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Terrestrial Biodiversity Basic Impact Assessment for the proposed Rehabilitation of the Rietspruit Dam near Ventersdorp, North-West Province©

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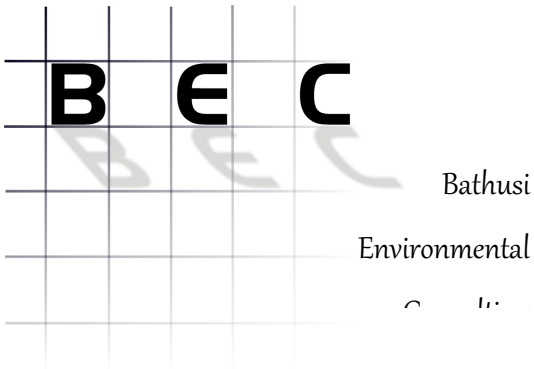

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in collaboration with

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SECTION A – ADMINISTRATION, PROJECT DETAILS & INTRODUCTARY COMMENTS

This report is compartmentalised as follows:

a) **Section A** Project introduction and administrative details, specialist introduction, report navigation, introductory section, and **EXECUTIVE SUMMARY**;
b) **Section B** A brief account of biophysical attributes and information of the local and regional environment;
c) **Section C** An overview of the botanical aspects of the receiving environment;
d) **Section D** An overview of the general faunal aspects of the receiving environment;
e) **Section E** A Biodiversity Basic Impact Assessment, recommend mitigation actions and EMP Contributions; and
f) **Section F** Impact Assessment, mitigation and EMP contributions, and concluding remarks.

I REPORT NAVIGATION

Section A

II LIST OF FIGURES

III LIST OF TABLES

IV LIST OF GRAPHS

V PROJECT DETAILS

Client:	Royal HaskoningDHV, on behalf of The Department of Water and Sanitation (North-West Province)
Report Name:	Terrestrial Biodiversity Basic Impact Assessment for the proposed Rehabilitation of the Rietspruit Dam near Ventersdorp, North-West Province
Report Type:	Biodiversity Basic Impact Assessment Report
BEC Project number:	RHD – RDR – 2015/19
Report Version:	2015.11.04.2
Report Status:	DRAFT REPORT
Date of Release:	4th November 2015
Report Author:	Riaan A. J. Robbeson (Pr.Sci.Nat.) (Bathusi Environmental Consulting)

VI REPORT REFERENCE

When used as a reference, or included as an addendum, this report should be cited as:
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VIII CONTRIBUTING SPECIALISTS

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'.*

Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg 14).

Table 1: Biodiversity specialists for this project	
Botanical Specialist:	**Riaan Robbeson (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of Expertise:	Botanical Scientist & Ecological Scientist
Registration Number:	*400005/03*
Faunal Specialist:	**Dewald Kamffer (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Conservation Biology), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of expertise:	Ecological Scientist & Zoological Scientist
Registration number:	*400204/05*

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X ACRONYMS & ABBREVIATIONS

BA	Basic Assessment
BEC	Bathusi Environmental Consulting cc
BGIS	Biodiversity GIS
CBA	Critical Biodiversity Areas
CBD	Convention on Biological Diversity
CITES	Convention of International Trade in Endangered Species
CR	Critically Endangered
DD	Data Deficient
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EN	Endangered
End	Endemic Species
ESA	Ecological Support Areas
GIS	Geographic Information System
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
LC	Least Concern
mmasl	Mean Meters Above Sea Level
NT	Near Threatened
NWPBCA	North West Province Biodiversity Conservation Assessment (Version 1.2)
Pr.Sci.Nat	Professional Natural Scientist (registered at SACNASP)
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
SEIA	Social and Environmental Impact Assessment
SDF	Spatial Development Framework
SSC	Species of Special Concern
VU	Vulnerable

XI GLOSSARY OF TERMS

Ad hoc	Random, non sequential, opportunistic observations
Anthropogenic	Human induced
Austral	Southern hemisphere
Avifauna	Birds
Biodiversity	Diversity among and within plant and animal species in an environment
Carnivore	Flesh eating animal
Commensal	A symbiotic relationship in which one species is benefited while the other is unaffected
Conspecific	Animals or plants belonging to the same species
Disjunct	Disjoined or distinct from one another
Diurnal	During the day
Endemic	Restricted to a certain geographic area
Eurytopic	Able to adapt to a wide range of environmental conditions; widely distributed (used for an animal or plant)
Granivore	Animals that eat seeds as the main part of their diet
Herbivorous	Animals that eat plants
Herpetofauna	Amphibians and Reptiles
Insectivorous	Animals that feed on insects as the main part of their diet
Lepidoptera	Butterflies
Mammal	A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, females that secrete milk for the nourishment of the young and (typically) the birth of live young
Monitoring	The collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a conservation or management objective
Nomenclature	The devising or choosing of names for things, especially in a science or other discipline
Passerine	Relating to or denoting birds of a large order distinguished by having feet that are adapted for perching, including all songbirds
Phylogenetic	The evolution of a genetically related group of organisms as distinguished from the development of the individual organism
Primate	Animals characterized by large brains relative to other mammals, as well as an increased reliance on stereoscopic vision at the expense of smell, the dominant sensory system in most mammals
Red Data	A taxon included in the UICN list of threatened species
Solitary	Animals that spend a majority of their lives without others of their species, with possible exceptions for mating and raising their young
Sympatric	Animals or plant species or populations occurring within the same or overlapping geographical areas
Territorial	The sociographical area that an animal of a particular species consistently defends against conspecifics (or, occasionally, animals of other species). Animals that defend territories in this way are referred to as territorial. Territoriality is only shown by a minority of species.
Threatened	Species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future. Species that are threatened are sometimes characterised by the population dynamics measure of critical dispensation, a mathematical measure of biomass related to population growth rate

XII INTRODUCTION

Biodiversity is a series of relationships in a complex web, which is also referred to as 'the web of life'. Our natural environment includes rivers, wetlands, coastlines, mountains, plains, grasslands, woodlands, forests, etc., as well as all the life on earth, such as plants, animals, reptiles, insects, and birds. South Africa is blessed with an exceptionally rich biodiversity; we have the recognition as one of the world's few 'megadiverse' countries. In addition to having an entire floral kingdom, it also includes two globally significant biodiversity 'hot spots' (the Cape and succulent Karoo regions), six Centres of Plant Diversity, two Endemic Bird Areas and the richest temperate flora in the world (Cowling, 2000).

Pressure is continually being exerted on these valuable natural resources of South Africa because of uncontrolled growth of human population. Energy consumption has increased exponentially as well as the drive to extract more economically valuable resources at ever-faster rates. Natural habitats that harbour valuable biodiversity are being lost at increasingly faster rates and over progressively wider areas, while managed lands are undergoing increasing simplification. Projections show that the extinction of species and degradation of ecosystems are likely to continue, and likely accelerate and drastic action is needed to arrest the uncontrolled extinction of species on a global scale caused by modern lifestyles. Many would argue, from spiritual and ethical points of view, that the diversity of life on Earth has intrinsic value, and that it is worth protecting for its own sake.

However, implementing 'biodiversity friendly' practices remains challenging within the entire developmental sphere, especially for smaller companies and peripheral players. This is partly because governments, while perhaps committed on paper to biodiversity, have found it difficult to create the right incentives and apply the necessary regulations in a way that could encourage all players to conserve biodiversity (ICMM, 2004). Achieving a balance while doing this requires better understanding and recognition of conservation and development imperatives by all stakeholders, including governments, business and conservation communities.

Despite the significant potential for negative impacts on biodiversity, there is a great deal that companies can do to minimize or prevent impacts on our irreplaceable natural resources. There are also many opportunities for companies to enhance biodiversity conservation within their areas of operations. Being proactive in the assessment and management of biodiversity is important not only for new operations but also for those that have been operating for many years, usually under regulatory requirements that were less focused on the protection and enhancement of biodiversity.

In summary, the threats to biodiversity are compelling. Unless they are addressed in a holistic manner, which considers social and economic as well as scientific considerations, the benefits of ecosystem services will be substantially diminished for future generations. Furthermore, the next 50 years could see a further acceleration in the degradation of ecosystem services unless action is taken to reverse current trends.

XIII PROJECT SYNOPSIS

The Department of Water and Sanitation is proposing to rehabilitate the outlet area of the Rietspruit Dam, which is located on the farms Vlakfontein IP 213 and Klipplaatdrift 214, near Ventersdorp in the North-West Province.

The main purpose of the rehabilitation is to increase safety measures at the outlet wall in terms of the Dam Safety Regulations, under the 1998 National Water Act. Construction activities are envisaged to take place in an area of approximately 5 ha in size on a portion of Vlakfontein IP 213 and will entail (*inter* alia) the following activities:

- Infilling and deposition of approximately 10 000 m³ of borrow material to stabilise the downstream face of the dam embankment;
- Approximately 100 m³ of silt to be dredged from the reservoir in order to open the river outlet valve's inlet;
- Widening the cross section footprint of the dam by 3.5 to 7 m along the length of the dam wall. The total increase in the footprint of the dam will be approximately 4 000 m².
- The footprint of the earth dam embankment will be increased by approximately 6 m in width, but the length will be unaltered; and
- Infill material will be sourced commercially from Witpoort Sand & Stone Quarry, which is approximately 18.5 km southeast from the Rietspruit Dam.

Towards this objective, The Department of Water and Sanitation has appointed Royal HaskoningDHV as the Environmental Assessment Practitioner (EAP) for the project to assist with the authorisation process. BEC has been appointed to conduct the biodiversity basic assessment report in order to advise the project as to biological and environmental sensitivities surrounding the proposed project. The major aim of this document is to elaborate on the perceived sensitivity of the receiving environment based on a brief site investigation and results of a desktop assessment of available information, informing the project with regards to potential fatal flaws, opportunities and constraints.

XIV EXECUTIVE SUMMARY

The Department of Water and Sanitation is proposing to rehabilitate the outlet area of the Rietspruit Dam, which is located on the farms Vlakfontein IP 213 and Klipplaatdrift 214, near Ventersdorp in the North-West Province. The main purpose of the rehabilitation is to increase safety measures at the outlet wall in terms of the Dam Safety Regulations, under the 1998 National Water Act. Construction activities are envisaged to take place in an area of approximately 5 ha in size on a portion of Vlakfontein IP 213.

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The NWPBCA indicates that the proposed project site is situated within a CBA Category 2 area, comprising of conservation important Vaal-Vet Sandy Grassland (Endangered). Category 2 areas include parts of 'Near-natural landscapes' where:

- Ecosystems and species largely intact and undisturbed;
- Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets; and
- These are landscapes that are approaching but have not passed their limits of acceptable change.

Ideally, these parts of the landscape need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. For CBAs the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat).. Fortunately, due to the small size of the proposed project, it is unlikely that natural habitat will be lost or adversely affected.

Floristic Environment

Mucina and Rutherford (2006) characterise the ecological type as the Vaal-Vet Sandy Grassland. Nationally, the conservation status is regarded as Endangered, implying an ecosystem that has undergone significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems.

Information obtained from the SANBI database indicates the known presence of only 110 plant species within the ¼-degree grid that is sympatric to the study area (2626BD). This low total of known sampling records reflects a paucity of floristic knowledge of the region; grasslands are generally known to exhibit a diverse and high diversity of plant species. The SANBI infobase for the 2626BD ¼-degree grid indicate the known presence of only one (1) species of conservation concern within the immediate region, namely *Cleome conrathii* (Near threatened). The presence of the Declining geophyte *Crinum bulbispermum* was recorded within the proposed rehabilitation area, more specifically at the interface of the wall and the dam. The timely removal of all individuals and relocation to the nearby wetland habitat downstream of the Rietspruit Dam is advised. It should be noted that the removal and relocation of protected plants are

subjected to permitting requirements. Taking cognisance of habitat types and status, the likelihood of plants of conservation concern persisting in the immediate vicinity cannot be excluded at this stage of the process.

A species richness of 86 plant taxa was recorded during the field investigations. This recorded species diversity is regarded representative of the regional ecological types that is spatially represented in the study area. The grassland physiognomy (within areas of natural/ habitat) of the region is reflected by a well-developed and diverse herbaceous layer, comprising of 27 forbs (31.4 %) and 14 grass species (16.3 %). Growth forms such as dwarf shrubs, prostrate herbs and succulent species contribute to the herbaceous layer of the vegetation. Although the wetlands of the study area are likely to be more diverse as indicated in this report, the five (5) sedge species (5.8 %) and 4 hydrophilic species (4.7 %) recorded in the site, indicates that most of the wetlands comprises relatively natural habitat. The absence of a diverse shrub or tree component (other than exotic species) reflects the grassland physiognomy. The locally dominant shrub layer indicates a moderate deteriorated state of the grassland because of inappropriate grazing regimes.

Due to the presence of ecologically sensitive habitat within the immediate vicinity of the proposed rehabilitation area, surrounding areas were also briefly assessed and included in the delineation process and subsequent discussions. A brief evaluation of aerial imagery revealed the presence of the following macro-habitat types within the project area and immediate surrounds:

- Aquatic habitat type (Rietspruit Dam) (medium-high floristic sensitivity);
- Deteriorated Grassland (medium floristic sensitivity);
- Floodplain & Drainage Channel Wetland Types (medium-high floristic sensitivity);
- *Imperata cylindrica* grassland (high floristic sensitivity);
- *Phragmites* reed stands (medium floristic sensitivity); and
- Transformed Habitat & Dam Infrastructure (low floristic sensitivity).

