*Pavonia columella*	LC
Asphodelaceae	**Aloe davyana*	LC	Ruscaceae	*Eriospermum corymbosum*	LC	Fabaceae	*Pearsonia cajanifolia* subsp. *cryptantha*	LC
Asphodelaceae	****Aloe ecklonis*[h]**	**LC**	Ruscaceae	*Eriospermum porphyrium*	LC	Fabaceae	*Pearsonia sessilifolia* subsp. *filifolia*	LC
Asphodelaceae	**Aloe graciliflora*	LC	Ruscaceae	*Eriospermum* sp.		Fabaceae	*Pearsonia sessilifolia* subsp. *sessilifolia*	LC
Asphodelaceae	*†*Aloe hlangapies*	VU	Brassicaceae	*Erucastrum austroafricanum*	LC	Geraniaceae	*Pelargonium alchemilloides*	LC
Asphodelaceae	**Aloe jeppeae*	LC	Fabaceae	*Erythrina zeyheri*	LC	Geraniaceae	*Pelargonium luridum*	LC
Asphodelaceae	**Aloe maculata* subsp. *maculata*	LC	**Myrtaceae**	***Eucalyptus camaldulensis*(NEM:BA)[a]**	**NE**	**Geraniaceae**	***Pelargonium minimum*[b]**	**LC**
Amaranthaceae	*Alternanthera pungens*	NE	**Myrtaceae**	***Eucalyptus cinerea*[a]**	**NE**	Geraniaceae	*Pelargonium sidoides*	LC
Fabaceae	*Alysicarpus zeyheri*	LC	**Myrtaceae**	***Eucalyptus sideroxylon*[a]**	**NE**	Pteridaceae	*Pellaea calomelanos* var. *calomelanos*	LC
Amaranthaceae	*Amaranthus hybridus* subsp. *hybridus* var. *hybridus*	NE	Ebenaceae	*Euclea crispa* subsp. *crispa*	LC	Ranunculaceae	*Peltocalathos baurii*	LC
Amaranthaceae	*Amaranthus thunbergii*	LC	Ebenaceae	*Euclea* sp.		Poaceae	*Pennisetum macrourum*	LC
Lythraceae	*Ammannia sagittifolia* var. *sagittifolia*		Hyacinthaceae	**Eucomis autumnalis* subsp. *clavata*	NE	Poaceae	*Pennisetum sphacelatum*	LC
Lythraceae	*Ammannia schinzii*		Hyacinthaceae	**Eucomis montana*	LC	**Poaceae**	***Pennisetum thunbergii*[b]**	**LC**
Boraginaceae	*Anchusa riparia*	LC	Hyacinthaceae	**Eucomis pallidiflora* subsp. *pallidiflora*	LC	Poaceae	*Pennisetum unisetum*	LC
Poaceae	*Andropogon appendiculatus*	LC	Orchidaceae	**Eulophia cooperi*	LC	Rubiaceae	*Pentanisia angustifolia*	LC
Poaceae	*Andropogon lacunosus*	LC	Orchidaceae	**Eulophia hians* var. *hians*	LC	Rubiaceae	*Pentanisia prunelloides*	LC
Poaceae	*Andropogon schirensis*	LC	Orchidaceae	**Eulophia hians* var. *inaequalis*	LC	Rubiaceae	*Pentanisia prunelloides* subsp. *latifolia*	LC
Apocynaceae	*Anisotoma pedunculata*	LC	Orchidaceae	**Eulophia hians* var. *nutans*	LC	Rubiaceae	*Pentanisia prunelloides* subsp. *prunelloides*	LC
Rubiaceae	*Anthospermum herbaceum*	LC	Orchidaceae	**Eulophia ovalis* var. *bainesii*	LC	Poaceae	*Perotis* sp.	
Rubiaceae	***Anthospermum hispidulum*[beh]**	**LC**	Orchidaceae	**Eulophia ovalis* var. *ovalis*	LC	Polygonaceae	*Persicaria amphibia*	LC
Rubiaceae	*Anthospermum rigidum* subsp. *rigidum*	LC	Orchidaceae	**Eulophia parvilabris*	LC	Polygonaceae	*Persicaria decipiens*	LC
Poaceae	*Anthoxanthum odoratum* var. *odoratum*	NE	Orchidaceae	**Eulophia* sp.		Polygonaceae	*Persicaria hystricula*	LC
Aponogetonaceae	*Aponogeton junceus*	LC	Euphorbiaceae	*Euphorbia arida*	LC	**Polygonaceae**	***Persicaria lapathifolia*[b]**	**NE**
Asteraceae	*Arctotis arctotoides*	LC	Euphorbiaceae	*Euphorbia clavarioides*	LC	Polygonaceae	*Persicaria madagascariensis*	NE
Fabaceae	*†Argyrolobium campicola*	NT	Euphorbiaceae	*Euphorbia gueinzii*	LC	Poaceae	*Phalaris arundinacea*	NE
Fabaceae	*Argyrolobium harveyanum*	LC	Euphorbiaceae	*Euphorbia inaequilatera*	LC	Poaceae	*Phalaris canariensis*	NE
Fabaceae	*Argyrolobium humile*	LC	Euphorbiaceae	*Euphorbia inaequilatera* var. *inaequilatera*	NE	Poaceae	*Phalaris minor*	NE
Fabaceae	*Argyrolobium lotoides*	LC	Euphorbiaceae	*Euphorbia natalensis*	LC	Bartramiaceae	*Philonotis falcata*	
Fabaceae	***Argyrolobium pauciflorum*[d]**	**LC**	**Euphorbiaceae**	***Euphorbia serpens*[b]**	**NE**	Bartramiaceae	*Philonotis hastata*	
Fabaceae	***Argyrolobium pseudotuberosum*[d]**	**LC**	Euphorbiaceae	*Euphorbia* sp.		Phyllanthaceae	*Phyllanthus glaucophyllus*	LC
Fabaceae	*Argyrolobium rupestre* subsp. *rupestre*	LC	**Euphorbiaceae**	***Euphorbia striata*[de]**	**LC**	Phyllanthaceae	*Phyllanthus maderaspatensis*	LC
Fabaceae	*Argyrolobium speciosum*	LC	Asteraceae	*Euryops gilfillanii*	LC	Solanaceae	*Physalis angulata*	NE
Fabaceae	*Argyrolobium transvaalense*	LC	Asteraceae	*Euryops laxus*	LC	**Solanaceae**	***Physalis peruviana*[b]**	**NE**
Fabaceae	*Argyrolobium tuberosum*	LC	Asteraceae	*Euryops pedunculatus*	LC	Solanaceae	*Physalis viscosa*	NE
Iridaceae	*Aristea torulosa*	LC	Asteraceae	*Euryops transvaalensis* subsp. *setilobus*	LC	Phytolaccaceae	*Phytolacca heptandra*	LC
Poaceae	***Aristida adscensionis*[dg]**	**LC**	Gentianaceae	*Exochaenium grande*	LC	Pteridaceae	*Pityrogramma argentea*	LC
Poaceae	***Aristida bipartita*[b]**	**LC**	**Convolvulaceae**	***Falkia oblonga*[b]**	**LC**	**Plantaginaceae**	***Plantago lanceolata*[bh]**	**LC**
Poaceae	*Aristida canescens* subsp. *canescens*	LC	Polygonaceae	*Fallopia convolvulus*	NE	**Plantaginaceae**	***Plantago rhodosperma*[de]**	**NE**
Poaceae	*Aristida congesta* subsp. *barbicollis*	LC	Asteraceae	*Felicia filifolia* subsp. *filifolia*	LC	Lamiaceae	*Platostoma rotundifolium*	LC
Poaceae	***Aristida congesta* subsp. *congesta*[g]**	**LC**	**Asteraceae**	***Felicia muricata* subsp. *muricata*[de]**	**LC**	Asteraceae	*Platycarphella parvifolia*	LC
Poaceae	*Aristida diffusa* subsp. *burkei*	LC	Asteraceae	*Felicia muricata* subsp. *strictifolia*	LC	Poaceae	*Poa annua*	NE

Poaceae	***Aristida diffusa* subsp. *diffusa*[deg]**	**LC**	Poaceae	*Festuca caprina*	LC	Poaceae	*Poa binata*	LC
Poaceae	***Aristida junciformis* subsp. *junciformis*[be]**	**LC**	Poaceae	*Festuca scabra*	LC	Poaceae	*Pogonarthria squarrosa*	LC
Poaceae	*Aristida recta*	LC	Cyperaceae	*Fimbristylis complanata*	LC	Caryophyllaceae	*Pollichia campestris*	LC
Poaceae	*Aristida scabrivalvis* subsp. *scabrivalvis*	LC	Poaceae	*Fingerhuthia africana*	LC	Asteraceae	*Polydora angustifolia*	LC
