

ECOLOGY SCOPING REPORT:

Mashishing Township Development, Mashishing, Mpumalanga



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Executive Summary

This document provides an assessment of the potential ecological sensitivities and impacts associated with the proposed Mashishing Township development, Mashishing, Mpumalanga Province.

The first section provides an outline of the Terms of Reference for the study, as well as the approach adopted for undertaking the assessment.

The next section provides an outline of the methodology used to undertake the assessment. This includes the approach taken to assess the sensitivity of the site and a summary of the background information used to undertake the assessment. Background information includes electronic databases with species information, Red Lists, published field guides and National and Provincial legislation, specifically regulations with published lists of species and/or ecosystems.

The next section provides details on legislation that applies to development of the site with respect to the ecological receiving environment. There are various acts that limit development or require permits before development can proceed. The most important of these are permits required in terms of protected species that could potentially occur on site.

The next section provides a description of the ecological receiving environment, including details on the location of the site, the regional vegetation patterns, local habitat patterns occurring on site, lists of plant and animal species of concern that are likely to occur there and a list of species that were observed on site during the site visit. Details of this section are summarised as follows:

1. The site is primarily within one regional vegetation types called Lydenburg Thornveld, which is considered in the scientific literature to be Vulnerable, but is not listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
2. The Mpumalanga Biodiversity Conservation Plan and the more recent Mpumalanga Biodiversity Sector Plan indicate that most remaining patches of natural habitat have moderate to low conservation value. The latter Plan does not show high sensitivity for any remaining natural habitat on site, but indicates that approximately half of the site is within a buffer zone for a protected area.
3. A broad habitat map of the study area was produced by mapping from aerial imagery for this project. This showed that significant parts of the study area have been transformed by informal housing and associated cultivation. Remaining natural areas include grassland and drainage lines.
4. There are fifteen Red or Orange List plant species that have been recorded from the quarter degree grid in which the study site is situated, of which five were considered to have a medium to high chance of occurring in the type of habitats available on site, one of which is listed as Critically Endangered, one as Near Threatened, and three as Declining.
5. There are two plant species protected according to the National Environmental Management: Biodiversity Act that have a geographical distribution that includes the site. These are *Merwillia plumbea* and *Crinum bulbispermum*, both of which could potentially occur on site.
6. There are no protected tree species that are likely to occur on site.

7. A total of 134 mammal species have a geographical distribution that includes the general study area in which the site is found. Of the species currently listed as threatened or protected (see Appendix 5 for list of protected species), the following are considered to have a medium to high probability of occurring on site, based on habitat suitability: Brown Hyaena, Serval and the Honey Badger. Given the nature of the proposed project and the fact that many of the species of concern are relatively mobile, few threatened, near threatened or protected mammal species are likely to be significantly negatively impacted by activities on the site.
8. The site contains habitat that is suitable for various frog species, although only one protected species could potentially occur on site, the Giant Bullfrog, also listed as Near Threatened in South Africa. The site does not contain breeding habitat for this species, so it would only occur there as foraging individuals, if at all.
9. A total of 110 reptile species have a geographical distribution that includes the general study area in which the site is found. Four species of conservation concern could potentially occur on site, namely Breyer's Long-tailed Seps, listed as Vulnerable, and the Coppery Grass Lizard, the Large-scaled Grass Lizard and the Striped Harlequin Snake, all three listed as Near Threatened.
10. A total of 418 bird species have a geographical distribution that includes the general study area in which the site is found. The site contains habitat that is suitable for various bird species of conservation concern. Those that could potentially be found on site are as follows: Grey-crowned Crane (EN), African Marsh Harrier (EN), Denham's Bustard (VU), Lanner Falcon, (VU), Southern Bald Ibis (VU), White-bellied Korhaan (VU), Secretarybird (VU), Blue Crane (NT), European Roller (NT), and Abdim's Stork (NT).
11. The site is not within, but is relatively close to two Important Bird Areas.
12. A sensitivity map of the site was produced that identifies areas of high sensitivity for the site. This includes habitat associated with wetlands and remaining patches of Vulnerable vegetation.

The next section of the report identifies a number of potential impacts for the proposed project. These are described and discussed. Some potential impacts are not considered to be important for this project at this site and further investigation of these is not required. The following impacts have been assessed as having medium or high significance prior to mitigation:

1. Loss/destruction of natural habitat,
2. Habitat fragmentation,
3. Displacement of fauna,
4. Flora direct or indirect mortality,
5. Invasion by alien plants.

The next section of the report provides some possible mitigation measures for managing potential impacts related to this project.

The next section provides a discussion of ecological patterns observed on site in order to contextualise the information relative to legal requirements and potential impacts related to the project.

The next section provides recommendations based on the Scoping assessment. The main recommendations are as follows:

- Wetland plant communities and an appropriate buffer should be omitted from the development footprint.

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- There are various species of concern that could or do occur on site. It is recommended that Botanical and Herpetological pre-construction walk-through surveys be undertaken to identify, locate and provide recommendations for rescue of any individuals of plant and reptile species of concern that may occur on site.
- Control measures for some potential impacts are relatively well-known and easy to implement and it is recommended that these be applied as mitigation measures for some potential impacts.

The final section provides conclusions for the study, which are as follows:

- Significant parts of the study area are either already settled or are cultivated or have been previously cultivated and are therefore not considered to have high sensitivity or biodiversity value. There are, however, areas of natural habitat that are classified as Endangered and have high conservation value.
- There are various plant and reptile species of concern that do or could occur on site. The identity and location of any that occur on site needs to be determined and appropriate steps taken to rescue and/or relocate any individuals that are found and obtain the necessary permits to ensure legal compliance.

The report includes a comprehensive list of Appendices containing lists of species and species of concern with a geographical distribution that includes the site as well as lists of species protected according to National legislation.

Declaration of Independence & Summary of Expertise

Appointment of specialist

David Hoare Consulting (Pty) Ltd was commissioned by Environmental Impact Management Services (Pty) Ltd to provide specialist consulting services for the Environmental Impact Assessment for the proposed Mashishing Township development in Mashishing in Mpumalanga Province. The consulting services comprise an assessment of potential impacts on flora and fauna in the study area by the proposed project.

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Summary of expertise

Dr David Hoare:

- Dr Hoare has majors in Botany and Zoology with distinction from Rhodes University, Grahamstown, an Honours Degree (with distinction) in Botany from Rhodes University, an MSc (cum laude) from the Department of Plant Science, University of Pretoria, and a PhD in Botany from the Nelson Mandela Metropolitan University, Port Elizabeth with a focus on grassland diversity.
- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting (Pty) Ltd, an independent consultancy, in 2001.

- Ecological consultant since 1995, with working experience in Gauteng, Mpumalanga, Limpopo, North West, Eastern Cape, Western Cape, Northern Cape and Free State Provinces, Tanzania, Kenya, Mozambique, Botswana and Swaziland.
- Conducted, or co-conducted, over 380 specialist ecological surveys as an ecological consultant. Areas of specialization include general ecology, biodiversity assessments, vegetation description and mapping, plant species surveys and remote sensing of vegetation. Has undertaken work in grassland, thicket, forest, savannah, fynbos, coastal vegetation, wetlands and nama-karoo vegetation, but has a specific specialization in grasslands and wetland vegetation.
- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

Independence

David Hoare Consulting (Pty) Ltd and its Directors have no connection with the proponent. David Hoare Consulting (Pty) Ltd is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. David Hoare is an independent consultant to Environmental Impact Management Services (Pty) Ltd and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work. The percentage work received directly or indirectly from the proponent in the last twelve months is 0% of turnover.

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Introduction

This document presents the results of the impact assessment process applied to the ecological receiving environment of the proposed Mashishing Township development near Mashishing in Mpumalanga Province.

In October 2017 David Hoare Consulting (Pty) Ltd was appointed by Environmental Impact Management Services (Pty) Ltd to undertake an assessment of the impacts of the project on flora, fauna and ecology in the study area.

Scope of Work

The specific terms of reference for the Scoping study are to provide a report containing the following information:

- Specialist declaration of independence and statement of objectivity for the assessment;
- Summary of the specialist's expertise to undertake Environmental Impact Assessments, including a knowledge of the relevant legislation, regulations and any guidelines that have relevance to the field of expertise;
- Description of the general surroundings in the study area, as well as site specific environment (within the defined study area on a relevant scale) with respect to the specific specialist field;
- Identification of potential sensitivities related to the field of expertise (e.g. red data species, sensitive visual receptors, heritage features, etc.);
- Identification of sensitivities within the study area (preparation of a GIS sensitivity map of the study area), based on findings during the site visit, aerial photography or other research;
- Identification and description of any impacts that may result from the proposed activities (both exploration and supplementary) during all phases of the project, including cumulative, residual and latent impacts. All phases of the project should be considered and these phases shall be classified as:
 - Planning and Design;
 - Construction;
 - Operation;
 - Decommissioning; and
 - Rehabilitation and Closure.
- Identify any legal provisions relevant to the specific field of expertise and the proposed activity (including relevant legislation, both National and Provincial, Department Guidelines and Management Frameworks);
- Identified potential impacts (cumulative, direct and indirect) will be quantified (where possible) and fully described for each feasible alternative;
- Identified potential impacts will be evaluated in accordance with the EIMS methodology to determine significance. Significance will be determined by considering and quantifying, where possible, the nature, extent, duration, intensity and probability of each potential impact;
- Comparative assessment of the identified alternatives (utilising the significance rating variances as specialist reasoning);

- Recommendations must be made regarding mitigation and / or management measures to address the unavoidable impacts identified;
- Residual and latent impacts after mitigation must then be evaluated (in accordance with the assessment methodology described above) such that actual implemented results can be measured against those predicted;
- Provide detailed mitigation/management measures for the management of the identified impacts for inclusion in the EMP. The recommendations and mitigation/management measures must be presented in a tabulated format for each phase of the project and must include:
 - Detailed description of mitigation measures or management options;
 - Means of measuring successful implementation (Performance Targets and Indicators);
 - Roles and responsibilities for implementation;
 - Timeframes for implementation; and
 - Targets and Key Performance Indicators.
- Compilation of an Action Plan for Implementation of the recommended mitigation measures as it pertains to the field of expertise. This plan must, at a minimum, include the following:
 - Management Principles & Objectives;
 - Methods and Materials for Implementation;
 - Responsibilities for Implementation;
 - Timeframes for Implementation;
 - Data Collection;
 - Applicable Standards;
 - Trending and analysis;
 - Targets and Key Performance Indicators;
 - Reporting; and
 - Review and Audit.
- Identify any gaps in knowledge, data or information, including:
 - Report on the adequacy of predictive methods utilised;
 - Report on the adequacy of underlying assumptions;
 - Report on uncertainties in the information provided; and
- The deliverable of the evaluation phase will be a specialist Impact Assessment Report including management and mitigation plan.

Legislative and policy framework

Relevant legislation is provided in this section to provide a description of the key legal considerations of importance to the proposed project from an ecological point of view. The applicable legislation is listed below.

Legislation

National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA requires, *inter alia*, that:

- “development must be socially, environmentally, and economically sustainable”,
- “disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied”,
- “a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions”.

NEMA states that “the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people’s common heritage.”

Environment Conservation Act No 73 of 1989 Amendment Notice No R1183 of 1997

The ECA states that:

Development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of, *inter alia*, the following factors:

- that pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
- that negative impacts on the environment and on peoples’ environmental rights be anticipated and prevented, and where they cannot be altogether prevented are minimised and remedied.

The developer is required to undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations (2014, as amended) in order to control activities which might have a detrimental effect on the environment. Such activities will only be permitted with written authorisation from a competent authority.

National Forests Act (Act no 84 of 1998)

Protected trees

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that (according to Section 15(1)) “no person may cut, damage, disturb, destroy or remove any *protected tree*, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister”. GN 1042 provides a list of protected tree species (amends GN 1012).

Forests

Prohibits the destruction of indigenous trees in any natural forest without a licence.

National Environmental Management: Biodiversity Act (Act No 10 of 2004)

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area is in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- (1) A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are “of a nature that may negatively impact on the survival of a listed threatened or protected species”.

Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs;
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment; and
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection

Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

The Environmental Impact Assessment (EIA) Regulations include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (R983 of 2014);
- Listing Notice 2: activities that require seeping and environmental impact report (EIR) (R984 of 2014); and
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R985 of 2014).

Activity 12 in Listing Notice 3 relates to the clearance of 300m² of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of S52 of the Biodiversity Act. This means any development that involves loss of natural habitat in a listed critically endangered or endangered ecosystem is likely to require at least a basic assessment in terms of the EIA regulations.

It is important to note that while the original extent of each listed ecosystem has been mapped, a basic assessment report in terms of the EIA regulations is triggered only in remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). Lists species protected according to National legislation.

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). Lists species protected according to National legislation.

Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled;

- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread; and
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

National Water Act (Act 36 of 1998)

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

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 Veld and Forest Fire Act (Act No. 101 of 1998)

Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

Mpumalanga Nature Conservation Act, No. 10 of 1998

This Act provides for the consolidation and amendment of laws relating to nature conservation in the Province. It includes a section on protected plants (Section 69), including a schedule (Schedule 11) in which a list of protected species is provided. The Act also specifies that all species listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora are protected. All species protected under the provincial legislation need to be specified on any clearing permit applications for the site. Protected species according to the Mpumalanga Nature Conservation Act are listed in Appendix 3.

Other Acts

Other Acts that may apply to biodiversity issues, but which are considered to not apply to the current site are as follows:

- National Environmental Management Protected Areas Act (Act No. 57 of 2003);
- Marine Living Resources Act (Act No. 18 of 1998);
- Sea Birds and Seals Protection Act (Act No. 46 of 1973);
- Lake Areas Development Act (Act No. 39 of 1975);

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- Mountain Catchment Areas Act (Act No. 63 of 1970); and
- Integrated Coastal Zone Management Act (Act No. 24 of 2008).

Background information used and details of site visits undertaken

This section provides an outline of the background information that was used to make the assessment of potential impacts on the ecological receiving environment as well as information on site visits undertaken.

Background information

Infrastructure layout plan

A study area boundary was provided that showed the proposed location of proposed development. This could be overlaid on aerial imagery in Google Earth to show the spatial relationship of proposed development and landscape features. This provided a spatial indication of the location of potential direct impacts on the biodiversity receiving environment.

Electronic databases

There are various electronic databases containing up-to-date on the threatened status and known distribution of plants and animals within the borders of South Africa (for example: <http://redlist.sanbi.org/> (species national threatened status), <http://www.iucnredlist.org> (species global threatened status), <http://posa.sanbi.org> (plant species distribution), <http://sibis.sanbi.org/> (species distribution), <http://vmus.adu.org.za> (species distribution)).

Published field guides

There are various published field guides providing habitat, distribution and identification information on various groups of plants and animals (for example: Friedmann & Daly 2004, Mills & Hes 1997, Monadjem et al. 2010 (mammals), Du Preez & Carruthers 2009 (amphibians), Alexander & Marais 2007, Branch 1988, Marais 2004, Tolley & Burger 2007 (reptiles), Chittenden 2007, Barnes 2000 (birds)).

National and Provincial legislation

Various National and Provincial legislation provide lists of protected plant and animal species, including the following:

1. GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List, published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004);

2. GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List, published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004);
3. Mpumalanga Nature Conservation Act, No. 10 of 1998;
4. National Forests Act (Act no 84 of 1998); and
5. Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection, published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Site visits undertaken

A single site visit was undertaken during the Scoping Phase of this assessment on 23 – 24 July 2018. The purpose of this site visit was to ground verify the habitat and sensitivity maps. At the time of this survey, the vegetation was still dry and senescent from winter. Parts of the natural areas had also been burnt. No floristic data was therefore collected during this survey.

Methodology

The assessment is to be undertaken in two phases, a Scoping phase and an Impact Assessment phase. This report provides a Scoping level description of the site and assessment of the activity.

The objective of the study was to provide a description of fauna and flora patterns within the study area in order to identify any highly sensitive areas that should be avoided during development. It was therefore necessary to provide checklists of sensitive species that could potentially occur in the study area as well as habitats with high conservation value. For potential species, only those of high conservation concern are provided. It was also intended to provide a broad sensitivity map of the study area based on available maps and database information.

Inventory surveys for EIAs

To assess impacts on biodiversity a complete inventory of species occurring on site is usually required. However, it can take long periods of time to determine the presence of flora and faunal species on site using established survey methods, after which it is found that usually only the most common species are detected.

It might seem self-evident that a more or less complete species list is vital for the assessment of impacts of a proposed development, as surely the species to be impacted need to be known. However, through the use of species accumulation curves, Thompson et al. (2007) have shown that massive levels of trapping are required to record >80% of the predicted vertebrate faunal assemblage. To a large extent the species to be impacted can be predicted from a literature and habitat review, and as long as errors of inclusion rather than exclusion are made, the species to be impacted will be known. A consequence of conducting an inventory survey is that a great deal of effort is put into work such as establishing and checking traplines that catch mostly common species, whose presence can be readily predicted. This effort can prevent the assessor from doing other, arguably more useful, work. For example, the zoologists' time might be better spent focussing on species of particular conservation significance, investigating rare habitats or developing an understanding of ecological processes. Due to the limitations of field-based inventory surveys, it has been recommended (Thompson et al. 2007) that the following approach be taken:

- Desktop review to identify issues that might arise with respect to a proposal (significant species, rare habitats and processes);
- Site inspection to familiarise the consultant with the site, the scale of the proposal and to determine the appropriate field programme;
- An impact assessment field programme that might involve targeted sampling for significant species, sampling of species sensitive to ecological processes, sampling in rare or significant habitats and sampling to investigate patterns of biodiversity; and
- If necessary, undertake a monitoring programme that targets selected significant species (or those that might be considered suitable as bio-indicators).

Assessment philosophy for this study

Sites vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the potential impacts of a proposed development often requires evaluating the conservation value of a site relative to other natural areas and relative to the national importance of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on the site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed here by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

Species

1. threatened plant species;
2. protected trees; and
3. threatened animal species.

Ecosystems

1. threatened ecosystems;
2. protected ecosystems;
3. critical biodiversity areas;
4. areas of high biodiversity; and
5. centres of endemism.

Processes

1. corridors;
2. mega-conservancy networks;
3. rivers and wetlands; and
4. important topographical features.

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to be significantly negatively affected if development occurs. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

1. Environment Conservation Act (Act 73 of 1989);
2. National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998); and

3. National Environmental Management Biodiversity Act, 2004. (Act 10 Of 2004).

Species of conservation concern

There are two types of species of concern for the site under investigation, (i) those listed by conservation authorities as being on a Red List and are therefore considered to be at risk of extinction, and (ii) those listed as protected according to National and/or Provincial legislation.

Red List plant species

Determining the conservation status of a species is required in order to identify those species that are at greatest risk of extinction and, therefore, in most need of conservation action. South Africa has adopted the IUCN Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo et al. 2009) contains a list of all species that are considered to be at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (<http://redlist.sanbi.org/>). According to the website of the Red List of Southern African Plants (<http://redlist.sanbi.org/>), *the conservation status of plants indicated on the Red List of South African Plants Online represents the status of the species within South Africa's borders. This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: <http://www.iucnredlist.org>.* The South African assessment is used in this study.

The purpose of listing Red List plant species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements in order to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (<http://posa.sanbi.org>) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species will then be assessed by comparing the habitat requirements with those habitats that occur on site.

Protected trees

Regulations published for the National Forests Act (Act 84 of 1998) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat

requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (<http://sibis.sanbi.org/>) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed in the Scoping Report and were considered as being at risk of occurring there.

Other protected species

National and Provincial legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following:

- National Environmental Management: Biodiversity Act (Act No 10 of 2004); and
- Mpumalanga Nature Conservation Act, No. 10 of 1998.

This legislation contains lists of species that are protected. These lists were scanned in order to identify any species that have a geographical range that includes the study area and habitat requirements that are met by those found on site. These species were searched for within suitable habitats on site or, where relevant, it was stated that it was considered possible that they could occur on site.

There is additional legislation that provides lists of protected species, but the legislation to which these are attached deal primarily with harvesting or trade in listed species and do not specifically address transformational threats to habitat or individuals. This includes the following legislation:

- CITES: Convention on the Trade in Endangered Species of Wild Fauna and Flora.

Terrestrial fauna species of concern

The purpose of listing fauna species of conservation concern is to provide information on the potential occurrence of species of special concern in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements in order to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists of threatened and near threatened animal species that have a geographical range that includes the study area were obtained from literature sources (for example, Alexander & Marais 2007, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997). The likelihood of any of them occurring was evaluated on the basis of habitat preference and habitats available at each of the proposed sites. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements*: most Red List animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status*: in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red List species (especially wetland-related habitats where water-quality plays a major role); and

- *Habitat linkage*: movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning of Red Data species within the study area.

Species probability of occurrence

For all threatened or protected flora and fauna that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match general habitat description for species (e.g. grassland), but detailed microhabitat requirements (e.g. mountain grassland on shallow soils overlying sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. mountain grassland on shallow soils overlying sandstone); and
- DEFINITE: species found in habitats on site.

Habitat sensitivity

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

1. The general status of the vegetation of the study area (which areas are transformed versus those that are still in a natural status);
2. Various provincial, regional or national level conservation planning studies may have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA). If available, the mapped results from these were taken into consideration in compiling the habitat sensitivity map; and
3. Habitats in which plant and/or animal species occur that may be protected or are considered to have high conservation status are considered to be sensitive.

An explanation of the different sensitivity classes is given in Table 1. Areas containing untransformed natural vegetation that is important for Red List organisms are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Table 1: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
<p>VERY HIGH “NO-GO” areas</p>	<p>Indigenous natural areas that are highly positive for the following:</p> <ul style="list-style-type: none"> • Presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • <u>High</u> conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, National Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act). <p>And may also be positive for the following:</p> <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, unique ecosystems). • <u>High</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). • <u>Low</u> ability to respond to disturbance (low resilience, dominant species very old). 	<ul style="list-style-type: none"> • CBA 1 areas. • Remaining areas of vegetation type listed in National Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable. • Protected forest patches. • Confirmed presence of populations of threatened species. • Confirmed presence of habitats essential for the survival of populations of threatened species.
<p>HIGH</p>	<p>Indigenous natural areas that are highly positive for <u>any</u> of the following:</p> <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, unique habitat). • Presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • <u>Low</u> ability to respond to disturbance (low resilience, dominant species very old). • Moderate to high conservation status (moderate to low proportion remaining intact, moderately fragmented, habitat for species that are at risk). 	<ul style="list-style-type: none"> • CBA 2 "critical biodiversity areas". • Confirmed presence of populations of species of intermediate threat status (near threatened, rare). • Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). • Confirmed habitat for species of lower threat status (near threatened, rare).

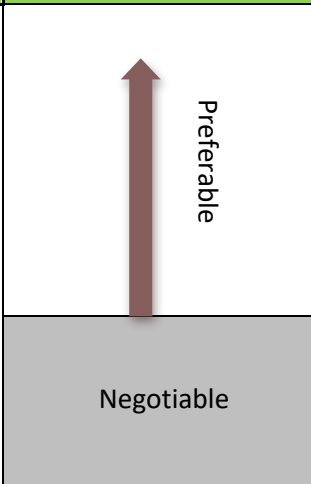
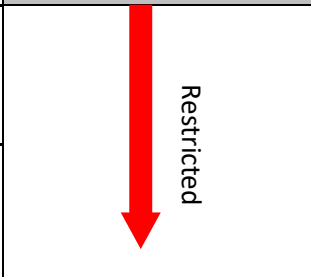
Sensitivity	Factors contributing to sensitivity	Example of qualifying features
	<ul style="list-style-type: none"> Moderate to high value ecological goods and services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). 	<ul style="list-style-type: none"> Habitat with exceptionally high diversity (richness or turnover). Habitat with unique species composition and narrow distribution. Habitat containing individuals of extreme age. Habitat with low ability to recover from disturbance. Habitat with exceptionally high diversity (richness, turnover). Habitat with unique species composition and/or narrow distribution. Ecosystem providing high value ecosystem goods and services.
MEDIUM-HIGH	Indigenous natural areas that are positive for one of the factors listed above, but not a combination of factors.	<ul style="list-style-type: none"> CBA 2 "corridor areas". Habitat with high diversity (richness, turnover). Habitat where a species of lower threat status (e.g. near threatened, rare) could potentially occur (habitat is suitable but no confirmed records).
MEDIUM	<p>Other indigenous natural areas in which factors listed above are of no particular concern.</p> <p>May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.</p>	
MEDIUM-LOW	Degraded or highly disturbed indigenous natural vegetation. May also include secondary vegetation in an advanced state of development in which habitat is still ecologically functional and which could potentially provide habitat for species of concern.	

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
LOW	No natural habitat remaining.	

A standardized sensitivity mapping methodology was used by all consultants on this project. This methodology utilizes a scoring system that identifies sensitive and non-sensitive areas in terms of the development activity, rather than being focused on the inherent sensitivity of the landscape/environment. The scoring methodology makes provision for specialists to score areas/features that would be suitable or preferred for development in the context of the proposed project and not purely on the perceived sensitivity of landscape features.

An explanation of the sensitivity ratings and weightings is given in Table 2.

Table 2: Sensitivity ratings and weightings.

Sensitivity rating	Description	Weighting	Preference
Least Concern	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for production or infrastructure placement.	-1	
Low/poor	The proposed development will not have a significant effect on the inherent feature status and sensitivity.	0	
High	The proposed development will negatively influence the current status of the feature.	+1	
Very high	The proposed development will significantly negatively influence the current status of the feature.	+2	

Impact assessment methodology

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2014, as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

Determination of Environmental Risk

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = (E+D+M+R) \times N$$

4

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 3.

Table 3: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	-1	Likely to result in a negative / detrimental impact
	+1	Likely to result in a positive / beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary)
	3	Local (i.e. the area within 5 km of the site)
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),

	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude / intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 4.

Table 4: Probability scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur).

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table 5: Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 6.

Table 6: Significance classes.

Environmental Risk Score	
Value	Description
<9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9-<17	Medium (i.e. where the impact could have a significant environmental risk),
≥17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

Receiving environment

Location of site

The study area is located to the north-west of the town of Mashishing / Lydenburg and directly adjacent to the existing Mashishing urban area (Figure 1). A local access road forms the northern boundary of the site, otherwise existing township areas form one boundary of the site and open landscapes the others. The study area falls within the quarter degree grid 2530AB.

Climate

The study area has warm summers and cold winters. Rainfall is largely seasonal and occurs in summer. Annual rainfall is above 700 mm per annum, which is considered to be moderately wet. Rainfall is

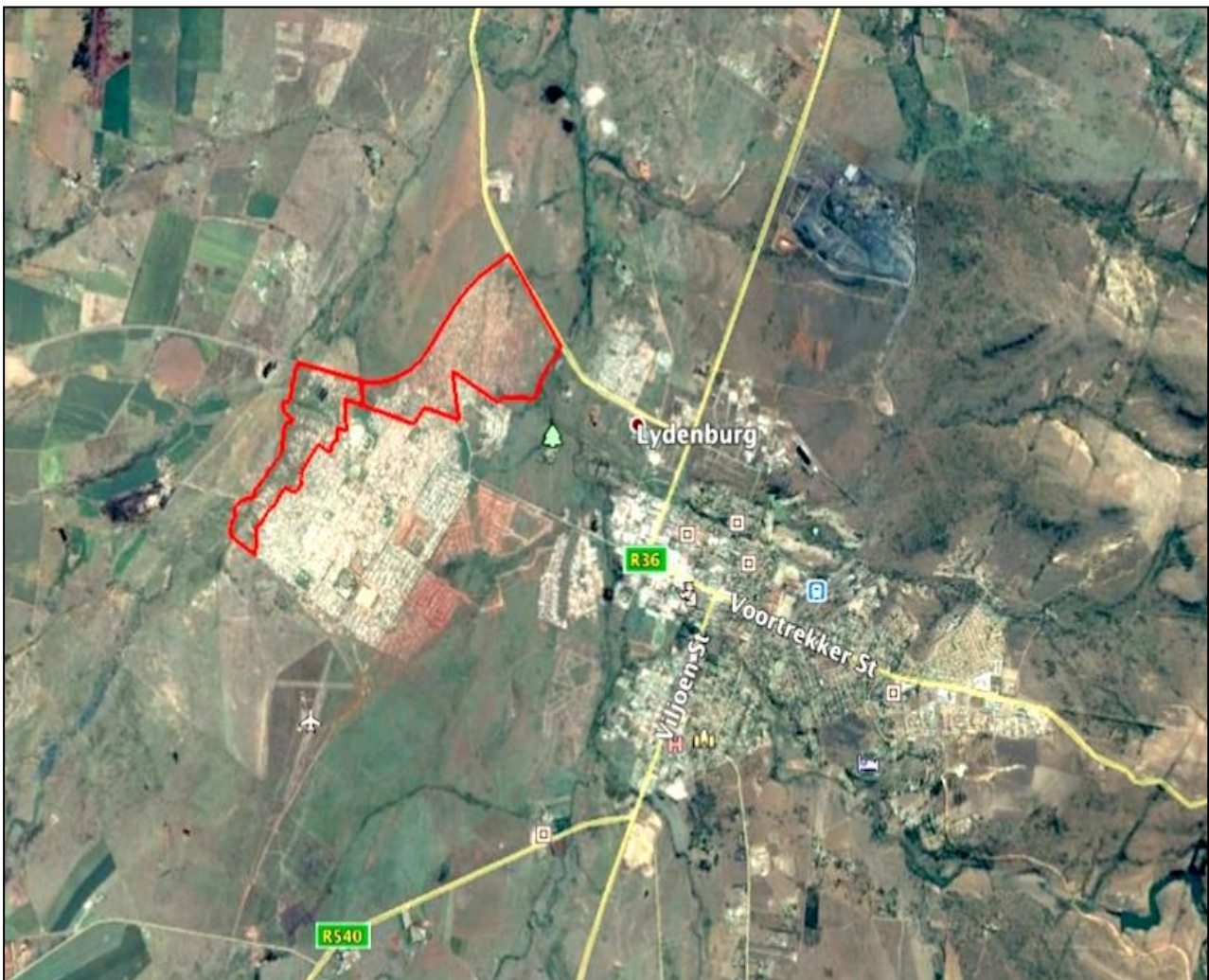


Figure 1: Location of the site to the north-west of Mashishing.

concentrated from October to April, which constitutes a relatively long growing season for vegetation and plant species. Winters may be fairly cool and an average of 9 days of frost occur per year.