Faunal Environment

This faunal assessment is based on a desktop appraisal of available information gleamed from various sources, as well as basic observations made during a brief site investigation. No detailed or long-term surveys were conducted for the assessment and results should be interpreted with caution. In particular, the account of animals observed on the site, immediate surrounds is not regarded comprehensive, and it is highly likely that a higher diversity of animals will inhabit the site and, particularly, natural habitat of the immediate surrounds.

A brief desktop appraisal provided species lists of the above-mentioned groups for the Q-degree grid 2626BD, including the regional status of each species recorded for these Q-degree grids. Only four invertebrate species have been recorded for 2626BD. Taking cognisance of the know diversity of invertebrates, this indicates a severe paucity of invertebrate knowledge of the region. No red data invertebrates are known to persist within this Q-grid. Recorded individuals include:

- Brown-veined White;
- African Monarch;
- Eyed Pansy; and
- African Grass Blue.

Fourteen herpetofaunal species have been recorded for 2626BD, none of which are currently considered threatened or listed as red data species, including:

- three toads;
- six frogs;
- two snakes;

- one girdled lizard;
- one skink; and
- one agama.

A total of one hundred and seventy-six (176) birds have been recorded in 2626BD, including birds from seventeen orders and fifty-eight families.

Nine mammals have recorded in 2626BD, including:

- one primate;
- three rodents;
- one hare;
- one shrew; and
- three carnivores.

The close relationship between vegetation units and specific faunal composition has been noted in several scientific studies. Broadly speaking, vegetation macro-habitats are representative of faunal habitat diversity for a given area; the preliminary macro-habitats described in this document are therefore regarded ecologically distinctive and descriptive of the faunal habitat diversity of the study area. Faunal habitats of varying levels of sensitivity were recorded in within the rehabilitation site and the immediate surrounds, namely:

- Transformed Faunal Habitat (low faunal sensitivity);
- Degraded Faunal Habitat (medium-low faunal sensitivity); and
- Natural Faunal Habitat (high faunal sensitivity).

The presence of the conservation important Grass-owl in habitat situated directly adjacent to the rehabilitation site is regarded the most important consideration for construction activities. Unmitigated and uncontrolled activities are likely to result in unacceptable, severe and permanent impacts on this sensitive receptor and the implementation of all mitigation and monitoring recommendations is strongly advised.

Basic Impact Assessment

Results of the basic impact assessment indicated a low and acceptable significance of impacts on biological attributes of the rehabilitation site. The implementation of generic mitigation strategies is regarded sufficient in controlling and preventing significant impacts within the rehabilitation area.

However, the basic impacts assessment revealed a high significance of impacts associated with construction and rehabilitation activities in floristically and faunal sensitive areas and receptors situated directly adjacent to the rehabilitation site. In order to prevent significant impacts, the implementation of site-specific and severe mitigation measures is strongly recommended. Should all recommended mitigation and monitoring recommendations be implemented on a dedicated and timely manner, the potential for significant impacts can be reduced to acceptable levels.

Concluding Remarks

On a local scale, agriculture accounts for the largest extent of habitat loss. In spite of a paucity of accurate biological data on a local and regional scale, a moderate sensitivity level is indicated to the region, implying the likely presence of biological attributes of special conservation concern. Due to the small size of the proposed rehabilitation activity, no additional habitat losses are expected provided the effective and timely implementation of all recommended mitigation measures.

All construction and rehabilitation activities should be guided by a comprehensive EMPr that takes cognisance of mitigation measures and recommendations presented in this report. The guidance and implementation of mitigation measures should be the responsibility with a well-versed Environmental Control Officer, in collaboration with recommendations compiled by a periodic biodiversity monitoring protocol. In particular, the implementation of a Grass-owl monitoring protocol and a potential conservation collaboration with landowners is strongly recommended.

It is the conclusion of this report that, with the successful and timely implementation of recommended, and other generic, mitigation measures, the proposed rehabilitation project of the Rietspruit Dam containment wall is unlikely to result in significant and permanent impacts on sensitive biodiversity receptors of the rehabilitation area and the immediate surrounds. Disruption of ecological processes is likely to be of short duration, and subsequently recovering to a normal status.

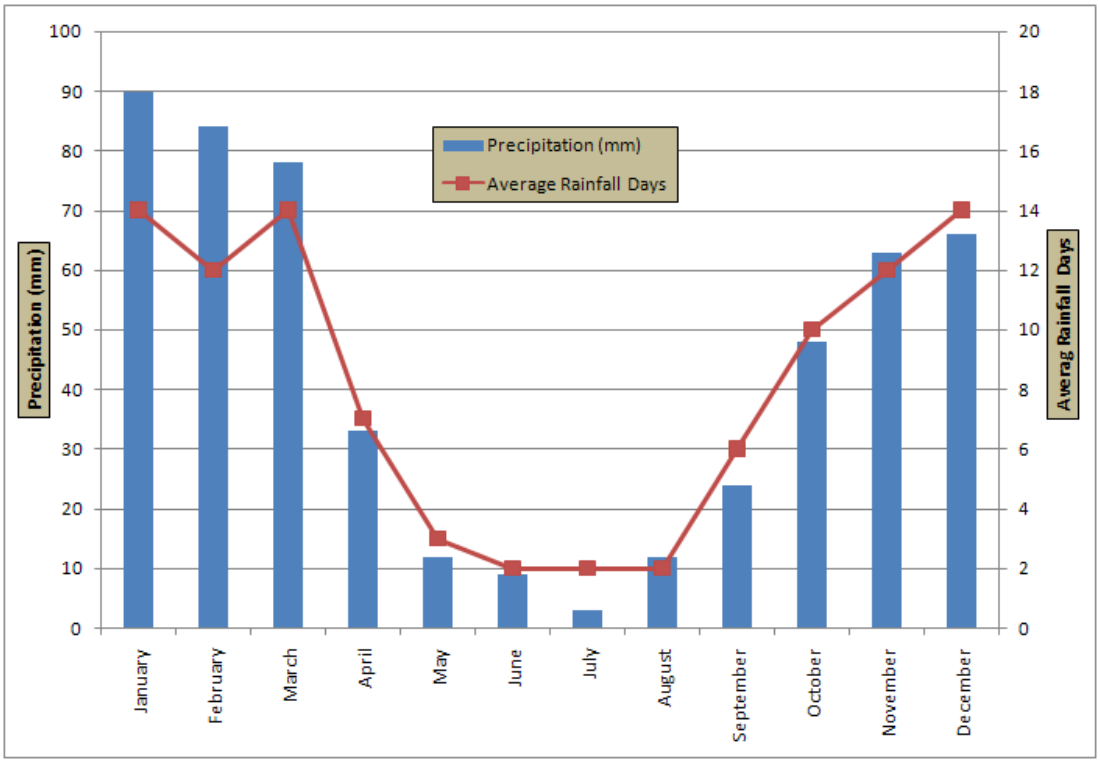
SECTION B – BIOPHYSICAL ATTRIBUTES OF THE RECIEVING ENVIRONMENT

1 LOCATION & PROJECT LAYOUT

The proposed Rietspruit Dam Rehabilitation Project is aimed at increasing safety measures along the outlet area of the Rietspruit Dam, which is situated on a portion of the farm Vlakfontein IP 213, geographically situated approximately 10.6 km south-southwest from Ventersdorp, in the North-West. The regional location of the site alternatives is illustrated in **Figure 1**. A composite Google Earth image of the region is presented in **Figure 2**.

2 REGIONAL CLIMATIC BACKGROUND

Ventersdorp normally receive an average of 522 mm of rain per year between 2000 and 2012, with most rainfall occurring mainly during midsummer. **Graph 1** indicates the average rainfall values for Ventersdorp per month. It receives the lowest rainfall (3 mm) in July and the highest (90 mm) in January. The monthly distribution of average daily maximum temperatures (refer **Graph 2**) indicates the average midday temperatures for Ventersdorp range from 17°C in June to 29°C in January. The region is the coldest during June when the mercury drops to 1°C on average during the night.



Graph 1: Rainfall data (averages) for Ventersdorp, North-West Province (2000 – 2012)

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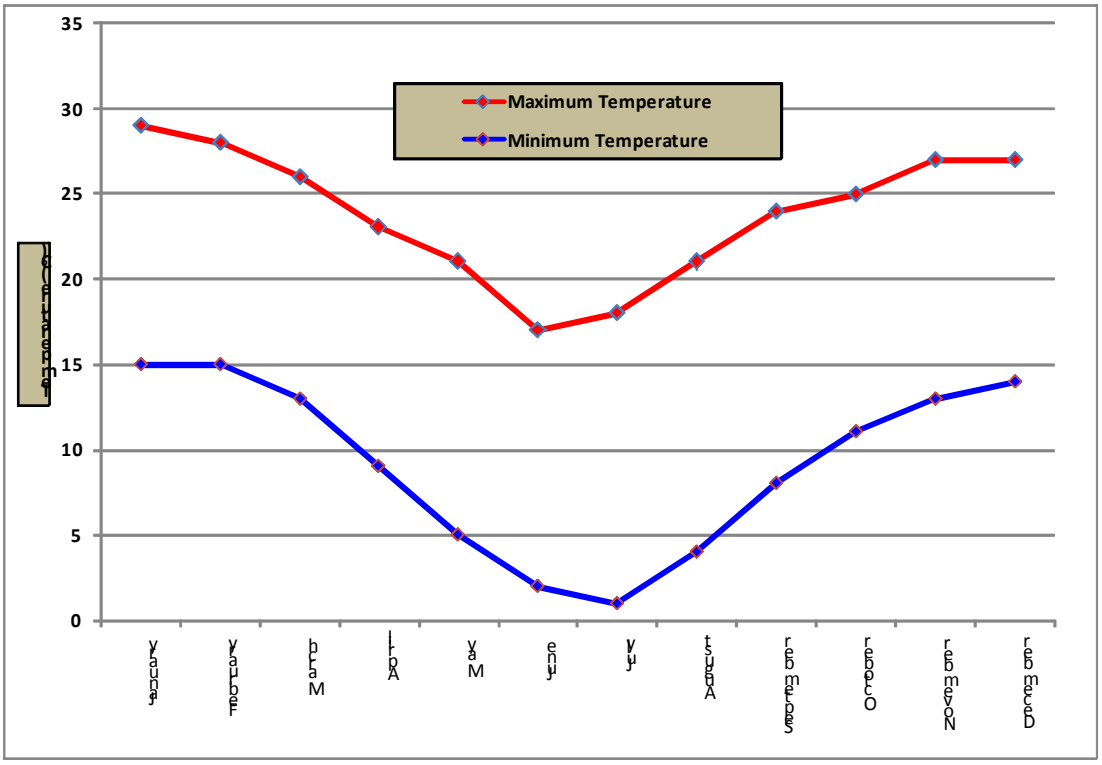


Graph 2: Temperature data (averages) for Ventersdorp, North-West Province (2000 – 2012)

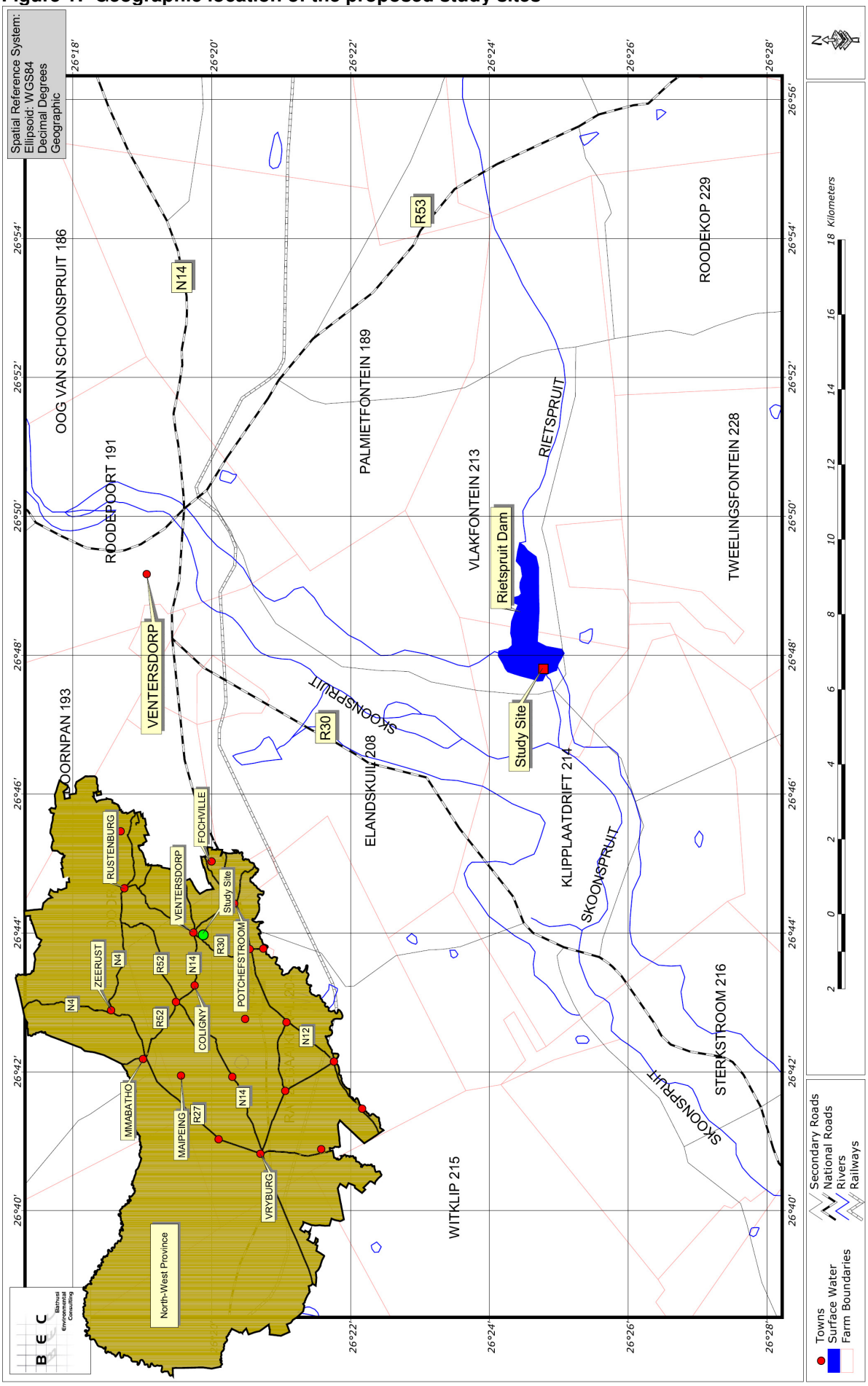
3 LAND COVER & LAND USE OF THE REGION

Land use often determines land cover; it is an important factor contributing to the condition of the land. Different uses have varying effects on the integrity of the land. Land cover categories of the general region are illustrated in **Figure 3**. For the purpose of this assessment, land cover are loosely categorized into classes that represent natural habitat and land cover categories that originated from habitat degradation and transformation on a local or regional scale. Areas that are characterized by high levels of transformation and habitat degradation are generally more suitable for development purposes as it is unlikely that biodiversity attributes of conservation importance will be present or affected by development. Conversely, areas that are characterized by extensive untransformed and pristine habitat are generally not regarded suitable options for development purposes.