Poaceae	*Aristida* sp.		**Poaceae**	***Fingerhuthia sesleriiformis*[b]**	**LC**	Polygalaceae	*Polygala africana*	LC
Poaceae	*Aristida vestita*	LC	Fissidentaceae	*Fissidens palmifolius*		Polygalaceae	*Polygala albida* subsp. *albida*	LC
Asteraceae	*Artemisia afra* var. *afra*	LC	**Cyperaceae**	***Fuirena coerulescens*[b]**	**LC**	Polygalaceae	*Polygala gerrardii*	LC
Poaceae	*Arundinella nepalensis*	LC	Rubiaceae	*Galium capense* subsp. *capense*	LC	Polygalaceae	*Polygala gracilenta*	LC
Apocynaceae	*Asclepias albens*	LC	Rubiaceae	*Galium capense* subsp. *garipense* var. *garipense*	NE	**Polygalaceae**	***Polygala hottentotta*[cfgh]**	**LC**
Apocynaceae	*Asclepias aurea*	LC	Asteraceae	*Gamochaeta antillana*	NE	Polygalaceae	*Polygala ohlendorfiana*	LC
Apocynaceae	*Asclepias brevicuspis*	LC	Asteraceae	*Gamochaeta pensylvanica*	NE	Polygalaceae	*Polygala transvaalensis*	LC
Apocynaceae	*Asclepias crassinervis*	LC	Asteraceae	*Gazania krebsiana* subsp. *arctotoides*	LC	Polygalaceae	*Polygala transvaalensis* subsp. *transvaalensis*	LC
Apocynaceae	*Asclepias cucullata* subsp. *cucullata*	LC	Asteraceae	*Gazania krebsiana* subsp. *serrulata*	LC	Polygalaceae	*Polygala uncinata*	LC
Apocynaceae	*Asclepias cultriformis*	LC	Asteraceae	*Gazania* sp.		Polygalaceae	*Polygala virgata* var. *decora*	LC
Apocynaceae	*Asclepias eminens*	LC	Asteraceae	*Geigeria aspera* var. *aspera*	LC	**Polygonaceae**	***Polygonum aviculare*[b]**	**NE**
Apocynaceae	*Asclepias fulva*	LC	Asteraceae	*Geigeria burkei* subsp. *burkei* var. *burkei*	NE	Polygonaceae	*Polygonum plebeium*	LC
Apocynaceae	***Asclepias gibba* var. *gibba*[e]**	**LC**	Asteraceae	*Geigeria burkei* subsp. *burkei* var. *intermedia*	NE	Pontederiaceae	*Pontederia ovalis*	NE
Apocynaceae	*Asclepias gibba* var. *media*	LC	Asteraceae	*Geigeria burkei* subsp. *valida*	LC	**Portulacaceae**	***Portulaca oleracea*[d]**	**NE**
Apocynaceae	*Asclepias macropus*	LC	Asteraceae	*Geigeria filifolia*	LC	Proteaceae	**Protea roupelliae* subsp. *roupelliae*	LC
Apocynaceae	*Asclepias multicaulis*	LC	Geraniaceae	*Geranium multisectum*	LC	Molluginaceae	*Psammotropha myriantha*	LC
Apocynaceae	*Asclepias* sp.		Geraniaceae	*Geranium robustum*	LC	**Asteraceae**	***Pseudognaphalium luteoalbum*[c]**	**LC**
Apocynaceae	*Asclepias stellifera*	LC	Geraniaceae	*Geranium wakkerstroomianum*	LC	Asteraceae	*Pseudognaphalium luteoalbum*[c]	LC
Cyperaceae	*Ascolepis capensis*	LC	Asteraceae	*Gerbera ambigua*	LC	Asteraceae	*Pseudognaphalium oligandrum*	LC
Fabaceae	*Aspalathus callosa*	LC	Asteraceae	*Gerbera piloselloides*	LC	Asteraceae	*Pseudopegolettia tenella*	LC
Asparagaceae	*Asparagus bechuanicus*	LC	Asteraceae	*Gerbera viridifolia*	LC	Orchidaceae	**Pterygodium dracomontanum*	LC
Asparagaceae	*Asparagus cooperi*	LC	Iridaceae	**Gladiolus crassifolius*	LC	Orchidaceae	**Pterygodium nigrescens*	LC
Asparagaceae	*Asparagus devenishii*	LC	Iridaceae	**Gladiolus dalenii* subsp. *dalenii*	LC	Asteraceae	*Pulicaria scabra*	LC
Asparagaceae	*†Asparagus fractiflexus*	EN	**Iridaceae**	****Gladiolus ecklonii*[f]**	**LC**	Lamiaceae	*Pycnostachys reticulata*	LC
Asparagaceae	*Asparagus laricinus*	LC	Iridaceae	**Gladiolus elliotii*	LC	Cyperaceae	*Pycreus betschuanus*	LC
Asparagaceae	*Asparagus ramosissimus*	LC	Iridaceae	**Gladiolus longicollis* subsp. *longicollis*	LC	Cyperaceae	*Pycreus chrysanthus*	LC
Asparagaceae	***Asparagus setaceus*[d]**	**LC**	Iridaceae	**Gladiolus longicollis* subsp. *platypetalus*	LC	Cyperaceae	*Pycreus cooperi*	LC
Asparagaceae	*Asparagus* sp.		Iridaceae	*†*Gladiolus paludosus*	VU	Cyperaceae	*Pycreus macranthus*	LC
Asparagaceae	*Asparagus virgatus*	LC	Iridaceae	**Gladiolus papilio*	LC	Cyperaceae	*Pycreus nitidus*	LC
Apocynaceae	*Aspidoglossum araneiferum*	LC	Iridaceae	*†*Gladiolus robertsoniae*	NT	**Rubiaceae**	***Pygmaeothamnus zeyheri* var. *zeyheri*[d]**	**LC**
Apocynaceae	*Aspidoglossum biflorum*	LC	Iridaceae	**Gladiolus sericeovillosus* subsp. *calvatus*	LC	**Rosaceae**	***Pyracantha angustifolia*(NEM:BA)[d]**	**NE**
Apocynaceae	*Aspidoglossum glanduliferum*	LC	Iridaceae	**Gladiolus sericeovillosus* subsp. *sericeovillosus*	LC	**Rosaceae**	***Pyracantha crenulata*(NEM:BA)[dh]**	**NE**
Apocynaceae	*Aspidoglossum interruptum*	LC	Iridaceae	**Gladiolus* sp.		Ranunculaceae	*Ranunculus dregei*	LC
Apocynaceae	*Aspidoglossum lamellatum*	LC	Iridaceae	**Gladiolus vinosomaculatus*	LC	**Ranunculaceae**	***Ranunculus multifidus*[bc]**	**LC**
Apocynaceae	*Aspidoglossum ovalifolium*	LC	**Iridaceae**	****Gladiolus woodii*[g]**	**LC**	Ranunculaceae	*Ranunculus trichophyllus*	LC
Apocynaceae	*†Aspidoglossum xanthosphaerum*	VU	**Fabaceae**	***Gleditsia triacanthos*(NEM:BA)[a]**	**NE**	Myrsinaceae	*Rapanea melanophloeos*	LC
Aspleniaceae	*Asplenium aethiopicum*	LC	Colchicaceae	*Gloriosa modesta*	LC	Apocynaceae	*Raphionacme hirsuta*	LC
Aspleniaceae	*Asplenium capense*	LC	Asteraceae	*Gnaphalium filagopsis*	LC	Poaceae	*Rendlia altera*	LC
Aspleniaceae	*Asplenium cordatum*	LC	Thymelaeaceae	*Gnidia fastigiata*	LC	**Fabaceae**	***Rhynchosia adenodes*[c]**	**LC**
Asteraceae	*Athrixia elata*	LC	Thymelaeaceae	*Gnidia gymnostachya*	LC	**Fabaceae**	***Rhynchosia nervosa*[c]**	**LC**
Poaceae	*Avena sativa*	NE	Thymelaeaceae	*Gnidia nodiflora*	LC	Fabaceae	*Rhynchosia pauciflora*	LC
Poaceae	*Avena* sp.		**Apocynaceae**	***Gomphocarpus fruticosus* subsp. *fruticosus*[bc]**	**LC**	Fabaceae	*Rhynchosia pedunculata*	
Iridaceae	*Babiana bainesii*	LC	**Scrophulariaceae**	***Gomphostigma virgatum*[b]**	**LC**	Fabaceae	*Rhynchosia reptabunda*	LC
Begoniaceae	*Begonia sutherlandii* subsp. *sutherlandii*	LC	**Amaranthaceae**	***Gomphrena celosioides*[d]**	**NE**	**Fabaceae**	***Rhynchosia totta* var. *totta*[bf]**	**LC**