Topography

The study site is generally moderately undulating. There are two drainage lines running from south to north, one along the western boundary and one along the eastern boundary. The site varies in elevation from approximately 1349 to 1432 m above sea level with the highest point being near the eastern end of the site and the lowest point in the drainage line on the north-eastern boundary.

Major soils

Landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There is one landtype in the study area, the Ba landtype (Land Type Survey Staff, 1987).

The B-group of landtypes contains soils with a plinthic catena in which upland duplex and marginalitic soils are rare. These are the soils that occupy a very large part of the interior of South Africa and have a catena that is represented in order from highest to lowest in the upland landscape by Hutton, Bainsvlei, Avalon and Longlands forms. The valley bottom is occupied by one or other gley soil (e.g. Rensburg, Willowbrook, Katspruit, Champagne forms). Plinthic soils must cover more than 10% of the area for it to be included in B-landtypes. The Ba land type indicates land in which red and/or yellow apedal soils (Hutton, Bainsvlei, Avalon, Glencoe and Pinedene forms) that are dystrophic and/or mesotrophic predominate over red and/or yellow apedal soils that are eutrophic, and in which red soils (mainly Hutton and Bainsvlei) occupy more than a third of the area (MacVicar et al. 1974).

Broad vegetation patterns of the area

According to the most recent vegetation map of the country (Mucina et al., 2005) the study area is within a single regional vegetation types, Lydenburg Thornveld (Mucina & Rutherford 2006) (Figure 2). A brief description of the regional vegetation type that occurs on site is provided below. Full descriptions can be found in Mucina et al. (2005).

Lydenburg Thornveld

Distribution Mpumalanga Province: Situated in a broad band between the high-lying mountains from just north of Ohrigstad, tapering southwards through Lydenburg to as far south as the area in the vicinity of the Kwena Dam. Altitude 1 160 –1 660 m.

Vegetation & Landscape Features This unit occurs at lower levels at the foot of the mountains and on undulating plains. This is open, frost-hardy woodland. Structurally this unit comprises closed grassland which is almost always wooded, sometimes densely so in rocky areas and less so in frost-ridden valleys where *Acacia*

karroo is still able to persist. Many woody plants have evolved a suffrutex habit (*Argyrobium wilmsii*), where aerial parts die back to an underground rootstock during cold winters.

Geology & Soils Red clay soils mostly derived from shales of the Pretoria Group (including the Silverton and Timeball Hill Formations). Shales occasionally intersected with bands of quartzite or andesite. Land types Ba, Fa, Ib and Ae, with predominantly Mispah, Glenrosa or Hutton soil forms.

Climate This unit occurs in the rainshadow of the Escarpment, where the climate is much drier and the winters are very cold (MAT 16°C). The rainfall is generally lower than in surrounding areas since it falls within a rainshadow. Rainfall 580–810 mm (MAP 707 mm). Most of this unit experiences fairly infrequent frost. See climate diagram for Gm 21 Lydenburg Thornveld.

Important Taxa Small Trees: *Acacia robusta* subsp. *robusta* (d), *Cussonia transvaalensis* (d), *Acacia caffra*, *A. karroo*, *Combretum erythrophyllum*, *Cussonia paniculata*, *Dombeya rotundifolia*. Tall Shrubs: *Diospyros lycioides* subsp. *guerkei*, *Euclea crispa* subsp. *crispa*, *Ormocarpum kirkii*, *Rhamnus prinoides*, *Vernonia crataegifolia*. Woody Climbers: *Jasminum quinatum* (d), *Acacia ataxacantha*. Low Shrubs: *Rubus transvaaliensis* (d), *Senecio microglossus* (d), *Anthospermum rigidum* subsp. *pumilum*, *Lippia javanica*, *Nemesia fruticans*, *Polygala nodiflora*, *Rhus gerrardii*. Succulent Shrubs: *Euphorbia clavarioides* var. *truncata*,

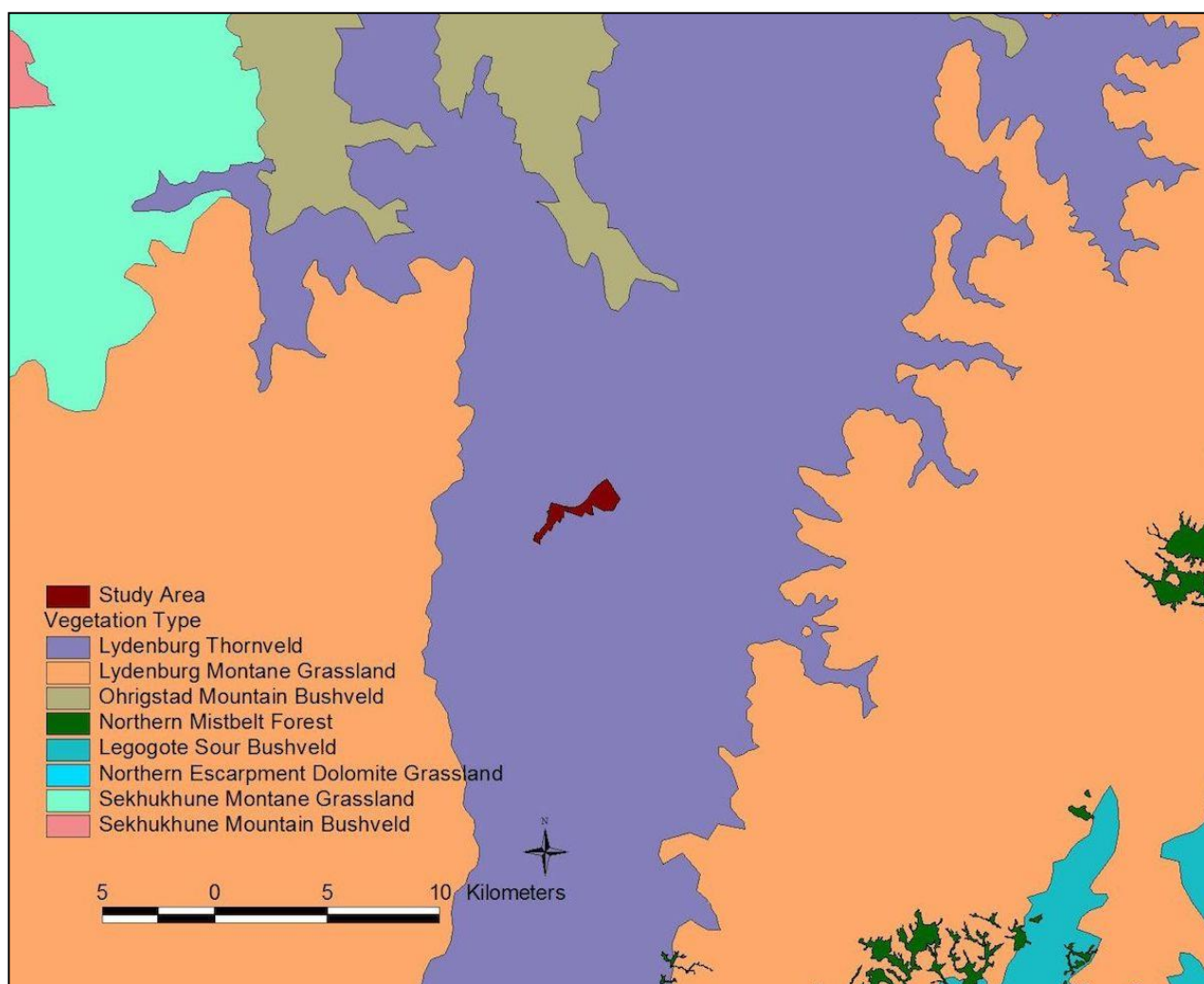


Figure 2: Regional vegetation types of the broad area.

Lopholaena coriifolia. Geoxylic Suffrutex: *Elephantorrhiza elephantina*. Graminoids: *Aristida canescens* (d), *A. congesta* (d), *A. diffusa* (d), *Brachiaria serrata* (d), *Bulbostylis burchellii* (d), *Digitaria tricholaenoides* (d), *Eragrostis racemosa* (d), *Heteropogon contortus* (d), *Microchloa caffra* (d), *Schizachyrium sanguineum* (d), *Trachypogon spicatus* (d), *Tristachya leucothrix* (d), *Andropogon schirensis*, *Bewsia biflora*, *Cymbopogon caesius*, *Diheteropogon amplexans*, *Elionurus muticus*, *Eragrostis chloromelas*, *E. gummiflua*, *E. patentissima*, *E. plana*, *Eulalia villosa*, *Hyparrhenia hirta*, *Melinis repens* subsp. *repens*, *Monocymbium ceresiiforme*, *Panicum natalense*, *Schizachyrium ursulus*, *Setaria nigrirostris*, *S. sphacelata*, *Sporobolus centrifugus*, *S. pyramidalis*, *Themeda triandra*, *Tristachya biseriata*, *T. rehmannii*. Herbs: *Acalypha glandulifolia*, *Dicoma anomala*, *Eriosema kraussianum*, *Geigeria burkei* subsp. *burkei*, *Helichrysum cephaloideum*, *H. rugulosum*, *Kohautia amatymbica*, *Maclodium zeyheri* subsp. *argyrophyllum*, *Rothea hirsuta*, *Schistostephium crataegifolium*, *Senecio bupleuroides*, *S. coronatus*, *Vernonia oligocephala*. Geophytic Herbs: *Hypoxis multiceps*, *H. rigidula* var. *pilosissima*. Succulent Herbs: *Aloe fosteri*, *A. greatheadii* var. *davyana*, *Kleinia stapeliiformis*.

Endemic Taxa Low Shrubs: *Argyrobolium wilmsii* (d), *Adenia wilmsii*. Geophytic Herb: *Gladiolus rufomarginatus*.

Conservation Vulnerable. The conservation target is 27% and 2% is protected (Gustav Klingbiel and Ohrigstad Dam Nature Reserves). A total of 22% of this unit has been transformed, mainly by dryland and irrigated cultivation. Rainfall generally too low for plantations. Erosion from very low (45%), low (26%) and moderate (18%).

Remark: It is a transition zone between the high-lying grasslands and the warmer and drier bushveld areas.

Conservation status of vegetation types

Driver et al. (2005) classified regional vegetation types into ecosystem status on the basis of rates of transformation and conservation (Table 7). The dominant vegetation type occurring in the study area (Lydenburg Thornveld) is classified as Vulnerable (Table 8). In this regional vegetation type, the amount of transformation is relatively high, and for Lydenburg Thornveld only 2% of the vegetation type is conserved (Table 2).

Lydenburg Thornveld is not listed in the National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).

Table 7: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Table 8: Conservation status of different vegetation types occurring in the study area, according to Driver et al. 2005 and Mucina et al. 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver et al. 2005	National Environmental: Biodiversity Act
Lydenburg Thornveld	27	2	22	Vulnerable	Not listed

Red List plant species of the study area

Threatened species or species of conservation concern that could occur in the area, as determined from database searches, are listed (Appendix 2). Status and habitat information for each species is supplied in Appendix 2. There is one species listed as Endangered, four as Vulnerable, five as Near Threatened, and five as Declining that have been previously recorded in the grid in which the site is found. Five of these could occur in the study area in habitats that may be present on site.

Adenia wilmsii, listed as Endangered, is found from Lydenburg to Waterval Boven on dolerite outcrops or red loam soil, in open woodland, 1300-1500 m. One population is known from Rooidraai Ridge on the farm Rooidraai to the south of Lydenburg, which is surrounded by scattered settlements. The species has been previously impacted due to urban expansion of Lydenburg. It has been previously recorded in the grid in which the site is found, but in habitat not similar to that found on site. There is a low possibility that it could occur on site, but care should be taken to exclude it as possibly occurring on site due to the close proximity of previous records of this species.

One species listed as Near Threatened could occur in the study area, one that is widely distributed (*Merwillia plumbea*). This species has a moderate probability of being found on site.

Three additional species of conservation concern, listed as Declining, have a high probability of occurring on site. These species are *Boophane disticha*, *Eucomis autumnalis* and *Hypoxis hemerocallidea*, all three of which are widespread plants.

It is therefore concluded that five listed plant species could potentially occur on site. A careful search within the footprint of proposed infrastructure is recommended to make sure of this.

Table 9: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and other categories of conservation concern (Victor & Keith 2004; Victor 2006).

Category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Threatened
EN	Endangered	Threatened
VU	Vulnerable	Threatened
NT	Near Threatened	Conservation concern
Declining	Declining taxa	Conservation concern
Rare	Rare	Conservation concern
Critically Rare	Rare: only one subpopulation	Conservation concern
DDD	Data Deficient: well known but not enough information for assessment	Data Deficient
DDT	Data Deficient: taxonomic problems	Data Deficient
LC	Least Concern	Least Concern

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. The species that have a geographical distribution that includes the study area are as follows: *Boscia albitrunca*, *Catha edulis*, *Curtisia dentata*, *Elaeodendron (Cassine) transvaalensis*, *Lydenburgia cassinoides*, *Ocotea bullata*, *Philenoptera violacea*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius*, *Prunus africana*, *Pterocarpus angolensis* and *Sclerocarya birrea* subsp. *caffra*.

- The small tree, *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi), occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. No such habitat is found on site and it is considered unlikely to occur there;
- The tree *Catha edulis* occurs in bushveld associated with evergreen forests, often in rocky places. No such habitat is found on site and it is considered unlikely to occur there;
- The tree, *Curtisia dentata*, is found in evergreen Afromontane forest, usually within the mist-belt, on grassy mountain slopes and as a small tree in coastal scrub forest. No such habitat is found on site and it is considered unlikely to occur there;
- The tree, *Elaeodendron transvaalensis*, is found in bushveld and on wooded hillsides, often on termite mounds or along streams. Suitable habitat occurs on site in the riparian vegetation on the eastern side of the site, and it is considered possible for it to occur there;
- The tree *Lydenburgia cassinoides* (Sekhukhune bushman's tea) is endemic to Sekhukhuneland and the southern Wolkberg, where it is found on dry hillsides and riverine fringes. The current site is just outside the known distribution range of this species. Habitats on site are not suitable for this species, even if it occurred in the area. It is considered highly unlikely that it would occur there.
- The tree *Ocotea bullata* occurs in montane forest. No such habitat occurs on site. The species is unlikely to occur there;
- The tree *Philenoptera violacea* (apple leaf) is a semi-deciduous, rounded tree up to 18 m tall that is found in bushveld at low to medium altitudes, usually on alluvial soil close to rivers. It has been previously recorded in the grid in which the site is located, but the habitat on site is not suitable and it is considered unlikely that it would occur there;

- The tree, *Pittosporum viridiflorum*, is found in open bushveld, rocky outcrops, thickets, forest margins and forests, and in riverine fringe thicket. Potential habitat is found in the general area and it is considered possible that it occurs around Lydenburg. It could potentially occur in the riparian area at the eastern side of the study area;
- The tree *Podocarpus falcatus* occurs in afromontane forest, occasionally in coastal and sand forest. It may also occur in wooded ravines, mountain forest patches and coastal swamp forest. No such habitat is found on site and it is considered unlikely to occur there;
- *Podocarpus latifolius*(yellowwood) is a large evergreen tree that grows up to 30 m in height. It is found in the moister southern and eastern parts of South Africa in coastal and Afromontane forest and often in mountainous areas. It has not previously been recorded in the grid in which the site is located, but has been recorded in the grid to the north. Based on the habitat requirements of this species and the fact that it has not previously been recorded in the grid, it is considered highly unlikely that it occurs on site;
- The tree, *Prunus africana* (African almond), is found in Afromontane forest, usually in mistbelt areas. No such habitat is found on site and it is considered unlikely to occur there;
- The tree *Pterocarpus angolensis* (kiaat) is found on well-drained soils in grassland and open bushveld. It has been previously recorded in the grid in which the site is located and habitat on site is potentially suitable. However, based on disturbance levels on site and high levels of harvesting of woody plants, it is considered possible but unlikely that it occurs there; and
- *Sclerocarya birrea* subsp. *caffra* is found in bushveld. No such habitat is found on site and it is considered unlikely to occur on site.

In summary, three species of protected trees could potentially occur on site or nearby, namely *Elaeodendron transvaalensis*, *Pittosporum viridiflorum* and *Pterocarpus angolensis*. From aerial imagery and the site visit it is clear that the site is highly degraded, but that the riparian habitat and adjacent grassland are habitat in which protected trees could occur.

Terrestrial fauna of conservation concern

All vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in Appendix 4. Those threatened or near threatened vertebrate species with a geographical distribution that includes the study area and habitat preference that includes habitats available in the study area are listed in Appendix 3, along with habitat information, and are discussed further.

Mammals

A total of 134 mammal species have a geographical distribution that includes the general study area in which the site is found (Friedmann & Daly 2004, Mills & Hes 1997). Twenty-one of the species with a geographical distribution that includes the site have been listed in the Red Data Book of the Mammals of South Africa (Friedmann & Daly 2004) (see Appendix 4). These species are as follows: Black Rhinoceros, Sable Antelope, Oribi, Sharp's Grysbok, Brown Hyaena, Serval, Spotted-necked Otter, Honey Badger, Percival's Short-eared Trident Bat, Lesser Long-fingered Bat, Natal long-fingered Bat, Temminck's Myotis, Welwitsch's Myotis, Rusty Pipistrelle, Blasius's Horseshoe Bat, Geoffroy's Horseshoe Bat, Ruppell's Horseshoe Bat,

Hildebrandt's Horseshoe Bat, Lander's Horseshoe Bat, Swinny's Horseshoe Bat, and Temminck's Ground Pangolin.

The Black Rhinoceros (*Diceros bicornis minor*) is listed as Vulnerable in South Africa (Friedmann & Daly 2004) and Critically Endangered globally (www.iucnredlist.org). The species is protected according to the National Environmental Management: Biodiversity Act. It is a browser occurring in bushveld habitats. No suitable habitat occurs on site and, if given the opportunity, the species would probably not occur there. It occurs either in conservation areas or in managed game farms and there are no wild populations. The species is therefore highly unlikely to occur on site.

The Sable Antelope (*Hippotragus niger niger*) is listed as Vulnerable in South Africa (Friedmann & Daly 2004) and Least Concern globally (www.iucnredlist.org). The species is protected according to the National Environmental Management: Biodiversity Act. It is a water-dependent grazer occurring in woody savanna habitats. No suitable habitat occurs on site and, if given the opportunity, the species would probably not occur there. It occurs either in conservation areas or in managed game farms and there are no wild populations. The species is therefore highly unlikely to occur on site.

The Oribi (*Ourebia ourebi*) is listed as Endangered in South Africa (Friedmann & Daly 2004) and Least Concern globally (www.iucnredlist.org). The species is protected according to the National Environmental Management: Biodiversity Act. The basis of its national listing is according to IUCN criterion C2a(ii), which means that there are fewer than 2500 mature individuals and at least 95% of these are restricted to a single population. The Oribi occurs throughout sub-Saharan Africa. Within South Africa it is restricted to mostly KwaZulu-Natal, eastern Free State and eastern Mpumalanga, with scattered occurrences in the Eastern Cape, Gauteng, North-West and Limpopo Provinces. It is found in open grassland with gentle topography at lower altitudes. Its habitat requirements include a mosaic of tall and short grasses to meet resting and feeding requirements. Oribi are highly water-dependent and tend to avoid steep slopes. The species has been recorded in the grid in which the site is located as well as other neighbouring and nearby grids. Partially suitable habitat occurs on site and, if given the opportunity, the species would possibly occur there. However, it occurs mostly either in conservation areas or in managed game farms and there are no significant wild populations. The species is therefore highly unlikely to occur on site.

Sharp's Grysbok (*Raphicerus sharpei*) is listed as Near Threatened in South Africa (Friedmann & Daly 2004) and Least Concern globally (www.iucnredlist.org). It has not been recorded in the grid in which the study area is found, nor from any neighbouring grids. It occurs in woody savanna and low shrubland habitats. No suitable habitat occurs on site and, if given the opportunity, the species would probably not occur there. The species is therefore highly unlikely to occur on site.

The Brown Hyaena (*Hyaena brunnea*) is listed as Near Threatened in both South Africa (Friedmann & Daly 2004, <http://vmus.adu.org.za>) and globally (www.iucnredlist.org). It is found in all parts of South Africa, but is more concentrated in the northern parts of the country. It is found in a variety of biomes, including desert areas, particularly along the west coast, semi-desert, open scrub and open woodland savannah (Mills & Hes 1997). It is a solitary scavenger that travels vast distances every day in search of food. It has a medium chance of occurring on site since the distribution range includes the study area and there are historical records from nearby grids. It is a mobile animal that is likely to move away from the path of any construction and development of parts of the study area is therefore highly unlikely to have any negative effect on the species.

The Serval (*Leptailurus serval*) is listed as Near Threatened in South Africa (Friedmann & Daly 2004, <http://vmus.adu.org.za>) and Least Concern globally (www.iucnredlist.org). It is widely distributed south of the Sahara where it is mostly found in savanna. The serval needs watercourses within its territory, so it does not live in semi-deserts or dry steppes (<https://en.wikipedia.org>). Servals also avoid dense equatorial jungles, although they may be found along forest fringes. Within South Africa, it is found in moist savannah and tall grassland mostly in the eastern half of the country. It has been recorded in the grid in which the study area is located as well as most surrounding grids. There is a high probability that it occurs in the study area. However, it is a mobile animal that is likely to move away from the path of any activities on site and these are therefore highly unlikely to have any negative effect on the species.

The Spotted-necked Otter (*Hydrictus (Lutra) maculicollis*) is listed as Near Threatened in both South Africa (Friedmann & Daly 2004) and globally (www.iucnredlist.org), although the UCT Animal Demography Unit have it listed as Least Concern (<http://vmus.adu.org.za>). The species is protected according to the National Environmental Management: Biodiversity Act. It is native to sub-Saharan Africa, where it is found in lakes and larger rivers throughout much of Africa south of 10°N. In South Africa, it is found in the eastern half of the country. It is found in permanent, unsilted and unpolluted rivers, streams and freshwater lakes, where sufficient numbers of its prey are present. Adequate riparian vegetation is essential to provide cover during periods of inactivity. It has not been recorded in the grid in which the study area is located, but the area is within its distribution range. There is a no riparian or riverine habitat on site and there is therefore a low probability that it occurs in the study area.

The Honey Badger (*Mellivora capensis*) listed as Near Threatened in South Africa (Friedmann & Daly 2004, <http://vmus.adu.org.za>) and as Least Concern globally (www.iucnredlist.org), has been previously recorded in the grid in which the site is located as well as most nearby grids. The site is also within the overall geographical distribution range of the species. It is a generalist predator, commensural with humans. It tolerates a wide variety of habitats from sea-level to montane forests and is widespread, although never common. There is a strong likelihood that it could occur on site within any habitat. It is a highly mobile species and not dependent on any particular location for survival. Development of parts of the study area is therefore highly unlikely to have any negative effect on the species.

Percival's Short-eared Trident Bat (*Cloeotis percivali*) is listed as Vulnerable globally and Critically Endangered in South Africa (Monadjem et al. 2010, <http://vmus.adu.org.za>), although the IUCN lists it as Least Concern (www.iucnredlist.org). It is largely confined to southern Africa with records from South Africa (KwaZulu-Natal), Swaziland, south-east Botswana, southern Zambia, Zimbabwe (the core of the distribution), and extralimital records from southern Democratic Republic of Congo, Malawi, northwestern Mozambique, and coastal Kenya. Its elevational range is from sea level to 1,000 m. In South Africa it occurs from northern KwaZulu-Natal, through Swaziland and northern South Africa. It appears to be associated with woodland and savanna. It roosts in caves and mine tunnels and possibly also in narrow crevices. It preys exclusively on Lepidoptera. It has not been previously recorded in the grid in which the study area is located or any surrounding grids and does not appear to occur in the Grassland Biome, but a distribution model (Monadjem et al. 2010) indicates that it could potentially occur close to the study area. Based on distribution and habitat requirements, it is considered unlikely that it occurs in the study area and development of parts of the study area is therefore highly unlikely to have any negative effect on the species.

Swinny's Horseshoe Bat (*Rhinolophus swinnyi*) is listed as Near Threatened globally and Endangered in South Africa (Monadjem et al. 2010, <http://vmus.adu.org.za>), although the IUCN lists it as Least Concern (www.iucnredlist.org). It has been recorded from the eastern parts of South Africa, much of Zimbabwe,

northwestern Mozambique, with additional scattered records further north in Malawi, Zambia, Democratic Republic of the Congo and Tanzania (including the island of Zanzibar) (Skinner and Chimimba 2005). In South Africa it occurs from the Eastern Cape and KwaZulu-Natal, through north-east South Africa. The study area is along the margin of the modelled distribution range. It is associated with Afromontane forest in the south of its range and savanna woodland to the north, although suitable roosting sites appear to be more important than vegetation type. It roosts in caves and mine tunnels where it occurs in small groups of up to 5 individuals. It preys primarily on Lepidoptera. It has not been previously recorded in the grid in which the study area is located or any surrounding grids, but a distribution model (Monadjem et al. 2010) indicates that it could potentially occur close to the study area. Based on distribution and habitat requirements, it is considered unlikely that it occurs in the study area and development of parts of the study area is therefore highly unlikely to have any negative effect on the species.

Other bats listed as Near Threatened in South Africa and Least Concern globally (Monadjem et al. 2010, <http://vmus.adu.org.za>). There are a number of Chiroptera that have a geographical distribution that includes the study area, some only marginally. These species are listed as Least Concern globally and Near Threatened in South Africa, including Lesser Long-fingered Bat, Natal long-fingered Bat, Temminck's Myotis, Welwitsch's Myotis, Rusty Pipistrelle, Blasius's Horseshoe Bat, Geoffroy's Horseshoe Bat, Ruppell's Horseshoe Bat, Hildebrandt's Horseshoe Bat and Lander's Horseshoe Bat. All these species depend on caves for roosting. They are therefore unlikely to be found on site other than during foraging excursions, except at specific potential roosting sites. Activities on site are therefore highly unlikely to have any negative effect on any of these species.

Temminck's Ground Pangolin (*Smutsia temminckii*) is listed as Vulnerable globally and in South Africa (Friedmann & Daly 2004, <http://vmus.adu.org.za>, www.iucnredlist.org). It is also listed on CITES Appendix II. It has been recorded from southeastern Chad, through South Sudan, much of East Africa and southern Africa as far south as the Northern Cape and North West Provinces of South Africa and northeast KwaZulu-Natal Province. In South Africa it occurs from the Eastern Cape and KwaZulu-Natal, through the Free State and into the Northern Cape, North-West Province, Gauteng and Mpumalanga. It is a predominantly solitary, terrestrial species that inhabits mainly savanna woodland in low-lying regions with moderate to dense scrub where average annual rainfall is between 250 mm and 1,400 mm. It also occurs in floodplain grassland, rocky slopes and sandveld up to 1,700 m, but does not inhabit forest or desert. It occurs widely on well-managed livestock farms where it is afforded protection from human persecution, but is absent from croplands. The most important habitat requirements are a sufficient population of the various ant and termite prey species and the availability of dens or above-ground debris in which to shelter. The species has not been recorded in any of the grids of the Mpumalanga Highveld area (<http://vmus.adu.org.za>), although it has been recorded in other grids dominated by mesic grasslands. Based on distribution and habitat requirements, it is considered unlikely that it occurs in the study area and development of parts of the study area is therefore highly unlikely to have any negative effect on the species.

Of the species currently listed as threatened or protected (see Appendix 5 for list of protected species), those listed in Table 10 are considered to have a medium to high probability of occurring on site and being potentially negatively affected by proposed activities on site.

Table 10: Mammal species of conservation concern with a likelihood of occurring in the study area.

Scientific name	Common name	Status
<i>Ourebia ourebi</i>	Oribi	Endangered
<i>Hyaena brunnea</i>	Brown hyaena	Near Threatened, protected
<i>Leptailurus serval</i>	Serval	Near Threatened, protected
<i>Mellivora capensis</i>	Honey Badger	Near Threatened, protected

Amphibians

A total of 25 frog species have a geographical distribution that includes the general study area in which the site is found (Du Preez & Carruthers 2009). Some of these species are only marginally present in the study area due to the fact that their distribution range ends close to the study area. Of the frog species that could potentially occur in the study area, none are listed in a threat category, but the Giant Bullfrog, listed as Near Threatened in South Africa (Minter et al. 2004, <http://vmus.adu.org.za/> accessed on 12 August 2018) and Least Concern globally (<http://www.iucnredlist.org/details/58535/0> accessed on 12 August 2018), is protected according to the National Environmental Management: Biodiversity Act (Act 10 of 2004).