The character of the general region is typified by significant recent developments. The result is nodal type developments dispersing from a central area. Historically the larger region was characterized by natural woodland and savanna habitat with extremely limited transformation levels. Land use in the region varies between game farming and cattle farming that utilized the natural savanna habitat. Extremely little arable agriculture is practiced, mainly because of relative low rainfall and poor soils that predominate in the region. Recent mining developments and associated infrastructure developments such as power stations, a more defined and intricate road infrastructure, housing, residential developments and a significant expansion of Lephalale, resulted in large-scale transformation of natural habitat of the region.

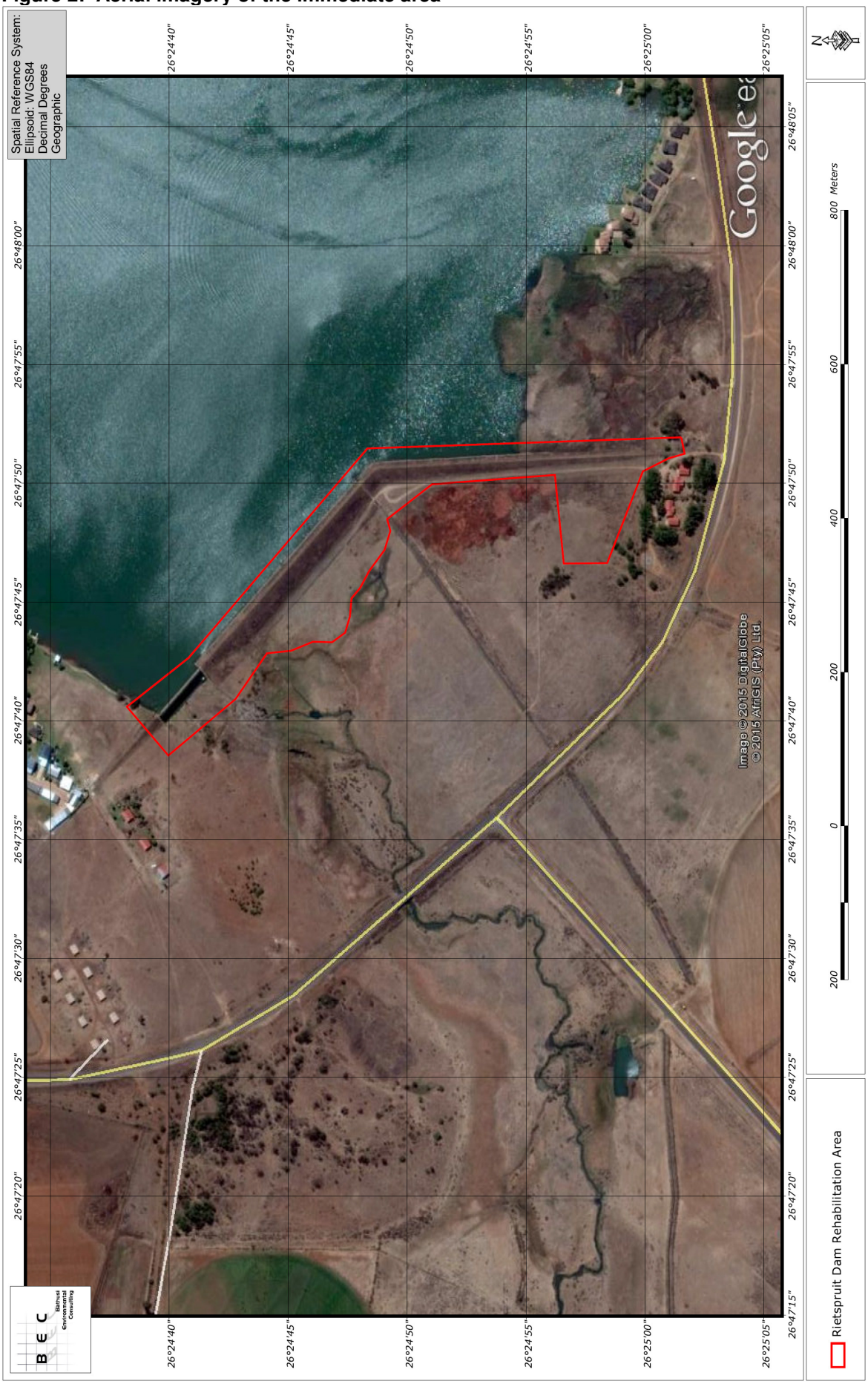
Ventersdorp Local Municipality is situated within the Kenneth Kaunda District Municipality and comprises 376 405 ha, of which 246 385 ha is currently untransformed (65.5 % of the municipality) (BGIS, 2007). A brief appraisal of available ENPAT data indicates that the major anthropogenic transformation activity in the immediate region of the study site is commercial agriculture. Remaining areas within the surrounds comprises of grasslands where intensive grazing cattle grazing is practiced (refer **Figure 3**).

Figure 1: Geographic location of the proposed study sites



Section B

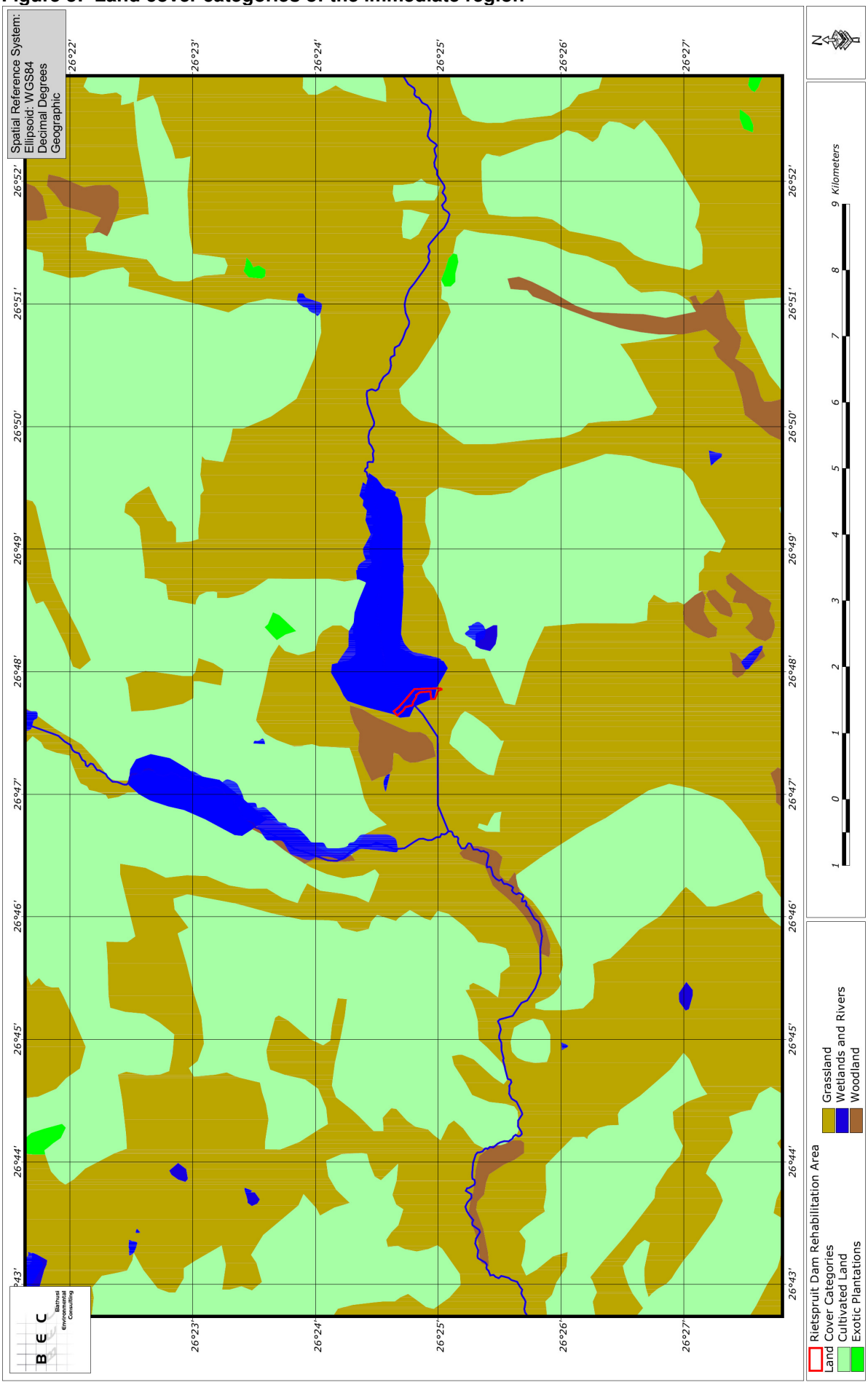
Figure 2: Aerial imagery of the immediate area



Imagery courtesy of www.googleearth.com

Section B

Figure 3: Land cover categories of the immediate region



Section B

4 DECLARED AREAS OF CONSERVATION

Three following reserves are situated within geographic proximity of the study site:

- Schoonspruit Nature Reserve – Nature Reserve (10 km north).
- Boskop Dam Nature Reserve – Nature Reserve (28 km southeast);
- Abe Bailey Provincial Nature Reserve – Provincial Nature Reserve (47 km north); and
- Lichtenburg Game Breeding Centre (70 km northwest)

None of these conservation areas is likely to be affected, either directly or indirectly, by the proposed rehabilitation project. **Figure 4** illustrates the spatial location of the study site in relation to conservation areas within the immediate surrounds.

5 LAND TYPES & SOILS

Although it is not in the scope of this report to present a detailed description of the soil types of the area, a basic description will suffice for this assessment as the association of habitat types and land types (soils) are typical of savanna vegetation. The rehabilitation site is situated within the Ba42 land type unit (refer **Figure 4**). The B- group includes a large area of the South African interior that is occupied by a catena, which in its perfect form is represented by (in order from highest to lowest in the upland landscape) Hutton, Bainsvlei, Avalon and Longlands forms. The valley bottoms are occupied by one or other gley soil. Soils with hard plinthite are common over sandstones in the moist climate zones in the eastern part of the country. Depending on the extent to which water tables have been operative over a landscape, Longlands, Avalon and related grey and yellow soils may predominate, even to the exclusion of red soils. Where water tables have not extended beyond the valley bottoms, red soils may predominate with plinthic soils restricted to narrow strips of land around valley bottoms or pans (Land Type Survey Staff, 1987).

The Ba land type represents a plinthic catena, indicating that the soils found in these land types are dependent on the oxidation state of Fe. Thus, red apedal soils will transition to yellow apedal soils as one move lower in the landscape. Ba42 is further described as dystrophic indicating that the elements mentioned have been leached to less than 5 $cmol.kg^{-1}$ clay (SIR, 1986., Soil-classification workgroup, 1991).