Asteraceae	*Berkheya discolor*	LC	Malvaceae	*Grewia flava*	LC	Cyperaceae	*Rhynchospora brownii*	LC
Asteraceae	*Berkheya echinacea* subsp. *echinacea*	LC	Malvaceae	*Grewia occidentalis* var. *occidentalis*	LC	Ricciaceae	*Riccia cavernosa*	
Asteraceae	*Berkheya insignis*	LC	Celastraceae	*Gymnosporia buxifolia*	LC	Ricciaceae	*Riccia crystallina*	
Asteraceae	*Berkheya onopordifolia* var. *onopordifolia*	LC	**Orchidaceae**	***Habenaria*[f]**		Ricciaceae	*Riccia stricta*	
Asteraceae	*Berkheya pinnatifida* subsp. *ingrata*	LC	Orchidaceae	*†*Habenaria barbertoni*	NT	Rubiaceae	*Richardia brasiliensis*	NE
Asteraceae	***Berkheya radula*[bcdeh]**	**LC**	Orchidaceae	**Habenaria clavata*	LC	**Rubiaceae**	***Richardia humistrata*[deh]**	**NE**
Asteraceae	***Berkheya rigida*[bceh]**	**LC**	Orchidaceae	**Habenaria dives*	LC	Apocynaceae	*Riocreuxia picta*	LC
Asteraceae	***Berkheya setifera*[c]**	**LC**	Orchidaceae	**Habenaria epipactidea*	LC	Apocynaceae	*Riocreuxia polyantha*	LC
Asteraceae	*Berkheya speciosa* subsp. *lanceolata*	LC	Orchidaceae	**Habenaria falcicornis* subsp. *caffra*	LC	Brassicaceae	*Rorippa fluviatilis* var. *fluviatilis*	LC
Asteraceae	*Berkheya zeyheri* subsp. *zeyheri*	LC	Orchidaceae	**Habenaria lithophila*	LC	Brassicaceae	*Rorippa nudiuscula*	LC
Apiaceae	*Berula repanda*	LC	**Amaryllidaceae**	****Haemanthus humilis* subsp. *hirsutus*[de]**	**LC**	**Rosaceae**	***Rosa*[c]**	
Asteraceae	***Bidens pilosa*[cdf]**	**NE**	Amaryllidaceae	**Haemanthus montanus*	LC	**Rosaceae**	***Rosa rubiginosa*(NEM:BA)[a]**	**NE**

Blechnaceae	*Blechnum attenuatum*	LC
Acanthaceae	*Blepharis natalensis*	LC
Acanthaceae	***Blepharis obermeyerae*[e]**	**LC**
Acanthaceae	*Blepharis subvolubilis*	LC
Amaryllidaceae	****Boophone disticha*[f]**	**LC**
Poaceae	*Bothriochloa insculpta*	LC
Poaceae	***Brachiaria eruciformis*[b]**	**LC**
Poaceae	*Brachiaria humidicola*	LC
Poaceae	*Brachiaria serrata*	LC
Orchidaceae	**Brachycorythis ovata* subsp. *ovata*	LC
Orchidaceae	**Brachycorythis pubescens*	LC
Brassicaceae	*Brassica rapa*	NE
Poaceae	*Briza minor*	NE
Poaceae	*Bromus catharticus*	NE
Poaceae	*Bromus leptoclados*	LC
Poaceae	*Bromus* sp.	
Orchidaceae	**Brownleea parviflora*	LC
Amaryllidaceae	**Brunsvigia natalensis*	LC
Amaryllidaceae	**Brunsvigia radulosa*	LC
Bryaceae	*Bryum apiculatum*	
Bryaceae	*Bryum argenteum*	
Bryaceae	*Bryum cellulare*	
Orobanchaceae	*Buchnera reducta*	LC
Orobanchaceae	*Buchnera* sp.	
Asphodelaceae	*Bulbine abyssinica*	LC
Asphodelaceae	***Bulbine capitata*[g]**	**LC**
Cyperaceae	*Bulbostylis boeckeleriana*	LC
Cyperaceae	*Bulbostylis humilis*	LC
Cyperaceae	*Bulbostylis oritrephes*	LC
Cyperaceae	*Bulbostylis schoenoides*	LC
Cyperaceae	*Bulbostylis scleropus*	LC
Asteraceae	*Callilepis salicifolia*	LC
Rubiaceae	*Canthium inerme*	LC
Cyperaceae	***Carex glomerabilis*[b]**	**LC**
Cyperaceae	*Carex ludwigii*	
Cyperaceae	*Carex rhodesiaca*	LC
Cyperaceae	*Carex spartea*	
Poaceae	*Catalepis gracilis*	LC
Apiaceae	*Centella asiatica*	LC
Rubiaceae	*Cephalanthus natalensis*	LC
Dipsacaceae	*Cephalaria pungens*	LC
Dipsacaceae	*Cephalaria zeyheriana*	LC
Caryophyllaceae	*Cerastium arabidis*	LC
Caryophyllaceae	*Cerastium capense*	LC
Apocynaceae	**Ceropegia breviflora*	
Apocynaceae	**Ceropegia rehmannii*	
Solanaceae	*Cestrum parqui*(NEM:BA)	
Scrophulariaceae	*Chaenostoma floribundum*	LC
Scrophulariaceae	*Chaenostoma neglectum*	LC
Scrophulariaceae	*Chaenostoma patrioticum*	LC
Fabaceae	*Chamaecrista capensis* var. *capensis*	LC
Verbenaceae	*Chascanum latifolium* var. *transvaalense*	LC
Verbenaceae	*Chascanum* sp.	
Pteridaceae	*Cheilanthes eckloniana*	LC
Pteridaceae	*Cheilanthes hirta* var. *brevipilosa* forma *laxa*	LC
Pteridaceae	*Cheilanthes hirta* var. *hirta*	LC
Pteridaceae	*Cheilanthes hirta* var. *nemorosa*	LC
Pteridaceae	*Cheilanthes multifida* subsp. *lacerata*	LC
Pteridaceae	*Cheilanthes quadripinnata*	LC
Pteridaceae	***Cheilanthes viridis* var. *viridis*[de]**	**LC**
Amaranthaceae	*Chenopodium album*	NE
Amaranthaceae	*Chenopodium hircinum*	NE
Asteraceae	*Haplocarpha lyrata*	LC
Asteraceae	*Haplocarpha nervosa*	LC
Asteraceae	***Haplocarpha scaposa*[bcd]**	**LC**
Poaceae	*Harpochloa falx*	LC
Orobanchaceae	*Harveya speciosa*	LC
Scrophulariaceae	*Hebenstretia angolensis*	LC
Scrophulariaceae	*Hebenstretia comosa*	LC
Scrophulariaceae	*Hebenstretia oatesii* subsp. *oatesii*	LC
Scrophulariaceae	*Hebenstretia rehmannii*	LC
Asteraceae	*Helichrysum adenocarpum* subsp. *adenocarpum*	LC
Asteraceae	*Helichrysum albilanatum*	LC
Asteraceae	*Helichrysum aureum* var. *monocephalum*	NE
Asteraceae	*Helichrysum auronitens*	LC
Asteraceae	*Helichrysum caespititium*	LC
Asteraceae	***Helichrysum callicomum*[h]**	**LC**
Asteraceae	*Helichrysum cephaloideum*	LC
Asteraceae	*Helichrysum chionosphaerum*	LC
Asteraceae	*Helichrysum miconiifolium*	LC
Asteraceae	*Helichrysum molestum*	LC
Asteraceae	*Helichrysum mundtii*	LC
Asteraceae	***Helichrysum nudifolium* var. *nudifolium*[fh]**	**LC**
Asteraceae	***Helichrysum nudifolium* var. *pilosellum*[e]**	**LC**
Asteraceae	*Helichrysum opacum*	LC
Asteraceae	*Helichrysum oreophilum*	LC
Asteraceae	*Helichrysum psilolepis*	LC
Asteraceae	***Helichrysum rugulosum*[defgh]**	**LC**
Asteraceae	*Helichrysum splendidum*	LC
Asteraceae	*Helichrysum subglomeratum*	LC
Poaceae	***Hemarthria altissima*[b]**	**LC**
Malvaceae	*Hermannia coccocarpa*	LC
Malvaceae	*Hermannia cordata*	LC
Malvaceae	*Hermannia cristata*	LC
Malvaceae	***Hermannia depressa*[cdeh]**	**LC**
Malvaceae	***Hermannia erodioides*[b]**	**LC**
Malvaceae	*Hermannia oblongifolia*	LC
Malvaceae	*Hermannia parviflora*	LC
Malvaceae	*Hermannia* sp.	