The Giant Bull Frog (*Pyxicephalus adspersus*) listed as Near Threatened in South Africa and Least Concern globally, is found in seasonal shallow grassy pans, vleis and other rain-filled depressions in open flat areas of grassland or savanna and, at the limits of its distribution, in Nama Karoo and thicket. For most of the year the species remains buried up to 1 m underground. They emerge only during the peak of the rainy season to forage and breed. If conditions are extremely dry, they may remain cocooned underground for several years. Long distances often separate suitable breeding sites. In order to breed, they require shallow, rain-filled depressions that retain water long enough for the tadpoles to metamorphose. Before and after breeding, bullfrogs forage in open grassland, feeding mostly on insects, but also on other frogs, lizards, snakes, small birds and rodents. After breeding males generally bury themselves within 100 m of the breeding site, but females may disperse up to 1 km away. Based on habitat requirements, there is a moderate probability that this species occurs in the study area. There is no breeding habitat on site and habitat on site would only be used for foraging. The site is also at the limit of the geographical distribution of this species.

It is concluded that the site contains habitat that is suitable for various frog species, although only one species of conservation concern could potentially occur in the study area, although the likelihood is not high. No frog species of concern are therefore potentially likely to be significantly affected by development on site.

Reptiles

A total of 110 reptile species have a geographical distribution that includes the general study area in which the site is found (Alexander & Marais 2007, Bates et al. 2014, Branch 1988, Marais 2004, Tolley & Burger 2007). Of the reptile species that could potentially occur in the study area, Breyer's Long-tailed Seps,

listed as Vulnerable, and the Coppery Grass Lizard, Large-scaled Grass Lizard and Striped Harlequin Snake, all listed as Near Threatened, have been listed in a threat category.

The Coppery Grass Lizard (*Chamaesaura aenea*), listed as Near Threatened, occurs in western Swaziland, Limpopo, Mpumalanga, Gauteng, KwaZulu-Natal (associated with the Drakensberg), northeastern Free State and Eastern Cape. It has been recorded in the grid in which the study area is located, as well as in grids to the south-west and east of there. Due to the geographical proximity of the study area to the known location of this species, it must be assumed that where suitable habitat occurs, there is a possibility of the species occurring on site. It is found in the Grassland Biome on the grassy slopes and plateau of the eastern Escarpment and Highveld at elevations of 1400-2200 m. It is thought to probably shelter in the base of grass tussocks. Threats to this species include habitat loss due to agriculture, plantations, mining and urbanisation, overgrazing by livestock, use of pesticides and poor fire management of the grasslands.

The Large-scaled Grass Lizard (*Chamaesaura macrolepis*), listed as Near Threatened, is endemic to Swaziland, Zimbabwe and South Africa, where it occurs in KwaZulu-Natal, Limpopo and Mpumalanga. It has not been recorded in the grid in which the study area is located, but is known from nearby grids. The study area is within the known geographical range of this species, which places the site within an area where it could possibly occur. It occurs in savanna, Indian Ocean Coastal Belt, Lowveld, Sub-Escarpment Savanna and Mesic Highveld Grassland. It is found in grassland, especially rocky, grassy hillsides. It may shelter in hollows in soil under rocks. Threats to this species include habitat loss due to agriculture, plantations, mining and urbanisation, overgrazing by livestock, use of pesticides and poor fire management of the grasslands. Based on known habitat requirements and distribution patterns, there is a moderate probability of this species occurring on site.

Breyer's Long-tailed Seps (*Tetradactylus breyeri*), listed as Vulnerable, is endemic to South Africa, where it occurs in Free State, Mpumalanga and KwaZulu-Natal. It has been recorded in one of the grids adjacent to the study area and the site is within its known distribution range. Due to the geographical proximity of the study area to the known location of this species, it must be assumed that where suitable habitat occurs, there is a possibility of the species occurring on site. It is found in montane and Highveld grassland at altitudes of 1400-2000 m and may take shelter under stones or in moribund termitaria. Threats to this species include habitat loss due to agriculture, plantations, mining and urbanisation, overgrazing by livestock, use of pesticides and poor fire management of the grasslands. Based on habitat requirements and geographical distribution, there is a strong possibility of this species occurring on site.

The Striped Harlequin Snake (*Homoroselaps dorsalis*), listed as Near Threatened, occurs in Limpopo, Mpumalanga, Gauteng, Free State and KwaZulu-Natal Provinces as well as in western Swaziland. It has a patchy distribution, but has been recorded the grid in which the site is located as well as one surrounding grid, and the overall geographical distribution includes the study area. It is partially fossorial and known to inhabit old termitaria in grassland habitat. Suitable habitat occurs on site and the study area is within the distribution range of this species. It is therefore considered possible that this species occurs on site. The main threat to this species is related to loss, degradation and fragmentation of suitable habitat.

There are therefore four reptile species of conservation concern that could potentially occur in the study area and that may therefore be affected by the proposed project, as shown in Table 11.

Table 11: Reptile species of conservation concern with a likelihood of occurring in the study area.

Scientific name	Common name	Status
<i>Chamaesaura aenea</i>	Coppery Grass Lizard	Near Threatened
<i>Chamaesaura macrolepis</i>	Large-scaled grass lizard	Near Threatened
<i>Tetradactylus breyeri</i>	Breyer's Long-tailed Seps	Vulnerable
<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	Near Threatened

Birds

A total of 418 bird species have a geographical distribution that includes the general study area in which the site is found (Chittenden 2007, SABAP2 accessed on 7 January 2018). A total of 364 of these species have been recently recorded in the pentad and surrounding pentads in which the site is located (2505_3020, SABAP2). This list includes a wide variety of species from different groups (see Appendix 3) and occurring in different types of habitats. The habitat on site is only potentially suitable for a smaller number of these species and not all would be expected to be found there.

A total of 23 of the bird species with a geographical distribution that includes the site are listed in "The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland" (Taylor et al. 2015) and/or on the IUCN Red List (www.iucnredlist.org). Seven of these are listed as Near Threatened, ten as Vulnerable, six as Endangered, and none as Critically Endangered. The Endangered species are Grey-crowned Crane, Martial Eagle, African Marsh Harrier, Black Harrier, Yellow-billed Stork, and Cape Vulture. The Vulnerable species are Denham's Bustard, Crowned Eagle, Verreaux's Eagle, Lanner Falcon, Striped Flufftail, Southern Bald Ibis, White-bellied Korhaan, African Grass Owl, Secretarybird, and Black Stork. The Near Threatened species are Blue Crane, Maccoa Duck, Greater Flamingo, Lesser Flamingo, European Roller, Greater Pained Snipe and Abdim's Stork. These species are each discussed in more detail below to assess the risk of them being affected by proposed activities on site.

The Grey Crowned Crane (*Balearica regulorum*), listed as **Endangered**, occurs from eastern DRC, Uganda and Kenya to south-eastern South Africa. Within South Africa, the species occurs from Eastern Cape / Transkei, KwaZulu-Natal, eastern Free State and through the central part of Mpumalanga. The site is just outside the mapped distribution range of the species (Taylor et al. 2015) but has been recorded in the pentad in which the site is located (sabap2.adu.org.za). It requires mixed wetland-grassland habitats. They typically nest within or on the edges of wetlands while foraging in wetlands, nearby grasslands and croplands. Non-breeders roost communally at night in trees or on overhead utility structures. Based on known distribution and habitat requirements, there is a possibility that the species could occur on site.

The Martial Eagle (*Polemaetus bellicosus*), listed as **Endangered**, is found mostly in open savanna and woodland on plains and also semi-arid shrublands and edges of forests. It is rare in mountainous areas and in naturally treeless grasslands. Birds will occupy any habitats where there are adequate tall trees or pylons for nesting and perching, including wind-pumps and alien trees. Martial Eagles generally require exceptionally large home ranges in excess of 130 km². It occurs at low densities in the study area. The species

is virtually absent from cultivated areas. The species could potentially occur in the study area, but the probability is considered to be relatively low. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za), but mapped distribution (Taylor et al. 2015) show it as absent from the study area. Based on distribution data, it is possible but unlikely that the study area constitutes the home range of individuals, but due to the large home ranges of individuals in comparison to the size of the site, any localised loss of habitat for individuals that may occur in the area is unlikely to affect any individuals significantly.

The African Marsh-Harrier (*Circus ranivorus*), listed as **Endangered**, is found in inland and coastal wetlands and adjacent moist grasslands. It is dependent on permanent wetlands. It is a common resident in the study area and has been recorded at a low reporting rate for the grid. The nest is built of sticks, reed stems and grass and usually placed in a reedbed over water. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za). Based on habitat requirements and historical distribution records, there is a moderate probability of the species being found in the study area and being potentially affected by proposed activities on site.

The Black Harrier (*Circus maurus*), listed as **Endangered**, is found mostly in the Fynbos Biome, but migrates annually to eastern grasslands in South Africa. Any individuals observed in the current study area would be non-breeding migrants. The study area is marginally within the historical distribution range of this species. Nevertheless, based on habitat requirements and historical distribution records, it is considered that there is a low probability of this species occurring on site. The species has not been recorded in the pentad in which the site is located nor in any surrounding pentads (sabap2.adu.org.za).

The Yellow-billed Stork (*Mycteria ibis*), listed as **Endangered**, is found on the shoreline of most inland freshwater bodies and also occasionally in estuaries. They forage in a diversity of permanent and seasonal wetland habitat where there is open shallow water that is generally free of vegetation. It is an uncommon non-breeding migrant in the study area. The main threat to the species is loss of wetland habitats, including the system of pans, marshes and floodplains on which the bird depends for foraging. Impacts on these habitats could affect individuals of the species. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za). Based on habitat requirements, there is a moderate probability of the species being found in the study area, but any individuals would be non-breeding migrants.

The Cape Vulture (*Gyps coprotheres*), listed as **Endangered**, breeds in cliff breeding sites in mountainous area but ranges widely in surrounding areas. It is mapped in Chittenden (2009) as a common resident in the study area. There is a very low probability of the species being found in the study area. Any localised loss of habitat is unlikely to affect any individuals significantly. The site does not contain cliff breeding sites. A small localised loss of habitat is unlikely to have any significant effect on this species. Although individuals may range over the study area, it is unlikely that individuals would be found on site. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za).

Denham's Bustard (*Neotis denhami*), listed as **Vulnerable**, has a wide but fragmented Afrotropical range. Within South Africa it occurs widely but sparsely over much of the meisc eastern half of South Africa, stretching into the Western Cape. It is known to occur in the sour grassland areas of Mpumalanga, from Wakkerstroom to Dullstroom and westwards towards Gauteng. It also occurs as fragmented populations in the Graskop area above the Blyde River Canyon as well as on the grassy plateau of the Waterberg in Limpopo. The site is within the known distribution range. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za). Based on geographical range, there is a moderate probability of the species being found in the study area.

The Crowned Eagle (*Stephanoaetus coronatus*), listed as **Vulnerable**, is confined to Lowveld and escarpment forests, including riparian forest along the Limpopo and Luvuvhu Rivers. The study area is within one of the marginal distribution areas of this species. The species is found mostly in forest, including gallery and riverine forest, but also occurs in woodland and forested gorges in savanna and grassland. Crowned Eagles are readily found in plantations of exotic trees. Based on habitat requirements and geographical distribution, there is a possibility of the species being found in the general area. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za), but at a low reporting rate. However, the site does not contain suitable habitat for the species and it is unlikely to be dependent on the site for roosting, foraging or nesting.

Verraeux's Eagle (*Aquila verreauxii*), listed as **Vulnerable**, is found in mountainous and rocky areas with large cliffs. It is a common resident in nearby areas and the study area is within the known distribution range of the species. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za), but at a low reporting rate. The site does not contain suitable habitat for the species and it is unlikely to be dependent on the site for roosting, foraging or nesting. Localised loss of habitat will not affect this species.

The Lanner Falcon (*Falco biarmicus*), listed as **Vulnerable**, favours open grassland or woodland near cliff or electricity pylon breeding sites. It prefers open grassland, cleared woodlands and agricultural areas. It is an uncommon resident in the study area. It nests on cliffs, using the stick nests of other species when breeding in trees or on electricity pylons. There is a moderate probability of the species being found in the study area. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za). Depending on the habitat affected, localised loss of natural areas could affect individuals of this species.

The Striped Flufftail (*Sarothrura affinis*), listed as **Vulnerable**, is found in fragmented patches of Afrotropical montane grassland. Within South Africa it is found in the mesic eastern parts of the country, extending into the fynbos parts of the Western Cape. It inhabits a wide variety of dense vegetation types that offer concealment but open ground below for foraging. In summer rainfall regions, it generally favours open upland sourveld grassland dominated by *Themeda triandra*, but with taller elements for cover, such as woody elements, bracken-briar thickets, patches of tall forbs and grassy cover near forest fringes. The species has not been recorded in the pentad in which the site is located (sabap2.adu.org.za). The species has been recorded from Pilgrim's Rest and Graskop. The site is just outside the known distribution range of this species and habitat on site is possibly marginally suitable. There is therefore a low probability of the site being suitable to support individuals of this species. The site is probably also burnt too often to be suitable for this species and the proximity of humans, as well as domestic cats, probably limit the likelihood of this species occurring on site.

The Southern Bald Ibis (*Geronticus calvus*), listed as **Vulnerable**, is endemic to South Africa, Lesotho and Swaziland, where it is found in north-eastern Free State, Mpumalanga, Limpopo, inland areas of KwaZulu-Natal, most of Lesotho and western Swaziland. The study area is located at the north-eastern extreme of this distribution but is within the known mapped distribution (Taylor et al. 2015). The species is found in high-altitude grasslands, although they may occur in grasslands right down to the coast. The species requires cliffs with suitable ledges, generally above water, for breeding. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za). Based on known distribution and habitat requirements, there is a possibility that the species could occur on site.

The White-bellied Korhaan (*Eupodotis senegalensis*), listed as **Vulnerable**, is most common in the Highveld regions east of Potchefstroom to southern Mpumalanga, as well as in the north-eastern Free State and the upper areas and midlands of KwaZulu-Natal. The study area is just within the north-eastern extend

of the distribution of this species within South Africa. It is near endemic to the Grassland Biome, sometimes occurring in ecotones with savanna and fynbos. Thought to require longer grass than most other bustards and generally avoids overgrazed and recently burnt areas. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za), and there is a possibility of it occurring in the study area. However, a small amount of habitat loss is unlikely to negatively affect the species.

The African Grass Owl (*Tyto capensis*), listed as **Vulnerable**, is found in tall rank, or dense, short, grassland. It is an uncommon resident in the general area. The known distribution is quite patchy and excludes the study area. In addition, the species has not been recorded in the pentad in which the site is located (sabap2.adu.org.za). It nests on the ground in tall grassland where it makes a network of tunnels in the grass. The major threat to this species is loss of habitat as well as degradation of habitat due to unfavourable grazing and burning practices that prevent the development of rank grassland. If any suitable habitat or breeding individuals occur, it would be important to protect any suitable habitat. Based on habitat requirements, there is a moderate probability of the species occurring in the general area. However, based on the known mapped distribution (from Taylor et al. 2015), the species is considered unlikely to occur on site.

The Secretarybird (*Sagittarius serpentarius*), listed as **Vulnerable**, prefers open grassland and scrub, with the ground cover shorter than 50 cm and with sufficient scattered trees as roost/nest sites. It is found throughout South Africa, although absent from mountain fynbos, forest, dense woodland and very rocky, hilly or mountainous woodland. It is a common resident in the study area. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za), and based on distribution and habitat requirements it could easily occur there. The species occurs throughout South Africa and individual birds move large distances within the region, i.e. they are highly mobile. Localised loss of habitat and general disturbance may affect individuals of this species, but it is unlikely to do more than displace localised individuals.

The Black Stork (*Ciconia nigra*), listed as **Vulnerable**, is associated with mountainous regions, but not restricted to them. It is a solitary cliff-nester. It is piscivorous and is reliant on shallow waterbodies, such as estuaries and rivers, in which it forages. It is absent from seasonal pans that lack fish. The species is found in most parts of South Africa and is a common resident in the study area. The species has been recorded at a relatively low reporting rate in the pentad in which the site is located (sabap2.adu.org.za). There is a moderate probability of the species occurring in the study area, but due to the absence of cliff breeding sites and suitable water bodies it is unlikely to breed or forage there. Therefore, based on habitat requirements, the species is considered unlikely to occur on site, even if it occurs in the general area.

The Blue Crane (*Anthropoides paradiseus*), listed as **Near Threatened**, is found mostly in natural grassland but also in wetlands, cultivated pastures and croplands. It is a common resident in the study area, and has been recorded in the pentad in which the site is located (sabap2.adu.org.za). Eggs are laid on the ground. There is a moderate probability of the species occurring in the study area. Localised loss of habitat and general disturbance may affect individuals of this species, but this will probably lead to localised displacement and not an overall effect on the population within the region. The species is relatively widely distributed in South Africa and not dependent on any small localised pieces of habitat. There is a possibility that individuals could potentially forage across the site, but are probably not likely to be encountered so close to human habitation.

The Maccoa Duck (*Oxyura maccoa*), listed as **Near Threatened**, is found during the breeding season in small, shallow and nutrient-rich inland freshwater lakes and also makes use of man-made infrastructure,

such as farm dams and sewage farms. Nests are in emergent vegetation over deep water. The known geographical distribution of this species (Taylor et al. 2015) excludes the general area in which the site is located. The species has not been recorded in the pentad in which the site is located (sabap2.adu.org.za). Based on distribution and habitat requirements, the species is considered unlikely to occur on site.

The Greater Flamingo (*Phoenicopterus roseus*), listed as **Near Threatened**, is found in saline and brackish shallow water bodies such as salt pans, large dams and coastal mudflats. The nest is a cone of mud. The general field guide distribution of the species (Chittenden 2007) includes the study area, but a detailed distribution map (Taylor et al. 2015) excludes the site. The species has not been recorded in the pentad in which the site is located (sabap2.adu.org.za). There is a low probability of the species occurring in the study area, and they occur within large pans, which do not occur on or near the site. Based on distribution and habitat requirements, the species is considered unlikely to occur on site.

The Lesser Flamingo (*Phoeniconaias minor*), listed as **Near Threatened**, is found in eutrophic shallow wetlands, especially salt pans. It breeds colonially and its nest is a cone of mud. The general field guide distribution of the species (Chittenden 2007) indicates that it is a common resident in the study area, but a detailed distribution map (Taylor et al. 2015) just excludes the site. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za), which indicates that it could be found on site, if suitable habitat is available. They occur within large pans, which do not occur on or near the site. Based on habitat requirements, the species is considered unlikely to occur on site.

The European Roller (*Croacus garrulus*), listed as **Near Threatened**, is found in open woodland, perching on open dead branches, telephone poles and power lines. It is a common non-breeding migrant in the study area, and occurs at low densities in the study area and surrounding areas. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za). Based on distribution data (Taylor et al. 2015), there is a moderate probability of the species occurring in the study area. Threats to this species are within its breeding range and not in southern Africa. The study area appears to have limited amounts of suitable habitat and it could easily occur there. It is unlikely that localised loss of habitat will affect the species in any significant way at all.

The Greater Painted-snipe (*Rostratula benghalensis*), listed as **Near Threatened**, is found in freshwater wetlands in vegetated waterside habitats with exposed mud. They occur sparsely along the shorelines of dams, lakes and pans, on the banks of slow-moving rivers, on marshy floodplains, in temporarily-flooded grassland and at rainwater pools on clay soils with plentiful adjacent cover. It is a common resident in the study area. The species has not been recorded in the pentad in which the site is located (sabap2.adu.org.za), but its wide mapped distribution (Taylor et al. 2015) indicates that it could easily occur in the general area that includes the site. However, based on habitat requirements, the species is considered unlikely to occur on site.

Abdims' Stork (*Ciconia abdimii*), listed as **Near Threatened**, is found in grassland, savanna woodland, near pans and cultivated lands in groups of up to 100 birds. It is a common non-breeding migrant in the study area. The species has been recorded in the pentad in which the site is located (sabap2.adu.org.za). The threats to the species are not well-understood and it has been listed until more detailed information is available to make an informed assessment. The species could potentially be seen on site, but since it is a migratory bird that does not breed in southern Africa, the site does not constitute critical habitat.

It is concluded that the site contains habitat that is suitable for various bird species of conservation concern. Those that are potentially significantly vulnerable to proposed activities in the study area are as

shown in Table 12. Key habitat appears to be wetlands and associated grasslands. An important factor for the current project is the existing urban area and the fact that the current proposal extends this urbanisation rather than creating a new urban node.

Table 12: Bird species of conservation concern with a likelihood of occurring on site and being affected by proposed activities on site.

Scientific name	Common name	Status
<i>Balearica regulorum</i>	Grey-crowned Crane	Endangered
<i>Circus ranivorus</i>	African Marsh Harrier	Endangered
<i>Neotis denhami</i>	Denham's Bustard	Vulnerable
<i>Falco biarmicus</i>	Lanner Falcon	Vulnerable
<i>Geronticus calvus</i>	Southern Bald Ibis	Vulnerable
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	Vulnerable
<i>Sagittarius serpentarius</i>	Secretarybird	Vulnerable
<i>Anthropoides paradiseus</i>	Blue Crane	Near Threatened
<i>Coracias garrulus</i>	European Roller	Near Threatened
<i>Ciconia abdimii</i>	Abdim's Stork	Near Threatened

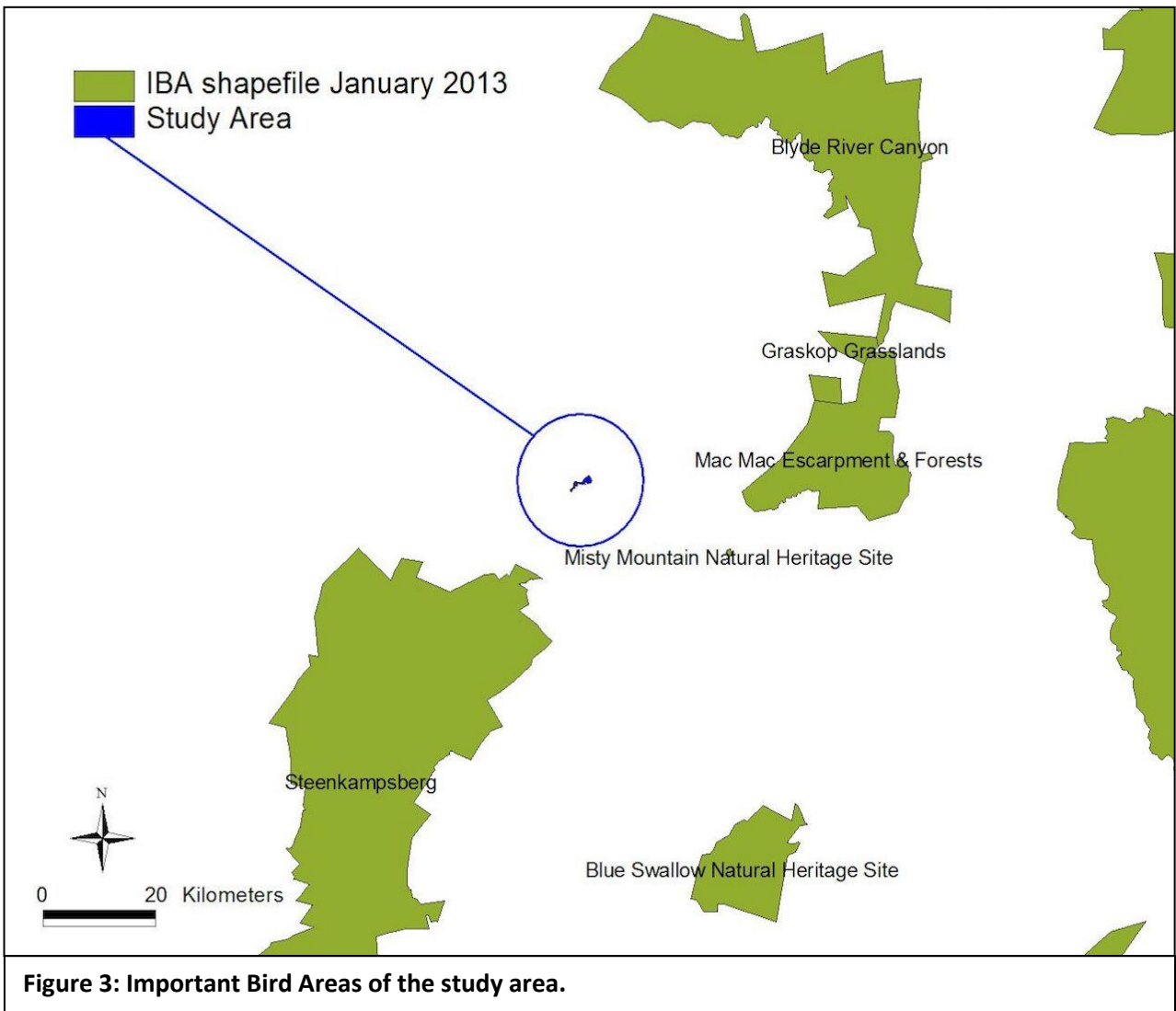
Important Bird Areas

The site does not fall within any Important Bird Area (IBA), as defined by BirdLife South Africa, but is in close proximity to a number of them. The Blyde River Canyon IBA and Graskop Grasslands IBA are to the north-east of the site, the Mac Mac Escarpment & Forests IBA to the east, the Misty Mountain Natural Heritage SITE IBA to the south-east, the Blue Swallow Natural Heritage Site IBA to the south, and the Steenkampsberg IBA to the south-west of the site. The two largest are the Blyde River Canyon IBA and the Steenkampsberg IBA. None of them are very close to the site – the Steenkampsberg IBA is 15 km away and the others are all more than 25 km away from the site (Figure 3).

IBA trigger species for the Blyde River Canyon IBA include Southern Bald Ibis, Cape Vulture, Taita Falcon, Blue Swallow, Bush Blackcap, Crowned Eagle, Secretarybird and Denham's Bustard, and regionally threatened species, Lanner Falcon, Half-collared Kingfisher, Orange Ground Thrush, White-backed Night Heron, Black-rumped Buttonquail, Striped Flufftail, African Finfoot and Black Stork.

IBA trigger species for the Steenkampsberg IBA include the globally threatened species, the Southern Bald Ibis, Wattled Crane, Blue Crane, Grey Crowned Crane, White-winged Flufftail, Rudd's Lark, Yellow-

breasted Pipit, Denham’s Bustard, Blue Korhaan and Secretarybird, and the regionally threatened species, African Marsh Harrier, Black-rumped Buttonquail, Striped Flufftail, White-bellied Korhaan, African Grass Owl, Black Stork and Lanner Falcon.



Aspect management plans for the area

There are two biodiversity management plans for Mpumalanga Province, the earlier version called the Mpumalanga Biodiversity Conservation Plan (MBCP), no longer used, and the more recent version called the Mpumalanga Biodiversity Sector Plan.

Mpumalanga Biodiversity Sector Plan

The Mpumalanga Biodiversity Sector Plan (Mpumalanga Parks and Tourism Agency 2014) classifies the natural vegetation of the Province according to the following categories:

1. Protected Areas;
2. Critical Biodiversity Areas;
3. Other natural areas;
4. Ecological Support Area; and
5. Modified.

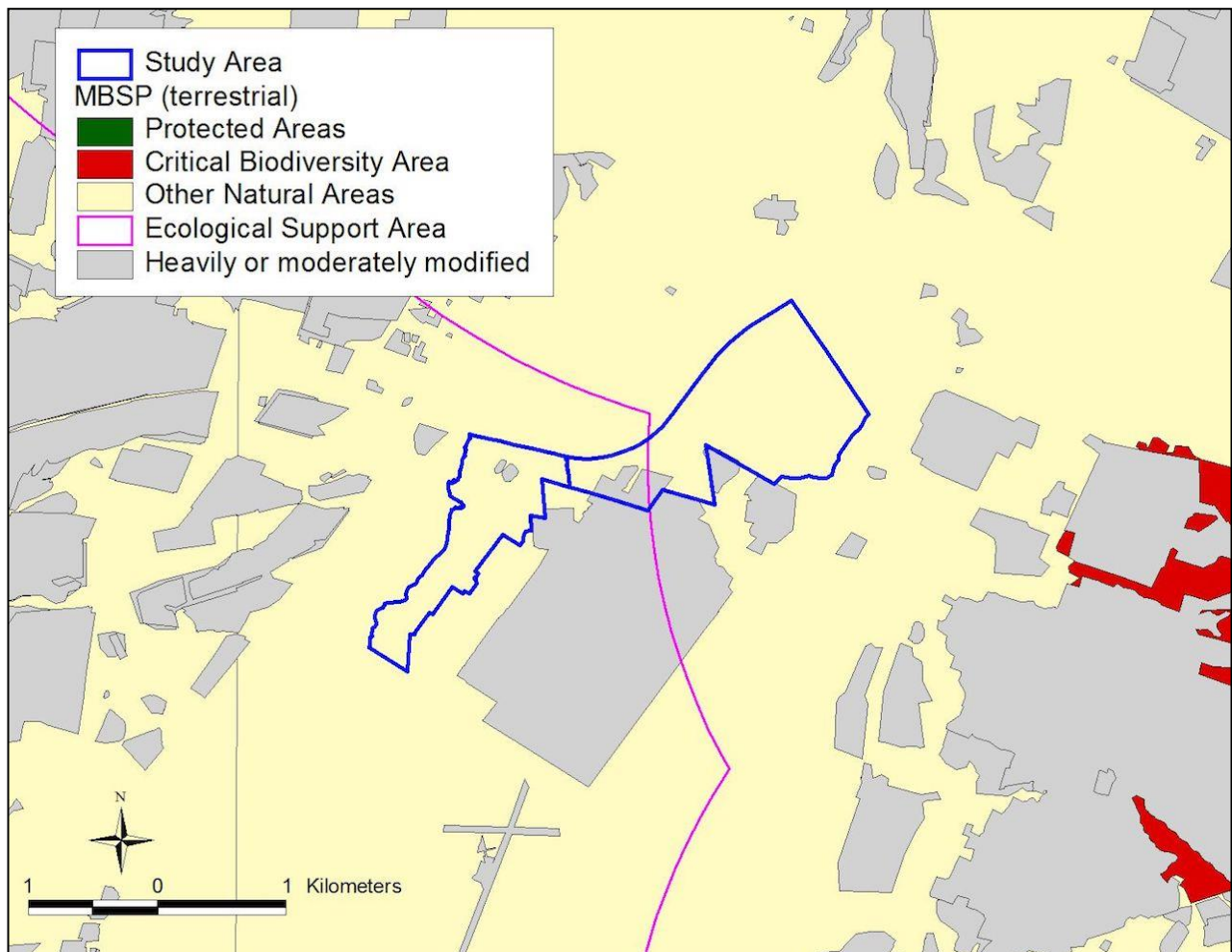


Figure 4: Parts of the study area in different categories of the MBSP.