Figure 4: Protected areas in the geographic proximity to the site

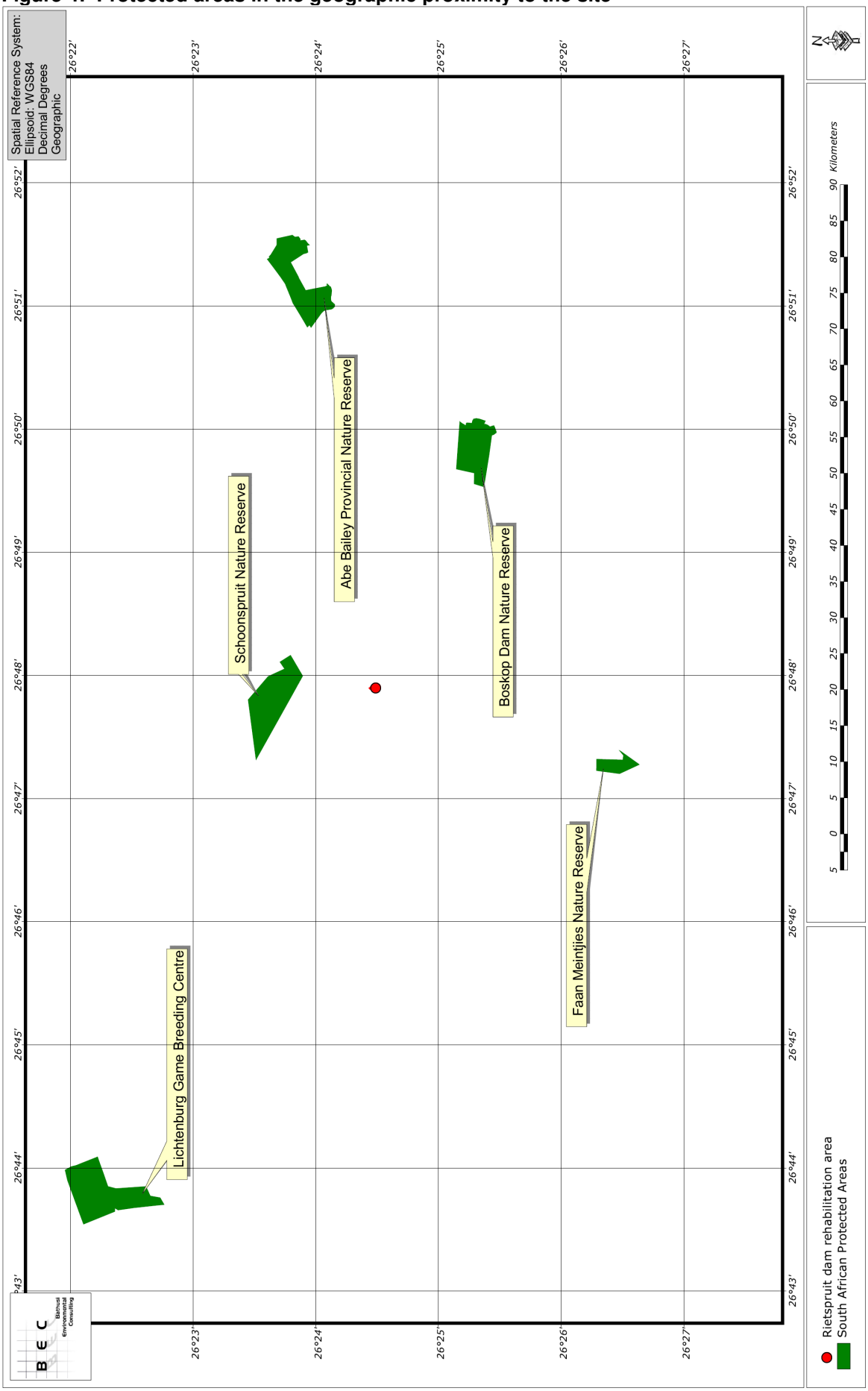
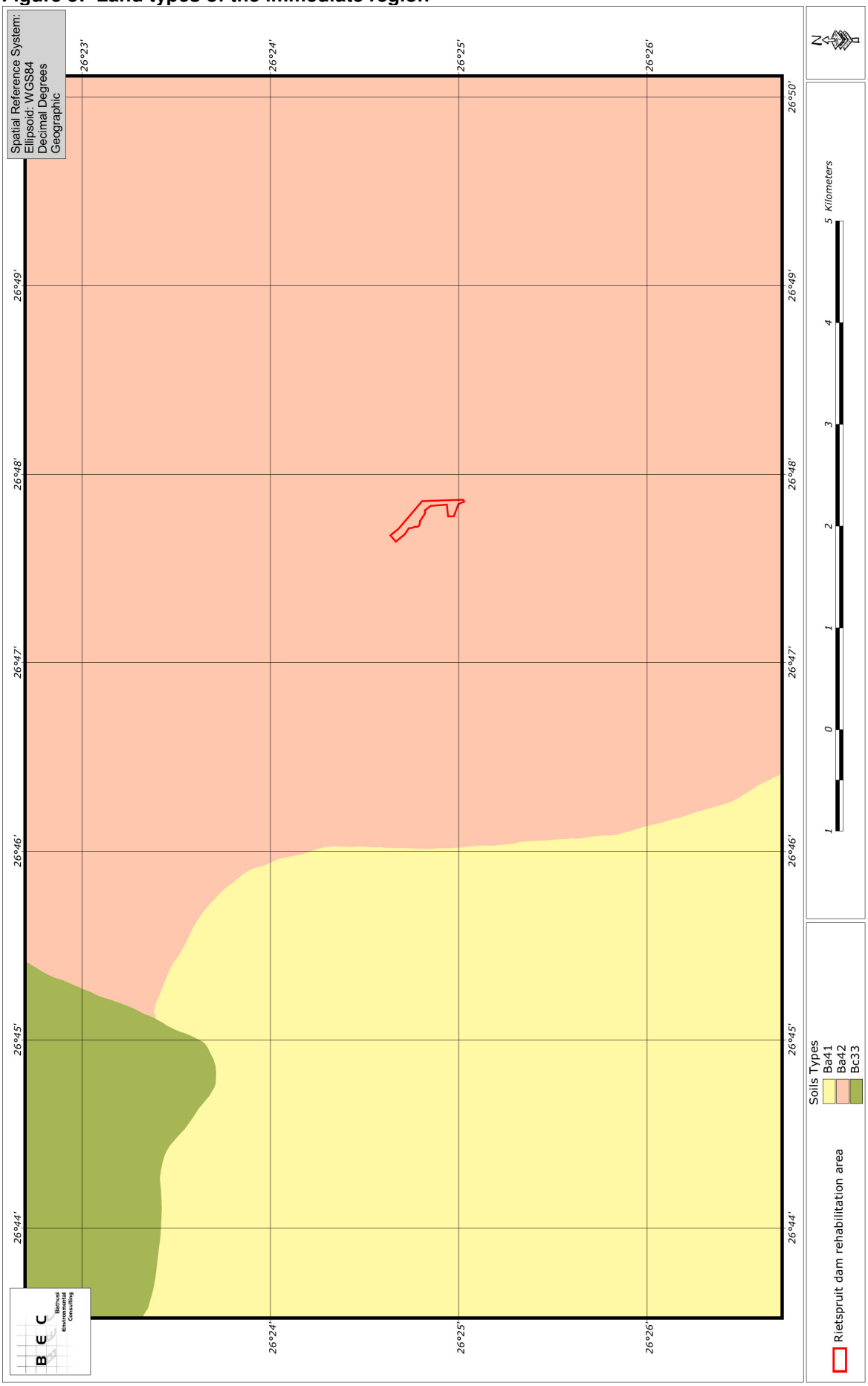


Figure 5: Land types of the immediate region



Section B

6 SURFACE WATER[1]

Water, salt and processes linked to concentration of both are the major controls of the creation, maintenance and development of peculiar habitats. Habitats formed in and around flowing and stagnant freshwater bodies, experiences waterlogging (seasonal or permanent) and flooding (regular, irregular or catastrophic), leading to formation of special soil forms. Invariably, both waterlogged and salt-laden habitats appear as 'special', deviating strongly from the typical surrounding zonal vegetation. They are considered to be of azonal character (Mucina & Rutherford, 2006). Water, in conjunction with geology, soil, topography and climate, is responsible for the creation of remarkably many types of habitats. Water chemistry, temperature and temporary changes in both, together with the amount of water (depth of water column), timing of occurrence (regular tides or irregular floods) and speed of its movement (discharge, flow and stagnation) are the major factors shaping the ecology of biotic communities occupying such habitats (Mucina & Rutherford, 2006).

Areas of surface water contribute significantly towards the local and regional biodiversity due to atypical habitat that is present within ecotonal areas. Ecotones (areas or zones of transition between different habitat types) are occupied by species occurring in both the bordering habitats, and are generally rich in species due to the confluence of habitats. In addition to daily visitors that utilize the water sources on a frequent basis, some flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas, exhibiting extremely low tolerance levels towards habitat variation. Ecotonal interface areas form narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering the high species richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds.

The site is situated within the Vaal Catchment area. The Rietspruit Dam is situated within the Rietspruit, which eventually feeds into the Skoonspruit, which is situated approximately 2 km to the west. A typical wetland has been established at the outlet of the dam because of constant water feed within a plains area. This wetland, although somewhat artificial, represents a significant and relatively sensitive area that should be considered during the rehabilitation process. The accurate delineation and mapping of the wetland should be addressed by a wetland specialist.

7 TOPOGRAPHY, RELIEF & SLOPES

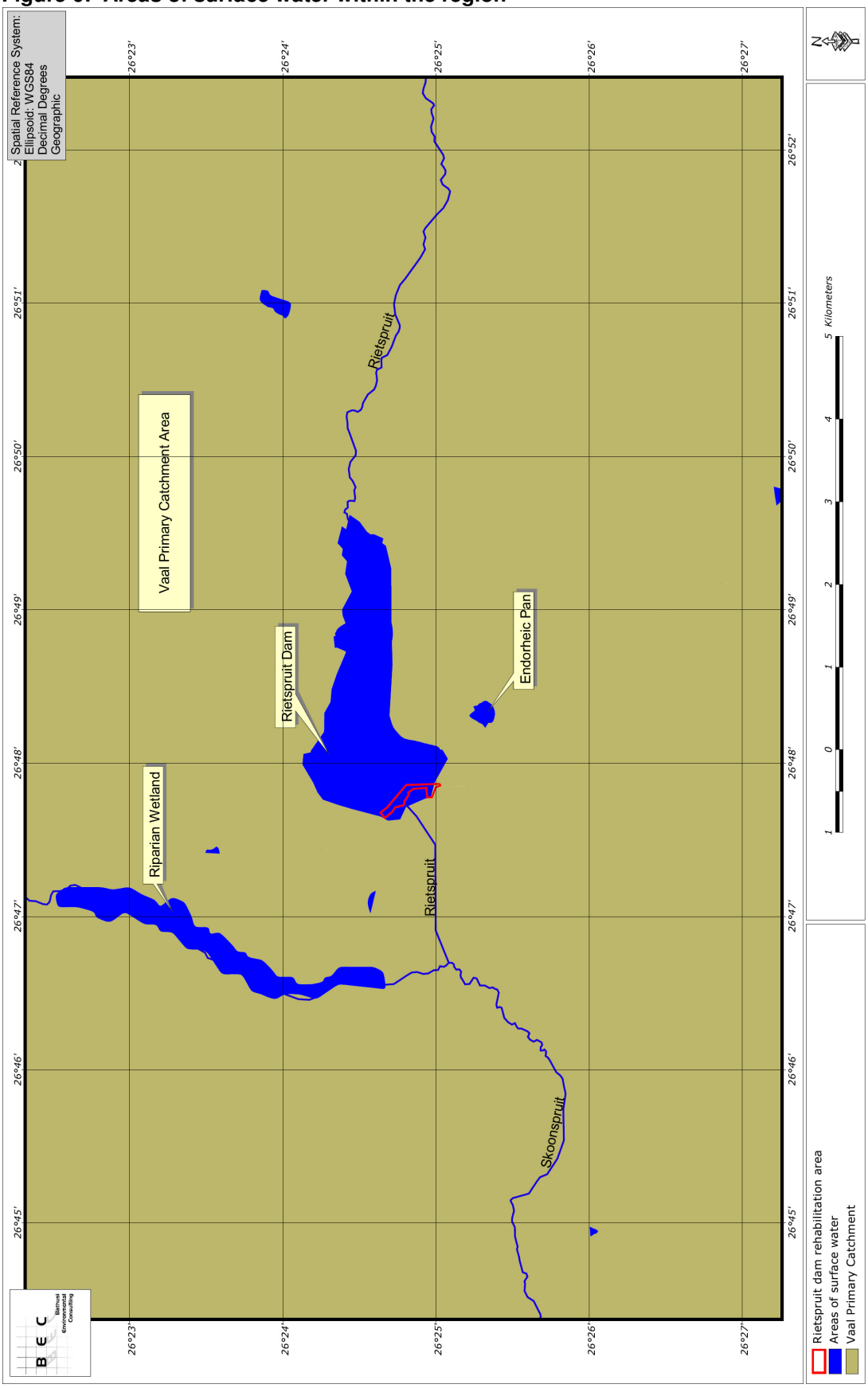
Topographical heterogeneity is recognized as a powerful influence contributing to the high biodiversity of southern Africa. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The species richness and biodiversity has been found to be significantly higher in areas of geomorphological heterogeneity.

Ridges and rocky outcrops are characterized by high spatial variability due to the range of differing aspects, slopes and altitudes all resulting in differing soil (*e.g.* depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. Temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. It follows that ridges will be characterized by a particularly high biodiversity.

[1] Please note that it is not the intention of this report to present a detailed account of the wetland and aquatic habitat types of the area; this is addressed in a separate specialist report. However, certain aspects do related to the biodiversity of the study area and general comments pertaining to this attribute are therefore included in this report.

The project area is situated approximately 1 400 m above sea level. Topography of the region is described as 'Slightly irregular undulating plains and hills'. No topographically distinct features were recorded on the site; slopes are generally less than 9 %.

Figure 6: Areas of surface water within the region



8 GEOLOGY

The rehabilitation site is situated within the Hospital Hill Shales (refer **Figure 7**), which comprises of interbedded quartzites and shales.