Malvaceae	***Hermannia transvaalensis*[f]**	**LC**
Caryophyllaceae	*Herniaria erckertii* subsp. *erckertii*	LC
Iridaceae	**Hesperantha coccinea*	LC
Iridaceae	*Hesperantha longicollis*	LC
Iridaceae	*†Hesperantha rupestris*	DD
Apiaceae	*Heteromorpha arborescens* var. *abyssinica*	LC
Poaceae	*Heteropogon contortus*	LC
Malvaceae	*Hibiscus aethiopicus* var. *ovatus*	LC
Malvaceae	***Hibiscus microcarpus*[e]**	**LC**
Malvaceae	***Hibiscus trionum*[b]**	
Asteraceae	*Hilliardiella aristata*	LC
Asteraceae	***Hilliardiella elaeagnoides*[f]**	**LC**
Asteraceae	*Hilliardiella hirsuta*	LC
Asteraceae	*Hilliardiella nudicaulis*	LC
Poaceae	*Holcus lanatus*	NE
Poaceae	*Hyparrhenia anamesa*	LC
Poaceae	*Hyparrhenia dregeana*	LC
Poaceae	*Hyparrhenia hirta*	LC
Poaceae	*Hyparrhenia* sp.	
Poaceae	***Hyparrhenia tamba*[cf]**	**LC**
Hypericaceae	*Hypericum aethiopicum* subsp. *sonderi*	LC
Hypericaceae	*Hypericum lalandii*	LC
Asteraceae	***Hypochaeris radicata*[e]**	**NE**
Hypoxidaceae	*Hypoxis acuminata*	LC
Hypoxidaceae	***Hypoxis argentea* var. *argentea*[d]**	**LC**
Lamiaceae	*Rotheca hirsuta*	LC
Rosaceae	*Rubus ludwigii* subsp. *ludwigii*	LC
Acanthaceae	*Ruellia cordata*	LC
Polygonaceae	*Rumex acetosella* subsp. *angiocarpus*	
Polygonaceae	*Rumex crispus*	NE
Polygonaceae	***Rumex lanceolatus*[be]**	**LC**
Polygonaceae	*Rumex sagittatus*	LC
Polygonaceae	*Rumex* sp.	
Polygonaceae	*Rumex woodii*	LC
Aizoaceae	*Ruschia* sp.	
Rutaceae	*Ruta graveolens*	NE
Poaceae	*Sacciolepis chevalieri*	LC
Poaceae	*Sacciolepis typhura*	LC
Salicaceae	***Salix babylonica*[b]**	**NE**
Salicaceae	*Salix babylonica* var. *babylonica*	NE
Lamiaceae	*Salvia aurita* var. *galpinii*	LC
Lamiaceae	*Salvia repens* var. *repens*	LC
Lamiaceae	*Salvia repens* var. *transvaalensis*	LC
Lamiaceae	*Salvia runcinata*	LC
Lamiaceae	*Salvia* sp.	
Rosaceae	*Sanguisorba minor* subsp. *muricata*	NE
Orchidaceae	**Satyrium hallackii* subsp. *ocellatum*	LC
Orchidaceae	**Satyrium longicauda* var. *longicauda*	NE
Orchidaceae	**Satyrium neglectum* subsp. *neglectum* var. *neglectum*	LC
Orchidaceae	**Satyrium parviflorum*	LC
Orchidaceae	**Satyrium trinerve*	LC
Dipsacaceae	***Scabiosa columbaria*[bde]**	**LC**
Amaryllidaceae	**Scadoxus puniceus*	LC
Asteraceae	***Schistostephium crataegifolium*[f]**	**LC**
Poaceae	*Schizachyrium sanguineum*	LC
Hyacinthaceae	*Schizocarphus nervosus*	LC
Orchidaceae	**Schizochilus zeyheri*	LC
Apocynaceae	*Schizoglossum atropurpureum* subsp. *atropurpureum*	LC
Apocynaceae	*Schizoglossum nitidum*	LC
Apocynaceae	*†Schizoglossum peglerae*	EN
Asteraceae	***Schkuhria pinnata*[bcde]**	**NE**
Cyperaceae	***Schoenoplectus decipiens*[b]**	**LC**
Cyperaceae	*Schoenoplectus muricinux*	LC
Cyperaceae	*Schoenoplectus pulchellus*	LC
Cyperaceae	*Schoenoxiphium* sp.	
Cyperaceae	***Scirpoides burkei*[b]**	**LC**
Anacardiaceae	*Searsia dentata*	LC
Anacardiaceae	***Searsia discolor*[d]**	**LC**
Anacardiaceae	*Searsia dregeana*	LC
Anacardiaceae	*Searsia gerrardii*	LC
Anacardiaceae	***Searsia pyroides* var. *pyroides*[d]**	**LC**
Anacardiaceae	*Searsia rigida* var. *rigida*	LC
Anacardiaceae	*Searsia tumulicola* var. *tumulicola*	LC
Gentianaceae	*Sebaea exigua*	LC
Gentianaceae	***Sebaea leiostyla*[b]**	**LC**
Gentianaceae	*Sebaea repens*	LC
Gentianaceae	*Sebaea sedoides* var. *sedoides*	LC
Scrophulariaceae	*Selago capitellata*	LC
Scrophulariaceae	*Selago cucullata*	LC
Scrophulariaceae	***Selago densiflora*[e]**	**LC**
Scrophulariaceae	*Selago galpinii*	LC
Scrophulariaceae	*Selago* sp.	
Asteraceae	***Senecio affinis*[e]**	**LC**
Asteraceae	*Senecio albanensis* var. *albanensis*	LC
Asteraceae	*Senecio bupleuroides*	LC
Asteraceae	*Senecio burchellii*	LC
Asteraceae	*Senecio coronatus*	LC

Amaranthaceae	*Chenopodium phillipsianum*	NE	**Hypoxidaceae**	***Hypoxis colchicifolia*[f]**	**LC**	Asteraceae	*Senecio erubescens* var. *erubescens*	NE
Gentianaceae	*Chironia krebsii*	LC	Hypoxidaceae	*Hypoxis filiformis*	LC	Asteraceae	*Senecio gregatus*	LC
Gentianaceae	*Chironia palustris* subsp. *palustris*	LC	Hypoxidaceae	*Hypoxis gerrardii*	LC	Asteraceae	*Senecio hieracioides*	LC
Gentianaceae	*Chironia palustris* subsp. *transvaalensis*	LC	Hypoxidaceae	*Hypoxis hemerocallidea*	LC	Asteraceae	*Senecio inaequidens*	LC
Gentianaceae	*Chironia purpurascens* subsp. *humilis*	LC	Hypoxidaceae	*Hypoxis iridifolia*	LC	**Asteraceae**	***Senecio inornatus*[f]**	**LC**
Poaceae	***Chloris virgata*[g]**	**LC**	Hypoxidaceae	*Hypoxis multiceps*	LC	Asteraceae	*Senecio isatideus*	LC
Agavaceae	*Chlorophytum comosum*	LC	**Hypoxidaceae**	***Hypoxis rigidula* var. *rigidula*[f]**	**LC**	Asteraceae	*Senecio laevigatus* var. *integrifolius*	LC
Agavaceae	***Chlorophytum cooperi*[c]**	**LC**	Hypoxidaceae	*Hypoxis* sp.		Asteraceae	*Senecio laevigatus* var. *laevigatus*	LC
Agavaceae	***Chlorophytum fasciculatum*[eg]**	**LC**	**Poaceae**	***Imperata cylindrica*[b]**	**LC**	Asteraceae	*Senecio latifolius*	LC
Agavaceae	*Chlorophytum galpinii*	LC	Poaceae	*Imperata cylindrica*[b]	LC	Asteraceae	*Senecio madagascariensis*	LC
Asteraceae	***Cineraria aspera*[e]**	**LC**	Fabaceae	*Indigastrum fastigiatum*	LC	Asteraceae	*Senecio othonniflorus*	LC
Asteraceae	*†Cineraria austrotransvaalensis*	NT	Fabaceae	*Indigofera buchananii*	LC	Asteraceae	*Senecio oxyriifolius* subsp. *oxyriifolius*	LC
Asteraceae	*Cineraria lyratiformis*	LC	Fabaceae	*Indigofera dimidiata*	LC	Asteraceae	*Senecio rhomboideus*	LC
Asteraceae	***Cirsium vulgare*(NEM:BA)[bc]**	**NE**	Fabaceae	*Indigofera dregeana*	LC	Asteraceae	*Senecio scitus*	LC
Vitaceae	*Cissus diversilobata*	LC	Fabaceae	*Indigofera evansiana*	LC	Asteraceae	*Senecio* sp.	