According to this assessment, the study area contains areas within three categories, namely Ecological Support Areas, Modified Areas and Other Natural Areas (Figure 4). The data layer contains overlapping features within a single data layer and is presented here with Ecological Support Areas transparent with pink border in order to show underneath patterns. The Ecological Support Area, shown here as transparent with pink border, is indicated in the GIS file as being a protected area buffer (all areas above and to the right of the pink line in Figure 4). With this exception, the MBSP appears to indicate that habitat on site is not important for the conservation of biodiversity, despite the elevated conservation status of the regional vegetation type. There are no CBA regions situated close to the site (see Figure 4), although there are patches within Lydenburg to the east of the site.

The MBSP is currently inaccurate in that it indicates that most of the site consists of habitat classified as “Other Natural Areas (including underneath the areas mapped as “Ecological Support Areas”), but aerial imagery indicates that most of these areas have been transformed by informal settlements. This is possibly a reflection of the speed at which habitat can be lost – the data layer was most likely accurate at the time of production and historical Google Earth imagery indicates that transformation was relatively recent.

Habitat map

The distribution of various natural and transformed areas on site is shown in Figure 5 (on page 59) for Mashishing A and in Figure 6 (on page 60) for Mashishing B, as mapped for this project from aerial imagery (Google Earth). The remaining natural areas on site were mapped into habitat units from recent aerial imagery. Each unit is described in more detail below.

Habitat units on site

Seasonal wetland

This includes mostly seasonally inundated sedge vegetation, occasional reedbeds and seasonally wet grassy areas, all within the valley bottom ecosystems or on the margins of riparian areas. It was mapped



PLATE 1: Seasonal wetlands in valley bottom.

from historical aerial imagery, dating back to before expansion of informal settlements in the study area and therefore excludes any artificially-created hygrophilous vegetation. In the valley system on the western side of the study area (Mashishing A) it has been impacted upon by localised cultivation of crops as well as the presence of various informal vehicle tracks and crossing points, but is still clearly a sedge-dominated vegetation (see Plate 2). The soils on this western side are mostly deep, greyish-black clays, typical of seasonally to permanently-inundated valley bottom areas.

On the eastern side of the study area associated with the Dorpsrivier valley, the wetlands are primarily seepage areas on the margins of the riparian zone or else secondary vegetation that has replaced riparian woodland. There are also seepage areas at the heads of small valleys that constitute the origins of wetland vegetation in down-stream areas, one adjacent to Kellysville on the south-eastern side of the study area, another adjacent to the R37 road from Lydenburg to Burgersfort at the turn-off into Mashishing, and a third one on the boundary between the Phase A and Phase B areas in the centre of the study area. The first two of these have been constricted by invading urbanization and the third one by surrounding subsistence agricultural activities.



PLATE 2: Tussocks of *Schoenoplectus corymbosus* in seasonal wetlands in valley bottom.

Stream

There is a perennial stream on the eastern boundary of the study area that runs from south to north. This stream is the Dorpsrivier, a system that emanates in the hills in the south of Lydenburg towards Dullstroom and travels northwards to eventually join the Steelpoort River at Burgersfort. In the study area, this stream consists of a pebble bed, along with localised pools and other natural variation in the in-stream habitats. At the northern end, where it exits the study area, it runs under a road bridge, at which point there is a low reservoir. The dam behind this reservoir is partially invaded by floating water-weeds, possibly the invasive *Eichhornia crassipes* (see Plate 3).

Riparian woodland

The banks of the Dorpsrivier are partially enclosed by tall riparian gallery woodland. In its natural state, this would have been a continuous woodland on both banks of the river, but it has been partially cleared and therefore exists as patches and segments interspersed by secondary tall grassland. Unfortunately, this woodland is dominated by a long list of various species of alien trees and is therefore in a relatively poor



PLATE 3: Dorpsrivier with riparian woodland and floating aquatics.

ecological state. Nevertheless, the ecosystem is functional and there is great potential to rehabilitate it to a more natural state.

Hygrophilous grassland

There are various tongues of moist grassland on the western and eastern side of the study area that extend from within the drainage valley eastwards or westwards towards the urban areas. These contain vegetation that has characteristics that indicate that it experiences at least seasonally elevated soil moisture conditions in that they are dominated by facultative wetland sedge, grass and forb species. These areas have been mapped from aerial imagery from prior to the expansion of urban areas into the drainage valley (imagery from 2003 and 2004) and therefore represent the stable plant communities that would be expected at these locations in the absence of human interference and landscape alteration. Unfortunately, these plant communities have been heavily impacted and it appears that the original species composition has been altered or lost to various degrees.



PLATE 4: Hygrophilous grassland with tussocks of *Scirpoides burkei* and *Schoenoplectus corymbosus*.

Artificial hygrophilous grassland

The original vegetation within the study area would have been grassland. These have been progressively replaced by expansion of settlements. This expansion of settlements has increased the area of hard surfaces, which are relatively impermeable to rainfall infiltration in comparison to the natural land cover. During rainfall events, water runs across these hard surfaces and gets concentrated into ditches on the sides of roads, after which it is expelled as concentrated sources of water at specific points in the landscape. In the natural state of the landscape, overland flow would be highly diffuse. In the altered state of the landscape, this concentrated rainfall flow is an artificial condition that results in localised concentration of water where it would not have previously occurred. The result is that the soils in these areas are wet for longer periods of time than they would be under natural conditions. The higher local moisture status has therefore become favourable for the establishment of plant species that would normally only occur under elevated soil moisture conditions. In the study area, this includes both indigenous species, such as *Scirpoides burkei* and *Schoenoplectus corymbosus*, as well as exotic species, such as *Pennisetum clandestinum* (kikuya grass) and *Paspalum dilatatum*. It is possible to see the development of these artificial hygrophilous grasslands by looking at historical aerial imagery on Google Earth, going back to the year 2003, when they didn't exist in the landscape, in comparison to most recent imagery, where they are an obvious feature on site.



PLATE 5: Artificial hygrophilous grassland with various weeds.

Grassland

The entire study area, with the exception of wetlands, would have been covered by grassland with scattered woody plants prior to settlement by people. The grassland for the area is a dense, closed-structured grass layer occurring in somewhat rocky to shallow soils with woody shrubs and trees becoming prominent in rocky outcrops and on ridges (see Plate 6). The grassland has a high diversity of grass and herb species and is adapted to relatively frequent fires, which would also tend to control the density of woody plants. In the study area, the remaining patches of grassland in the eastern part of the study area are still in good condition, but elsewhere they have been degraded to various degrees. In some parts the degradation is severe and has altered the species composition and structure of the grasslands. Nevertheless, these are all still natural grasslands, irrespective of the level of degradation.



PLATE 6: Natural grassland with diverse grasses and forbs still evident in winter state.

Degraded grassland

Areas with grassland structure, but without the expected indigenous species composition and the expert opinion that the original species composition is unlikely to be recovered through any rehabilitation process. The loss of the original indigenous species composition is possibly related to extreme over-utilization, trampling and soil disturbance followed by invasion by weedy species.

Rocky outcrop scrub

There are two small rock outcrops in the south-western part of the study area (Mashishing A) that protrude from the landscape and contain a scrubby woodland. There is high rock cover and, essentially, the plant community is a scrubby grassland, still dominated by grasses rather than woody plants. It is, however, a community that is structurally distinct from surrounding grasslands.



PLATE 7: Scrub woodland on small rock outcrop.

Urban

This is the largest land cover in the study area and occupies areas adjacent to existing formal urban areas outside the boundary of the study area. This includes all houses, roads, buildings, and gardens and bare ground surrounding buildings. In the study area, there is a significant area of informal urbanization that has taken place, with roads graded into the landscape or organically developed and houses either formally or informally constructed.

Quarry

This is an excavated area and surrounding areas where building or mining rubble has been dumped in the southern / south-western corner of the study area. It has resulted in the complete removal of vegetation as well as soil and the underlying geology to a depth of more than 2 m.

Cultivation

These are areas currently under active cultivation, either recently ploughed, containing a crop or currently fallow but without established perennial secondary vegetation. Cultivated areas do not occur extensively in the study area. There is one main patch in the central part of the study area where the Phase A and Phase B areas meet. There are also a few small areas of cultivation in the south-western corner of the study area.

Disturbed areas

These are vegetated areas, but with weedy composition in combination with bare ground and/or rubble. There may be localized areas of bare or almost bare soil. The weeds are most likely to be exotic, but there are also indigenous weeds that could occur in these areas. Disturbed areas are located primarily alongside the main roads in the study area, along the northern boundary and along the eastern boundary.

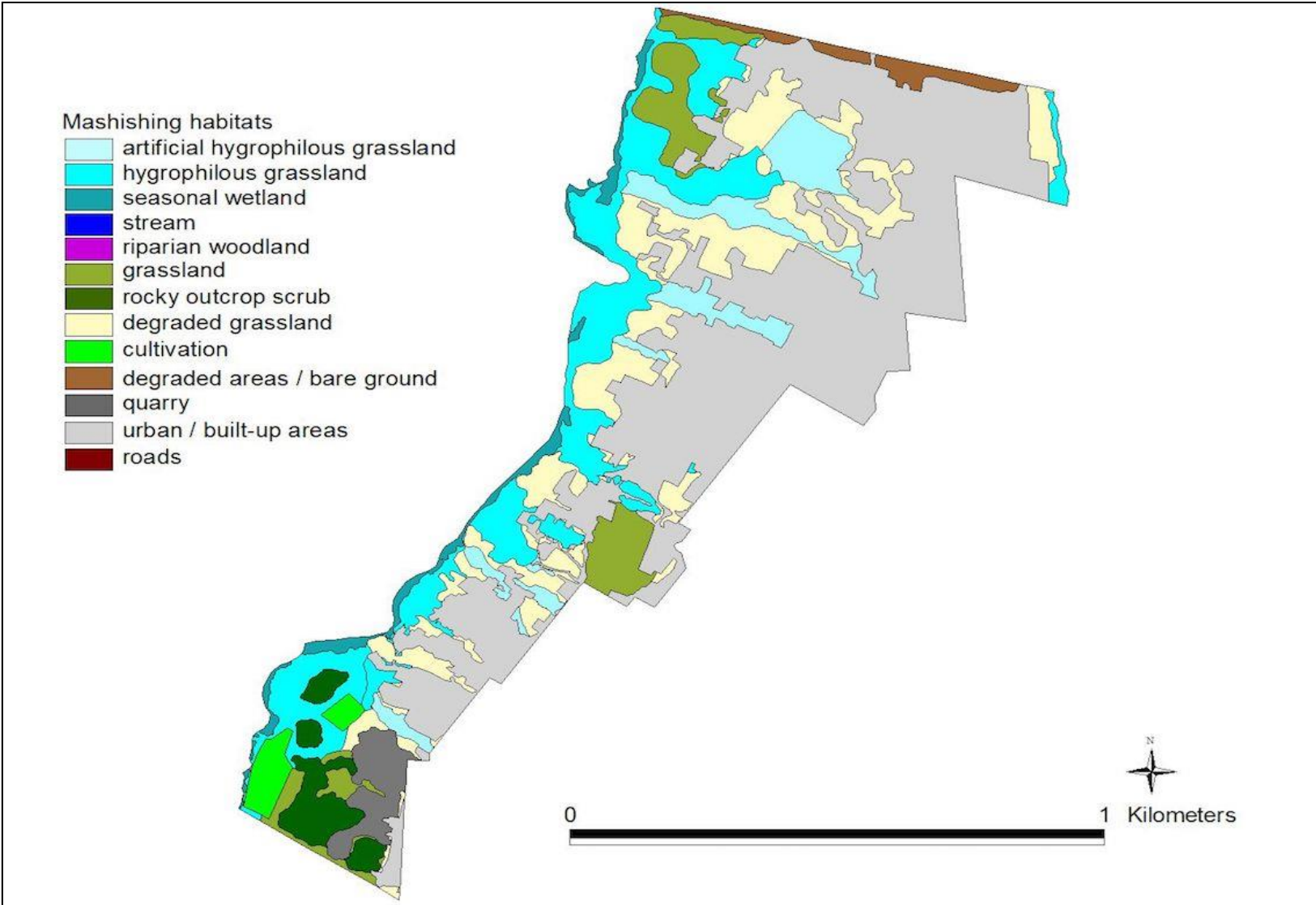
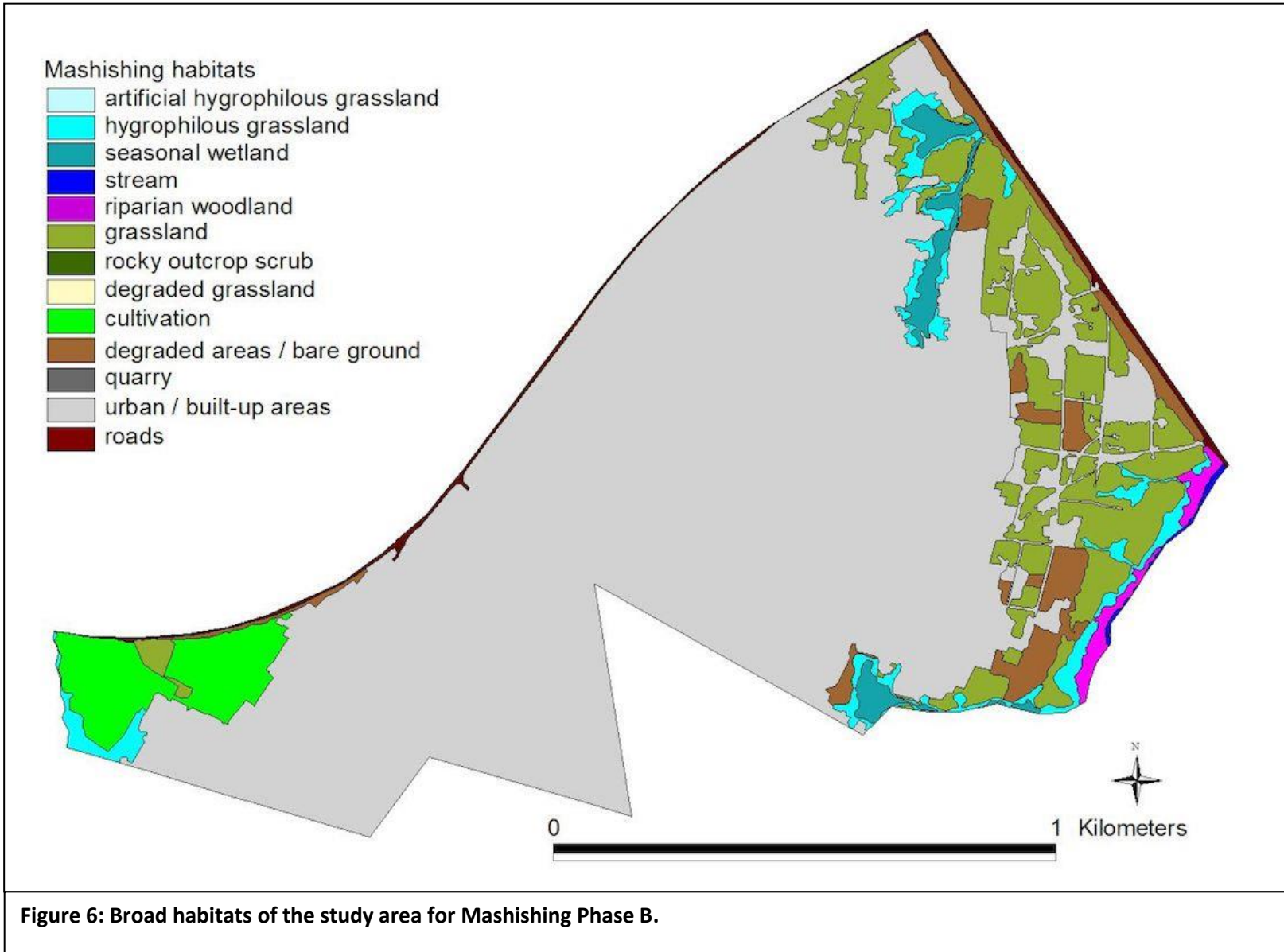


Figure 5: Broad habitats of the study area for Mashishing Phase A.



Calculation of areas of each habitat unit

Areas in hectares of different habitats are as given in the table below for Mashishing Phase A (Table 13) and Phase B (Table 14). Also provided are the areas affected directly by the proposed footprint of the development within the study area.

Table 13: Area in hectares of different habitats on site for Phase A:

Broad habitat	Status	Area (ha) Total	Area (ha) Footprint
<i>Grassland</i>	Natural (= "indigenous vegetation")	4.810	3.648
<i>Hygrophilous grassland</i>	Natural (= "indigenous vegetation")	10.319	3.970
<i>Rocky outcrop scrub</i>	Natural (= "indigenous vegetation")	2.367	1.925
<i>Seasonal wetland</i>	Natural (= "indigenous vegetation")	2.734	0.181
<i>Degraded grassland</i>	Natural (= "indigenous vegetation")	13.347	9.464
<i>Artificial hygrophilous grassland</i>	Secondary	10.000	4.958
<i>Cultivation</i>	Transformed	1.164	0.308
<i>Degraded areas / bare ground</i>	Transformed	1.262	0.396
<i>Quarry</i>	Transformed	1.854	1.854
<i>Urban / built-up land</i>	Transformed	35.048	34.241
TOTAL		82.905	

Table 14: Area in hectares of different habitats on site for Phase B:

Broad habitat	Status	Area (ha) Total	Area (ha) Footprint
<i>Grassland</i>	Natural (= "indigenous vegetation")	17.655	12.439
<i>Hygrophilous grassland</i>	Natural (= "indigenous vegetation")	4.051	0.881
<i>Stream</i>	Natural (= "indigenous vegetation")	0.229	0.000

<i>Riparian woodland</i>	Natural (= "indigenous vegetation")	1.039	0.000
<i>Seasonal wetland</i>	Natural (= "indigenous vegetation")	2.270	0.169
<i>Cultivation</i>	Transformed	5.610	4.225
<i>Degraded areas / bare ground</i>	Transformed	5.322	2.560
<i>Roads</i>	Transformed	1.846	0.036
<i>Urban / built-up land</i>	Transformed	114.104	107.300
TOTAL		152.356	

According to EIA regulations (GNR 983), the following is a listed activity requiring an EIA:

"The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-
(i) the undertaking of a linear activity; or
(ii) maintenance purposes undertaken in accordance with a maintenance management plan."

As per the definition of GNR 546 and GNR 983, GNR 984 and GNR 985, "Indigenous vegetation refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years."

The Department of Environmental Affairs has produced an explanatory document (dated February 2015) providing examples of indigenous vegetation in which one example discusses secondary vegetation in previously cultivated areas: Example: area *"was ploughed and under crop production...now overgrown by many indigenous plants, indigenous grass, indigenous shrubs and even indigenous trees...does NOT meet the definition of indigenous vegetation"*. This indicates clearly that secondary vegetation in previously cultivated areas is not considered, in this example, to be "indigenous vegetation" according to the definition, despite the presence of indigenous species.

Based on an interpretation of "indigenous vegetation", it is calculated that a total of **23.213 hectares** of primary indigenous vegetation and **9.464 hectares** of degraded indigenous vegetation will be directly affected by the proposed development (within the development footprint), of which **19.188 hectares is in Phase A** and **13.489 hectares is in Phase B**.

Spatial sensitivity mapping

There are features on site that need to be taken into account in order to evaluate sensitivity of the site and its surroundings. These include the following:

1. **Drainage areas:** There are two non-perennial streams running through the study area. They are both narrow. The one in the western part of the site is unchannelled and it is defined more by a difference in vegetation structure and species composition, with a higher incidence of tall shrubs than the surrounding grassland. The stream in the central part of the site is transformed by the settlement through which it runs and is channelled. The drainage areas can be separated into “seasonal wetland”, “hygrophilous grassland” and “artificial hygrophilous grassland”, of which those in the first category are classified as wetlands and are protected according to the National Water Act. All three classes constitute important ecological areas in terms of hydrological processes.
2. **Natural vegetation:** The major vegetation type of this region is Lydenburg Thornveld, which is listed as Vulnerable in the scientific literature, but is not listed according to the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004). These remaining patches of vegetation have high conservation value.

A summary of the factors used to classify sensitive habitats on site is given in Table 13. A map of sensitive habitats is shown in Figure 8.

Table 13: Factors contributing to sensitivity classification of different habitats on site.

Vegetation/habitat type	Sensitivity	Reason
Remaining patches of Vulnerable vegetation type	Medium High	<ul style="list-style-type: none"> • Vegetation type listed as Vulnerable in scientific literature, but not listed according to the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004). • Potential habitat for species of concern.
Drainage areas classified as wetlands	High	<ul style="list-style-type: none"> • Protected habitats (areas protected according to national / provincial legislation, e.g. National Water Act). • Ecosystem providing high value ecosystem goods and services.

A standardized sensitivity mapping approach was used to map habitat sensitivity on site. The methodology for scoring sensitivity is provided in the Methodology section of this report. For mapping purposes, the sensitivity scores for features occurring in the study area are as follows (Table 14) and presented in Figure 9.

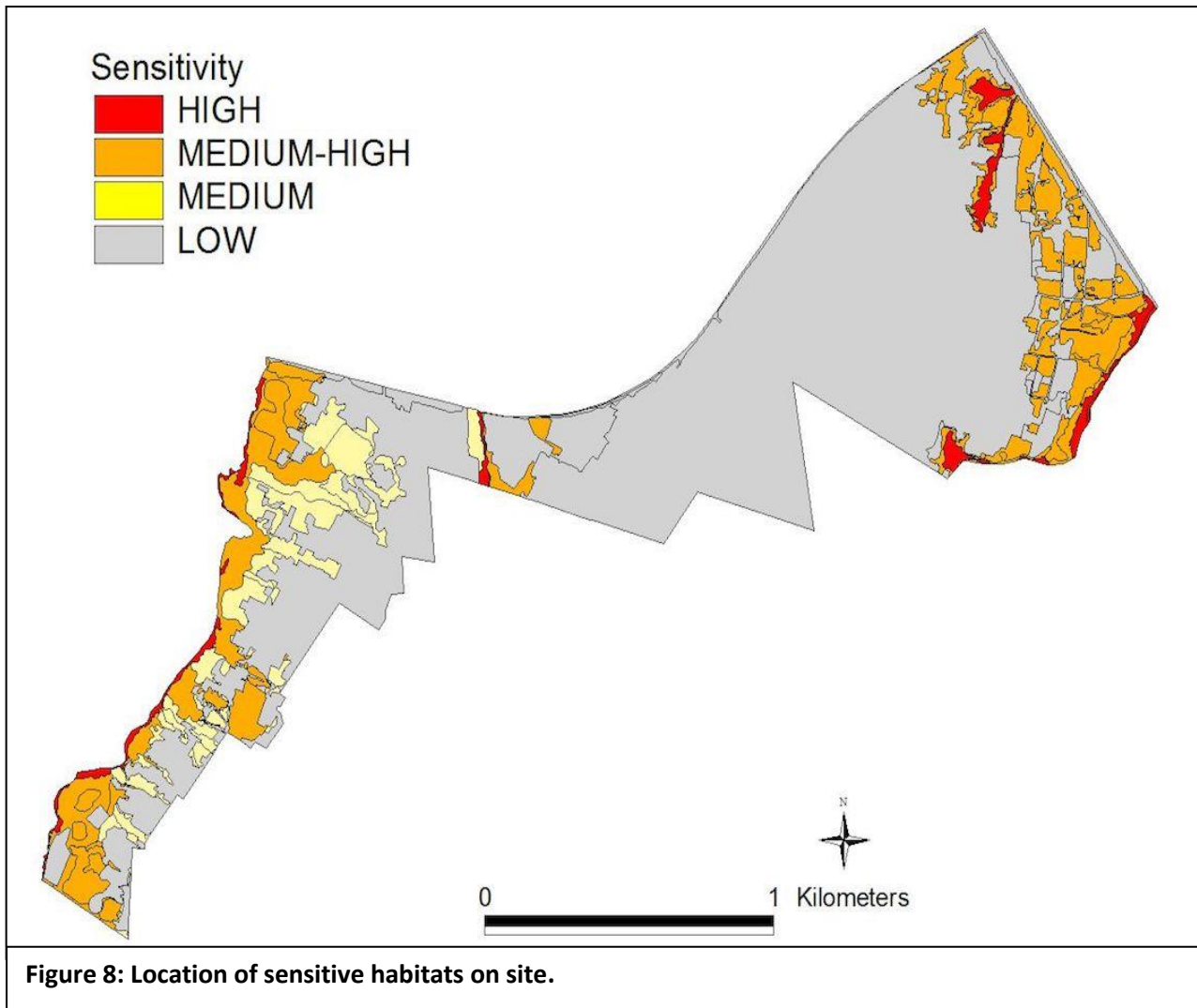
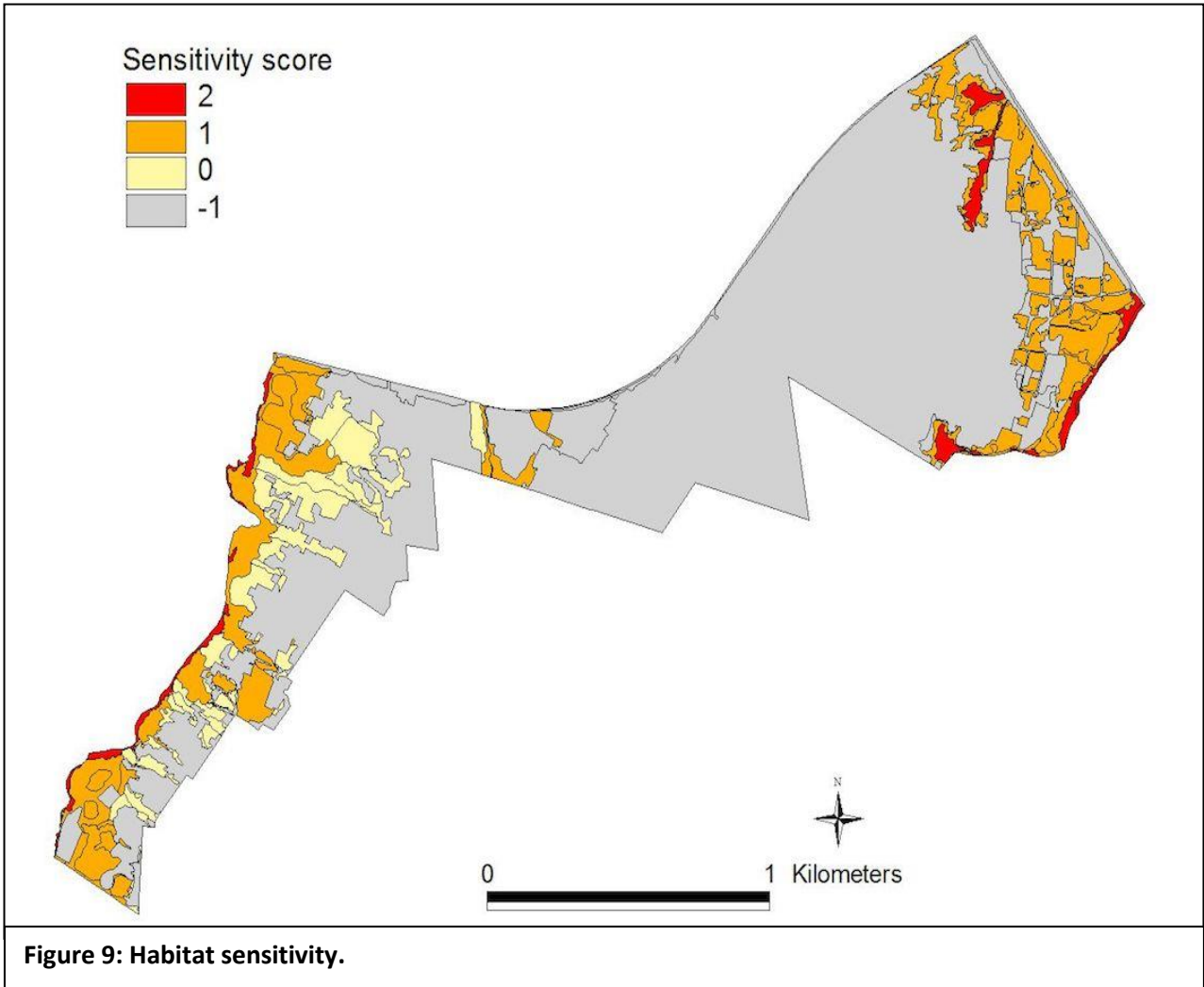


Figure 8: Location of sensitive habitats on site.

Table 14: Sensitivity ratings for features in the study area and explanations for ratings assigned.