9 REGIONAL CONSERVATION PLANNING

The North West Province Biodiversity Conservation Assessment (Version 1.2) (Desmet, et. al., 2009) (NWPBCA) provides for a strategic categorisation of biodiversity attributes of the province, based on a conservation assessment of the North West Province. This assessment is used to inform the development of the Provincial Biodiversity Sector plans, bioregional plans, and also be used to inform Spatial Development Frameworks (SDFs), Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and in the Environmental Impact Assessment (EIA) process in the province. This report also forms the basis, through mapping of critical biodiversity areas (CBAs), for the development of a biodiversity sector plan document in line with SANBI's guidelines on the development of bioregional plans.

CBA's are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools.

Ecological support areas (ESA's) represent landscape sections that are not essential for meeting biodiversity representation targets/thresholds, but which play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

Figure 8 provides an illustration of the spatial representation of CBA's within the immediate region of the rehabilitation project area. The NWPBCA indicates that the proposed project site is situated within a CBA Category 2 area, comprising of conservation important Vaal-Vet Sandy Grassland (Endangered). Category 2 areas include parts of 'Near-natural landscapes' where:

- Ecosystems and species largely intact and undisturbed;
- Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets; and
- These are landscapes that are approaching but have not passed their limits of acceptable change.

Ideally, these parts of the landscape need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. For CBAs the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat).. Fortunately, due to the small size of the proposed project, it is unlikely that natural habitat will be lost or adversely affected.

Figure 7: Geological patterns of the general region

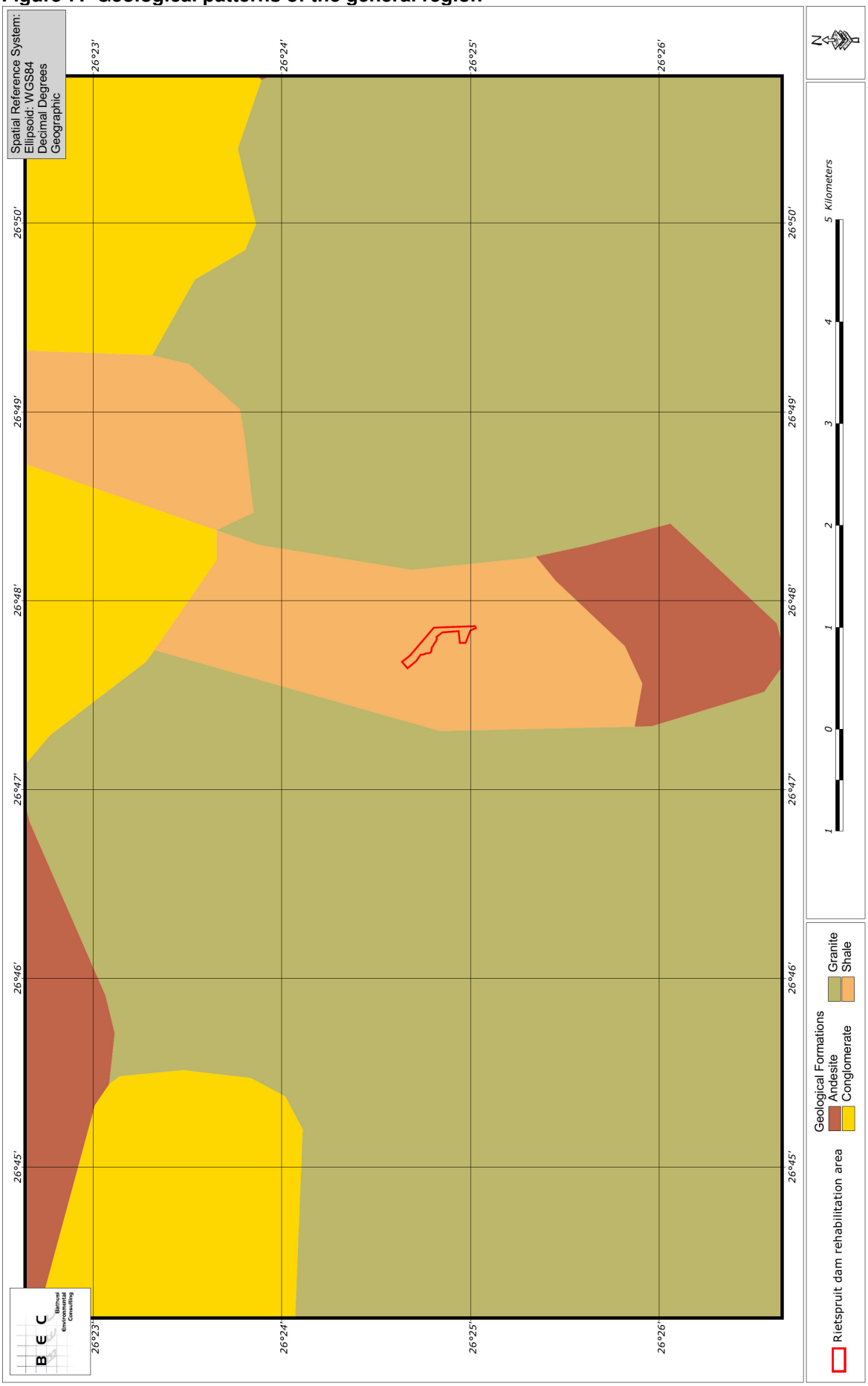
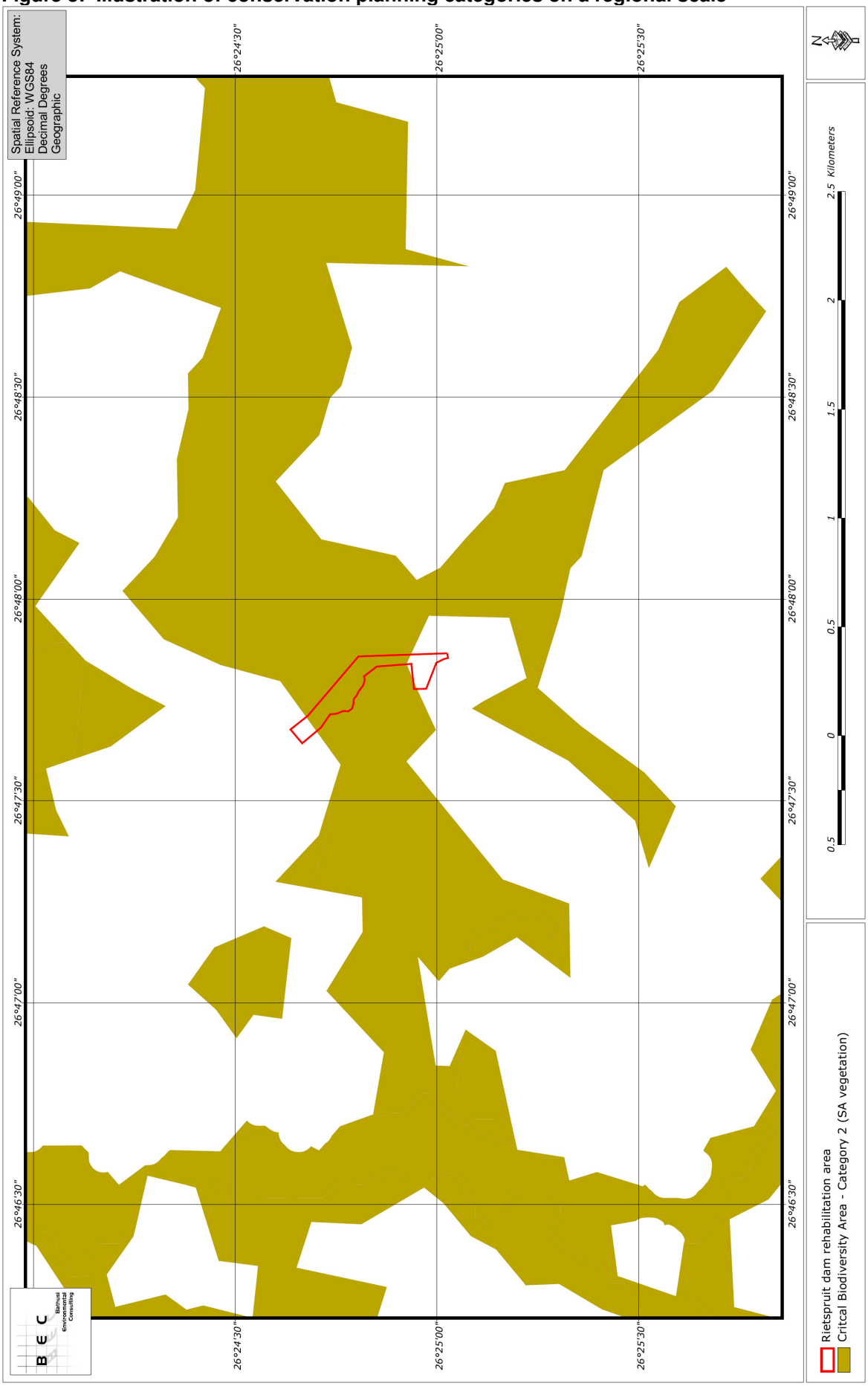


Figure 8: Illustration of conservation planning categories on a regional scale



10 BACKGROUND TO THE GRASSLAND ECOLOGY

Grassland defines itself: landscapes dominated by grass. Although grasses are the most visible plants, grasslands have a higher diversity than other herbaceous species, especially those with belowground storage organs such as bulbs or tubers. These plants produce many of our spectacular wild flowers and contribute to biodiversity that is second only to the Cape Fynbos in species richness. Grassland species are particularly well adapted to being defoliated, whether by grazing, fire or frost. Repeated defoliation, within reason, does no real harm to such plants nor does it reduce productivity.

African grasslands are particularly old, stable and resilient ecosystems. Most plants are perennials and surprisingly long lived, with very few annual species, which are the pioneer plants needed to repair disturbances. This renders grasslands vulnerable to destruction by cultivation; once ploughed it is invaded by weedy pioneer plants that are mostly alien. Although many grassland plants do produce seed, very little germinates, most being used as vital food for their rich rodent, insect and bird fauna. North West Province grasslands are mainly found in the highveld above 1 300 m. These are cool, dry open landscapes, with rainfall of approximately 500 $mm.yr^{-1}$. Frost, hailstorms and lightning strikes are however common during periodic raining events. The natural occurrence of fire and other defoliating events favour grassland plants over woody species, helping to maintain the open treeless character of grasslands. Grasslands have shallow-rooted vegetation with a growing season limited to about six months of the year. The non-growing seasons are characterised by cool and dry conditions, during which time most foliage is removed or killed by frost, and dies back to ground level.

Grasslands originally covered approximately a third of North West Province, but much of this has been transformed by agriculture and other development as large parts of these grasslands occur on deep fertile soils of high agricultural value. The unproductive winter and spring seasons in grassland require agricultural strategies for livestock and cultivation that bridge this gap in economic productivity. This substantial and irreversible reduction of the biome is due mainly to cultivation, especially industrial scale agriculture and timber growing. These land uses destroy biodiversity but extensive livestock grazing can be reasonably biodiversity-friendly, provided good management and safe stocking rates are applied.

The palatability of grass and its value as food for livestock increases with decreasing rainfall, which is also correlated with altitude, also extending from grassland into savannas. Although sweetveld grasses produce less biomass than sourveld grasses, they have higher food value and lower fibre. This means the plant nutrients are more available in lower rainfall areas due to less leaching of the soil by high rainfall. The 650 mm rainfall isoline approximately separates these two livestock zones. Fire is a characteristic feature of grassland (and savannas) and is a necessary component of good land management. Grassland plants depend on fire, they resprout annually from their rootstocks.

Without frequent fire, grasslands eventually become invaded with woody species and some herbaceous plants die. Regular burning to complement good grazing management helps to prevent the increase of species unpalatable to livestock, including woody species that result in bush encroachment. The large number of conservation important species in grasslands is a particular problem for environmental impact assessments. They are mostly small, very localised and visible for only a few weeks in the year when they flower. Most surveys will not pick them up and special skills are required to locate and identify them reliably.

11 REGIONAL FLORISTIC CHARACTERISATION

The study site is spatially situated in the Dry Highveld Grassland Bioregion that is situated on the extensive central plateau of South Africa. The topography is flat to undulating, occasionally broken by small mountains, typically found in the Free State, or incised river valleys, such as the Orange, Vaal and Olifants Rivers. The major environmental factor controlling vegetation patterns and the recognition of different vegetation types is annual rainfall, which forms an east to west gradient of decreasing moisture across the Highveld. Dry Highveld Grassland prevails in the western regions of the Grassland Biome where the mean annual precipitation (MAP) is below 600 mm per annum; these grasslands therefore fall into the 'sweet' grassland type with a predominance of chloridoid grasses.

Mucina and Rutherford (2006) characterise the ecological type as the Vaal-Vet Sandy Grassland (Mucina & Rutherford, 2006) (refer **Figure 9**). This type is situated in the North-West and Free State Provinces, south of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, Bothaville and to the Brandfort area north of Bloemfontein. The topography is a plains-dominated landscape with some scattered, slightly irregular undulating plains and hills. Vegetation is mainly low-tussock grasslands with an abundant karroid element. The dominance of *Themeda triandra* is an important feature of this vegetation unit. Locally low cover of *T triandra* is associated with an increase in *Elionurus muticus, Cymbopogon pospischilii* and *Aristida congesta*, frequently attributed to heavy grazing and/or erratic rainfall. Nationally, the conservation status is regarded as Endangered, implying an ecosystem that has undergone significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems. Only 0.3 % of this ecological type is statutorily conserved in the Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolwespruit and Soetdoring Nature Reserves. More than 63 % is currently transformed for cultivation (ploughed for commercial crops) and the rest under strong grazing pressure from cattle and sheep. The endemic species *Lessertia phillipsiana* is known to persist in this vegetation type.