Ranunculaceae	*Clematis brachiata*	LC	Fabaceae	*Indigofera frondosa*	LC	Asteraceae	*Senecio speciosus*	LC
Cleomaceae	*Cleome monophylla*	LC	Fabaceae	*Indigofera hedyantha*	LC	Asteraceae	*Senecio subcoriaceus*	LC
Peraceae	*Clutia hirsuta* var. *hirsuta*	LC	**Fabaceae**	***Indigofera hilaris* var. *hilaris*[c]**	**LC**	Asteraceae	*Senecio venosus*	LC
Peraceae	*Clutia monticola* var. *monticola*	LC	Fabaceae	*Indigofera longibarbata*	LC	Fabaceae	*Senegalia ataxacantha*	LC
Peraceae	*Clutia natalensis*	LC	Fabaceae	*Indigofera melanadenia*	LC	**Asteraceae**	***Seriphium plumosum*[deh]**	**LC**
Peraceae	*Clutia* sp.		Fabaceae	*Indigofera obscura*	LC	**Poaceae**	***Setaria incrassata*[bf]**	**LC**
Peraceae	*Clutia virgata*	LC	Fabaceae	*Indigofera placida*	LC	Poaceae	*Setaria italica*	NE
Cucurbitaceae	*Coccinia adoensis*	LC	Fabaceae	*Indigofera rostrata*	LC	**Poaceae**	***Setaria nigrirostris*[b]**	**LC**
Colchicaceae	*Colchicum longipes*	LC	**Fabaceae**	***Indigofera sanguinea*[d]**	**LC**	**Poaceae**	***Setaria pumila*[c]**	**LC**
Colchicaceae	*Colchicum melanthioides* subsp. *transvaalense*	LC	Fabaceae	*Indigofera* sp.		Poaceae	*Setaria* sp.	
Colchicaceae	*Colchicum striatum*	LC	Fabaceae	*Indigofera tristoides*	LC	Poaceae	*Setaria sphacelata* var. *sphacelata*	LC
Commelinaceae	***Commelina africana* var. *africana*[e]**	**LC**	Fabaceae	*Indigofera zeyheri*	LC	**Poaceae**	***Setaria sphacelata* var. *torta*[e]**	**LC**
Commelinaceae	*Commelina africana* var. *krebsiana*	LC	Convolvulaceae	*Ipomoea bathycolpos*	LC	**Caryophyllaceae**	***Silene burchellii*[e]**	**LC**
Commelinaceae	*Commelina africana* var. *lancispatha*	LC	**Convolvulaceae**	***Ipomoea crassipes* var. *crassipes*[dfg]**	**LC**	Caryophyllaceae	*Silene burchellii* subsp. *modesta*	LC
Commelinaceae	*Commelina benghalensis*	LC	Convolvulaceae	*Ipomoea oblongata*	LC	Caryophyllaceae	*Silene burchellii* subsp. *pilosellifolia*	LC
Apiaceae	*Conium chaerophylloides*	LC	**Convolvulaceae**	***Ipomoea ommanneyi*[f]**	**LC**	Caryophyllaceae	*Silene undulata*	LC
Convolvulaceae	*Convolvulus arvensis*(NEM:BA)	NE	Convolvulaceae	*Ipomoea simplex*	LC	Brassicaceae	*Sinapis arvensis*	NE
Convolvulaceae	*Convolvulus natalensis*	LC	Cyperaceae	*Isolepis cernua* var. *cernua*	LC	Brassicaceae	*Sisymbrium capense*	LC
Convolvulaceae	*Convolvulus sagittatus*	LC	Cyperaceae	*Isolepis costata*	LC	Brassicaceae	*Sisymbrium turczaninowii*	LC
Convolvulaceae	*Convolvulus thunbergii*	LC	Cyperaceae	*Isolepis sepulcralis*	LC	Apocynaceae	*Sisyranthus huttoniae*	LC
Asteraceae	*Conyza gouanii*	LC	Cyperaceae	*Isolepis setacea*	LC	Apocynaceae	*Sisyranthus imberbis*	LC
Asteraceae	*Conyza pinnata*	LC	**Scrophulariaceae**	***Jamesbrittenia aurantiaca*[b]**	**LC**	Solanaceae	*Solanum aculeatissimum*	NE
Asteraceae	***Conyza podocephala*[be]**	**LC**	Scrophulariaceae	*Jamesbrittenia montana*	LC	**Solanaceae**	***Solanum campylacanthum*[be]**	**LC**
Apocynaceae	*Cordylogyne globosa*	LC	Scrophulariaceae	*Jamesbrittenia* sp.		Solanaceae	*Solanum capense*	LC
Asteraceae	***Cosmos bipinnatus*[b]**	**NE**	Scrophulariaceae	*Jamesbrittenia stricta*	LC	Solanaceae	*Solanum humile*	LC
Asteraceae	*Cotula australis*	LC	Juncaceae	*Juncus dregeanus* subsp. *dregeanus*	LC	Solanaceae	*Solanum lichtensteinii*	LC
Acanthaceae	***Crabbea acaulis*[ce]**	**LC**	**Juncaceae**	***Juncus exsertus*[b]**	**LC**	**Solanaceae**	***Solanum nigrum*[e]**	**NE**
Acanthaceae	*Crabbea hirsuta*	LC	Juncaceae	*Juncus oxycarpus*	LC	Solanaceae	*Solanum retroflexum*	LC
Crassulaceae	***Crassula alba*[e]**	**LC**	Juncaceae	*Juncus punctorius*	LC	Asteraceae	*Sonchus asper* subsp. *asper*	NE
Crassulaceae	*Crassula alba* var. *alba*	NE	Acanthaceae	*Justicia anagalloides*	LC	Asteraceae	*Sonchus nanus*	LC
Crassulaceae	*Crassula barbata* subsp. *barbata*	LC	Aizoaceae	*†Khadia carolinensis*	VU	Asteraceae	*Sonchus oleraceus*	NE
Crassulaceae	*Crassula compacta*	LC	Achariaceae	*Kiggelaria africana*	LC	Orobanchaceae	*Sopubia cana* var. *cana*	LC
Crassulaceae	***Crassula lanceolata* subsp. *transvaalensis*[e]**	**LC**	Asphodelaceae	**Kniphofia albescens*	LC	Orobanchaceae	*Sopubia simplex*	LC
Crassulaceae	*Crassula natans* var. *minus*	LC	Asphodelaceae	**Kniphofia porphyrantha*	LC	Orobanchaceae	*Sopubia* sp.	