Feature	Score	Reason
Transformed areas	-1	These areas are already degraded or transformed and the proposed project will not affect this current status.
Natural areas	+1	Natural areas of vegetation are considered to have high intrinsic biodiversity value. If there is any loss or degradation of this habitat, the natural vegetation is only replaceable over periods of time that exceed human life-spans, which means that it is essentially permanently lost if it is removed. This further highlights the high value of these areas for biodiversity retention.
Drainage areas	+2	The drainages and associated vegetation are ecologically sensitive and have high intrinsic biodiversity value. The system is interconnected in a way where any damage could lead to changes to the entire ecosystem and the way it functions, including to downstream areas.

A sensitivity map, based on these scores is provided below (Figure 9), and is also supplied as a GIS file.



Potential impacts

Identification of potential impacts

This section provides a description of potential impacts associated with the project. Potential impacts are according to the following table:

Table 15: Potential impacts associated with the proposed project.

Impact	Affected feature	Caused by	Project phases
Habitat loss/destruction	Vegetation communities; Faunal habitat; Aquatic ecosystems.	Direct removal	Construction
Habitat fragmentation & edge effects	Vegetation communities; Faunal habitat	Direct removal	Construction
Loss of or damage to wetlands	Drainage areas	Direct destruction; Siltation; Water pollution	Construction Operation
Displacement of faunal species	Faunal populations and individuals	Habitat loss; Noise & other sensory disturbance	Construction Operation
Blockage of seasonal & dispersal movements	Faunal populations and individuals	Habitat loss Habitat fragmentation Noise & other sensory disturbance	Construction Operation
Flora direct & indirect mortality	Individuals or populations of species of conservation concern	Direct destruction Illegal removal	Construction
Fauna direct & indirect mortality	Individuals or populations of species of conservation concern	Direct destruction Illegal hunting / poaching / removal	Construction Operation
Introduction/invasion by alien (non-native) species	Vegetation communities Aquatic ecosystems (Faunal habitat) (Individuals or populations of species of conservation concern)	Habitat disturbance Introduction of alien species (seeds / fragments) on transport vehicles Poor control of existing aliens Poor habitat and soil management	Operation

		Poor rehabilitation measures (e.g. incorrect seed mixes)	
--	--	--	--

Description of potential impacts

Habitat loss/destruction

The regional vegetation type on site is Lydenburg Thornveld, classified in the scientific literature as Vulnerable (Mucina et al. 2008) and not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011). Any areas of natural habitat within this regional vegetation type are therefore considered to have high conservation status.

Habitat loss refers to physical disturbance of habitats through clearing, grading and other permanent to semi-permanent loss or degradation. Loss of habitat on site could lead to loss of biodiversity as well as habitat important for the survival of populations of various species.

Habitat fragmentation & edge effects

The footprint of human activities on the land base can influence wildlife populations by affecting the capability or utility of habitats. The collection of multiple footprints results in fragmentation, defined as the process whereby a large, continuous area of habitat is both reduced in area and divided into two or more fragments or habitat “isolates” (Wilcove et al. 1986; Primack 1993). Fragmentation, in turn, can initiate population extinction processes through three main effects that can act independently or in cumulative fashion. These effects are as follows (Strom, K.B., D. Walker and R. Eccles, 2000):

1. The creation of habitat patches of insufficient size and/or quality to meet a species’ requirements (individuals and/or populations);
2. Reduction of species mobility within and between supportive habitats, (loss of connectivity); and
3. Effects that are associated with increased amounts of edge habitats (direct and indirect mortality effects, parasitism, etc.).

With fragmentation habitat is not only lost, but the remaining habitat is broken into increasing smaller fragments, causing species populations to become increasingly isolated. Habitat fragmentation is a concern because of its potential to isolate populations and reduce biodiversity. Many species are particularly wary of human activity and will not cross a cleared area, such as roads, to gain access to habitat on the other side. This reduces the amount of suitable habitat for that species and may potentially isolate animals from their prey or others within their population.

The site is already significantly fragmented due to existing settlement and previous and ongoing agricultural activities on site. It is not expected that the proposed activities will cause any significant additional fragmentation, because the site is located adjacent to existing urban areas.

Impacts on wetland vegetation

The site contains two narrow drainages that run through the site, one in a near natural state and the other altered significantly by the existing settlement on site. These contain vegetation typically associated with wetlands, which are protected according to the National Water Act and also constitute important ecological areas in terms of hydrological processes and as refugia for species.

Construction may lead to some direct or indirect loss of or damage to vegetation of wetlands or drainage lines or impacts that affect the catchment of these areas. This could lead to localised loss of wetland vegetation and may lead to downstream impacts that affect a greater extent of wetland vegetation or impact on wetland function. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to the hydrology of wetlands can have an impact on the structure and functioning of those wetlands, including loss of wetland vegetation.

Displacement of faunal species

The site contains a moderate to high diversity of fauna, including species that are listed or protected. The destruction of habitats on site and the general presence of industrial activities on site may lead to populations of fauna moving away or being negatively affected while on site. This will, however, probably be minimal relative to existing impacts on site and will be localised at any one point in time.

Blockage of seasonal & dispersal movements

Connectivity refers to the ability of wildlife to move through the landscape. It is a critical element with respect to the maintenance of ecological integrity. Movements of wildlife are impacted from the cumulative effects of habitat loss, fragmentation, reduced habitat effectiveness and physical blockage of movements (e.g., fences, buildings, heavily used roads). Most obvious blockages in movement typically occur in areas with both high human activity in conjunction with physical impediments such as fenced highways and towns. Even if there are no defined, highly utilized wildlife movement corridors through the development areas, the construction and operation of facility sites, roads, above-ground infrastructure and other linear facilities can create zones of disturbance and high risk for some wildlife, and can impede the natural ability of wildlife to move through the area during day-to-day foraging activities or seasonal movements.

Due to the existing moderate levels of fragmentation in and around the study area due to current and previous urban and agricultural activities in combination with the highly localised nature of the proposed activities, this potential impact is not considered to be potentially significant. Also, the site is adjacent to existing settlement and human disturbance and all mobile species probably avoid the area.

Flora direct & indirect mortality

Plant species 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.

Threatened species include those classified 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 plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

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

Up to five plant species of concern were identified that could potentially occur on site, namely the Endangered species, *Adenia wilmsii*, the Near Threatened species, *Merwillia plumbea*, and the Declining plant species, *Boophane disticha*, *Eucomis autumnalis* and *Hypoxis hemerocallidea*, and the protected species, *Merwillia plumbea* and *Crinum bulbispermum*. Confirmation of the occurrence or not of these species on site should be undertaken.

Impacts on protected trees

It has been determined that a number of species of protected tree have a geographical distribution that includes the site, but habitat conditions on site were unfavourable for many of them. There are three protected tree species for which suitable habitat occurs on site and for which there is a possibility that they could occur on site, namely *Elaeodendron transvaalensis*, *Pittosporum viridiflorum* and *Pterocarpus angolensis*. The probability of this impact occurring is therefore rated as moderate.

Fauna direct & indirect mortality

Activities and the presence of more people surrounding the development area can contribute to an increase in direct and indirect mortalities of wildlife species. Increases in traffic along access roads has the potential to increase the number of animals killed in an area. In addition to traffic kills, indirect mortality from hunting and trapping is also a significant concern associated with activities and increased access.

There are a number of animal species that could potentially be affected on site, including the Brown Hyaena (NT), the Serval (NT), the Honey Badger (NT), the Coppery Grass Lizard (NT), the Large-scaled Grass Lizard (NT), Breyer's Long-tailed Seps (VU), the Striped Harlequin Snake (NT), Grey-crowned Crane (EN), African Marsh Harrier (EN), Denham's Bustard (VU), Lanner Falcon, (VU), Southern Bald Ibis (VU), White-bellied Korhaan (VU), Secretarybird (VU), Blue Crane (NT), European Roller (NT), and Abdim's Stork (NT).

Introduction/invasion by alien (non-native) species

Major factors contributing to invasion by alien invader plants includes, *inter alia*, high disturbance (such as clearing for construction activities) and negative grazing practices (Zachariades et al. 2005). Exotic species

are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins et al. 2003). Consequences of this may include:

1. loss of indigenous vegetation;
2. change in vegetation structure leading to change in various habitat characteristics;
3. change in plant species composition;
4. change in soil chemical properties;
5. loss of sensitive habitats;
6. loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. fragmentation of sensitive habitats;
8. change in flammability of vegetation, depending on alien species;
9. hydrological impacts due to increased transpiration and runoff; and
10. impairment of wetland function.

There are existing populations of alien plants in nearby areas. There is a high possibility that alien plants could be introduced to areas within the footprint of the proposed activities from surrounding areas in the absence of control measures. The potential consequences may be of moderate seriousness for surrounding natural habitats. Control measures could prevent the impact from occurring. These control measures are relatively standard and well-known.

Impact assessment

Assessment of impacts associated with planning and design

No impacts on the ecological receiving environment have been identified that will occur during the Planning and Design Phase of the project.

Assessment of impacts associated with construction

Loss/destruction of natural habitat

The proposed development will lead to the loss of some natural habitat. It is not possible to avoid this loss without refraining from development of the natural parts of the site.

A. Loss Destruction of natural habitat					
Impact Name	Loss Destruction of natural habitat				
Alternative	n/a				
Phase	Construction				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	5	5
Extent of Impact	1	1	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	2
Environmental Risk (Pre-mitigation)					-20,00
Mitigation Measures					
<i>Leave natural habitats as well as a buffer zone out of the footprint of development.</i>					
<i>Rehabilitate disturbed areas as soon as possible.</i>					
<i>Control alien plants.</i>					
Environmental Risk (Post-mitigation)					-8,00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					1
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					3
<i>The impact may result in the irreplaceable loss of resources of high value (services and/or functions).</i>					
Prioritisation Factor					1,33
Final Significance					-10.67

Habitat fragmentation and edge effects

Due to the existing fragmentation of natural habitat, limited fragmentation and edge effects are expected.

B. Habitat fragmentation and edge effects					
Impact Name	Habitat fragmentation and edge effects				
Alternative	n/a				
Phase	Construction				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	2	1
Extent of Impact	1	1	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	2	1
Environmental Risk (Pre-mitigation)					-6,5
Mitigation Measures					
<i>Undertake activities in previously disturbed areas and/or habitats with lower sensitivity, i.e. leave remaining natural habitats outside of the footprint of development.</i> <i>Limit effects on surrounding areas.</i> <i>Rehabilitate disturbed areas as soon as possible.</i>					
Environmental Risk (Post-mitigation)					-3,00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					1
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					2
<i>The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.</i>					
Prioritisation Factor					1,33
Final Significance					-4.00

Displacement of faunal species

The proposed activities on site will lead to localised damage of habitat. The site is adjacent to an existing urban area, which would discourage fauna from using the site. The overall loss of habitat is, however, expected to be quite a small proportion of the total habitat within the general area. Loss of faunal habitat will therefore be low.

C. Displacement of faunal species	
Impact Name	Displacement of faunal species
Alternative	n/a
Phase	Construction
Environmental Risk	

Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	1	1
Extent of Impact	2	2	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					-13,00
Mitigation Measures					
<i>Undertake activities in previously disturbed places and/or habitats with a lower sensitivity score.</i>					
<i>Limit effects on surrounding areas.</i>					
<i>Rehabilitate disturbed areas as soon as possible.</i>					
Environmental Risk (Post-mitigation)					-13,00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					1
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					1
<i>The impact is unlikely to result in irreplaceable loss of resources.</i>					
Prioritisation Factor					1,00
Final Significance					-13,00

Blockage of seasonal and dispersal movements

Proposed activities will result in insignificant loss of habitat, especially migration corridors. Habitat fragmentation is also expected to be minimal.

F. Blockage of seasonal and dispersal movements					
Impact Name	Blockage of seasonal and dispersal movements				
Alternative	n/a				
Phase	Construction				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	1	1
Extent of Impact	2	2	Reversibility of Impact	2	2
Duration of Impact	1	1	Probability	2	1
Environmental Risk (Pre-mitigation)					-3,00
Mitigation Measures					
<i>Undertake activities in previously disturbed places and/or habitats with a lower sensitivity score.</i>					
<i>Limit effects on surrounding areas.</i>					
<i>Rehabilitate disturbed areas as soon as possible.</i>					
Environmental Risk (Post-mitigation)					-1,50
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					1

<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>	
Degree of potential irreplaceable loss of resources	1
<i>The impact is unlikely to result in irreplaceable loss of resources.</i>	
Prioritisation Factor	1,00
Final Significance	-1,50

Flora direct & indirect mortality

There are various plant species of concern that could potentially be affected by the proposed activities on site, namely the Endangered species, *Adenia wilmsii*, the Near Threatened species, *Merwillia plumbea*, and the Declining plant species, *Boophane disticha*, *Eucomis autumnalis* and *Hypoxis hemerocallidea*, and the protected species, *Merwillia plumbea* and *Crinum bulbispermum*. Whether these occur on site or not is unknown and if any occur there then the exact location of these is unknown and a flora walk-through survey is required to improve the confidence in this assessment.

E. Flora direct and indirect mortality					
Impact Name	Flora direct and indirect mortality				
Alternative	n/a				
Phase	Construction				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	4	2
Extent of Impact	2	2	Reversibility of Impact	3	2
Duration of Impact	5	3	Probability	4	2
Environmental Risk (Pre-mitigation)					-14,00
Mitigation Measures					
<i>Walk-through survey of local site prior to activity.</i>					
<i>Obtain permits for any listed/protected species found on site.</i>					
<i>Modify footprint of proposed development, if necessary.</i>					
<i>Search and rescue, where appropriate.</i>					
Environmental Risk (Post-mitigation)					-4,50
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					2
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					3
<i>The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.</i>					
Prioritisation Factor					1,50
Final Significance					-6,75

Protected trees direct & indirect mortality

There are three species of protected trees that could potentially be affected by the proposed activities on site, namely *Elaeodendron transvaalensis*, *Pittosporum viridiflorum* and *Pterocarpus angolensis*. The area where they are likely to occur is in the riparian zone on the eastern side of the study area and in surrounding grasslands on the slopes overlooking the riparian zone. Whether these occur on site or not is unknown and if any occur there then the exact location of these is unknown. A protected tree walk-through survey is required to improve the confidence in this assessment.

F. Protected trees direct and indirect mortality					
Impact Name	Protected tree direct and indirect mortality				
Alternative	n/a				
Phase	Construction				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	2	1
Extent of Impact	2	1	Reversibility of Impact	3	3
Duration of Impact	5	2	Probability	2	1
Environmental Risk (Pre-mitigation)					-6,00
Mitigation Measures					
<i>Walk-through survey of local site prior to activity.</i>					
<i>Obtain permits for any protected trees found on site.</i>					
<i>Modify footprint of proposed development, if necessary.</i>					
Environmental Risk (Post-mitigation)					-1,75
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					2
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					1
<i>The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.</i>					
Prioritisation Factor					1,17
Final Significance					-2,04

Fauna direct and indirect mortality

There are risks to fauna, for example illegal hunting/poaching as well as threats from movement of machinery. During construction, relatively sedentary species may suffer direct mortality. Sedentary species that could occur on site are the reptile species of conservation concern, namely the Coppery Grass Lizard (Near Threatened), Large-scaled Grass Lizard (Near Threatened), Breyer's Long-tailed Seps (Vulnerable) and the Striped Harlequin Snake (Near Threatened).

The assessment is based on a worst-case scenario affecting species of the highest conservation status.

G. Fauna direct and indirect mortality					
Impact Name	Fauna direct and indirect mortality				
Alternative	n/a				
Phase	Construction				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	2	2	Reversibility of Impact	3	3
Duration of Impact	4	3	Probability	3	2
Environmental Risk (Pre-mitigation)					-9,75
Mitigation Measures					
<i>Undertake site-specific walk-through surveys for potential species of concern.</i> <i>Undertake activities in previously disturbed areas and/or habitats with lower sensitivity.</i> <i>Locate activities on the boundaries of existing disturbance.</i> <i>Use existing access roads as much as possible.</i>					
Environmental Risk (Post-mitigation)					-5,50
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					1
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					3
<i>The impact may result in the irreplaceable loss of resources of high value (services and/or functions).</i>					
Prioritisation Factor					1,33
Final Significance					-7,33

Assessment of impacts associated with operation

Introduction/invasion by alien (non-native) species

Disturbing activities on site will favour alien plants in places. In most cases, it is in the interests of the land owner to control infestations.

H. Introduction/invasion by alien species					
Impact Name	Introduction/invasion by alien species				
Alternative	n/a				
Phase	Operation				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	3	1

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Extent of Impact	3	2	Reversibility of Impact	3	2
Duration of Impact	4	3	Probability	4	1
Environmental Risk (Pre-mitigation)					-13,00
Mitigation Measures					
<i>Undertake activities in previously disturbed areas and/or habitats with lower sensitivity.</i> <i>Locate activities on the boundaries of existing disturbance.</i> <i>Use existing access roads as much as possible.</i> <i>Rehabilitate disturbed areas as soon as possible.</i> <i>Manage alien plants within close proximity to the site.</i> <i>Compile an alien plant management plan.</i>					
Environmental Risk (Post-mitigation)					-2,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					1
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					3
<i>The impact may result in the irreplaceable loss of resources of high value (services and/or functions).</i>					
Prioritisation Factor					1,33
Final Significance					-2.67

Assessment of impacts associated with decommissioning

No impacts on the ecological receiving environment have been identified that will occur during the Decommissioning Phase of the project.

Assessment of impacts associated with rehabilitation and closure

No impacts on the ecological receiving environment have been identified that will occur during the Rehabilitation and Closure Phase of the project.

Mitigation measures

This section of the report provides a description of mitigation measures that could be applied to minimize identified impacts.

Mitigation measures

Rehabilitation Programme

Rehabilitation Programme should be established before construction. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after completion of construction. This Rehabilitation Programme must be approved by the relevant government departments.

Botanical walk-through survey

Depending on the outcomes of the EIA-Phase field survey, it may be recommended that a pre-activity walk-through survey should be undertaken to list the identity and location of all listed and protected species. This would only be necessary in the case where large numbers of plants are detected during the EIA-Phase survey and significant field time would be required to record all individuals. If not, the EIA-Phase field survey will constitute an adequate walk-through survey for these purposes. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. If possible, areas of concentrations of species of concern should be avoided by modifying the footprint of the proposed development.

Obtain permits for protected plants and trees

It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants, although the effectiveness of this measure is controversial and is also, in principle, not supported by SANBI or the IUCN.

Search and rescue

Note that Search and Rescue as a mitigation measure is not supported, in principle, by either the South African National Biodiversity Institute nor the IUCN. Experience, and published results also indicate that Search and Rescue has a very low success rate. If undertaken, search and rescue operation of all listed species within the activity footprint. For each individual plant that is rescued, the plant must be photographed before removal, tagged with a unique number or code and a latitude longitude position recorded using a hand-held

GPS device. The plants must be planted into a container to be housed within a temporary nursery on site or immediately planted into the target habitat. If planted into natural habitat, the position must be marked to aid in future monitoring of that plant. Rescued plants housed in temporary nursery may be used in one of two ways: (1) transplanted into suitable natural habitats near to where they were rescued, or (2) used for replanting in rehabilitation areas. Receiver sites must be matched as closely as possible with the origin of the plants and, where possible, be placed as near as possible to where they originated.

Modify development footprint

Where large numbers of species of concern or populations of species of high conservation concern are found, it is recommended that the footprint of the proposed development be modified to exclude these areas, as well as an appropriate buffer zone around them.

Herpetological walk-through survey

If the EIA-Phase field survey identifies a high likelihood of reptile species of concern being found on site then, prior to construction, a reptile specialist should undertake a walk-through survey to determine whether any of the four reptile species of concern occur on site or not. Four species of concern have been listed as potentially occurring on site. If necessary, recommendations should be obtained from a herpetologist regarding safe removal from the site of any affected individuals and translocation to nearby natural habitats.

Alien plant management plan

It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species, especially within the riparian habitat. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures.

Undertake regular monitoring

Monitoring should be undertaken to evaluate the success of mitigation measures. Monitoring methods are detailed in the following section of this report.

Environmental management plan

The Environmental Management Plan provided below (Table 16) describes the mitigation measures required to manage potential impacts on the ecological receiving environment due to the proposed activities by the proponent.

Table 16: Mitigation measures, including requirements for timeframes, roles and responsibilities.

No.	Mitigation measures	Phase	Timeframe	Responsible party for implementation	Monitoring party (frequency)	Target	Performance indicators (Monitoring tool)
A	The Applicant shall obtain permits for the removal of any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements must be identified during a botanical walk-through survey.	Planning	Prior to construction	Applicant ECO	ECO (annually) Independent botanical specialist (once-off)	No protected species removed without a permit.	All permits in place.
B	Undertake plant search and rescue of protected / listed plants that occur on site.	Planning	Prior to construction	Applicant ECO	ECO (once-off) Independent botanical specialist (once-off)	All identified plants rescued and/or accounted for.	Survival rate of rescued plants.
C	If identified from the EIA-Phase field survey as being necessary, then undertake a walk-through survey (Botanical and Herpetological).	Planning	Prior to construction	Applicant ECO	ECO (once-off) Independent botanical specialist (once-off) Independent reptile specialist (once-off)	Walk-through survey completed successfully.	Receipt of walk-through survey report.

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D	Compile and implement a Rehabilitation programme	Planning	Prior to construction Rehabilitation and closure	Applicant Contractor ECO	ECO (weekly)	Disturbed areas effectively rehabilitated.	Soil stability. Plant growth with acceptable cover and species composition.
E	Compile and implement an Alien Plant Management Plan	Operation	Operation	Applicant ECO	ECO (monthly) Independent botanical specialist (annually)	Alien plants effectively controlled.	Number, density and location of alien plants.

Action plan

The Action Plan provided below (Table 17) describes the implementation plan for the recommended mitigation measures. This is a draft management plan and will be further developed and updated during the EIA Phase.

Table 17: Action Plan for implementation of recommended mitigation measures.

Phase	Management Action	Timeframe for implementation	Responsible Party for Implementation	Responsible Party for Monitoring / Audit / Review (frequency)
Planning	Obtain permits for protected species	1 month prior to construction	Applicant Botanical Specialist to be appointed	Environmental Manager (annually) Botanical Specialist (external review as required)
	Plant search and rescue	1 month prior to construction	Applicant Botanical Specialist to be appointed	Environmental Manager (once-off) Botanical Specialist (external review as required)
	Botanical walk-through survey, if identified from EIA-Phase as being necessary	6 months prior to construction	Applicant Botanical Specialist to be appointed	Environmental Manager (once-off)
	Herpetological walk-through survey, if identified from EIA-Phase as being necessary	6 months prior to construction	Applicant Reptile Specialist to be appointed	Environmental Manager (once-off)
	Compile Rehabilitation programme	1 month prior to construction	Applicant	Environmental Manager

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			Botanical Specialist to be appointed	(once-off) Botanical Specialist (external review as required)
	Compile Alien Plant Management Plan	1 month prior to construction	Applicant Botanical Specialist to be appointed	Environmental Manager (once-off) Botanical Specialist (external review as required)
	Monitoring of demarcated sensitive habitats	Throughout construction	Environmental officer (weekly)	ECO (monthly audit)
Construction	Specialist investigation upon discovery of previously unidentified biodiversity features (listed or protected species, sensitive habitat)	As required	Ecological Specialist to be appointed (as required)	Environmental Manager/ECO (audit and review as required)
	Implement Alien Management Plan	Throughout construction and for one year after construction	Environmental officer (weekly)	ECO (monthly audit) Botanical Specialist (external review as required)

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	Monitoring of demarcated sensitive habitats	Throughout construction	Environmental officer (weekly)	ECO (monthly audit) Botanical Specialist (external review as required)
Rehabilitation & closure	Implement Rehabilitation Plan	Immediately after construction until complete	Environmental officer (weekly)	ECO (monthly audit) Botanical Specialist (external review as required)

Monitoring plan

The following section provides details of the monitoring activities that are required for the project in order to ensure that management actions are properly implemented. The section is in draft format and will be updated during the EIA phase.

Monitoring activities required to ensure that management actions are implemented.

Obtain permits for protected species	
Conceptual management strategy (Principles & Objectives)	Ensure that permits for the removal of any species protected according to National or Provincial legislation are obtained.
Baseline data	Identity, location and number of individuals of each affected species
Proposed monitoring locations	Environmental office
Recommended Data collection/sampling	Visual inspection of documentation
Recommended Methods and materials	Visual inspection of documentation
Applicable Parameters & Standards	Legal requirement for permits, as per applicable legislation
Recommended Timeframes & Responsibilities for Implementation where appropriate	Prior to construction / operation Applicant is responsible
Recommended Targets and Key Performance Indicators	All permits in place
Recommended Data Interpretation, Trending and Analysis	None
Recommended Reporting	Once-off confirmation
Recommendations for audit and review	External review

Plant search & rescue	
Conceptual management strategy (Principles & Objectives)	Monitoring of plants relocated during search and rescue to evaluate whether the intervention was successful or not.
Baseline data	Identity, location and number of individuals of each affected species
Proposed monitoring locations	At site where relocated plants relocated to
Recommended Data collection/sampling	Count number of individual plants of each species
Recommended Methods and materials	Count number of individual plants of each species
Applicable Parameters & Standards	Conditions of authorisation
Recommended Timeframes & Responsibilities for Implementation where appropriate	Prior to construction / operation Applicant is responsible
Recommended Targets and Key Performance Indicators	100% survival of translocated plants
Recommended Data Interpretation, Trending and Analysis	Survival rate
Recommended Reporting	Annually
Recommendations for audit and review	External review

Discussion

This section of the report provides a discussion of the site in terms of biodiversity features on site in relation to the proposed activities.

The natural habitat on site varies from having low biodiversity value to having relatively high biodiversity value in different parts of the study area. According to the most recent South African vegetation map (Mucina & Rutherford 2006) the study area falls entirely within Lydenburg Thornveld, which is considered in the scientific literature to be Vulnerable, but is not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).

Mapping from aerial imagery indicates that significant parts of the study area have been transformed by informal cultivation and urban spread. There are areas of natural habitat still remaining. Remaining patches of Vulnerable vegetation have been classified as having MEDIUM-HIGH sensitivity, vegetation of drainage areas and wetlands as having HIGH sensitivity and transformed areas as having LOW sensitivity.

There are various protected tree species with a geographical distribution that includes the site. However, an examination of aerial imagery shows no woody vegetation on site, with the exception of some alien thickets. It is therefore considered unlikely that any protected trees occur on site. None were seen during the brief ground verification site visit in July 2018. This can be confirmed during a more thorough field survey of the site.

Up to five plant species of concern were identified that could potentially occur on site, namely the Endangered species, *Adenia wilmsii*, the Near Threatened species, *Merwillia plumbea*, the Declining plant species, *Boophane disticha*, *Eucomis autumnalis* and *Hypoxis hemerocallidea*, and the protected species, *Merwillia plumbea* and *Crinum bulbispermum*. Confirmation of the occurrence or not of these species on site should be undertaken prior to construction.

There are various vertebrate fauna species of concern that could potentially occur on site. The study area contains habitat that could potentially support a number of different species of mammals of low conservation concern. Given the nature of the proposed project and the fact that many of the species of concern are relatively mobile, few threatened, near threatened or protected mammal species are likely to be significantly negatively impacted by proposed activities on the site.

The site contains habitat that is suitable for various frog species, although only one species of conservation concern is likely to occur in the study area, namely the Giant Bullfrog, listed as Near Threatened in South Africa, and also protected under the National Environmental Management: Biodiversity Act (Act 10 of 2004). The probability of this species occurring on site was rated as low due to the absence of breeding habitat.

A total of 110 reptile species have a geographical distribution that includes the general study area in which the site is found, of which four species of conservation concern could potentially occur on site, namely Breyer's Long-tailed Seps, listed as Vulnerable, and the Coppery Grass Lizard, the Large-scaled Grass Lizard and the Striped Harlequin Snake, all three listed as Near Threatened.

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A total of 418 bird species have a geographical distribution that includes the general study area in which the site is found. A total of 23 of the bird species with a geographical distribution that includes the site are listed in a conservation category. Those could potentially occur on site are as follows: Grey-crowned Crane (EN), African Marsh Harrier (EN), Denham's Bustard (VU), Lanner Falcon, (VU), Southern Bald Ibis (VU), White-bellied Korhaan (VU), Secretarybird (VU), Blue Crane (NT), European Roller (NT), and Abdim's Stork (NT). The study area not within, but is within 30 km of a number of Important Bird Areas.

There are some disturbed wetland systems on site, and there are two drainage lines, one in relatively good condition and the other partially altered/disturbed. These wetland habitats are important in a biodiversity sense in that they provide habitat for a variety of plant and animal species of concern and contain vegetation typical of such habitats. These wetland areas are protected according to the National Water Act (Act 36 of 1998).

The impact assessment indicates that the following impacts are potentially of medium or high significance for the proposed project:

- Loss/destruction of natural habitat;
- Habitat fragmentation;
- Displacement of fauna;
- Flora direct or indirect mortality; and
- Invasion by alien plants.

Recommendations

Based on the ecological assessment, this section of the report provides recommendations for the project, based on the scoping process presented here. The following recommendations are made:

- Areas of wetland vegetation, and an appropriate buffer, should be omitted from the development footprint;
- There are various species of concern that could or do occur on site. It is recommended that the EIA-Phase field survey concentrate on Botanical and Herpetological issues, as identified. Further pre-construction walk-through surveys may be recommended to identify, locate and provide recommendations for rescue of any individuals of plant and reptile species of concern that may occur on site; and
- Control measures for some potential impacts are relatively well-known and easy to implement and it is recommended that these be applied as mitigation measures for some potential impacts.