Important taxa include the following:

- **Graminoids -** *Anthephora pubescens*, *Aristida congesta*, *Chloris virgata*, *Cymbopogon caesius*, *C. pospischilii, Cynodon dactylon*, *Digitaria argyrograpta*, *D. eriantha, Elionurus muticus*, *Eragrostis chloromelas*, *E. lehmanniana*, *E. plana*, *E. trichophora*, *E. curvula, E. obtusa, E. superba, Heteropogon contortus*, *Panicum coloratum, P. gilvum*, *Setaria sphacelata*, *Themeda triandra*, *Tragus berteronianus*, *Brachiaria serrata, Pogonarthria squarrosa, Trichoneura grandiglumis* and *Triraphis andropogonoides.*
- **Herbs -** *Stachys spathulata*, *Barleria macrostegia, Berkheya onopordifolia* var. *onopordifolia, Chamaesyce inaequilatera, Geigeria aspera* var. *aspera, Helichrysum caespititium, Hermannia depressa, Hibiscus pusillus, Monsonia burkeana, Rhynchosia adenodes, Selago densiflora* and*, Hilliardiella oligocephala.*
- **Geophytic Herbs -** *Bulbine narcissifolia* and *Ledebouria marginata.*
- **Succulent Herb -** *Tripteris aghillana* var. *integrifolia*
- **Low Shrubs -** *Felicia muricata*, *Pentzia globosa*, *Anthospermum rigidum* subsp. *pumilum, Helichrysum dregeanum, H. paronychioides* and *Ziziphus zeyheriana.*

Figure 9: Illustration of regional vegetation context of the study site

Section C

12 PHYTODIVERSITY – REGIONAL CONTEXT

Information obtained from the SANBI database indicates the known presence of only 110 plant species within the ¼-degree grid that is sympatric to the study area (2626BD) (Appendix 1). This low total of known sampling records reflects a paucity of floristic knowledge of the region; grasslands are generally known to exhibit a diverse and high diversity of plant species. A basic appraisal of available floristic sampling records (refer **Table 2**) indicates the structural prominence of the woody component of the vegetation; trees (25 species, 7.5 %) and shrubs (31 species, 9.3 %). The compositional dominance of the herbaceous layer is typical of the regional flora, comprising of 115 herb species (34.5 %), dwarf shrubs (13.5 %), 42 grass species (12.6 %) and 16 succulent species (4.8 %).

Table 2: Growth form analysis of available floristic sampling records

Growth Form	*Account*	*Percentage*
Climbers	2	1.8 %
Creepers	1	0.9 %
Cyperoids (Sedges)	4	3.6 %
Dwarf shrubs	8	7.3 %
Geophytes (Bulbous)	10	9.1 %
Graminoids (Grasses)	20	18.2 %
Herbs	45	40.9 %
Parasites	4	3.6 %
Shrubs	5	4.5 %
Succulents	9	8.2 %
Trees	2	1.8 %
Total	**110**	

13 PLANTS OF CONSERVATION CONCERN

South Africa's Red List system is based on the IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001), amended to include additional categories to indicate species that are of local conservation concern (refer **Figure 7**). The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). The SANBI infobase for the 2626BD ¼-degree grid indicate the known presence of only one (1) species of conservation concern within the immediate region, namely *Cleome conrathii* (Near threatened). Similar to the regional phytodiversity, this low number reflects the paucity of floristic knowledge, rather than the true absence of plant taxa of conservation concern from the area. It is highly likely that, with a more detailed assessment of the region, numerous plants of conservation concern will be recorded.

Taking cognisance of habitat types and status, the likelihood of plants of conservation concern persisting in the immediate vicinity is cannot be excluded at this stage of the process.

The presence of the Declining[2] geophyte *Crinum bulbispermum* was recorded within the proposed rehabilitation area, more specifically at the interface of the wall and the dam. *Crinum* species are threatened by harvesting for the medicinal plant trade. The different species in this genus is difficult identify accurately, particularly for laymen and also without flowering material, and the users and market traders do not accurately distinguish between the species, hence they are all at risk of over-exploitation. The species most

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

commonly found in the markets are *Crinum bulbispermum, C. stuhlmannii, C. macowanii* and *C. moorei;* the latter species being the most vulnerable due to its smaller distribution and possibly the most distinctive because of the neck that forms a false stem (Verdoorn, 1973).

The bulbs are usually very large (usually > 10 cm diameter) and heavy, and are sold in moderate quantities throughout the market. Not much known specifically about the prevalence of *Crinum bulbispermum* in the market. It tends to occur in large colonies and a large proportion of the subpopulation would be harvested when found by muthi harvesters. Several people have noticed subpopulations being targeted *e.g.* around Suikerbosrand (L. Mills, pers. comm., 2008); near Winterton (C.R. Scott-Shaw, pers. comm., 2008) and in parts of Mpumalanga (M. Lötter, pers. comm., 2008).

14 RECORDED PHYTODIVERSITY (2015)

It should be noted that the compilation of a comprehensive botanical inventory for the study site was not a principal objective of the assessment.

A species richness of 86 plant taxa were recorded during the field investigations (refer **Appendix 1**). This recorded species diversity is regarded representative of the regional ecological types that is spatially represented in the study area (refer **Section 11**). The presence of various weeds and invasive species within the grassland and, in particular, at the interface of natural habitat and transformed areas, indicates the extensive presence of degraded/ transformed habitat. The grassland physiognomy (within areas of natural/ habitat) of the region is reflected by a well-developed and diverse herbaceous layer (refer **Table 3**), comprising of 27 forbs (31.4 %) and 14 grass species (16.3 %). Growth forms such as dwarf shrubs, prostrate herbs and succulent species contribute to the herbaceous layer of the vegetation. Although the wetlands of the study area are likely to be more diverse as indicated in this report, the five (5) sedge species (5.8 %) and 4 hydrophilic species (4.7 %) recorded in the site, indicates that most of the wetlands comprises relatively natural habitat. The absence of a diverse shrub or tree component (other than exotic species) reflects the grassland physiognomy. The locally dominant shrub layer indicates a moderate deteriorated state of the grassland because of inappropriate grazing regimes.

Table 3: Growth form appraisal of floristic diversity of the study site

Growth Form	*Account*	*Percentage*
Climbers	1	1.2 %
Dwarf shrubs	4	4.7 %
Ferns	1	1.2 %
Forbs	27	31.4 %
Geophytes	5	5.8 %
Grasses	14	16.3 %
Hydrophilics	4	4.7 %
Prostrate herbs	7	8.1 %
Sedges	5	5.8 %
Shrubs	5	5.8 %
Small trees	5	5.8 %
Succulents	4	4.7 %
Trees	4	4.7 %
Climbers	1	1.2 %
Total	**86**	

A brief appraisal of the dominant families recorded on the site indicates the, typically prominent Asteraceae (18 species, 20.9 %) and Poaceae (graminoids) (15 species, 17.4 %).

15 PRELIMINARY MACRO-HABITAT TYPES

Due to the presence of ecologically sensitive habitat within the immediate vicinity of the proposed rehabilitation area, surrounding areas were also briefly assessed and included in the delineation process and subsequent discussions.

A brief evaluation of aerial imagery revealed the presence of the following macro-habitat types within the project area and immediate surrounds (refer **Figure 10**):

- Aquatic habitat type (Rietspruit Dam);
- Deteriorated Grassland;
- Floodplain & Drainage Channel Wetland Types;
- *Imperata cylindrica* grassland;
- *Phragmites* reed stands; and
- Transformed Habitat & Dam Infrastructure.

15.1 Aquatic habitat type (Rietspruit Dam)

The bottom part of the Rietspruit dam, including the physical dam wall comprises of a narrow band of aquatic weeds and vegetation that are frequently inundated during periods of high water levels. While the largest extent of the vegetation comprises of weeds and poor quality species, the Declining geophyte *Crinum bulbispermum* was recorded within this section of the dam. It is therefore emphasised that, should physical habitat disturbances in these parts of the rehabilitation site result, the individuals be relocated to suitable, adjacent habitat within the Ephemeral floodplain habitat below the dam wall.

Typically, a low floristic sensitivity would be ascribed to these parts, as the habitat is artificial and in a deteriorated state. However, because of the presence of a conservation important plant taxon, a medium-high floristic sensitivity is ascribed. The accurate and timely implementation of management recommendations will prevent the exacerbation of expected and likely impacts on plants of conservation concern.

15.2 Deteriorated Grassland

Most of the terrestrial grassland habitat below the dam wall is continuously subjected to incorrect management strategies that include severe grazing pressure as well as inappropriate fire regimes. Resultantly, the herbaceous layer comprises of plant taxa that indicate a deteriorated grassland status, manifesting as poor quality grasses and herbs that proliferate under poor management.

Species typically recorded within this part of the site include the grasses *Aristida* species, *Cymbopogon pospischilii, Eragrostis capensis, E. chloromelas, Hyparrhenia hirta*, and *Themeda triandra.* The low abundance levels of *Themeda triandra* provides further indication of the deteriorated status of these grasslands. Forb species that similarly reflect a deteriorated status include *Berkheya carlinopsis, B. setifera, Lantana rugosa,* as well as the shrubs *Asparagus laricinus, Gomphocarpus fruticosus,* and *Seriphium plumosum.*

Because these terrestrial grasslands are moderately representative of the regionally Endangered Vaal-Vet Sandy Grasslands a medium sensitivity is ascribed, in spite of a poor ecological status. Preservation of

these grassland areas through prevention of physical habitat disturbance is regarded an effective strategy in limiting the potential impact within these parts.

15.3 Floodplain & Drainage Channel Wetland Types

The extensive wetland below the dam wall is a result of continual water within the system. This area is characterised by an extensive floodplain that surrounds the drainage channel, which is presumably the original drainage channel of the Rietspruit. Surrounding floodplain wetlands are characterised by local depressions that forms shallow pools, which are continuously flooded during periods of water releases from the dam.

The vegetation of these parts comprise of an admixture of obligate wetland taxa as well as a measure of terrestrial taxa that proliferates during periods of temporary flooding. Species that tend to dominate within these parts include the weed Cirsium vulgare, various sedges, including *Cyperus marginatus*, *C. rupestris* as well as *Phragmites australis* and *Typha capensis, Ranunculus multifidus, Sium repandum*, and *Ciclospermum leptophyllum*.

This unit provides a significant habitat for a diverse faunal component and appears to be functioning ecologically effective. Although the origin of most of this unit might be slightly artificial, the floristic status seems to be moderately pristine and suitable for a number of plant taxa of conservation concern that are typically associated with this habitat type. Specific mention is made of the Declining Crinum bulbispermum, which was recorded within close proximity of this unit. The apparent absence of this species from the wetland area is likely a result of two explanations; either it was not observed during the field deployment as the entire area was not inspected, or local harvesting by muthi-collectors might account for depleted numbers.

A medium-high floristic sensitivity is ascribed to these parts of the area and any impact within these parts that will result in surface disturbances is regarded significant.

15.4 *Imperata cylindrica* grassland

A significant patch of *Imperata cylindrica* is situated directly adjacent to the existing dam wall. This unit, although situated outside the proposed project area, is regarded significant and extremely sensitive, not as a result of any particular floristic attribute, but due to the suitability for the conservation important Grass Owl (*Tyto capensis*), which was recorded during the field deployment.

The flora of this unit is characterised by a dominant layer of the hydromorphic grass *Imperata cylindrica.* The floristic richness of these parts is low, due to the dominance of *Imperata*, but is also dependent on the severity and frequency of disturbance events, such as fire and grazing applications. The significant presence of the encroacher shrubs *Asparagus laricinus* and *A. suaveolens* provides evidence of the threat that could negatively effect on the ecological functionality of this unit should inappropriate management strategies continue to be applied.

The proximity of this unit to the proposed project area warrants the implementation of significant mitigation measures in order to prevent any adverse impacts within the unit as well as on the sensitive owl species inhabiting the area. Two aspects are mentioned (*inter alia*); timing of construction activities outside the known breeding period of these animals as well as the prevention of any surface impacts that might result in a loss of habitat.

A cursory inspection of the immediate surrounds indicates that this unit presents the only significant *Imperata* stand within a radius of approximately 5 km. While this unit does not comprise of any significant floristic attribute or plant taxa, the unique dominance of the *Imperata* grass creates a floristic environment that is atypical on a local and regional scale as well as known (and confirmed) habitat for conservation important animals. A high floristic sensitivity is therefore ascribed to this unit.