Crassulaceae	***Crassula setulosa*[e]**	**LC**	Asphodelaceae	*†*Kniphofia typhoides*	NT	Poaceae	*Sorghum bicolor* subsp. *arundinaceum*	LC
Crassulaceae	*Crassula setulosa* var. *setulosa* forma *setulosa*	NE	Poaceae	*Koeleria capensis*	LC	Rubiaceae	*Spermacoce natalensis*	LC
Crassulaceae	*Crassula* sp.		Rubiaceae	*Kohautia amatymbica*	LC	**Poaceae**	***Sporobolus africanus*[bcdh]**	**LC**
Crassulaceae	*Crassula tuberella*	LC	Rubiaceae	*Kohautia caespitosa* subsp. *brachyloba*	LC	**Poaceae**	***Sporobolus albicans*[bg]**	**LC**
Crassulaceae	***Crassula vaginata* subsp. *vaginata*[d]**	**LC**	Cyperaceae	*Kyllinga alata*	LC	Poaceae	*Sporobolus centrifugus*	LC
Asteraceae	*Crepis hypochaeridea*	NE	Cyperaceae	*Kyllinga erecta* var. *erecta*	LC	Poaceae	*Sporobolus discosporus*	LC
Amaryllidaceae	****Crinum bulbispermum*[b]**	**LC**	Cyperaceae	*Kyllinga pulchella*	LC	Poaceae	*Sporobolus fimbriatus*	LC
Amaryllidaceae	**Crinum graminicola*	LC	Fabaceae	*Lablab purpureus* subsp. *uncinatus*	LC	Poaceae	*Sporobolus* sp.	
Iridaceae	*Crocosmia paniculata*	LC	**Asteraceae**	***Lactuca inermis*[c]**	**LC**	Lamiaceae	*Stachys hyssopoides*	LC
Fabaceae	*Crotalaria distans* subsp. *distans*	LC	Hydrocharitaceae	*Lagarosiphon major*	LC	Lamiaceae	*Stachys kuntzei*	LC
Fabaceae	*Crotalaria eremicola* subsp. *eremicola*	LC	Verbenaceae	*Lantana rugosa*	LC	Lamiaceae	*Stachys natalensis* var. *natalensis*	LC
Fabaceae	*Crotalaria globifera*	LC	Thymelaeaceae	*Lasiosiphon burchellii*	LC	Lamiaceae	*Stachys nigricans*	LC
Fabaceae	*Crotalaria magaliesbergensis*	LC	Thymelaeaceae	*Lasiosiphon caffer*	LC	Lamiaceae	*Stachys* sp.	
Fabaceae	*Crotalaria* sp.		**Thymelaeaceae**	***Lasiosiphon capitatus*[d]**	**LC**	Apocynaceae	*Stenostelma periglossoides*	LC

Fabaceae	*Crotalaria sphaerocarpa* subsp. *sphaerocarpa*	LC	Thymelaeaceae	*Lasiosiphon kraussianus*	LC	Apocynaceae	*†Stenostelma umbelluliferum*	NT
Fabaceae	*Crotalaria virgulata* subsp. *grantiana*	LC	Thymelaeaceae	*Lasiosiphon microcephalus*	LC	Menispermaceae	*Stephania abyssinica* var. *tomentella*	LC
Poaceae	*Ctenium concinnum*	LC	Asteraceae	*Lasiospermum pedunculare*	LC	Poaceae	*Stiburus alopecuroides*	LC
Cucurbitaceae	*Cucumis anguria* var. *longaculeatus*	LC	**Hyacinthaceae**	***Ledebouria apertiflora*[e]**	**LC**	Poaceae	*Stiburus conrathii*	LC
Cucurbitaceae	*Cucumis hirsutus*	LC	Hyacinthaceae	*Ledebouria burkei* subsp. *burkei*	LC	Poaceae	*Stipagrostis zeyheri* subsp. *sericans*	LC
Cucurbitaceae	*Cucumis myriocarpus* subsp. *myriocarpus*	LC	Hyacinthaceae	*Ledebouria cooperi*	LC	Gesneriaceae	*Streptocarpus dunnii*	LC
Cucurbitaceae	***Cucumis zeyheri*[e]**	**LC**	Hyacinthaceae	*Ledebouria humifusa*	LC	Gesneriaceae	*Streptocarpus galpinii*	LC
Cupressaceae	***Cupressus arizonica* var. *arizonica*[a]**	**NE**	Hyacinthaceae	*Ledebouria leptophylla*	LC	Gesneriaceae	*Streptocarpus pentherianus*	LC
Commelinaceae	***Cyanotis speciosa*[e]**	**LC**	Hyacinthaceae	*Ledebouria ovatifolia*	LC	Orobanchaceae	*Striga asiatica*	LC
Amaranthaceae	*Cyathula cylindrica* var. *cylindrica*	LC	**Hyacinthaceae**	***Ledebouria ovatifolia* subsp. *ovatifolia*[bd]**	**LC**	**Orobanchaceae**	***Striga bilabiata* subsp. *bilabiata*[e]**	**LC**
Amaranthaceae	*Cyathula uncinulata*	LC	Hyacinthaceae	*Ledebouria revoluta*	LC	Orobanchaceae	*Striga elegans*	LC
Orobanchaceae	*Cycnium adonense*	LC	Hyacinthaceae	*Ledebouria* sp.		**Orobanchaceae**	***Striga gesnerioides*[f]**	**LC**
Orobanchaceae	***Cycnium tubulosum* subsp. *tubulosum*[b]**	**LC**	**Poaceae**	***Leersia hexandra*[b]**	**LC**	Lamiaceae	*Syncolostemon albiflorus*	LC
Poaceae	*Cymbopogon caesius*	LC	Fabaceae	*Leobordea adpressa* subsp. *adpressa*	LC	Lamiaceae	*Syncolostemon concinnus*	LC
Poaceae	*Cymbopogon dieterlenii*	LC	Fabaceae	*Leobordea divaricata*	LC	Lamiaceae	*Syncolostemon pretoriae*	LC
Poaceae	***Cymbopogon pospischilii*[eg]**	**NE**	Fabaceae	*Leobordea eriantha*	LC	**Asteraceae**	***Tagetes minuta*[ceg]**	**NE**
Poaceae	*Cymbopogon prolixus*	LC	Fabaceae	*Leobordea foliosa*	LC	Scrophulariaceae	*Teedia lucida*	LC
Poaceae	***Cynodon dactylon*[cde]**	**LC**	Fabaceae	*Leobordea mucronata*		Fabaceae	*Tephrosia capensis* var. *acutifolia*	LC
Poaceae	*Cynodon hirsutus*	LC	Lamiaceae	*Leonotis ocymifolia* var. *raineriana*	LC	**Fabaceae**	***Tephrosia capensis* var. *capensis*[cde]**	**LC**
Poaceae	*Cynodon transvaalensis*	LC	**Brassicaceae**	***Lepidium africanum* subsp. *africanum*[e]**	**LC**	Fabaceae	*Tephrosia multijuga*	LC
Boraginaceae	*Cynoglossum austroafricanum*	LC	Brassicaceae	*Lepidium schinzii*	LC	Fabaceae	*Tephrosia natalensis* subsp. *natalensis*	LC
Boraginaceae	***Cynoglossum hispidum*[c]**	**LC**	Brassicaceae	*Lepidium transvaalense*	LC	Fabaceae	*Tephrosia semiglabra*	LC
Boraginaceae	*Cynoglossum lanceolatum*	LC	Fabaceae	*Lessertia affinis*	LC	Scrophulariaceae	*Tetraselago longituba*	LC
Cyperaceae	***Cyperus congestus*[b]**	**LC**	Fabaceae	*Lessertia frutescens* subsp. *microphylla*	LC	Lamiaceae	*Teucrium trifidum*	LC
Cyperaceae	*Cyperus denudatus*	LC	Oleaceae	*Ligustrum vulgare*(NEM:BA)	NE	**Poaceae**	***Themeda triandra*[bcdefgh]**	**LC**
Cyperaceae	*Cyperus difformis*	LC	Limeaceae	*Limeum viscosum* subsp. *transvaalense*	LC	Santalaceae	*Thesium asterias*	LC
Cyperaceae	***Cyperus esculentus* var. *esculentus*[c]**	**LC**	Limeaceae	*Limeum viscosum* subsp. *viscosum* var. *glomeratum*	NE	Santalaceae	*Thesium costatum* var. *costatum*	LC
Cyperaceae	***Cyperus fastigiatus*[b]**	**LC**	Scrophulariaceae	*Limosella longiflora*	LC	Santalaceae	*Thesium costatum* var. *juniperinum*	LC
Cyperaceae	***Cyperus haematocephalus*[b]**	**LC**	Scrophulariaceae	*Limosella maior*	LC	Santalaceae	*Thesium goetzeanum*	LC
Cyperaceae	*Cyperus longus* var. *longus*	NE	Scrophulariaceae	*Limosella* sp.		Santalaceae	*Thesium lesliei*	LC
Cyperaceae	*Cyperus longus* var. *tenuiflorus*	NE	Plantaginaceae	*Linaria vulgaris*(NEM:BA)	NE	Santalaceae	*Thesium pallidum*	LC
Cyperaceae	*Cyperus marginatus*	LC	Linderniaceae	*Linderniella nana*		Santalaceae	*Thesium resedoides*	LC
Cyperaceae	*Cyperus obtusiflorus* var. *flavissimus*	LC	Linaceae	*Linum thunbergii*	LC	Santalaceae	*Thesium scirpioides*	LC
Cyperaceae	***Cyperus rigidifolius*[b]**	**LC**	Fabaceae	*Listia heterophylla*	LC	Santalaceae	*Thesium* sp.	