Conclusion

The following conclusions can be made with regards to the proposed Mashishing Township Development and its potential impacts on the ecological receiving environment:

- Significant parts of the study area are either already settled or are cultivated or have been previously cultivated and are therefore not considered to have high sensitivity or biodiversity value. There are, however, areas of natural habitat that are classified as Vulnerable and have high conservation value; and
- There are various plant and reptile species of concern that do or could occur on site. The identity and location of any that occur on site needs to be determined and appropriate steps taken to rescue and/or relocate any individuals that are found and obtain the necessary permits to ensure legal compliance.

Assumptions, uncertainties and gaps in knowledge

The following assumptions, limitations and gaps in knowledge apply to this assessment:

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be located in an area where it was not formerly known to exist;
- Lists of threatened, rare and sensitive species are dynamic in the sense that new information is collected on a continuous basis, information does not necessarily become quickly available in the public domain and important information is sometimes only available from obscure or restricted sources. There is therefore the possibility that species of concern for the site have not been detected from general literature sources. The latest available information was used for this assessment;
- Animal species, especially birds, are mostly highly mobile and often migrate seasonally. Any field assessment of relatively short duration is therefore unlikely to record anything more than the most common species that happen to be on site at the time of the survey. Such field surveys are generally a poor reflection of the overall diversity of species that could potentially occur on site;
- This study excludes any assessment of invertebrates;
- This study does not constitute a formal wetland study. Their description here is in terms of them being unique habitats and/or containing a unique species composition, but does not constitute a legally determined wetland boundary; and
- It is difficult to accurately map secondary grasslands from aerial imagery and areas currently mapped as natural may possibly be secondary. The only way to accurately map such degradation is through extensive field-based surveys where plant species composition can be used to confirm whether an area is secondary or not. The budget and timeframes associated with this assessment are inadequate for undertaking such a detailed study. Uncertainty surrounding the location of secondary grasslands therefore remains.

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APPENDICES:

Appendix 1: Plant species historically recorded from the grid in which the study area falls.

Source: <http://newposa.sanbi.org>, accessed on 17 January 2018

Acacia mearnsii De Wild.*
Acalypha caperonioides Baill. var. caperonioides
Acalypha glandulifolia Buchinger ex Meisn.
Acalypha sp.
Acalypha villicaulis Hochst.
Acalypha wilmsii Pax ex Prain & Hutch.
Achyranthes aspera L. var. aspera*
Acrotome hispida Benth.
Actiniopteris radiata (J.König ex Sw.) Link
Adenia digitata (Harv.) Engl.
Adenia wilmsii Harms EN
Adiantum capillus-veneris L.
Adiantum poiretii Wikstr.
Aeollanthus buchnerianus Briq.
Aeschynomene rehmannii Schinz var. leptobotrya (Harms ex Baker f.) J.B.Gillett
Afroaster comptonii (Lippert) J.C.Manning & Goldblatt
Afroaster lydenburgensis (Lippert) J.C.Manning & Goldblatt
Agapanthus inapertus P.Beauv. subsp. pendulus (L.Bolus) F.M.Leight.
Agrostis barbuligera Stapf var. barbuligera
Agrostis lachnantha Nees var. lachnantha
Ajuga ophrydis Burch. ex Benth.
Alberta magna E.Mey. NT
Alchemilla woodii Kuntze
Alectra capensis Thunb.
Alectra orobanchoides Benth.
Alepidea peduncularis Steud. ex A.Rich.
Alepidea setifera N.E.Br.
Alloteropsis semialata (R.Br.) Hitchc. subsp. eckloniana (Nees) Gibbs Russ.
Aloe affinis A.Berger
Aloe arborescens Mill.
Aloe branddraaiensis Groenew.
Aloe castanea Schönland
Aloe chortolirioides A.Berger var. woolliana (Pole-Evans) Glen & D.S.Hardy
Aloe fosteri Pillans
Aloe globuligemma Pole-Evans
Aloe greatheadii Schönland var. davyana (Schönland) Glen & D.S.Hardy
Aloe integra Reynolds VU
Aloe linearifolia A.Berger NT
Aloe minima Baker
Aloe reitzii Reynolds var. reitzii NT
Aloe verecunda Pole-Evans
Alysicarpus rugosus (Willd.) DC. subsp. rugosus
Alysicarpus rugosus (Willd.) DC. subsp. perennirufus J.Léonard
Amaranthus hybridus L. subsp. hybridus
Ammocharis coranica (Ker Gawl.) Herb.
Andropogon appendiculatus Nees

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Andropogon eucomus Nees
Andropogon mannii Hook.f.
Anomodon pseudotristis (Müll.Hal.) Kindb.
Antheophora pubescens Nees
Anthospermum rigidum Eckl. & Zeyh. subsp. *rigidum*
Anthospermum rigidum Eckl. & Zeyh. subsp. *pumilum* (Sond.) Puff
Argyrobium tomentosum (Andrews) Druce
Argyrobium wilmsii Harms
Aristea abyssinica Pax
Aristea torulosa Klatt
Aristida congesta Roem. & Schult. subsp. *congesta*
Aristida congesta Roem. & Schult. subsp. *barbicollis* (Trin. & Rupr.) De Winter
Aristida diffusa Trin. subsp. *burkei* (Stapf) Melderis
Aristida sciurus Stapf
Arundinella nepalensis Trin.
Asclepias adscendens (Schltr.) Schltr.
Asclepias albens (E.Mey.) Schltr.
Asclepias aurea (Schltr.) Schltr.
Asclepias eminens (Harv.) Schltr.
Ascolepis capensis (Kunth) Ridl.
Aspalathus callosa L.
Asparagus africanus Lam.
Asparagus asparagoides (L.) Druce
Asparagus cooperi Baker
Asparagus larinicus Burch.
Asparagus ramosissimus Baker
Asparagus virgatus Baker
Aspidoglossum validum Kupicha DDD
Aspilia mossambicensis (Oliv.) Wild
Asplenium protensum Schrad.
Asplenium rutifolium (P.J.Bergius) Kunze
Asplenium splendens Kunze subsp. *splendens*
Asplenium stoloniferum Bory
Asterella bachmannii (Steph.) S.W.Arnell
Asterella muscicola (Steph.) S.W.Arnell
Asterella wilmsii (Steph.) S.W.Arnell
Astragalus atropilosulus (Hochst.) Bunge subsp. *burkeanus* (Harv.) J.B.Gillett
Athrixia elata Sond.
Athrixia phyllicoides DC.
Athyrium schimperii Moug. ex Fée
Atrichum androgynum (Müll.Hal.) A.Jaeger
Avena sp.
Babiana bainesii Baker
Baccharoides adoensis (Sch.Bip. ex Walp.) H.Rob.
Barbula indica (Hook.) Spreng.
Barleria ovata E.Mey. ex Nees
Barleria wilmsiana Lindau
Begonia sutherlandii Hook.f. subsp. *sutherlandii*
Berkheya echinacea (Harv.) O.Hoffm. ex Burt Davy subsp. *echinacea*
Berkheya insignis (Harv.) Thell.
Berkheya mackenii (Harv.) Roessler
Berkheya setifera DC.
Berkheya speciosa (DC.) O.Hoffm. subsp. *lanceolata* Roessler
Berkheya zeyheri Oliv. & Hiern subsp. *zeyheri*
Berula repanda (Hiern) Spalik & S.R.Downie
Bewsia biflora (Hack.) Gooss.

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Blechnum australe L. subsp. australe
Blepharis innocua C.B.Clarke
Blepharis leendertziae Oberm.
Bowkeria cymosa MacOwan
Brachiaria bovonei (Chiov.) Robyns
Brachiaria brizantha (A.Rich.) Stapf
Brachiaria serrata (Thunb.) Stapf
Brachycorythis ovata Lindl. subsp. ovata
Brachylaena rotundata S.Moore
Brachylaena transvaalensis E.Phillips & Schweick.
Brachymenium pulchrum Hook.
Brachystelma circinatum E.Mey.
Brachystelma foetidum Schltr.
Brachystelma pygmaeum (Schltr.) N.E.Br. subsp. pygmaeum
Brachystelma remotum R.A.Dyer RARE
Brachystelma stellatum E.A.Bruce & R.A.Dyer RARE
Breonadia salicina (Vahl) Hepper & J.R.I.Wood
Bridelia micrantha (Hochst.) Baill.
Bromus catharticus Vahl
Bromus sp.
Brunsvigia radulosa Herb.
Bryoerythrophyllum campylocarpum (Müll.Hal.) H.A.Crum
Bryum apiculatum Schwägr.
Bryum cellulare Hook.
Bryum pseudotriquetrum (Hedw.) G.Gaertn., B.Mey. & Scherb.
Buddleja auriculata Benth.
Buddleja salviifolia (L.) Lam.
Bulbine angustifolia Poelln.
Bulbine capitata Poelln.
Bulbostylis contexta (Nees) M.Bodard
Bulbostylis schoenoides (Kunth) C.B.Clarke
Callicostella tristis (Müll.Hal.) Broth.
Calpurnia aurea (Aiton) Benth. subsp. aurea
Canthium kuntzeanum Bridson
Capparis sp.
Cardiospermum corindum L.
Carex spicatopaniculata Boeck. ex C.B.Clarke
Carissa bispinosa (L.) Desf. ex Brenan
Cassipourea malosana (Baker) Alston
Cenchrus ciliaris L.
Centella asiatica (L.) Urb.
Cephalanthus natalensis Oliv.
Cerastium capense Sond.
Ceratodon purpureus (Hedw.) Brid. subsp. stenocarpus (Bruch & Schimp. ex Müll.Hal.) Dixon
Ceratotheca triloba (Bernh.) Hook.f.
Ceropegia carnosa E.Mey.
Ceropegia nilotica Kotschy var. nilotica
Chaenostoma floribundum Benth.
Chaenostoma neglectum J.M.Wood & M.S.Evans
Chaenostoma sp.
Chamaecrista mimosoides (L.) Greene
Chamaecrista stricta E.Mey.
Chascanum latifolium (Harv.) Moldenke var. transvaalense Moldenke
Cheilanthes eckloniana (Kunze) Mett.
Cheilanthes hirta Sw. var. hyaloglandulosa (W.Jacobsen & N.Jacobsen) J.E.Burrows
Cheilanthes hirta Sw. var. brevopilosa W.Jacobsen & N.Jacobsen

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Chenopodium carinatum R.Br.
Chironia krebsii Griseb.
Chironia palustris Burch. subsp. transvaalensis (Gilg) I.Verd.
Chlorophytum bowkeri Baker
Chlorophytum cooperi (Baker) Nordal
Chlorophytum fasciculatum (Baker) Kativu
Chlorophytum recurvifolium (Baker) C.Archer & Kativu
Chlorophytum transvaalense (Baker) Kativu
Cienfuegosia gerrardii (Harv.) Hochr.
Cienfuegosia sp.
Cirsium vulgare (Savi) Ten.*
Citrullus lanatus (Thunb.) Matsum. & Nakai
Clausena anisata (Willd.) Hook.f. ex Benth. var. anisata
Clematis brachiata Thunb.
Cleome gynandra L.
Cleome hirta (Klotzsch) Oliv.
Cleome maculata (Sond.) Szyszyl.
Cleome monophylla L.
Cliffortia nitidula (Engl.) R.E.Fr. & T.C.E.Fr. subsp. pilosa Weim. (not listed)
Cliffortia repens Schltr.
Clutia monticola S.Moore var. monticola
Clutia natalensis Bernh.
Clutia sp.
Coccinia adoensis (A.Rich.) Cogn.
Coccinia rehmannii Cogn.
Coix lacryma-jobi L.
Colchicum melanthoides (Willd.) J.C.Manning & Vinn. subsp. transvaalense (U.Müll.-Doblies & D.Müll.-Doblies)
J.C.Manning & Vinn.
Colchicum striatum (Hochst. ex A.Rich.) J.C.Manning & Vinn.
Combretum apiculatum Sond. subsp. apiculatum
Combretum erythrophyllum (Burch.) Sond.
Combretum hereroense Schinz
Combretum molle R.Br. ex G.Don
Commelina africana L. var. lancispatha C.B.Clarke
Commelina africana L. var. krebsiana (Kunth) C.B.Clarke
Commelina diffusa Burm.f. subsp. scandens (Welw. ex C.B.Clarke) Oberm.
Commelina livingstonii C.B.Clarke
Convolvulus natalensis Bernh. ex Krauss
Convolvulus sagittatus Thunb.
Conyza aegyptiaca (L.) Aiton
Conyza pinnata (L.f.) Kuntze
Conyza scabrida DC.
Conyza ulmifolia (Burm.f.) Kuntze
Corchorus confusus Wild
Cotoneaster coriaceus Franch.
Cotoneaster pannosus Franch.
Cotula australis (Spreng.) Hook.f.
Cotyledon barbeyi Schweinf. ex Baker
Cotyledon orbiculata L. var. oblonga (Haw.) DC.
Crabbea acaulis N.E.Br.
Crabbea angustifolia Nees
Crabbea hirsuta Harv.
Crabbea nana Nees
Crassula alba Forssk. var. alba
Crassula compacta Schönland
Crassula lanceolata (Eckl. & Zeyh.) Endl. ex Walp. subsp. transvaalensis (Kuntze) Toelken

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Crassula natans Thunb. var. natans
Crassula pellucida L. subsp. brachypetala (Drège ex Harv.) Toelken
Crassula peploides Harv.
Crassula sarcocaulis Eckl. & Zeyh. subsp. sarcocaulis
Crassula setulosa Harv. var. jenkinsii Schönland
Crassula vaginata Eckl. & Zeyh. subsp. vaginata
Craterostigma wilmsii Engl. ex Diels
Crepidomanes melanotrichum (Schltdl.) J.P.Roux
Crinum macowanii Baker
Crocoshmia paniculata (Klatt) Goldblatt
Crossandra greenstockii S.Moore
Crotalaria lotoides Benth.
Crotalaria monteiroi Taub. ex Baker f. var. galpinii Burttt Davy ex I.Verd.
Crotalaria recta Steud. ex A.Rich.
Crotalaria sphaerocarpa Perr. ex DC. subsp. sphaerocarpa
Cryptocarya liebertiana Engl.
Ctenium concinnum Nees
Cucumis hirsutus Sond.
Cucumis quintanilhae R.Fern. & A.Fern.
Cucumis zeyheri Sond.
Cyanotis speciosa (L.f.) Hassk.
Cyathula cylindrica Moq. var. cylindrica
Cyathula uncinulata (Schrad.) Schinz
Cycnium racemosum Benth.
Cycnium tubulosum (L.f.) Engl. subsp. tubulosum
Cymbopappus piliferus (Thell.) B.Nord. VU
Cynodon dactylon (L.) Pers.
Cynoglossum austroafricanum Hilliard & B.L.Burttt
Cynoglossum hispidum Thunb.
Cynorkis kassneriana Kraenzl.
Cyperus albostriatus Schrad.
Cyperus congestus Vahl
Cyperus indecorus Kunth var. indecorus
Cyperus keniensis Kük.
Cyperus obtusiflorus Vahl var. obtusiflorus
Cyperus obtusiflorus Vahl var. flavissimus (Schrad.) Boeck.
Cyperus rigidifolius Steud.
Cyperus semitrifidus Schrad.
Cyperus sphaerospermus Schrad.
Cyphia elata Harv. var. elata
Cyphia stenopetala Diels
Cyphostemma cirrhosum (Thunb.) Desc. ex Wild & R.B.Drumm. subsp. transvaalense (Szyszyl.) Wild & R.B.Drumm.
Cyphostemma segmentatum (C.A.Sm.) J.J.M.van der Merwe
Cyphostemma sp.
Cyphostemma spinosopilosum (Gilg & M.Brandt) Desc.
Cyrтанthus breviflorus Harv.
Dactylis glomerata L.
Dais cotinifolia L.
Delosperma sp. .
Denekia capensis Thunb.
Dianthus basuticus Burttt Davy subsp. basuticus
Dianthus mooiensis F.N.Williams subsp. mooiensis
Dichilus reflexus (N.E.Br.) A.L.Schutte
Dichrocephala integrifolia (L.f.) Kuntze subsp. integrifolia
Dicliptera clinopodia Nees
Diclis rotundifolia (Hiern) Hilliard & B.L.Burttt

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Dicoma anomala Sond. subsp. gerrardii (Harv. ex F.C.Wilson) S.Ortiz & Rodr.Oubiña
Dicoma anomala Sond. subsp. anomala
Dicoma sp.
Dicranella subsubulata (Hampe ex Müll.Hal.) A.Jaeger
Didymodon tophaceus (Brid.) Lisa
Dierama insigne N.E.Br.
Dierama medium N.E.Br.
Dierama mossii (N.E.Br.) Hilliard
Dierama nebrownii Hilliard
Dierama sp.
Digitaria flaccida Stapf
Digitaria sanguinalis (L.) Scop.
Digitaria tricholaenoides Stapf
Diheteropogon amplexens (Nees) Clayton var. amplexens
Dimorphotheca jucunda E.Phillips
Dimorphotheca spectabilis Schltr.
Dioscorea cotinifolia Kunth
Dioscorea dregeana (Kunth) T.Durand & Schinz
Diospyros lycioides Desf. subsp. sericea (Bernh.) De Winter
Diospyros lycioides Desf. subsp. guerkei (Kuntze) De Winter
Diospyros whyteana (Hiern) F.White
Dipcadi viride (L.) Moench
Disa cooperi Rchb.f.
Disa extinctoria Rchb.f. NT
Disa patula Sond. var. transvaalensis Summerh.
Disa stachyoides Rchb.f.
Dissotis canescens (E.Mey. ex R.A.Graham) Hook.f.
Ditrichum brachypodium (Müll.Hal.) Broth.
Dolichos falciformis E.Mey.
Dombeya pulchra N.E.Br.
Dombeya rotundifolia (Hochst.) Planch. var. rotundifolia
Dovyalis caffra (Hook.f. & Harv.) Warb.
Dovyalis zeyheri (Sond.) Warb.
Drimia delagoensis (Baker) Jessop
Drimia multisetosa (Baker) Jessop
Drimia sp.
Drosera burkeana Planch.
Drosera madagascariensis DC.
Dryopteris athamantica (Kunze) Kuntze
Dryopteris inaequalis (Schltdl.) Kuntze
Dumortiera hirsuta (Sw.) Nees
Dyschoriste burchellii (Nees) Kuntze
Dyschoriste setigera (Pers.) J.C.Manning & Goldblatt
Ehrharta erecta Lam. var. natalensis Stapf
Elaphoglossum acrostichoides (Hook. & Grev.) Schelpe
Elionurus muticus (Spreng.) Kunth
Emilia transvaalensis (Bolus) C.Jeffrey
Entodon macropodus (Hedw.) Müll.Hal.
Entodon natalensis Rehmann ex Müll.Hal.
Epilobium capense Buchinger ex Hochst.
Epilobium hirsutum L.
Epilobium salignum Hausskn.
Equisetum ramosissimum Desf. subsp. ramosissimum
Eragrostis caesia Stapf
Eragrostis capensis (Thunb.) Trin.
Eragrostis chloromelas Steud.

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Eragrostis curvula (Schrad.) Nees
Eragrostis gummiflua Nees
Eragrostis lehmanniana Nees var. *lehmanniana*
Eragrostis obtusa Munro ex Ficalho & Hiern
Eragrostis patentipilosa Hack.
Eragrostis plana Nees
Eragrostis planiculmis Nees
Eragrostis racemosa (Thunb.) Steud.
Eragrostis sclerantha Nees subsp. *sclerantha*
Eragrostis sp.
Eragrostis superba Peyr.
Eragrostis tef (Zuccagni) Trotter
Eragrostis trichophora Coss. & Durieu
Erica caffrorum Bolus var. *caffrorum*
Erica cerinthoides L. var. *barbertona* (Galpin) Bolus
Erica cerinthoides L. var. *cerinthoides*
Erica cerinthoides L.
Erica drakensbergensis Guthrie & Bolus
Erica leucopelta Tausch var. *leucopelta*
Erica revoluta (Bolus) L.E.Davidson
Erica woodii Bolus var. *woodii*
Erica woodii Bolus var. *robusta* Dulfer
Eriochrysis brachypogon (Stapf) Stapf
Eriosema cordatum E.Mey.
Eriosema ellipticifolium Schinz
Eriosema gunniae C.H.Stirt.
Eriosema kraussianum Meisn.
Eriosema nutans Schinz
Eriosema psoraleoides (Lam.) G.Don
Eriosema simulans C.H.Stirt. (not listed)
Eriospermum cooperi Baker var. *cooperi*
Eriospermum flagelliforme (Baker) J.C.Manning
Eucalyptus grandis W.Hill ex Maiden*
Euclea crispa (Thunb.) Gürke subsp. *crispa*
Euclea sp.
Eucomis autumnalis (Mill.) Chitt. subsp. *clavata* (Baker) Reyneke
Eucomis pallidiflora Baker subsp. *pallidiflora*
Eugenia natalitia Sond.
Eulalia villosa (Thunb.) Nees
Eulophia angolensis (Rchb.f.) Summerh.
Eulophia hians Spreng. var. *nutans* (Sond.) S.Thomas
Eulophia ovalis Lindl. var. *bainesii* (Rolfe) P.J.Cribb & la Croix
Eulophia parviflora (Lindl.) A.V.Hall
Eulophia streptopetala Lindl.
Euphorbia epicyparissias E.Mey. ex Boiss.
Euphorbia excelsa A.C.White, R.A.Dyer & B.Sloane
Euphorbia inaequilatera Sond. var. *inaequilatera*
Euphorbia monteiroi Hook.f. subsp. *ramosa* L.C.Leach
Euryops laxus (Harv.) Burt Davy
Euryops pedunculatus N.E.Br.
Eustachys paspaloides (Vahl) Lanza & Mattei
Exorhthea holstii Steph.
Fadogia tetraquetra K.Krause
Fadogia tetraquetra K.Krause var. *tetraquetra*
Falkia oblonga Bernh. ex C.Krauss
Faurea rochetiana (A.Rich.) Chiov. ex Pic.Serm.

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Felicia filifolia (Vent.) Burtt Davy subsp. *filifolia*
Felicia muricata (Thunb.) Nees subsp. *muricata*
Felicia rosulata Yeo
Festuca caprina Nees
Festuca costata Nees
Festuca scabra Vahl
Ficinia stolonifera Boeck.
Ficus abutilifolia (Miq.) Miq.
Ficus ingens (Miq.) Miq. var. *ingens*
Ficus salicifolia Vahl
Ficus sur Forssk.
Fimbristylis complanata (Retz.) Link
Fimbristylis dichotoma (L.) Vahl subsp. *dichotoma*
Fissidens asplenioides Hedw.
Fissidens bryoides Hedw.
Floribundaria floribunda (Dozy & Molk.) M.Fleisch.
Fossombronia crispa Nees
Freesia laxa (Thunb.) Goldblatt & J.C.Manning subsp. *laxa*
Fuirena pubescens (Poir.) Kunth var. *pubescens*
Galium scabrelloides Puff
Galopina circaeoides Thunb.
Gazania krebiana Less. subsp. *serrulata* (DC.) Roessler
Geigeria burkei Harv. subsp. *burkei*
Geigeria burkei Harv. subsp. *burkei*
Geigeria burkei Harv. subsp. *burkei*
Geigeria ornativa O.Hoffm. subsp. *ornativa*
Geranium wakkerstroomianum R.Knuth
Gerbera ambigua (Cass.) Sch.Bip.
Gerbera jamesonii Bolus ex Adlam
Gerbera piloselloides (L.) Cass.
Gisekia africana (Lour.) Kuntze var. *africana*
Gladiolus calcaratus G.J.Lewis
Gladiolus crassifolius Baker
Gladiolus dalenii Van Geel subsp. *dalenii*
Gladiolus ecklonii Lehm.
Gladiolus exiguus G.J.Lewis
Gladiolus longicollis Baker subsp. *platypetalus* (Baker) Goldblatt & J.C.Manning
Gladiolus rufomarginatus G.J.Lewis RARE
Gladiolus woodii Baker
Gloriosa modesta (Hook.) J.C.Manning & Vinn.
Gnaphalium filagopsis Hilliard & B.L.Burtt
Gnidia gymnostachya (C.A.Mey.) Gilg
Gnidia phaeotricha Gilg
Gnidia sp.
Gomphocarpus fruticosus (L.) Aiton f. subsp. *fruticosus*
Gomphocarpus fruticosus (L.) Aiton f. subsp. *decipiens* (N.E.Br.) Goyder & Nicholas
Gomphostigma virgatum (L.f.) Baill.
Gomphrena celosioides Mart.
Gossypium herbaceum L. subsp. *africanum* (Watt) Vollesen
Graderia subintegra Mast.
Grewia flava DC.
Grewia vernicosa Schinz
Greyia radlkoferi Szyszyl.
Gunnera perpensa L.
Gymnanthemum corymbosum (L.f.) H.Rob.
Gymnanthemum crataegifolium (Hutch.) H.Rob.

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Gymnanthemum myrianthum (Hook.f.) H.Rob.
Gymnopentzia bifurcata Benth.
Gymnosporia buxifolia (L.) Szyszyl.
Gymnosporia harveyana Loes. subsp. harveyana
Gymnosporia heterophylla (Eckl. & Zeyh.) Loes.
Gymnosporia polyacantha (Sond.) Szyszyl. subsp. vacciniifolia (P.Conrath) Jordaan
Habenaria dregeana Lindl.
Habenaria epipactidea Rchb.f.
Habenaria falcicornis (Burch. ex Lindl.) Bolus subsp. caffra (Schltr.) J.C.Manning
Habenaria tridens Lindl.
Haemanthus humilis Jacq. subsp. hirsutus (Baker) Snijman
Halleria lucida L.
Haplocarpha scaposa Harv.
Harpochloa falx (L.f.) Kuntze
Hebenstretia angolensis Rolfe
Hebenstretia dentata L.
Hebenstretia oatesii Rolfe subsp. oatesii
Helichrysum acutatum DC.
Helichrysum albilanatum Hilliard
Helichrysum athrixiifolium (Kuntze) Moeser
Helichrysum aureolum Hilliard
Helichrysum caespititium (DC.) Harv.
Helichrysum callicomum Harv.
Helichrysum candolleanum H.Buek
Helichrysum cephaloideum DC.
Helichrysum chionosphaerum DC.
Helichrysum difficile Hilliard
Helichrysum edwardsii Wild
Helichrysum herbaceum (Andrews) Sweet
Helichrysum lepidissimum S.Moore
Helichrysum miconiifolium DC.
Helichrysum mimetes S.Moore
Helichrysum mixtum (Kuntze) Moeser var. mixtum
Helichrysum monticola Hilliard
Helichrysum mundtii Harv.
Helichrysum nudifolium (L.) Less.
Helichrysum nudifolium (L.) Less. var. nudifolium
Helichrysum nudifolium (L.) Less. var. pilosellum (L.f.) Beentje
Helichrysum obductum Bolus
Helichrysum oreophilum Klatt
Helichrysum pallidum DC.
Helichrysum paronychioides DC.
Helichrysum platypterum DC.
Helichrysum reflexum N.E.Br.
Helichrysum rugulosum Less.
Helichrysum splendidum (Thunb.) Less.
Helichrysum stenopterum DC.
Helichrysum subluteum Burt Davy
Helichrysum thapsus (Kuntze) Moeser
Helichrysum truncatum Burt Davy
Helictotrichon turgidulum (Stapf) Schweick.
Helinus integrifolius (Lam.) Kuntze
Heliophila rigidiuscula Sond.
Hemarthria altissima (Poir.) Stapf & C.E.Hubb.
Hermannia boraginiflora Hook.
Hermannia brachymalla K.Schum.