15.5 *Phragmites* reed stands

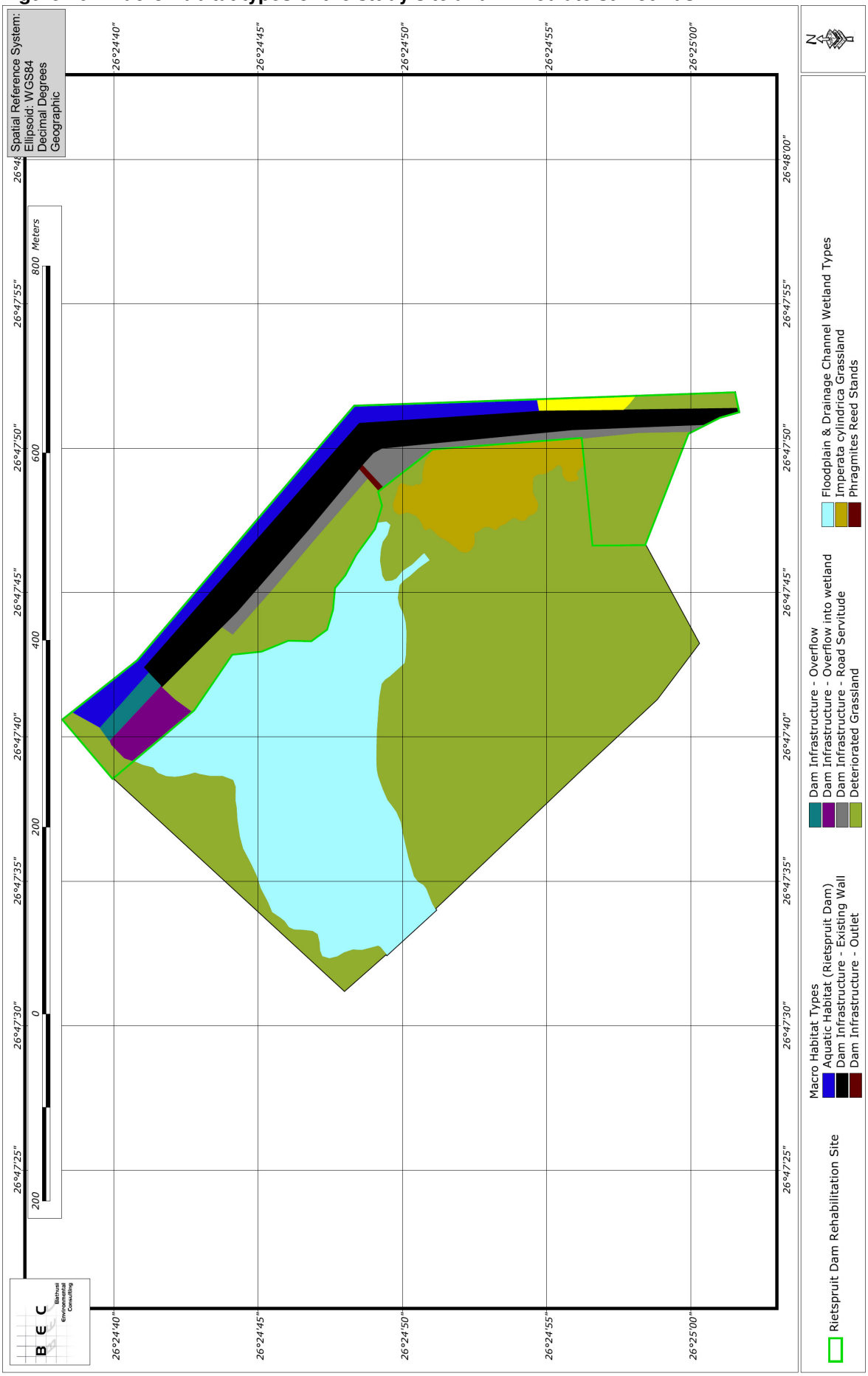
Parts of the Rietspruit Dam situated directly adjacent to the existing dam wall is inhabited by extensive stands of reeds *Phragmites australis*), manifesting as a monoculture of the reeds. While it is not regarded as sensitive, the contribution to faunal diversity is noted. A medium-low floristic sensitivity is ascribed to these parts.

15.6 Transformed Habitat & Dam Infrastructure

The existing dam wall, as well as other infrastructure such as the overflow area, access roads, etc, comprise of vegetation of little floristic value or importance. The artificial nature of these areas further dictates that the likelihood of plant taxa of conservation concern persisting within these parts is regarded low. A low floristic sensitivity is ascribed to these areas.

It should however be noted that, because of the proximity to areas of floristic sensitivity, activities within these areas should be governed with extreme caution in order to prevent any (potential or exacerbated) impacts within adjacent sensitive areas.

Figure 10: Macro-habitat types of the study site and immediate surrounds



Section C

16 FLORISTIC SENSITIVITY

For existing protected areas and species, the floristic importance ascribed to certain areas is obvious. Similarly, many countries will have differentiated the biodiversity importance of their protected areas (national or local) as part of their designation. Outside of protected areas, but within areas that are clearly of value for biodiversity, the evaluation of importance is more complex and vague. It is important to note that the absence of protected status should never be interpreted as low biodiversity importance; many areas of international importance for biodiversity lie outside of protected areas. The challenge is to include a suitable range of criteria to determine whether the site is of local, regional, national or international importance. Although no universal standard exists, some of the common criteria include the following:

- **Species/habitat richness:** In general, the greater the diversity of habitats or species in an area, the more valuable the area is. Habitat diversity within an ecosystem can also be very valuable. Habitat mosaics are extremely valuable, as some species that depend on different types of habitat may live in the transition zone between the habitats.
- **Species endemism:** Endemic species typically occur in areas where populations of a given species have been isolated for sufficiently long to evolve distinctive species-specific characteristics, which prevent out-breeding with other species populations.
- **Keystone species:** A keystone species is one that exerts great influence on an ecosystem relative to its abundance or total biomass. For example, a keystone predator may prevent its prey from overrunning an ecosystem. Other keystone species act as 'ecosystem engineers' and transfer nutrients between ecosystems.
- **Rarity:** The concept of rarity can apply to ecosystems and habitats as well as to species. Rarity is regarded as a measure of susceptibility to extinction, and the concept is expressed in a variety of terms such as vulnerable, rare, threatened or endangered.
- **Size of the habitat:** The size of a natural area is generally considered as important. It must be big enough to be viable, which relates to the resistance of ecosystems and habitats to activities at the margins, loss of species and colonization of unwanted species. Habitat connectivity is also of related importance and refers to the extent of linkages between areas of natural habitat – high levels of connectivity between different habitats or patches of the same habitat are desirable.
- **Population size:** For example, in international bird conservation, it has become established practice to regard 1 per cent of a species' total population as significant in terms of protective requirements. For some large predators, it is important to know that an area is large enough to encompass the home range of several individuals and allow them to persist successfully.
- **Fragility:** This refers to the sensitivity of a particular ecosystem or habitat to human-induced or natural environmental changes and its resilience to such changes.
- **Value of ecosystem services:** The critical importance of ecosystem services is widely appreciated.

Habitat sensitivity is categorised as follows:

Low No natural habitat remaining; this category is represented by developed/ transformed areas, nodal and linear infrastructure, areas of agriculture or cultivation, areas where exotic species dominate exclusively, mining land (particularly surface mining), etc. The possibility of these areas reverting to a natural state is impossible, even with the application of detailed and expensive rehabilitation activities. Similarly, the likelihood of plant species of conservation importance occurring in these areas is regarded negligent.

Medium – low All areas where the natural habitat has been degraded, with the important distinction that the vegetation has not been decimated and a measure of the original vegetation remain, albeit dominated by secondary climax species. The likelihood of plant species of conservation importance occurring in these areas is regarded low. These areas also occur as highly fragmented and isolated patches, typical to

cultivated fields, areas that have been subjected to clearing activities and areas subjected to severe grazing pressure. The species composition of these areas is typically low and is frequently dominated by a low number of species, or invasive plants.

Medium Indigenous natural habitat that comprehend habitat with a high diversity, but characterised by moderate to high levels of degradation, fragmentation and habitat isolation. Also includes areas where flora species of conservation importance could potentially occur, but habitat is regarded marginal;

Medium – high Indigenous natural vegetation that comprehend a combination of the following attributes:

- The presence of habitat that is suitable for the presence of these species;
- Areas that are characterised by a high/ moderate-high intrinsic floristic diversity;
- Areas characterised by moderate to low levels of habitat fragmentation and isolation;
- Regional vegetation types that are included in the lower conservation categories, particularly prime examples of these vegetation types;
- Low to moderate levels of habitat transformation;
- A moderate to high ability to respond to disturbance factors;

It may also include areas that are classified as protected habitat, but that are of a moderate status;

High Indigenous natural vegetation that comprehend for a combination of the following attributes:

- The presence of plant species of conservation importance, particularly threatened categories (Critically Endangered, Endangered, Vulnerable);
- Areas where 'threatened' plants are known to occur, or habitat that is highly suitable for the presence of these species;
- Regional vegetation types that are included in the 'threatened' categories (Critically Endangered, Endangered, Vulnerable), particularly prime examples of these vegetation types;
- Habitat types are protected by national or provincial legislation (Lake Areas Act, National Forest Act, draft Ecosystem List of NEM:BA, Mountain Catchment Areas Act, Ridges Development Guideline, Integrated Coastal Zone Management Act, etc.);
- Areas that have an intrinsic high floristic diversity (species richness, unique ecosystems), with particular reference to Centres of Endemism;

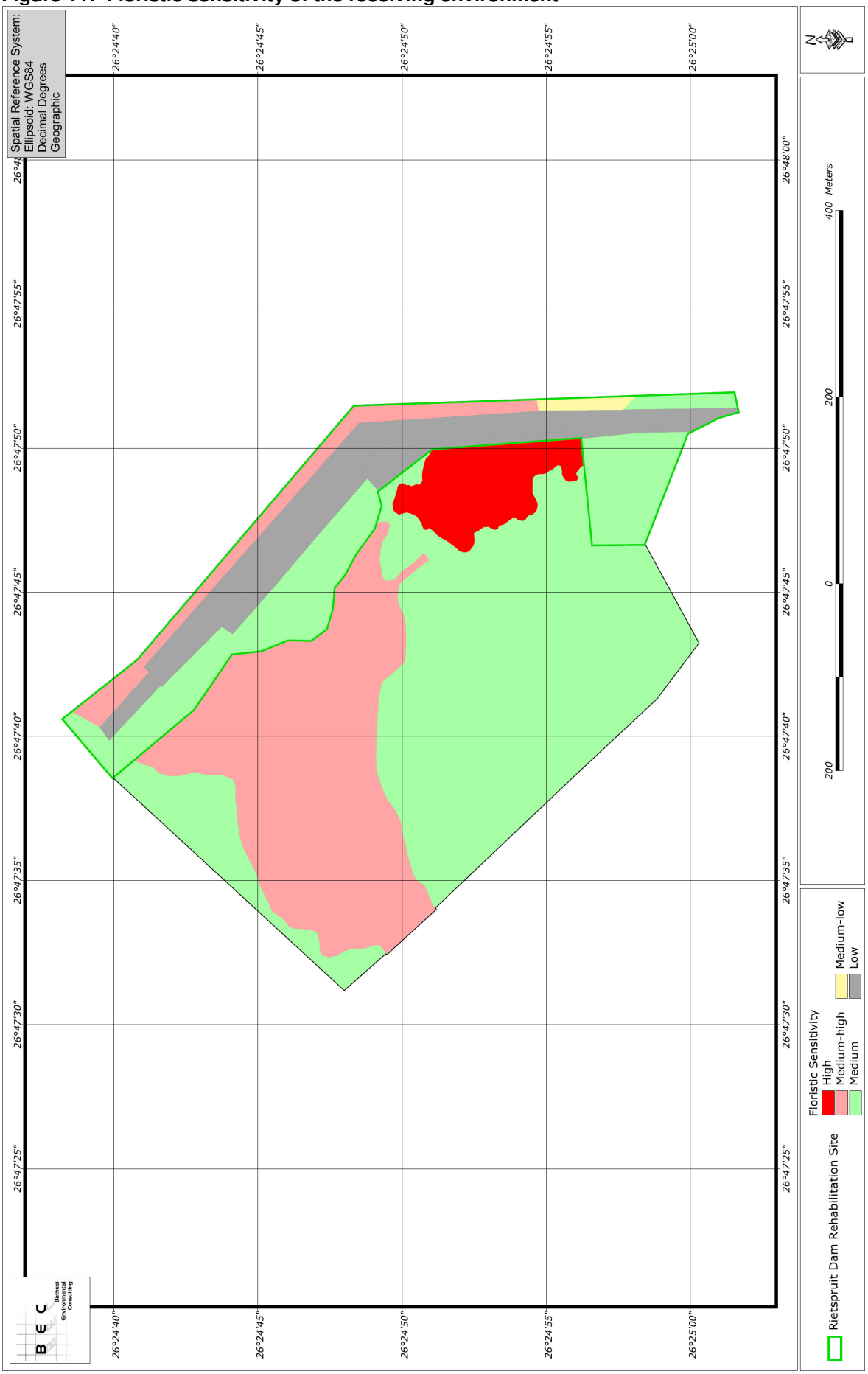
These areas are also characterised by low transformation and habitat isolation levels and contribute significantly on a local and regional scale in the ecological functionality of nearby and dependent ecosystems, with particular reference to catchment areas, pollination and migration corridors, genetic resources. A major reason for the high conservation status of these areas is the low ability to respond to disturbances (low plasticity and elasticity characteristics).

Sensitivity Criteria employed in assessing the floristic sensitivity of separate units may vary between different areas comprising of a similar habitat type, depending on location, type of habitat, size, etc. General floristic sensitivity estimations are presented in **Table 4**. These estimations are used to ascribe a general floristic sensitivity value to units of the respective variations, illustrated in **Figure 14**. Additional aspects that are taken into consideration include surrounding habitat sensitivity, conservation potential, fragmentation and habitat isolation factors. Therefore, different units of a habitat variation might be ascribed a relative wide range of floristic sensitivities.