Cyperaceae	*Cyperus rupestris* var. *rupestris*	LC	Boraginaceae	*Lithospermum cinereum*	LC	Acanthaceae	*Thunbergia atriplicifolia*	LC
Cyperaceae	*Cyperus schlechteri*	LC	**Lobeliaceae**	***Lobelia acutangula*[b]**	**LC**	Acanthaceae	*Thunbergia pondoensis*	LC
Cyperaceae	***Cyperus turbatus*[e]**		Lobeliaceae	*Lobelia erinus*	LC	Asteraceae	*Tolpis capensis*	LC
Cyperaceae	*Cyperus uitenhagensis*	LC	**Lobeliaceae**	***Lobelia flaccida* subsp. *flaccida*[h]**	**LC**	Asphodelaceae	*Trachyandra asperata* var. *carolinensis*	LC
Cyperaceae	***Cyperus usitatus*[bg]**	**LC**	**Lobeliaceae**	***Lobelia sonderiana*[b]**	**LC**	Asphodelaceae	*Trachyandra asperata* var. *macowanii*	LC
Lobeliaceae	*Cyphia elata*	LC	Poaceae	*Lolium multiflorum*	NE	Asphodelaceae	*Trachyandra asperata* var. *nataglencoensis*	LC
Amaryllidaceae	**Cyrtanthus breviflorus*	LC	Poaceae	*Lolium temulentum*	NE	Asphodelaceae	*Trachyandra asperata* var. *swaziensis*	LC
Amaryllidaceae	**Cyrtanthus stenanthus*	LC	Poaceae	*Lophacme digitata*	LC	Asphodelaceae	*Trachyandra gerrardii*	LC
Amaryllidaceae	**Cyrtanthus tuckii*	LC	Asteraceae	*Lopholaena segmentata*	LC	Asphodelaceae	*Trachyandra saltii* var. *saltii*	LC
Poaceae	*Dactylis glomerata*	NE	Fabaceae	*Lotononis evansiana*		**Poaceae**	***Trachypogon spicatus*[f]**	**LC**
Solanaceae	***Datura stramonium*(NEM:BA)[e]**	**NE**	Fabaceae	*Lotononis laxa*	LC	Poaceae	*Tragus berteronianus*	LC
Aizoaceae	*Delosperma* sp.	NE	Fabaceae	*Lotus discolor* subsp. *discolor*	LC	Poaceae	*Tragus racemosus*	LC
Aizoaceae	*Delosperma sutherlandii*	LC	Poaceae	*Loudetia densispica*	LC	Zygophyllaceae	*Tribulus terrestris*	LC
Asteraceae	***Denekia capensis*[b]**	**LC**	Poaceae	*Loudetia simplex*	LC	**Poaceae**	***Trichoneura grandiglumis*[e]**	**LC**
Caryophyllaceae	*Dianthus basuticus* subsp. *basuticus* var. *basuticus*	NE	Asteraceae	*Macledium zeyheri* subsp. *zeyheri*	LC	Pottiaceae	*Trichostomum brachydontium*	
Caryophyllaceae	***Dianthus mooiensis*[e]**	**LC**	Malvaceae	*Malva parviflora* var. *parviflora*	NE	**Fabaceae**	***Trifolium africanum*[b]**	**LC**
Caryophyllaceae	*Dianthus mooiensis* subsp. *mooiensis* var. *dentatus*	NE	Scrophulariaceae	*Manulea bellidifolia*	LC	Fabaceae	*Trifolium africanum* var. *africanum*	NE
Caryophyllaceae	*Dianthus transvaalensis*	LC	Scrophulariaceae	*Manulea paniculata*	LC	Fabaceae	*Trifolium africanum* var. *lydenburgense*	NE
Fabaceae	*Dichilus strictus*	LC	Scrophulariaceae	*Manulea rhodantha* subsp. *aurantiaca*	LC	Fabaceae	*Trifolium burchellianum* subsp. *burchellianum*	LC
Asteraceae	*Dichrocephala integrifolia* subsp. *integrifolia*	LC	Celastraceae	*Maytenus undata*	LC	Fabaceae	*Trifolium pratense* var. *pratense*	NE
Scrophulariaceae	*Diclis reptans*	LC	Fabaceae	*Medicago laciniata* var. *laciniata*	NE	Poaceae	*Trisetopsis imberbis*	LC
Scrophulariaceae	***Diclis rotundifolia*[b]**	**LC**	**Fabaceae**	***Medicago polymorpha*[b]**	**NE**	**Poaceae**	***Tristachya leucothrix*[c]**	**LC**
Asteraceae	***Dicoma anomala* subsp. *anomala*[de]**	**LC**	Fabaceae	*Medicago sativa*	NE	Alliaceae	*Tulbaghia acutiloba*	LC

Asteraceae	*Dicoma anomala* subsp. *gerrardii*	LC	Scrophulariaceae	*Melanospermum rupestre*	LC	Alliaceae	*Tulbaghia cernua*	LC
Asteraceae	*Dicoma* sp.		Scrophulariaceae	*Melanospermum* sp.		Alliaceae	*Tulbaghia leucantha*	LC
Pottiaceae	*Didymodon tophaceus*		Scrophulariaceae	*Melanospermum transvaalense*	LC	Alliaceae	*Tulbaghia ludwigiana*	LC
Iridaceae	*Dierama insigne*	LC	Orobanchaceae	*Melasma scabrum* var. *scabrum*	LC	Alliaceae	*Tulbaghia* sp.	