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Hermannia depressa N.E.Br.
Hermannia lancifolia Szyszyl.
Hermannia montana N.E.Br.
Hermannia sp.
Hermannia staurostemon K.Schum.
Hermannia transvaalensis Schinz
Hesperantha coccinea (Backh. & Harv.) Goldblatt & J.C.Manning
Heteromorpha arborescens (Spreng.) Cham. & Schltdl. var. abyssinica (Hochst. ex A.Rich.) H.Wolff
Heteromorpha involucreta Conrath
Heteropogon contortus (L.) Roem. & Schult.
Hibiscus pusillus Thunb.
Hibiscus trionum L.
Hilliardiella aristata (DC.) H.Rob.
Hilliardiella hirsuta (DC.) H.Rob.
Hilliardiella oligocephala (DC.) H.Rob.
Hippobromus pauciflorus (L.f.) Radlk.
Homalium dentatum (Harv.) Warb.
Huernia zebrina N.E.Br. subsp. insigniflora (C.A.Maass) Bruyns
Hyparrhenia dregeana (Nees) Stapf ex Stent
Hyparrhenia hirta (L.) Stapf
Hyparrhenia quarrei Robyns
Hyparrhenia rufa (Nees) Stapf var. rufa
Hyparrhenia sp.
Hypericum aethiopicum Thunb. subsp. sonderi (Bredell) N.Robson
Hypericum lalandii Choisy
Hypericum revolutum Vahl subsp. revolutum
Hypnum cupressiforme Hedw. var. cupressiforme
Hypodontium dregei (Hornsch.) Müll.Hal.
Hypoestes forskalii (Vahl) R.Br.
Hypoxis filiformis Baker
Hypoxis hemerocallidea Fisch., C.A.Mey. & Avé-Lall. Declining
Hypoxis iridifolia Baker
Hypoxis rigidula Baker var. rigidula
Impatiens hochstetteri Warb. subsp. hochstetteri
Imperata cylindrica (L.) Raeusch.
Indigostrum costatum (Guill. & Perr.) Schrire subsp. macrum (E.Mey.) Schrire
Indigofera atrata N.E.Br.
Indigofera circinnata Benth. ex Harv.
Indigofera frondosa N.E.Br.
Indigofera hiliaris Eckl. & Zeyh. var. hiliaris
Indigofera hiliaris Eckl. & Zeyh.
Indigofera lydenbergensis N.E.Br.
Indigofera lydenburgensis N.E.Br.
Indigofera masonae N.E.Br.
Indigofera obscura N.E.Br.
Indigofera ormocarpoides Baker
Indigofera rhytidocarpa Benth. ex Harv. subsp. rhytidocarpa
Indigofera sanguinea N.E.Br.
Indigofera sp.
Indigofera swaziensis Bolus var. swaziensis
Indigofera torulosa E.Mey. var. angustiloba (Baker f.) J.B.Gillett
Indigofera torulosa E.Mey. var. torulosa
Indigofera tristoides N.E.Br.
Ipomoea adenioides Schinz var. adenioides
Ipomoea bathycolpos Hallier f.
Ipomoea crassipes Hook. var. crassipes

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Ipomoea magnusiana Schinz
Ipomoea oblongata E.Mey. ex Choisy
Ipomoea obscura (L.) Ker Gawl. var. *obscura*
Ipomoea purpurea (L.) Roth*
Isolepis cernua (Vahl) Roem. & Schult. var. *cernua*
Isolepis costata Hochst. ex A.Rich.
Itea rhamnoides (Harv.) Kubitzki
Jamesbrittenia accrescens (Hiern) Hilliard
Jamesbrittenia aurantiaca (Burch.) Hilliard
Jamesbrittenia burkeana (Benth.) Hilliard
Jamesbrittenia grandiflora (Galpin) Hilliard
Jamesbrittenia sp.
Jasminum quinquatum Schinz
Jatropha latifolia Pax var. *latifolia*
Juncus dregeanus Kunth
Juncus dregeanus Kunth subsp. *dregeanus*
Justicia anagalloides (Nees) T.Anderson
Justicia divaricata Licht. ex Roem. & Schult.
Kalanchoe lanceolata (Forssk.) Pers.
Kalanchoe rotundifolia (Haw.) Haw.
Kiggelaria africana L.
Kleinia stapeliiformis (E.Phillips) Stapf
Kniphofia galpinii Baker
Kniphofia linearifolia Baker
Kniphofia rigidifolia E.A.Bruce
Kniphofia triangularis Kunth subsp. *obtusiloba* (A.Berger) Codd RARE
Koeleria capensis (Steud.) Nees
Kohautia amatymbica Eckl. & Zeyh.
Kohautia virgata (Willd.) Bremek.
Kyllinga alba Nees
Lablab purpureus (L.) Sweet subsp. *uncinatus* Verdc.
Lactuca inermis Forssk.
Lagarosiphon major (Ridl.) Moss ex Wager
Lantana rugosa Thunb.
Lasiosiphon burchellii Meisn.
Lasiosiphon caffer Meisn.
Lasiosiphon capitatus (L.f.) Burttt Davy
Lasiosiphon kraussianus (Meisn.) Meisn.
Lasiosiphon microcephalus (Meisn.) J.C.Manning & Magee
Lasiosiphon splendens (Meisn.) Endl.
Ledebouria cooperi (Hook.f.) Jessop
Ledebouria floribunda (Baker) Jessop
Ledebouria marginata (Baker) Jessop
Ledebouria revoluta (L.f.) Jessop
Ledebouria sp. Aellen
Leersia hexandra Sw.
Leobordea carinata (E.Mey.) B.-E.van Wyk & Boatwr.
Leobordea divaricata Eckl. & Zeyh.
Leobordea eriantha (Benth.) B.-E.van Wyk & Boatwr.
Leobordea pulchra (Dümmer) B.-E.van Wyk & Boatwr.
Leonotis ocyimifolia (Burm.f.) Iwarsson
Leonotis pentadentata J.C.Manning & Goldblatt
Lepidium africanum (Burm.f.) DC. subsp. *africanum*
Leptodon smithii (Hedw.) F.Weber & D.Mohr
Leptospermum scoparium J.R.Forst. & G.Forst.
Lessertia frutescens (L.) Goldblatt & J.C.Manning subsp. *microphylla* (Burch. ex DC.) J.C.Manning & Boatwr.

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Lessertia frutescens (L.) Goldblatt & J.C.Manning subsp. frutescens
Lessertia stricta L.Bolus
Leucanthemum vulgare Lam.
Leucosidea sericea Eckl. & Zeyh.
Limeum pauciflorum Moq.
Limosella longiflora Kuntze
Limosella maior Diels
Linum thunbergii Eckl. & Zeyh.
Lipocarpha rehmannii (Ridl.) Goetgh.
Lippia javanica (Burm.f.) Spreng.
Lippia wilmsii H.Pearson
Lobelia erinus L.
Lobelia flaccida (C.Presl) A.DC. subsp. flaccida
Lolium multiflorum Lam.
Lopholaena coriifolia (Sond.) E.Phillips & C.A.Sm.
Lopholaena disticha (N.E.Br.) S.Moore
Lopholaena segmentata (Oliv.) S.Moore
Loudetia simplex (Nees) C.E.Hubb.
Loudetia sp.
Macleodium zeyheri (Sond.) S.Ortiz subsp. zeyheri
Maerua angolensis DC. subsp. angolensis
Maerua rosmarinoides (Sond.) Gilg & Gilg-Ben.
Maesa lanceolata Forssk.
Marchantia debilis K.I.Goebel
Marchantia pappeana Lehm. subsp. pappeana
Melanospermum rupestre (Hiern) Hilliard
Melasma scabrum P.J.Bergius var. scabrum
Melinis nerviglumis (Franch.) Zizka
Melinis repens (Willd.) Zizka subsp. repens
Melinis sp.
Mentha longifolia (L.) Huds. subsp. polyadena (Briq.) Briq.
Merwillia plumbea (Lindl.) Speta NT
Merxmullera macowanii (Stapf) Conert
Microchloa caffra Nees
Microchloa kunthii Desv.
Mielichhoferia bryoides (Harv.) Wijk & Margad.
Miscanthus junceus (Stapf) Pilg.
Mohria vestita Baker
Momordica foetida Schumach.
Monocymbium cerasiiforme (Nees) Stapf
Monopsis decipiens (Sond.) Thulin
Monsonia attenuata Harv.
Moraea elliotii Baker
Moraea pallida (Baker) Goldblatt
Moraea spathulata (L.f.) Klatt
Moraea stricta Baker
Morella serrata (Lam.) Killick
Mundulea sericea (Willd.) A.Chev. subsp. sericea
Muraltia empetroides Chodat
Myrothamnus flabellifolius Welw.
Myrsine africana L.
Neckera valentiniana Besch.
Nemesia fruticans (Thunb.) Benth.
Nemesia umbonata (Hiern) Hilliard & B.L.Burt
Nerine angustifolia (Baker) Baker
Nesaea sagittifolia (Sond.) Koehne var. sagittifolia

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Nesaea schinzii Koehne
Nidorella anomala Steetz
Nolletia rarifolia (Turcz.) Steetz
Nuxia congesta R.Br. ex Fresen.
Ochna natalitia (Meisn.) Walp.
Ocimum americanum L. var. *americanum*
Ocimum filamentosum Forssk.
Ocimum obovatum E.Mey. ex Benth. subsp. *obovatum*
Ocimum serratum (Schltr.) A.J.Paton
Oenothera rosea L'Hér. ex Aiton
Oenothera tetraptera Cav.
Oldenlandia herbacea (L.) Roxb. var. *herbacea*
Olea capensis L. subsp. *enervis* (Harv. ex C.H.Wright) I.Verd.
Olinia emarginata Burttt Davy
Oocephala centaureoides (Klatt) H.Rob. & Skvarla
Ophioglossum reticulatum L.
Ophrestia oblongifolia (E.Mey.) H.M.L.Forbes var. *oblongifolia*
Ornithogalum candicans (Baker) J.C.Manning & Goldblatt
Ornithogalum paludosum Baker
Ornithogalum saundersiae Baker
Orthochilus leontoglossus (Rchb.f.) Bytebier
Orthochilus odontoglossus (Rchb.f.) Bytebier
Orthostichella pandurifolia (Müll.Hal.) W.R.Buck
Osmunda regalis L.
Osteospermum auriculatum (S.Moore) Norl.
Osteospermum moniliferum L. subsp. *septentrionale* (Norl.) J.C.Manning & Goldblatt
Osteospermum moniliferum L. subsp. *canescens* (DC.) J.C.Manning & Goldblatt
Osteospermum muricatum E.Mey. ex DC. subsp. *muricatum*
Osteospermum scariosum DC. var. *scariosum*
Osteospermum striatum Burttt Davy
Otholobium nigricans C.H.Stirt.
Otholobium wilmsii (Harms) C.H.Stirt.
Othonna natalensis Sch.Bip.
Oxalis corniculata L.
Oxalis depressa Eckl. & Zeyh.
Oxalis obliquifolia Steud. ex A.Rich.
Oxalis semiloba Sond. subsp. *semiloba*
Oxygonum dregeanum Meisn. subsp. *lanceolatum* Germish.
Pachycarpus macrochilus (Schltr.) N.E.Br.
Pachystigma pygmaeum (Schltr.) Robyns
Pachystigma thamnus Robyns
Panicum ecklonii Nees
Panicum maximum Jacq.
Panicum natalense Hochst.
Panicum schinzii Hack.
Papillaria africana (Müll.Hal.) A.Jaeger
Parinari capensis Harv. subsp. *capensis*
Paspalum dilatatum Poir.
Paspalum scrobiculatum L.
Paspalum urvillei Steud.
Passerina montana Thoday
Pavetta schumanniana F.Hoffm. ex K.Schum.
Pavonia burchellii (DC.) R.A.Dyer
Pavonia columella Cav.
Pavonia transvaalensis (Ulbr.) A.Meeuse
Pearsonia aristata (Schinz) Dümmer

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Pearsonia cajanifolia (Harv.) Polhill subsp. *cryptantha* (Baker) Polhill
Pearsonia sessilifolia (Harv.) Dümmer subsp. *sessilifolia*
Pearsonia sessilifolia (Harv.) Dümmer subsp. *filifolia* (Bolus) Polhill
Pearsonia sessilifolia (Harv.) Dümmer subsp. *marginata* (Schinz) Polhill
Pearsonia uniflora (Kensit) Polhill
Peddiea africana Harv.
Pelargonium acraeum R.A.Dyer
Pelargonium alchemilloides (L.) L'Hér.
Pelargonium dispar N.E.Br.
Pelargonium luridum (Andrews) Sweet
Pelargonium sidoides DC.
Pelekium ramusculosum (Mitt.) Touw
Pelekium versicolor (Hornsch. ex Müll.Hal.) Touw
Pennisetum macrourum Trin.
Pentanisia angustifolia (Hochst.) Hochst.
Pentanisia prunelloides (Klotzsch ex Eckl. & Zeyh.) Walp. subsp. *prunelloides*
Periglossum mackenii Harv.
Persicaria attenuata (R.Br.) Soják subsp. *africana* K.L.Wilson
Persicaria decipiens (R.Br.) K.L.Wilson
Persicaria lapathifolia (L.) Gray
Philonotis dregeana (Müll.Hal.) A.Jaeger
Phygelius aequalis Harv. ex Hiern
Phyllica paniculata Willd.
Phyllanthus maderaspatensis L.
Phyllanthus nummulariifolius Poir. var. *nummulariifolius*
Phymaspermum acerosum (DC.) Källersjö
Physalis peruviana L.
Phytolacca octandra L.*
Pimpinella transvaalensis H.Wolff
Pittosporum viridiflorum Sims PROTECTED TREE
Plagiochasma rupestre (J.R.Forst. & G.Forst.) Steph. var. *rupestre*
Plantago lanceolata L.
Plantago major L.
Plantago virginica L.
Platostoma rotundifolium (Briq.) A.J.Paton
Plectranthus fruticosus L'Hér.
Plectranthus rubropunctatus Codd
Pleopeltis macrocarpa (Bory ex Willd.) Kaulf.
Pleopeltis polypodioides (L.) E.G.Andrews & Windham subsp. *ecklonii* (Kunze) J.P.Roux
Plumbago zeylanica L. (not listed)
Poa annua L.
Pogonarthria squarrosa (Roem. & Schult.) Pilg.
Pohlia sp.
Pollichia campestris Aiton
Polygala hottentotta C.Presl
Polygala houtboshiana Chodat
Polygala krumana Burch. ex Ficalho & Hiern
Polygala transvaalensis Chodat subsp. *transvaalensis*
Polygala virgata Thunb. var. *decora* (Sond.) Harv.
Polygala wilmsii Chodat
Polytrichum commune Hedw.
Poroathamnium stipitatum (Mitt.) Touw ex De Sloover
Porostrichum madagassum Kiaer ex Besch.
Portulacaria afra Jacq.
Potamogeton pusillus L.
Printzia huttoni Harv.

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Prionodon densus (Sw. ex Hedw.) Müll.Hal.
Protea caffra Meisn. subsp. *caffra*
Protea roupelliae Meisn. subsp. *roupelliae*
Protea roupelliae Meisn.
Protea welwitschii Engl.
Psammotropha myriantha Sond.
Pseudarthria hookeri Wight & Arn. var. *hookeri*
Pseudopegolettia tenella (DC.) H.Rob., Skvarla & V.A.Funk
Pseudopegolettia thodei (E.Phillips) H.Rob., Skvarla & V.A.Funk
Psoralea pinnata L. var. *pinnata*
Ptaeroxylon obliquum (Thunb.) Radlk.
Pteris sp.
Pterobryopsis hoehnelii (Müll.Hal.) Müll.Hal.
Pterocelastrus echinatus N.E.Br.
Pterodiscus speciosus Hook.
Pterogoniadelphus assimilis (Müll.Hal.) Ochyra & Zijlstra
Pulicaria scabra (Thunb.) Druce
Pycnostachys reticulata (E.Mey.) Benth.
Pycreus nitidus (Lam.) J.Raynal
Pycreus rehmannianus C.B.Clark
Pygmaeothamnus chamaedendrum (Kuntze) Robyns var. *chamaedendrum*
Rabdosiella calycina (Benth.) Codd
Racopilum capense Müll.Hal. ex Broth.
Ranunculus multifidus Forssk.
Raphanus raphanistrum L.
Raphionacme galpinii Schltr.
Raphionacme hirsuta (E.Mey.) R.A.Dyer
Rendlia altera (Rendle) Chiov.
Rhamnus prinoides L'Hér.
Rhamphicarpa brevipedicellata O.J.Hansen
Rhamphicarpa fistulosa (Hochst.) Benth.
Rhoicissus rhomboidea (E.Mey. ex Harv.) Planch.
Rhoicissus tridentata (L.f.) Wild & R.B.Drumm. subsp. *cuneifolia* (Eckl. & Zeyh.) Urton
Rhynchosia caribaea (Jacq.) DC.
Rhynchosia crassifolia Benth. ex Harv.
Rhynchosia minima (L.) DC. var. *prostrata* (Harv.) Meikle
Rhynchosia monophylla Schltr.
Rhynchosia nervosa Benth. ex Harv. var. *nervosa*
Rhynchosia pentheri Schltr. ex Zahlbr. var. *pentheri*
Rhynchosia sordida (E.Mey.) Schinz
Rhynchosia sp.
Rhynchosia totta (Thunb.) DC. var. *totta*
Rhynchosia villosa (Meisn.) Druce
Rhynchostegiella sp.
Riccia atropurpurea Sim
Riccia elongata Perold
Riccia natalensis Sim
Riccia nigrella DC.
Riccia okahandjana S.W.Arnell
Robinia pseudoacacia L.*
Rothea caerulea (N.E.Br.) P.P.J.Herman & Retief
Rothea hirsuta (Hochst.) R.Fern.
Rothea louwalbertsii (P.P.J.Herman) P.P.J.Herman & Retief
Rubus cuneifolius Pursh
Rubus rigidus Sm.
Rubus sp.

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Ruellia cordata Thunb.
Rumex crispus L.
Rumex lanceolatus Thunb.
Rumex sagittatus Thunb.
Rumex woodii N.E.Br.
Ruttya ovata Harv.
Salix mucronata Thunb. subsp. woodii (Seemen) Immelman
Salvia coccinea Etl. (not listed)
Salvia runcinata L.f.
Satureja biflora (Buch.-Ham. ex D.Don) Briq.
Satyrium cristatum Sond. var. cristatum
Satyrium cristatum Sond. var. longilabiatum A.V.Hall
Satyrium hallackii Bolus subsp. ocellatum (Bolus) A.V.Hall
Satyrium neglectum Schltr. subsp. neglectum
Scabiosa columbaria L.
Schistostephium crataegifolium (DC.) Fenzl ex Harv.
Schizaea pectinata (L.) Sw.
Schizocarphus nervosus (Burch.) Van der Merwe
Schizochilus ceciliae Rolfe subsp. transvaalensis (Rolfe) H.P.Linder
Schizochilus lilacinus Schelpe ex H.P.Linder RARE
Schizochilus zeyheri Sond.
Schmidtia pappophoroides Steud.
Schotia brachypetala Sond.
Sclerochiton harveyanus Nees
Scutia myrtina (Burm.f.) Kurz
Searsia batophylla (Codd) Moffett VU
Searsia dentata (Thunb.) F.A.Barkley
Searsia discolor (E.Mey. ex Sond.) Moffett
Searsia gerrardii (Harv. ex Engl.) Moffett
Searsia lancea (L.f.) F.A.Barkley
Searsia lucida (L.) F.A.Barkley forma lucida
Searsia pyroides (Burch.) Moffett var. pyroides
Searsia pyroides (Burch.) Moffett var. gracilis (Engl.) Moffett
Searsia rigida (Mill.) F.A.Barkley var. dentata (Engl.) Moffett
Searsia sekhukhuniensis (Moffett) Moffett RARE
Searsia tumulicola (S.Moore) Moffett var. meeuseana (R.Fern. & A.Fern.) Moffett
Searsia tumulicola (S.Moore) Moffett var. tumulicola
Searsia wilmsii (Diels) Moffett
Searsia zeyheri (Sond.) Moffett
Sebaea filiformis Schinz
Sebaea leiostyla Gilg
Sebaea sedoides Gilg var. sedoides
Selago atherstonei Rolfe
Selago lydenburgensis Rolfe
Selago sp.
Selago tenuifolia (Rolfe) Hilliard
Sematophyllum brachycarpum (Hampe) Broth.
Sematophyllum subpinnatum (Brid.) E.Britton
Senecio achilleifolius DC.
Senecio coronatus (Thunb.) Harv.
Senecio evelynae Muschl.
Senecio gerrardii Harv.
Senecio glaberrimus DC.
Senecio gregatus Hilliard
Senecio inornatus DC.
Senecio isatideus DC.

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Senecio isatidioides E.Phillips & C.A.Sm.
Senecio latifolius DC.
Senecio microglossus DC.
Senecio othonniflorus DC.
Senecio panduriformis Hilliard
Senecio pentactinus Klatt
Senecio pleistocephalus S.Moore
Senecio polyodon DC. var. polyodon
Senecio pterophorus DC.
Senecio purpureus L.
Senecio scitus Hutch. & Burt Davy
Senecio sp. (Harv.) Burt Davy
Senecio speciosus Willd.
Senegalia ataxacantha (DC.) Kyal. & Boatwr.
Senegalia galpinii (Burt Davy) Seigler & Ebinger
Senegalia senegal (L.) Britton var. rostrata (Brenan) Kyal. & Boatwr.
Seriphium plumosum L.
Sesamum triphyllum Welw. ex Asch. var. triphyllum
Sesbania macrantha Welw. ex E.Phillips & Hutch. var. levis J.B.Gillett
Sesbania punicea (Cav.) Benth.
Setaria lindenbergiana (Nees) Stapf
Setaria nigrirostris (Nees) T.Durand & Schinz
Setaria pumila (Poir.) Roem. & Schult.
Setaria sp.
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. sericea (Stapf) Clayton
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. torta (Stapf) Clayton
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. sphacelata
Sida chrysantha Ulbr.
Sida dregei Burt Davy
Silene burchellii Otth subsp. pilosellifolia (Cham. & Schltld.) J.C.Manning & Goldblatt
Silene burchellii Otth subsp. modesta J.C.Manning & Goldblatt
Silene undulata Aiton subsp. undulata
Silene undulata Aiton
Smithia erubescens (E.Mey.) Baker f.
Solanum aculeastrum Dunal var. aculeastrum
Solanum campylacanthum Hochst. ex A.Rich. subsp. panduriforme (Drège ex Dunal) J.Samuels
Solanum giganteum Jacq.
Solanum lichtensteinii Willd.
Solanum retroflexum Dunal
Solanum supinum Dunal var. supinum
Sonchus wilmsii R.E.Fr.
Sopubia cana Harv. var. glabrescens Diels
Sopubia cana Harv. var. cana
Spermacoce natalensis Hochst.
Sphagnum truncatum Hornsch.
Sphedamnocarpus pruriens (A.Juss.) Szyszyl. subsp. pruriens
Sporobolus africanus (Poir.) Robyns & Tournay
Sporobolus centrifugus (Trin.) Nees
Sporobolus conrathii Chiov.
Sporobolus pectinatus Hack.
Sporobolus stapfianus Gand.
Stachys simplex Schltr.
Stapelia leendertziae N.E.Br.
Stephania abyssinica (Quart.-Dill. & A.Rich.) Walp. var. tomentella (Oliv.) Diels
Stiburus conrathii Hack.
Stipagrostis uniplumis (Licht.) De Winter var. uniplumis

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Streptocarpus galpinii Hook.f.
Streptocarpus sp.
Striga asiatica (L.) Kuntze
Striga bilabiata (Thunb.) Kuntze subsp. *bilabiata*
Striga elegans Benth.
Striga gesnerioides (Willd.) Vatke
Stylochaeton natalensis Schott
Symphyogyna brasiliensis Nees & Mont.
Symphyogyna podophylla (Thunb.) Nees & Mont.
Syncolostemon canescens (Gürke) D.F.Otieno
Syncolostemon eriocephalus I.Verd.
Syncolostemon punctatus (Codd) D.F.Otieno
Syncolostemon subvelutinus (Gürke) D.F.Otieno
Syncolostemon transvaalensis (Schltr.) D.F.Otieno
Syrrhopodon gaudichaudii Mont.
Syzygium gerrardii (Harv. ex Hook.f.) Burtt Davy
Tarchonanthus parvicapitulatus P.P.J.Herman
Tephrosia capensis (Jacq.) Pers. var. *capensis*
Tephrosia elongata E.Mey. var. *elongata*
Tephrosia multijuga R.G.N.Young
Tephrosia polystachya E.Mey. var. *latifolia* Harv.
Tephrosia semiglabra Sond.
Teramnus labialis (L.f.) Spreng. subsp. *labialis*
Tetradenia galpinii (N.E.Br.) Phillipson & C.F.Steyn
Tetraselago longituba (Rolfe) Hilliard & B.L.Burtt
Tetraselago wilmsii (Rolfe) Hilliard & B.L.Burtt
Teucrium trifidum Retz.
Thamnosma africana Engl.
Themeda triandra Forssk.
Thesium racemosum Bernh.
Thesium sp.
Thunbergia atriplicifolia E.Mey. ex Nees
Thunbergia natalensis Hook.
Thunbergia pondoensis Lindau
Tolpis capensis (L.) Sch.Bip.
Tortula atrovirens (Sm.) Lindb.
Trachyandra saltii (Baker) Oberm. var. *saltii*
Trachypodopsis serrulata (P.Beauv.) M.Fleisch.
Trachypogon spicatus (L.f.) Kuntze
Tragus berteronianus Schult.
Triaspis hypericoides (DC.) Burch. subsp. *nelsonii* (Oliv.) Immelman
Tribulus zeyheri Sond. subsp. *zeyheri*
Tricalysia capensis (Meisn. ex Hochst.) Sim var. *transvaalensis* Robbr.
Trichoneura grandiglumis (Nees) Ekman
Trichostomum brachydontium Bruch
Trifolium africanum Ser. var. *africanum*
Trifolium africanum Ser. var. *lydenburgense* J.B.Gillett
Trifolium campestre Schreb. var. *campestre*
Trifolium incarnatum L. var. *incarnatum*
Trifolium repens L.
Tristachya biseriata Stapf
Tristachya leucothrix Trin. ex Nees
Triumfetta obtusicornis Sprague & Hutch.
Triumfetta pilosa Roth var. *effusa* (E.Mey. ex Harv.) Wild
Triumfetta welwitschii Mast. var. *welwitschii*
Tulbaghia nutans Vosa

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Turraea obtusifolia Hochst.
Ursinia nana DC. subsp. *leptophylla* Prassler
Utricularia livida E.Mey.
Vaccinium exul Bolus
Vachellia karroo (Hayne) Banfi & Gallaso
Valeriana capensis Thunb. var. *capensis*
Vallisneria spiralis L.
Vangueria infausta Burch. subsp. *infausta*
Vepris reflexa I.Verd.
Verbena bonariensis L.
Verbena rigida Spreng.
Veronica anagallis-aquatica L.
Veronica persica Poir.
Vicia sativa L. subsp. *sativa*
Vigna unguiculata (L.) Walp. subsp. *unguiculata*
Vigna vexillata (L.) A.Rich. var. *vexillata*
Vigna vexillata (L.) A.Rich. var. *angustifolia* (Schumach. & Thonn.) Baker
Viscum rotundifolium L.f.
Vitex obovata E.Mey. subsp. *wilmsii* (Gürke) Bredek. & D.J.Botha
Wahlenbergia magaliesbergensis Lammers
Wahlenbergia rivularis Diels
Wahlenbergia sp.
Wahlenbergia undulata (L.f.) A.DC.
Wahlenbergia virgata Engl.
Waltheria indica L.
Watsonia occulta L.Bolus
Watsonia pulchra N.E.Br. ex Goldblatt
Weissia controversa Hedw.
Widdringtonia nodiflora (L.) Powrie
Withania somnifera (L.) Dunal
Xanthium spinosum L.
Xanthium strumarium L.
Xenostegia tridentata (L.) D.F.Austin & Staples subsp. *angustifolia* (Jacq.) Lejoly & Lisowski
Xerophyta retinervis Baker
Xerophyta schlechteri (Baker) N.L.Menezes
Xerophyta viscosa Baker
Xyris obscura N.E.Br.
Xysmalobium acerateoides (Schltr.) N.E.Br.
Xysmalobium undulatum (L.) Aiton f. var. *undulatum*
Zaluzianskya elongata Hilliard & B.L.Burt
Zaluzianskya katharinae Hiern
Zaluzianskya spathacea (Benth.) Walp.
Zantedeschia albomaculata (Hook.) Baill. subsp. *macrocarpa* (Engl.) Letty
Zantedeschia sp.
Zinnia peruviana (L.) L.
Ziziphus zeyheriana Sond.
Zornia capensis Pers. subsp. *capensis*
Zornia milneana Mohlenbr.

Appendix 2: Plant species of conservation importance (Threatened, Near Threatened and Declining) that have historically been recorded in the study area.

Sources: South African National Biodiversity Institute in Pretoria.

Family	Taxon	National status (SA)	Distribution	Likelihood of occurrence
Passifloraceae	<i>Adenia wilmsii</i>	Endangered	Lydenburg to Waterval Boven. Dolerite outcrops or red loam soil, in open woodland, 1300-1500 m. One population known from Rooidraai Ridge on the farm Rooidraai, which is surrounded by scattered settlements. Previously impacted due to urban expansion of Lydenburg.	MEDIUM , overall geographical distribution includes this area, known from Lydenburg, habitat on site probably not suitable.
Rubiaceae	<i>Alberta magna</i>	Near Threatened	Restricted to a highly specialized habitat on the margins of scarp forests in KwaZulu-Natal and Pondoland. (PROBABLE WRONG RECORD FOR THIS GRID)	ZERO
Asphodelaceae	<i>Aloe integra</i>	Vulnerable	Mpumalanga, from Vaalhoek north of Pilgrim's Rest southwards to Amsterdam. Found in dry Highveld grassland (including Lydenburg Montane Grassland, not Lydenburg Thornveld), on exposed, rocky sites with short grass on north- and northwest-facing slopes	LOW , overall geographical distribution includes this area, but no suitable montane grassland habitat.
Asphodelaceae	<i>Aloe linearifolia</i>	Near Threatened	Central and southern KwaZulu-Natal and the Pondoland region of the Eastern Cape. High rainfall mistbelt, Ngongoni and coastal grassland, occurs in short grasslands in hilly areas, often in rocky outcrops. (PROBABLE WRONG RECORD FOR THIS GRID)	ZERO
Asphodelaceae	<i>Aloe reitzii</i> var. <i>reitzii</i>	Near Threatened	Limpopo and Mpumalanga, Roosenekal and Belfast areas. Granite outcrops and rocky slopes in montane grassland.	LOW , overall geographical distribution includes this area, but no suitable montane grassland habitat.
Asteraceae	<i>Cymbopappus piliferus</i>	Vulnerable	Mpumalanga, from Ohrigstad to Belfast. Lydenburg Montane Grassland on rocky quartzitic ridges in montane grassland.	LOW , overall geographical distribution includes this area, but no suitable montane grassland habitat.
Orchidaceae	<i>Disa extincoria</i>	Near Threatened	Limpopo, Mpumalanga, from Swaziland to Tzaneen. In grassland, on the crest of the escarpment in damp grassland and swamps, from 1000-1300m.	LOW , overall geographical distribution includes this area, but no suitable escarpment habitat.
Anacardiaceae	<i>Searsia batophylla</i>	Vulnerable	Limpopo, Sekhukhuneland. Dry bushveld, in low-lying areas and along watercourses, 650-975m.	LOW , overall geographical distribution excludes this area
Aquifoliaceae	<i>Ilex mitis</i> var. <i>mitis</i>	Declining	Widespread from Table Mountain in the Western Cape to Ethiopia and also Madagascar. Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes. Not recorded in current grid.	LOW , overall geographical distribution includes this area, but no suitable habitat.

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Amaryllidaceae	<i>Boophone disticha</i>	Declining	Widespread in South Africa and other countries in dry grassland and rocky outcrops. Harvested for medicinal use.	HIGH , overall geographical distribution includes this area.
Hyacinthaceae	<i>Bowiea volubilis</i> var. <i>volubilis</i>	Vulnerable	Low and medium altitudes, predominantly in summer rainfall areas, throughout South Africa and elsewhere in Africa. In Gauteng, Mpumalanga and North West it is often found in open woodland or on steep rocky hills, usually in well-shaded situations. Harvested for medicinal use.	LOW , overall geographical distribution includes this area, but no suitable habitat.
Hyacinthaceae	<i>Drimia altissima</i>	Declining	Hot, dry bushveld and thicket, countrywide and elsewhere in Africa. Harvested for medicinal use.	LOW , overall geographical distribution includes this area, but no suitable habitat.
Hyacinthaceae	<i>Merwillia plumbea</i>	Near Threatened	Variety of grassland habitats in summer rainfall areas of South Africa. Harvested for medicinal use.	MEDIUM , overall geographical distribution includes this area.
Hypoxidaceae	<i>Hypoxis hemerocallidea</i>	Declining	Wide range of habitats throughout southern Africa. Harvested for medicinal use.	HIGH , overall geographical distribution includes this area.
Hyacinthaceae	<i>Eucomis autumnalis</i>	Declining	Damp, open grassland and sheltered places from the coast to 2450 m.	HIGH , overall geographical distribution includes this area.

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria*IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

Appendix 3: Plant species protected according to the Mpumalanga Nature Conservation Act, No. 10 of 1998

Schedule 11: Protected Plants (Section 69(1)(a))

all species of tree ferns, excluding the bracken fern	all species of the genus: <i>Cyathea capensis</i> and <i>Cyathea dregei</i>
all species of cycads in Republic of South Africa and the seedlings of the species of cycads referred to in Schedule 12.	all species of the family <i>Zamiaceae</i> occurring in the Republic of South Africa and the seedlings of the species of <i>Encephalartos</i> referred to in Schedule 12.
all species of yellow wood	<i>Podocarpus</i> spp.
all species of arum lilies	<i>Zantedeschia</i> spp.
"volstruiskos"	<i>Schizobasis intricata</i>
"knoklimop"	<i>Bowiea volubilis</i>
all species of red-hot pokers	<i>Kniphofia</i> spp.
all species of aloes, excluding: (a) all species not occurring in Mpumalanga and (b) the following species: all species of haworthias all species of agapanthus all species of squill	<i>Aloe</i> spp., excluding: (a) all species not occurring in Mpumalanga and (b) the following species: <i>Haworthia</i> spp. <i>Agapanthus</i> spp. <i>Scilla</i> spp.
all species of pineapple flower	<i>Eucomis</i> spp.
all species of dracaena	<i>Dracaena</i> spp.
all species of paint brush	<i>Haemanthus</i> spp. and <i>Scadoxus</i> spp.
Cape poison bulb	<i>Boophone disticha</i>
all species of clivia	<i>Clivia</i> spp.
all species of brunsvigia	<i>Brunsvigia</i> spp.
all species of crinum	<i>Crinum</i> spp.
ground lily	<i>Ammocharis coranica</i>
all species of fire lily	<i>Cyrtanthus</i> spp.
all species of elephantsfoot	<i>Dioscorea</i> spp.
river lily	<i>Hesperantha coccinea</i>
all species of gladioli	<i>Gladiolus</i> spp.
all species of watsonia	<i>Watsonia</i> spp.
wild ginger	<i>Siphonochilus aethiopicus</i>
all species of orchids	All species of the family <i>Orchidaceae</i>
all species of the family proteaceae	All species of the family <i>Proteaceae</i>
all species of black stinkwood	<i>Ocotea</i> spp.
kiaat	<i>Pterocarpus angolensis</i>
tamboti	<i>Spirostachys angolensis</i>
the following species of Euphorbias: <i>Euphorbia bernardii</i> and <i>Euphorbia grandialata</i>	the following species of Euphorbias: <i>Euphorbia bernardii</i> and <i>Euphorbia grandialata</i>
common bersama	<i>Bersama tysoniana</i>
red ivory	<i>Berchemia zeyheri</i>
Pepperbark tree	<i>Warburgia salutaris</i>
all species of adenia	<i>Adenia</i> spp.

bastard onion wood	Cassipourea gerrardii
assegai tree	Curtisia dentata
all species of olive trees	all species of the genus Olea
all species of impala lilies	All species of the genus Adenium
kudu lily	Pachypodium saundersii
all species of brachystelma	Brachystelma spp.
all species of ceropegia	Ceropegia spp.
all species of huerniopsis and huernia	Huerniopsis and Huernia spp.
all species of duvalia	Duvalia spp.
all species of stapeliads	Stapelia spp.
all species of orbeanthus	Orbeanthus spp.
all species of orbeas	Orbea spp.
all species of orbeopsis	Orbeopsis spp.

Schedule 12: Specially Protected Plants (Section 69(1)(b))

(a) all plants, excluding seedlings, of the following species of cycads: dolomiticus, dyer, middelburg, eugene marais, heenan, inopinus, laevifolius, lanatus, lebombo, ngoyanus, paucidentatus, modjadje and villosus	a) all plants, excluding seedlings, of the following species of the Genus Encephalartos: E. dolomiticus, E. dyerianus, E. middelburgensis, E. eugene maraissii, E. heenanii, E. inopinus, E. laevifolius, E. lanatus, E. lebomboensis, E. ngoyanus, E. paucidentatus, E. traansvenosus and E. villosus and any species derived from the above species
(b) all plants of the following species of cycads: cupidus and humilus	(b) all plants of the following species of the genus Encephalartos: E. cupidus and E. humilus
(c) all species of cycads in their natural habitat	(c) all plants of the Genus Encephalartos in their natural habitat

Appendix 4: List of protected tree species (National Forests Act).

<i>Acacia erioloba</i>	<i>Acacia haematoxylon</i>
<i>Adansonia digitata</i>	<i>Afzelia quanzensis</i>
<i>Balanites</i> subsp. <i>maughamii</i>	<i>Barringtonia racemosa</i>
<i>Boscia albitrunca</i>	<i>Brachystegia spiciformis</i>
<i>Breonadia salicina</i>	<i>Bruguiera gymnorhiza</i>
<i>Cassipourea swaziensis</i>	<i>Catha edulis</i>
<i>Ceriops tagal</i>	<i>Cleistanthus schlechteri</i> var. <i>schlechteri</i>
<i>Colubrina nicholsonii</i>	<i>Combretum imberbe</i>
<i>Curtisia dentata</i>	<i>Elaeodendron (Cassine) transvaalensis</i>
<i>Erythrophysa transvaalensis</i>	<i>Euclea pseudebenus</i>
<i>Ficus trichopoda</i>	<i>Leucadendron argenteum</i>
<i>Lumnitzera racemosa</i> var. <i>racemosa</i>	<i>Lydenburgia abottii</i>
<i>Lydenburgia cassinoides</i>	<i>Mimusops caffra</i>
<i>Newtonia hildebrandtii</i> var. <i>hildebrandtii</i>	<i>Ocotea bullata</i>
<i>Ozoroa namaensis</i>	<i>Philenoptera violacea (Lonchocarpus capassa)</i>
<i>Pittosporum viridiflorum</i>	<i>Podocarpus elongatus</i>
<i>Podocarpus falcatus</i>	<i>Podocarpus henkelii</i>
<i>Podocarpus latifolius</i>	<i>Protea comptonii</i>
<i>Protea curvata</i>	<i>Prunus africana</i>
<i>Pterocarpus angolensis</i>	<i>Rhizophora mucronata</i>
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	<i>Securidaca longependunculata</i>
<i>Sideroxylon inerme</i> subsp. <i>inerme</i>	<i>Tephrosia pondoensis</i>
<i>Warburgia salutaris</i>	<i>Widdringtonia cedarbergensis</i>
<i>Widdringtonia schwarzii</i>	

Boscia albitrunca, *Catha edulis*, *Curtisia dentata*, *Elaeodendron (Cassine) transvaalensis*, *Lydenburgia cassinoides*, *Ocotea bullata*, *Philenoptera violacea*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius*, *Prunus africana*, *Pterocarpus angolensis* and *Sclerocarya birrea* subsp. *caffra* have a geographical distribution that coincides with the study area.

Appendix 5: Animal species with a geographical distribution that includes the study area.

Notes:

1. Species of conservation concern are in red lettering.
2. Species protected according to the National Environmental Management: Biodiversity Act of 2004 (Act 10 of 2000) marked with "N".

Mammals:

Impala
Red hartebeest
Springbok
^NWhite rhinoceros
^NBlack wildebeest
Blue wildebeest
Blesbok
^NBlack rhinoceros VU
Plains zebra
Sable antelope VU
Waterbuck
Klipspringer
^NOribi EN
Grey rhebok
Warthog
Bushpig
Steenbok
Sharp's grysbok NT
Reedbuck
Mountain reedbuck
Common duiker
Cape buffalo
Eland
Nyala
Bushbuck
Kudu
Yellow-spotted rock hyrax
Rock hyrax
^NCape clawless otter
Water mongoose
Black-backed jackal
Caracal
African civet
Yellow mongoose
African wild cat
Slender mongoose
Small-spotted genet
Large-spotted genet
Dwarf mongoose
^NBrown hyaena NT
White-tailed mongoose
Striped polecat
^NServal NT
^NSpotted-necked otter NT
^NHoney badger NT
Banded mongoose
^NLeopard
African weasel
Aardwolf
Meller's mongoose
Cape fox
Little free-tailed bat
Percival's short-eared trident bat VU
Gambian epauletted fruit bat
Wahlberg's epauletted fruit bat
Long-tailed serotine bat
Sundevall's leaf-nosed bat
Lesser long-fingered bat NT
Natal long-fingered bat NT
Midas free-tailed bat
Rufous hairy bat
Temminck's myotis NT
Welwitsch's myotis NT
Cape serotine bat
Banana bat
Aloe bat
Egyptian slit-faced bat
Dusky pipistrelle
Rusty pipistrelle NT
Blasius's horseshoe bat NT
Geoffroy's horseshoe bat NT
Darling's horseshoe bat
Ruppell's horseshoe bat NT
Hildebrandt's horseshoe bat NT
Lander's horseshoe bat NT
Bushveld horseshoe bat
Swinny's horseshoe bat NT
Egyptian fruit bat
Robert's flat-headed bat
Yellow-bellied house bat
Green house bat
Egyptian free-tailed bat
Mauritian tomb bat
Hottentott's golden mole
^NSouth African Hedgehog
Reddish-grey musk shrew
Greater musk shrew

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Tiny musk shrew	Common dwarf gecko
Lesser red musk shrew	Black-spotted dwarf gecko
Swamp musk shrew	Spotted dwarf gecko
Lesser grey-brown musk shrew	Transvaal gecko
Dark-footed forest shrew	Cape gecko
Forest shrew	Speckled gecko
Least dwarf shrew	Van Son's gecko
Greater dwarf shrew	Holub's sandveld lizard
Lesser dwarf shrew	Delelände's sandveld lizard
Cape hare	Ornate sandveld lizard
Scrub hare	Coppery grass lizard NT
Natal red rock rabbit	Cape grass lizard
Jameson's red rock rabbit	Large-scaled grass lizard NT
Hewitt's red rock rabbit	Jone's girdled lizard
Vervet monkey	Common girdled lizard
Southern lesser galago	Common crag lizard
Thick-tailed bushbaby	(Van Dam's dragon lizard)
Chacma baboon	(Barberton dragon lizard)
Spiny mouse	Wilhelm's flat lizard
Tete veld rat	(Sekhukhune flat lizard)
Namaqua rock mouse	Yellow-throated plated lizard
Common mole-rat	Common giant plated lizard
African marsh rat	Breyer's long-tailed seps VU
Grey climbing mouse	Short-headed legless skink
Brant's climbing mouse	Thin-tailed legless skink
Chestnut climbing mouse	Giant legless skink
Woodland dormouse	(Spotted-neck snake-eyed skink)
Rock dormouse	Wahlberg's snake-eyed skink
Porcupine	Sundevall's writhing skink
Single-striped mouse	Cape skink
Multimammate mouse	Red-sided skink
Pygmy mouse	Rainbow skink
Angoni vlei rat	Speckled rock skink
Vlei rat	Striped skink
Laminate vlei rat	Variable skink
Tree squirrel	Montane dwarf burrowing skink
Striped mouse	(Mozambique dwarf burrowing skink)
Pouched mouse	Southern rock monitor
Fat mouse	Nile monitor
Highveld gerbil	Northern dwarf chameleon
Bushveld gerbil	Common flap-necked chameleon
Tree rat	Eastern ground agama
Greater cane rat	Southern rock agama
Short-snouted elephant shrew	Southern tree agama
Rock elephant shrew	Bibron's blind snake
^N Temminck's ground pangolin VU	Schlegel's giant blind snake
Aardvark	Delelände's beaked blind snake
Reptiles:	Distant's thread snake
Marsh terrapin	Incognito thread snake
Lobatse hinged-back tortoise	Jacobsen's thread snake
Speke's hinged-back tortoise	Peter's thread snake
Leopard tortoise	(Long-tailed thread snake)
Turner's gecko	Southern African python protected
Common tropical house gecko	Puff adder
Wahlberg's velvet gecko	Berg adder
	Snouted night adder

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Rhombic night adder
KwaZulu-Natal purple-glossed snake
Common purple-glossed snake
Black-headed centipede eater
Bibron's stiletto snake
Striped harlequin snake NT
Spotted harlequin snake
Common house snake
Common file snake
Black file snake
Swazi rock snake
Aurora snake
Yellow-bellied snake
Spotted rock snake
Olive ground snake
Dusky-bellied water snake
Brown water snake
Cape wolf snake
Variegated wolf snake
Eastern bark snake
Dwarf sand snake
Short-snouted grass snake
Cross-marked grass snake
Olive grass snake
Western yellow-bellied sand snake
Fork-marked sand snake
Spotted grass snake
Striped grass snake
Many-spotted snake
South African slug-eater
Sundevall's shovel-snout
Mole snake
Black mamba
Boulenger's garter snake
Sundevall's garter snake
Rinkhals
Snouted cobra
Mozambique spitting cobra
Red-lipped snake
Southern brown egg eater
Rhombic egg eater
Boomslang
Southeastern green snake
Western Natal green snake
Spotted bush snake
Eastern tiger snake
Southern twig snake

Amphibians:

Bushveld rain frog
Eastern olive toad
Guttural Toad
Flat-backed toad
Raucous Toad
(Red toad)
(Natal cascade frog)

Painted reed frog
Bubbling Kassina
Snoring Puddle Frog
Plain grass frog
Striped grass frog
Common Platanna
Boettger's Caco
Bronze caco
Mountain caco
Common River Frog
(Cape River Frog)
Giant Bull Frog
Striped stream frog
Clicking stream frog
Tremolo Sand Frog
Knocking sand frog
Natal Sand Frog
Tandy's sand frog

Birds:

Apalis Bar Throated
Apalis, Yellow-breasted
Avocet, Pied
Babbler, Arrow-marked
Barbet, Acacia Pied
Barbet, Black-collared
Barbet, Crested
Batis Cape
Batis, Chinspot
Bee-eater, European
Bee-eater, Little
Bee-eater, Swallow-tailed
Bee-eater, White-fronted
Bishop, Southern Red
Bishop, Yellow
Bishop, Yellow-crowned
Bittern Eurasian (previously CR, now LC)
Bittern, Little
Bokmakierie
Boubou Southern
Brownbul Terrestrial
Brubru
Bulbul, Dark-capped
Bunting, Cape
Bunting, Cinnamon-breasted
Bunting, Golden-breasted
Bush-shrike, Grey-headed
Bush-shrike, Olive
Bush-shrike, Orange-breasted
Bustard, Black-bellied
Bustard Denham's VU
Buttonquail, Kurrichane
Buzzard Common
Buzzard, European Honey
Buzzard, Forest
Buzzard Jackal

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Buzzard, Lizard
Buzzard, Steppe
Camaroptera, Green-backed
Camaroptera, Grey-backed
Canary Black-throated
Canary Brimstone
Canary, Cape
Canary Forest
Canary, Yellow-fronted
Chat, Anteating
Chat, Buff-streaked
Chat, Familiar
Cisticola, Cloud
Cisticola, Croaking
Cisticola, Desert
Cisticola, Lazy
Cisticola, Levallant's
Cisticola, Rattling
Cisticola, Red-faced
Cisticola, Wailing
Cisticola, Wing-snapping
Cisticola, Zitting
Cliff-chat, Mocking
Cliff-swallow, South African
Coot, Red-knobbed
Cormorant, Reed
Cormorant, White-breasted
Coucal, Burchell's
Coucal, White-browed
Courser, Temminck's
Crake Baillon's
Crake, Black
Crane, Blue VU/NT in SA
Crane, Grey-crowned EN
Crombec Long-billed
Crow, Cape
Crow, Pied
Cuckoo, African
Cuckoo African Emerald
Cuckoo Black
Cuckoo, Diederik
Cuckoo, Great Spotted
Cuckoo, Jacobin
Cuckoo, Klaas's
Cuckoo, Levallant's
Cuckoo, Red-chested
Cuckooshrike Black
Cuckooshrike Grey
Darter, African
Dove, Cape Turtle
Dove, Laughing
Dove Lemon
Dove, Namaqua
Dove, Red-eyed
Dove, Rock
Dove Tambourine
Drongo, Fork-tailed
Duck, African Black
Duck, Knob-billed
Duck, Maccoa NT
Duck, Mallard
Duck, White-backed
Duck, White-faced Whistling
Duck, Yellow-billed
Eagle African Fish
Eagle Black-chested Snake
Eagle, Booted
Eagle, Brown Snake
Eagle Crowned VU
Eagle, Long-crested
Eagle, Martial EN
Eagle, Steppe
Eagle, Verreaux's VU
Eagle, Wahlberg's
Egret, Great
Egret, Little
Egret Western Cattle
Egret, Yellow-billed
Eremomela Burnt-necked
Eremomela Green-capped
Eremomela, Yellow-bellied
Falcon, Amur
Falcon, Lanner VU
Falcon Peregrine
Finch African Quail-
Finch, Cuckoo
Finch, Cut-throat
Finch Red-headed
Finch Scaly-feathered
Finfoot African
Firefinch African
Firefinch, Jameson's
Firefinch, Red-billed
Fiscal, Common
Flamingo, Greater NT
Flamingo, Lesser NT
Flufftail Buff-spotted
Flufftail Red-chested
Flufftail Striped VU
Flycatcher African Dusky
Flycatcher African Paradise
Flycatcher, Ashy
Flycatcher Blue-mantled Crested
Flycatcher, Fairy
Flycatcher, Fiscal
Flycatcher, Grey Tit-
Flycatcher, Pale
Flycatcher, Southern Black
Flycatcher Spotted
Francolin, Coqui
Francolin, Crested
Francolin Grey-winged

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Francolin Red-winged
Francolin, Shelley's
Go-away-bird, Grey
Goose, Egyptian
Goose, Spur-winged
Goshawk African
Goshawk, Gabar
Grassbird Cape
Grebe, Great Crested
Grebe, Little
Greenbul Sombre
Greenshank, Common
Guineafowl, Helmeted
Gull, Grey-headed
Hamerkop
Harrier African Marsh- EN
Harrier, Black EN
Hawk, African Cuckoo
Harrier-Hawk, African
Hawk-eagle, African
Helmet-shrike, Retz's
Helmet-shrike, White-crested
Heron, Black-crowned Night-
Heron, Black
Heron, Black-headed
Heron, Goliath
Heron, Green-backed
Heron, Grey
Heron, Purple
Heron, Squacco
Hobby Eurasian
Honey-buzzard, European
Honeybird Brown-backed
Honeyguide Greater
Honeyguide, Lesser
Honeyguide Scaly-throated
Hoopoe, African
Hornbill, African Grey
Ibis, African Sacred
Ibis, Glossy
Ibis, Hadedda
Ibis, Southern Bald VU
Jacana, African
Kestrel, Greater
Kestrel, Lesser
Kestrel, Rock
Kingfisher, African Pygmy
Kingfisher, Brown-hooded
Kingfisher, Giant
Kingfisher Half-collared
Kingfisher, Malachite
Kingfisher, Pied
Kingfisher, Striped
Kingfisher, Woodland
Kite, Black
Kite, Black-shouldered
Kite, Yellow-billed
Korhaan, White-bellied VU
Lapwing Black-winged
Lapwing, Blacksmith
Lapwing, Crowned
Lapwing, Wattled
Lark, Eastern Long-billed
Lark, Flappet
Lark, Red-capped
Lark, Rufous-naped
Lark, Sabota
Lark, Spike-heeled
Longclaw, Cape
Mannikin, Bronze
Mannikin, Red-backed
Martin, Banded
Martin, Brown-throated
Martin Common House
Martin, Rock
Martin, Sand
Moorhen, Common
Mousebird, Red-faced
Mousebird, Speckled
Myna, Common
Neddicky
Nightjar, European
Nightjar, Fiery-necked
Nightjar, Freckled
Nightjar Pennant-winged
Nightjar, Rufous-cheeked
Oriole Black-headed
Oriole, Eurasian Golden
Osprey Western
Ostrich, Common
Owl, African Grass VU
Owl African Wood
Owl, Cape Eagle-
Owl, Marsh
Owl Spotted Eagle-
Owl Verreaux's Eagle-
Owl Western Barn
Owlet, Pearl-spotted
Oxpecker, Red-billed
Palm-swift, African
Petronia Yellow-throated
Pigeon, African Olive-
Pigeon, Speckled
Pipit, African
Pipit, Buffy
Pipit, Long-billed
Pipit, Plain-backed
Pipit, Striped
Pipit, Yellow-breasted
Plover, Caspian
Plover, Common Ringed
Plover, Kittlitz's

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Plover, Three-banded
Pochard, Southern
Prinia, Black-chested
Prinia, Drakensberg
Prinia, Karoo
Prinia, Tawny-flanked
Puffback Black-backed
Pytilia, Green-winged
Quail, Common
Quelea, Red-billed
Rail, African
Raven White-necked
Robin White-starred
Robin-chat, Cape
Robin-chat Chorister
Robin-chat, White-browed
Robin-chat, White-throated
Roller, Broad-billed
Roller, European NT
Roller, Lilac-breasted
Roller, purple
Ruff
Sandgrouse, Double-banded
Sandpiper, Common
Sandpiper, Curlew
Sandpiper, Green
Sandpiper, Marsh
Sandpiper, Wood
Saw-wing Black
Scimitarbill, Common
Scrub-robin, White-browed
Secretarybird VU
Seed-eater, Streaky-headed
Shikra
Shoveler, Cape
Shrike, Crimson-breasted
Shrike, Lesser Grey
Shrike Red-backed
Shrike, Southern White-crowned
Snipe, African
Snipe, Greater Painted NT
Sparrow, Cape
Sparrow, House
Sparrow, Northern Grey-headed
Sparrow, Southern Grey-headed
Sparrowhawk, Black
Sparrowhawk Little
Sparrowhawk, Ovambo
Sparrowhawk Rufous-breasted
Spoonbill, African
Spurfowl, Natal
Spurfowl Red-knecked
Spurfowl, Swainson's
Starling, Cape Glossy
Starling, Pied
Starling, Red-winged
Starling, Violet-backed
Starling, Wattled
Stilt, Wattled
Stint, Little
Stonechat, African
Stork, Abdim's NT
Stork, Black VU
Stork, White
Stork, Yellow-billed EN
Sugarbird, Gurney's
Sunbird Amethyst
Sunbird Greater Double-collared
Sunbird, Malachite
Sunbird, Scarlet-chested
Sunbird Southern Double-collared
Sunbird, White-bellied
Swallow, Barn
Swallow, Greater Striped
Swallow, Grey-rumped
Swallow Lesser Striped
Swallow, Pearl-breasted
Swallow, Red-breasted
Swallow, South African Cliff
Swallow, White-throated
Swallow, Wire-tailed
Swamphen, African
Swift, African Black
Swift, Alpine
Swift, Common
Swift, Horus
Swift, Little
Swift, White-rumped
Tchagra, Black-crowned
Tchagra, Brown-crowned
Tchagra Southern
Teal, Cape
Teal, Hottentot
Teal, Red-billed
Tern, Whiskered
Tern, White-winged
Thick-knee, Spotted
Thick-knee Water
Thrush Cape Rock
Thrush, Groundscaper
Thrush, Karoo
Thrush, Kurrichane
Thrush Olive
Thrush Sentinel Rock
Thrush, Short-toed Rock
Tinkerbird, Yellow-fronted
Tinkerbird, Yellow-rumped
Tit, Southern Black
Tit-Babbler Chestnut-vented
Trogon Narina
Turaco Knysna
Turaco, Purple-crested

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Vulture, Cape - EN

Wagtail, African Pied
Wagtail, Cape
Wagtail, Mountain
Wagtail, Western Yellow
Warbler African Reed
Warbler, Broad-tailed
Warbler, Drak-capped Yellow
Warbler, Garden
Warbler, Great Reed
Warbler, Icterine
Warbler, Lesser Swamp
Warbler, Little Rush
Warbler Marsh
Warbler, Sedge
Warbler, Willow
Warbler Yellow-throated Woodland
Waxbill, Common
Waxbill, Orange-breasted
Waxbill Swee
Waxbill, Violet-eared
Weaver, Cape
Weaver, Golden
Weaver, Lesser Masked
Weaver, Spectacled
Weaver, Thick-billed
Weaver, Village
Weaver, White-browed Sparrow-
Weaver Southern Masked
Wheatear, Capped
Wheatear, Mountain
White-eye, Cape
White-eye, Orange River
Whydah, Long-tailed Paradise
Whydah, Pin-tailed
Widowbird, Fan-tailed
Widowbird, Long-tailed
Widowbird, Red-collared
Widowbird, White-winged
Wood-hoopoe, Green
Woodpecker, Bearded
Woodpecker, Cardinal
Woodpecker, Golden-tailed
Woodpecker, Ground
Woodpecker Olive
Wryneck, Red-throated

Appendix 6: Flora and vertebrate animal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Flora

Adenium swazicum
Aloe pillansii
Diaphanathe millarii
Dioscorea ebutsniorum
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

Reptilia

Loggerhead sea turtle
Leatherback sea turtle
Hawksbill sea turtle

Aves

Wattled crane
Blue swallow
Egyptian vulture
Cape parrot

Mammalia

Riverine rabbit
Rough-haired golden mole

ENDANGERED SPECIES

Flora

Angraecum africae
Encephalartos arenarius
Encephalartos cupidus
Encephalartos horridus
Encephalartos laevifolius
Encephalartos leboomboensis
Encephalartos msinganus
Jubaeopsis caffra

Siphonochilus aethiopicus
Warburgia salutaris
Newtonia hilderbrandi

Reptilia

Green turtle
Giant girdled lizard
Olive ridley turtle
Geometric tortoise

Aves

Blue crane
Grey crowned crane
Saddle-billed stork
Bearded vulture
White-backed vulture
Cape vulture
Hooded vulture
Pink-backed pelican
Pel's fishing owl
Lappet-faced vulture

Mammalia

Robust golden mole
Tsessebe
Black rhinoceros
Mountain zebra
African wild dog
Gunning's golden mole
Oribi
Red squirrel
Four-toed elephant-shrew

VULNERABLE SPECIES

Flora

Aloe albida
Encephalartos cycadifolius
Encephalartos Eugene-maraisii
Encephalartos ngovanus
Merwillia plumbea
Zantedeschia jucunda

Aves

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White-headed vulture
Tawny eagle
Kori bustard
Black stork
Southern banded snake eagle
Blue korhaan
Taita falcon
Lesser kestrel
Peregrine falcon
Bald ibis
Ludwig's bustard
Martial eagle
Bataleur
Grass owl

Mammalia

Cheetah
Samango monkey
Giant golden mole
Giant rat
Bontebok
Tree hyrax
Roan antelope
Pangolin
Juliana's golden mole
Suni
Large-eared free-tailed bat
Lion
Leopard
Blue duiker

PROTECTED SPECIES

Flora

Adenia wilmsii
Aloe simii
Clivia mirabilis
Disa macrostachya
Disa nubigena
Disa physodes
Disa procera
Disa sabulosa
Encephelartos altensteinii
Encephelartos caffer
Encephelartos dyerianus
Encephelartos frederici-guilielmi
Encephelartos ghellinckii
Encephelartos humilis
Encephelartos lanatus
Encephelartos lehmannii
Encephelartos longifolius
Encephelartos natalensis
Encephelartos paucidentatus

Encephelartos princeps
Encephelartos senticosus
Encephelartos transvenosus
Encephelartos trispinosus
Encephelartos umbeluziensis
Encephelartos villosus
Euphorbia clivicola
Euphorbia meloformis
Euphorbia obesa
Harpagophytum procumbens
Harpagophytum zeyherii
Hoodia gordonii
Hoodia currorii
Protea odorata
Stangeria eriopus

Amphibia

Giant bullfrog
African bullfrog

Reptilia

Gaboon adder
Namaqua dwarf adder
Smith's dwarf chameleon
Armadillo girdled lizard
Nile crocodile
African rock python

Aves

Southern ground hornbill
African marsh harrier
Denham's bustard
Jackass penguin

Mammalia

Cape clawless otter
South African hedgehog
White rhinoceros
Black wildebeest
Spotted hyaena
Black-footed cat
Brown hyaena
Serval
African elephant
Spotted-necked otter
Honey badger
Sharpe's grysbok
Reedbuck
Cape fox