Iridaceae	*Dierama mossii*	LC	Melianthaceae	*Melianthus dregeanus* subsp. *insignis*	LC	Brassicaceae	*Turritis glabra*	NE
Iridaceae	*Dierama* sp.		Poaceae	*Melinis nerviglumis*	LC	Typhaceae	*Typha capensis*	LC
Iridaceae	*Dierama tyrium*	LC	Poaceae	*Melinis* sp.		Poaceae	*Urochloa panicoides*	LC
Poaceae	*Digitaria ciliaris*	NE	Fabaceae	*Melolobium alpinum*	LC	Asteraceae	*Ursinia montana* subsp. *montana*	LC
Poaceae	*Digitaria diagonalis* var. *diagonalis*	LC	Fabaceae	*Melolobium calycinum*	LC	Asteraceae	*Ursinia nana* subsp. *leptophylla*	LC
Poaceae	*Digitaria diversinervis*	LC	Fabaceae	*Melolobium candicans*	LC	Asteraceae	*Ursinia nana* subsp. *nana*	LC
Poaceae	***Digitaria eriantha*[g]**	**LC**	**Fabaceae**	***Melolobium microphyllum*[e]**	**LC**	Asteraceae	*Ursinia paleacea*	LC
Poaceae	*Digitaria flaccida*	LC	Fabaceae	*Melolobium obcordatum*	LC	Asteraceae	*Ursinia tenuiloba*	LC
Poaceae	*Digitaria sanguinalis*	NE	Fabaceae	*Melolobium wilmsii*	LC	Lentibulariaceae	*Utricularia prehensilis*	LC
Poaceae	*Digitaria* sp.		Lamiaceae	*Mentha aquatica*	LC	Fabaceae	*Vachellia karroo*	LC
Poaceae	***Digitaria ternata*[bc]**	**LC**	**Lamiaceae**	***Mentha longifolia* subsp. *capensis*[b]**	**LC**	Valerianaceae	*Valeriana capensis* var. *capensis*	LC
Poaceae	*Digitaria tricholaenoides*	LC	Lamiaceae	*Mentha longifolia* subsp. *polyadena*	LC	Rubiaceae	*Vangueria pygmaea*	LC
Poaceae	***Diheteropogon amplectens* var. *amplectens*[f]**	**LC**	Hyacinthaceae	*†Merwilla plumbea*	NT	Rubiaceae	*Vangueria thamnus*	LC
Asteraceae	*Dimorphotheca caulescens*	LC	Poaceae	*Microchloa caffra*	LC	**Verbenaceae**	***Verbena bonariensis*(NEM:BA)[b]**	**NE**
Asteraceae	*Dimorphotheca jucunda*	LC	Phrymaceae	*Mimulus gracilis*	LC	**Verbenaceae**	***Verbena brasiliensis*(NEM:BA)[d]**	**NE**
Asteraceae	*Dimorphotheca spectabilis*	LC	Nyctaginaceae	*Mirabilis jalapa*(NEM:BA)	NE	**Verbenaceae**	***Verbena litoralis*[e]**	**NE**
Asteraceae	*Dimorphotheca zeyheri*	LC	Apocynaceae	*†Miraglossum davyi*	VU	**Verbenaceae**	***Verbena rigida*(NEM:BA)[d]**	**NE**
Dioscoreaceae	**Dioscorea dregeana*	LC	Apocynaceae	*Miraglossum pulchellum*	LC	Plantaginaceae	*Veronica anagallis-aquatica*	LC
Ebenaceae	***Diospyros austroafricana* var. *microphylla*[de]**	**LC**	Poaceae	*Miscanthus junceus*	LC	Fabaceae	*Vigna oblongifolia* var. *oblongifolia*	LC
Ebenaceae	*Diospyros lycioides* subsp. *guerkei*	LC	Poaceae	*Monocymbium ceresiiforme*	LC	Fabaceae	*Vigna* sp.	
Ebenaceae	***Diospyros lycioides* subsp. *lycioides*[de]**	**LC**	**Lobeliaceae**	***Monopsis decipiens*[bdf]**	**LC**	Fabaceae	*Vigna unguiculata* subsp. *unguiculata* var. *unguiculata*	NE
Hyacinthaceae	*Dipcadi brevifolium*	LC	**Geraniaceae**	***Monsonia angustifolia*[de]**	**LC**	**Fabaceae**	***Vigna vexillata* var. *vexillata*[f]**	**LC**
Hyacinthaceae	*Dipcadi marlothii*	LC	Geraniaceae	*Monsonia attenuata*	LC	Campanulaceae	*Wahlenbergia* sp.	
Hyacinthaceae	*Dipcadi viride*	LC	Geraniaceae	*Monsonia brevirostrata*	LC	**Campanulaceae**	***Wahlenbergia undulata*[b]**	**LC**
Orchidaceae	**Disa aconitoides* subsp. *aconitoides*	LC	Iridaceae	*Moraea elliotii*	LC	Campanulaceae	*Wahlenbergia virgata*	LC
Orchidaceae	**Disa cooperi*	LC	**Iridaceae**	***Moraea pallida*[b]**	**LC**	Iridaceae	**Watsonia bella*	LC
Orchidaceae	**Disa nervosa*	LC	Iridaceae	*Moraea pubiflora*	LC	Iridaceae	**Watsonia pulchra*	LC
Orchidaceae	**Disa patula* var. *transvaalensis*	LC	Iridaceae	*Moraea simulans*	LC	Solanaceae	*Withania somnifera*	LC
Orchidaceae	**Disa stachyoides*	LC	Iridaceae	*Moraea stricta*	LC	Apocynaceae	*Woodia* sp.	
Orchidaceae	**Disa versicolor*	LC	Boraginaceae	*Myosotis graminifolia*	LC	**Asteraceae**	***Xanthium spinosum*(NEM:BA)[be]**	**NE**
Orchidaceae	**Disperis cooperi*	LC	Boraginaceae	*Myosotis sylvatica*	NE	Convolvulaceae	*Xenostegia tridentata* subsp. *angustifolia*	LC
Orchidaceae	**Disperis fanniniae*	LC	Brassicaceae	*Nasturtium officinale*(NEM:BA)	NE	Xyridaceae	*Xyris gerrardii*	LC
Fabaceae	*Dolichos angustifolius*	LC	**Scrophulariaceae**	***Nemesia fruticans*[bde]**	**LC**	Apocynaceae	*Xysmalobium asperum*	LC
Fabaceae	*Dolichos falciformis*	LC	Scrophulariaceae	*Nemesia* sp.		Apocynaceae	*Xysmalobium parviflorum*	LC
Hyacinthaceae	*Drimia calcarata*	LC	Orchidaceae	**Neobolusia tysonii*	LC	Apocynaceae	*Xysmalobium stockenstromense*	LC
Hyacinthaceae	*Drimia depressa*	LC	**Amaryllidaceae**	***Nerine angustifolia*[b]**	**LC**	Apocynaceae	*Xysmalobium undulatum*	NE
Hyacinthaceae	*†Drimia elata*	DD	Amaryllidaceae	*†Nerine gracilis*	VU	**Apocynaceae**	***Xysmalobium undulatum* var. *undulatum*[bd]**	**LC**
Hyacinthaceae	*Drimia multisetosa*	LC	Amaryllidaceae	*Nerine krigei*	LC	**Asparagaceae**	***Yucca gloriosa*[a]**	
Hyacinthaceae	*Drimia pauciflora*	LC	Amaryllidaceae	*Nerine laticoma*	LC	Scrophulariaceae	*Zaluzianskya elongata*	LC
Hyacinthaceae	*Drimia sphaerocephala*	LC	Amaryllidaceae	*Nerine rehmannii*	LC	Scrophulariaceae	*Zaluzianskya rubrostellata*	LC
Dryopteridaceae	*Dryopteris athamantica*	LC	Asteraceae	*Nidorella anomala*	LC	Scrophulariaceae	*Zaluzianskya* sp.	
Acanthaceae	*Dyschoriste burchellii*	LC	Asteraceae	*Nidorella auriculata*	LC	Scrophulariaceae	*Zaluzianskya spathacea*	LC
Amaranthaceae	*Dysphania ambrosioides*	NE	Asteraceae	*Nidorella hottentotica*	LC	Araceae	**Zantedeschia albomaculata* subsp. *albomaculata*	LC
Amaranthaceae	*Dysphania multifida*	NE	Asteraceae	*Nidorella resedifolia* subsp. *resedifolia*	LC	Araceae	**Zantedeschia albomaculata* subsp. *macrocarpa*	LC
Amaranthaceae	*Dysphania schraderiana*	NE	Menyanthaceae	*Nymphoides thunbergiana*	LC	Araceae	**Zantedeschia rehmannii*	LC
Poaceae	*Echinochloa crus-galli*	LC	Ochnaceae	*Ochna natalitia*	LC	**Amaryllidaceae**	***Zephyranthes candida*[c]**	
Boraginaceae	*Echium plantagineum*(NEM:BA)	NE	Lamiaceae	*Ocimum obovatum* subsp. *obovatum* var. *obovatum*	NE	Asteraceae	*Zinnia peruviana*	NE
Poaceae	*Ehrharta erecta* var. *natalensis*	LC	Onagraceae	*Oenothera jamesii*	NE	Rhamnaceae	*Ziziphus mucronata* subsp. *mucronata*	LC
Cyperaceae	***Eleocharis dregeana*[b]**	**LC**	**Onagraceae**	***Oenothera rosea*[b]**	**NE**	Rhamnaceae	*Ziziphus zeyheriana*	LC
Cyperaceae	*Eleocharis limosa*	LC	Onagraceae	*Oenothera stricta* subsp. *stricta*	NE	Fabaceae	*Zornia capensis* subsp. *capensis*	LC
Fabaceae	*Elephantorrhiza elephantina*	LC	Onagraceae	*Oenothera tetraptera*	NE	Fabaceae	*Zornia linearis*	LC
Fabaceae	*Elephantorrhiza praetermissa*	LC	**Rubiaceae**	***Oldenlandia herbacea* var. *herbacea*[d]**	**LC**	Fabaceae	*Zornia milneana*	LC