Table 4: General floristic sensitivity estimations for macro habitat types

Criteria	*RD species*	*Landscape sensitivity*	*Status*	*Species diversity*	*Functionality/ fragmentation*	*TOTAL*	*SENSITIVITY INDEX*	*SENSITIVITY CLASS*
Community					*Criteria Ranking*			
Aquatic habitat type (Rietspruit Dam)	10	8	2	2	8	210	66%	**medium-high**
Deteriorated Grassland	3	8	5	6	6	172	54%	**medium**
Floodplain & Drainage Channel Wetland Types	7	8	7	8	8	240	75%	**medium-high**
Imperata cylindrica grassland	10	10	8	6	10	288	90%	**high**
Phragmites reed stands	2	4	6	2	6	116	36%	**medium-low**
Transformed Habitat & Dam Infrastructure	1	2	2	2	2	54	17%	**low**

Figure 11: Floristic sensitivity of the receiving environment



SECTION D – DESK-TOP ASSESSMENT OF FAUNAL ATTRIBUTES OF THE RECIEVING ENVIRONMENT

17 REGIONAL FAUNAL INFORMATION

This faunal assessment is based on a desktop appraisal of available information gleamed from various sources, as well as basic observations made during a brief site investigation. No detailed or long-term surveys were conducted for the assessment and results should be interpreted with caution. In particular, the account of animals observed on the site, immediate surrounds is not regarded comprehensive, and it is highly likely that a higher diversity of animals will inhabit the site and, particularly, natural habitat of the immediate surrounds.

The Rietspruit Dam is located in the Q-degree 2626BD south of Ventersdorp in the North-West Province of South Africa (refer **Figures 1 & 2**). Q-degree distribution data on various animal and plant groups were sourced from The Animal Demography Unit (ADU) of the University of Cape Town (UCT) within their Virtual Museum (vmus.adu.org.za). Similarly, pentad and Q-degree grid distribution data on the birds of South Africa was sourced from The South African Bird Atlas Project 2 provides (sabap2.adu.org.za). Distribution data on the following animal groups is currently available:

i. Echinoderms (Echinodermata);
ii. Fish (Osteichthyes);
iii. Scorpions (Scorpiones);
iv. Spiders (Araneae);
v. Dragonflies and Damselflies (Insecta: Odonata);
vi. Lacewings (Insecta: Neuroptera & Megaloptera)
vii. Butterflies and Moths (Insecta: Lepidoptera);
viii. Frogs (Amphibia: Anura);
ix. Reptiles (Reptilia: Testudines & Squamata);
x. Birds (Aves); and
xi. Mammals (Mammalia).

A brief desktop appraisal provided species lists of the above-mentioned groups for the Q-degree grid 2626BD, including the regional status of each species recorded for these Q-degree grids. Historic sampling records for animals in the Q-grid 2626BD are listed in **Tables 5 – 8**. Red data species are indicated in **red**, alien and invasive species in **blue** and species recorded during the brief field investigation in **green**.

Only four invertebrate species have been recorded for 2626BD (refer **Table 5**). Taking cognisance of the know diversity of invertebrates, this indicates a severe paucity of invertebrate knowledge of the region. No red data invertebrates are known to persist within this Q-grid. Recorded individuals include:

- Brown-veined White;
- African Monarch;
- Eyed Pansy; and
- African Grass Blue.

Fourteen herpetofaunal species have been recorded for 2626BD, none of which are currently considered threatened or listed as red data species (refer **Table 6**), including:

- three toads;
- six frogs;
- two snakes;

- one girdled lizard;
- one skink; and
- one agama.

A total of one hundred and seventy-six (176) birds have been recorded in 2626BD, including birds from seventeen orders and fifty-eight families (refer **Table 7**).

Nine mammals have recorded in 2626BD (refer **Table 8**), including:

- one primate;
- three rodents;
- one hare;
- one shrew; and
- three carnivores.

The species lists in **Tables 7** and **8** include four (4) red data birds and one (1) red data mammal.

Table 5: Invertebrates of the Q-degree grid 2626BD

Order	*Family*	*Genus species*	*English Name*	*Regional Status*
Lepidoptera	Pieridae	*Belenois aurota* (Fabricius, 1793)	Brown-veined White	Least concern
	Nymphalidae	*Danaus chryssipus orientis* (Aurivillius, 1909)	African Monarch	Least concern
		Junonia orithya madagascariensis Guenée, 1865	Eyed Pansy	Least concern
	Lycaenidae	*Zizeeria knysna knysna* (Trimen, 1862a)	African Grass Blue	Least concern

Table 6: Herpetofauna of the Q-degree grid 2626BD

Order	*Family*	*Genus species*	*English Name*	*Regional Status*
Anura	Bufonidae	*Amietophrynus garmani* Meek, 1897	Eastern Olive Toad	Least concern
		Amietophrynus gutturalis Power, 1927	Guttural Toad	Least concern
		Schismaderma carens Smith, 1848	Red Toad	Least concern
	Pyxicephalidae	*Amietia quecketti* Channing A & Baptista N, 2013	Queckett's River Frog	Least concern
		Cacosternum boettgeri (Boulenger, 1882)	Common Caco	Least concern
		Strongylopus fasciatus Smith, 1849	Striped Stream Frog	Least concern
		Tomopterna cryptotis Boulenger, 1907	Tremelo Sand Frog	Least concern
	Hyperoliidae	*Kassina senegalensis* Duméril and Bibron, 1841	Bubbling Kassina	Least concern
	Pipidae	*Xenopus laevis* Daudin, 1802	Common Platanna	Least concern
Squamata	Colubridae	*Dasypeltis scabra* (Linnaeus, 1758)	Rhombic Egg-eater	Least concern
		Psammophylax rhombeatus (Linnaeus, 1758)	Spotted Grass Snake	Least concern
	Scincidae	*Trachylepis varia* (Peters, 1867)	Variable Skink	Least concern
	Cordylidae	*Cordylus vittifer* Reichenow, 1887	Common Girdled Lizard	Least concern
	Agamidae	*Agama atra* Daudin, 1802	Southern Rock Agama	Least concern

Table 7: Birds of the Q-degree grid 2626BD

Order	*Family*	*Genus species*	*English Name*	*Regional Status*
Struthioniformes	Struthionidae	*Struthio camelus* Linnaeus, 1758	Common Ostrich	Least concern
Ciconiiformes	Podicipedidae	*Podiceps cristatus*(Linnaeus, 1758)	Great Crested Grebe	Least concern
		Tachybaptus ruficollis (Pallas, 1764)	Little Grebe	Least concern
	Phalacrocoracidae	*Microcarbo africanus* (Gmelin, 1789)	Reed Cormorant	Least concern
		Phalacrocorax carbo (Linnaeus, 1758)	White-breasted Cormorant	Least concern
	Anhingidae	*Anhinga rufa* (Daudin, 1802)	African Darter	Least concern
	Ardeidae	*Ardea cinerea* Linnaeus, 1758	Grey Heron	Least concern
		Ardea goliath Cretzschmar, 1829	Goliath Heron	Least concern
		Ardea melanocephala Children & Vigors, 1826	Black-headed Heron	Least concern
		Ardea purpurea Linnaeus, 1766	Purple Heron	Least concern
		Ardeola ralloides (Scopoli, 1769)	Squacco Heron	Least concern
		Bubulcus ibis (Linnaeus, 1758)	Cattle Egret	Least concern
		Egretta ardesiaca (Wagler, 1827)	Black Heron	Least concern
		Egretta garzetta (Linnaeus, 1766)	Little Egret	Least concern
		Egretta intermedia (Wagler, 1829)	Yellow-billed Egret	Least concern
	Scopidae	*Scopus umbretta* Gmelin, 1789	Hamerkop	Least concern
	Threskiornithidae	*Bostrychia hagedash* (Latham, 1790)	Hadeda Ibis	Least concern
		Platalea alba Scopoli, 1786	African Spoonbill	Least concern
		Plegadis falcinellus (Linnaeus, 1766)	Glossy Ibis	Least concern
		Threskiornis aethiopicus (Latham, 1790)	African Sacred Ibis	Least concern
	Phoenicopteridae	*Phoenicopterus roseus* Pallas, 1811	Greater Flamingo	Near threatened
Anseriformes	Anatidae	*Alopochen aegyptiaca* (Linnaeus, 1766)	Egyptian Goose	Least concern
		Anas erythrorhyncha Gmelin, 1789	Red-billed Teal	Least concern
		Anas platyrhynchos Linnaeus, 1758	Mallard Duck	Least concern
		Anas smithii (Hartert, 1891)	Cape Shoveler	Least concern
		Anas undulata C.F. Dubois, 1839	Yellow-billed Duck	Least concern
		Netta erythrophthalma (Wied-Neuwied, 1833)	Southern Pochard	Least concern
		Anser anser (Linnaeus, 1758)	Domestic Goose	Least concern
		Oxyura maccoa (Eyton, 1838)	Maccoa Duck	Least concern
		Plectropterus gambensis (Linnaeus, 1766)	Spur-winged Goose	Least concern
	Dendrocygnidae	*Dendrocygna bicolor* (Vieillot, 1816)	Fulvous Duck	Least concern
		Dendrocygna viduata (Linnaeus, 1766)	White-faced Duck	Least concern
		Thalassornis leuconotus Eyton, 1838	White-backed Duck	Least concern

Table 7: Birds of the Q-degree grid 2626BD

Order	*Family*	*Genus species*	*English Name*	*Regional Status*
Falconiformes	Sagittariidae	*Sagittarius serpentarius* (J.F. Miller, 1779)	Secretarybird	Near threatened
	Accipitridae	*Buteo buteo vulpinus* (Gloger, 1833)	Steppe Buzzard	Least concern
		Elanus caeruleus (Desfontaines, 1789)	Black-shouldered Kite	Least concern
		Haliaeetus vocifer (Daudin, 1800)	African Fish-Eagle	Least concern
		Milvus aegyptius (Gmelin, 1788)	Yellow-billed Kite	Least concern
	Falconidae	*Falco amurensis* Radde, 1863	Amur Falcon	Least concern
		Falco naumanni Fleischer, 1818	Lesser Kestrel	Vulnerable
		Falco rupicoloides A. Smith, 1829	Greater Kestrel	Least concern
		Falco rupicolus Daudin, 1800	Rock Kestrel	Least concern
		Falco vespertinus Linnaeus, 1766	Red-footed Falcon	Least concern
Galliformes	Phasianidae	*Pternistis swainsonii* (A.Smith, 1836)	Swainson's Spurfowl	Least concern
		Scleroptila levaillantoides (A. Smith, 1836)	Orange River Francolin	Least concern
	Numididae	*Numida meleagris* (Linnaeus, 1758)	Helmeted Guineafowl	Least concern
Gruiformes	Rallidae	*Fulica cristata* Gmelin, 1789	Red-knobbed Coot	Least concern
		Gallinula chloropus (Linnaeus, 1758)	Common Moorhen	Least concern
		Rallus caerulescens Gmelin, 1789	African Rail	Least concern
		Sarothrura rufa (Vieillot, 1819)	Red-chested Flufftail	Least concern
	Otididae	*Afrotis afraoides* (A. Smith, 1831)	Northern Black Korhaan	Least concern
Charadriiformes	Charadriidae	*Charadrius tricollaris* Vieillot, 1818	Three-banded Plover	Least concern
		Vanellus armatus (Burchell, 1822)	Blacksmith Lapwing	Least concern
		Vanellus coronatus (Boddaert, 1783)	Crowned Lapwing	Least concern
		Vanellus senegallus (Linnaeus, 1766)	African Wattled Lapwing	Least concern
	Scolopacidae	*Gallinago nigripennis* Bonaparte, 1839	African Snipe	Least concern
		Philomachus pugnax (Linnaeus, 1758)	Ruff	Least concern
	Recurvirostridae	*Himantopus himantopus* (Linnaeus, 1758)	Black-winged Stilt	Least concern
	Burhinidae	*Burhinus capensis* (Lichtenstein, 1823)	Spotted Thick-knee	Least concern
	Glareolidae	*Rhinoptilus africanus* (Temminck, 1807)	Double-banded Courser	Least concern
	Laridae	*Chlidonias hybrida* (Pallas, 1811)	Whiskered Tern	Least concern
Columbiformes	Columbidae	*Columba guinea* Linnaeus, 1758	Speckled Pigeon	Least concern
		Columba livia Gmelin, 1789	Rock Dove	Least concern
		Oena capensis (Linnaeus, 1766)	Namaqua Dove	Least concern
		Streptopelia capicola (Sundevall, 1857)	Cape Turtle-Dove	Least concern
		Streptopelia semitorquata (Ruppell, 1837)	Red-eyed Dove	Least concern
		Streptopelia senegalensis (Linnaeus, 1766)	Laughing Dove	Least concern
Musophagiformes	Musophagidae	*Corythaixoides concolor* (A. Smith, 1833)	Grey Go-away-bird	Least concern

Table 7: Birds of the Q-degree grid 2626BD

Order	*Family*	*Genus species*	*English Name*	*Regional Status*
Cuculiformes	Cuculidae	*Chrysococcyx caprius* (Boddaert, 1783)	Diderick Cuckoo	Least concern
		Cuculus solitarius Stephens, 1815	Red-chested Cuckoo	Least concern
	Centropodidae	*Centropus superciliosus burchellii* Swainson, 1838	Burchell's Coucal	Least concern
Strigiformes	Tytonidae	*Tyto capensis* (A. Smith, 1834)	African Grass-Owl	Vulnerable
	Strigidae	*Asio capensis* (A. Smith, 1834)	Marsh Owl	Least concern
Apodiformes	Apodidae	*Apus affinis* (J.E. Gray, 1830)	Little Swift	Least concern
		Apus barbatus (P.L. Sclater, 1866)	African Black Swift	Least concern
		Apus caffer (Lichtenstein, 1823)	White-rumped Swift	Least concern
		Cypsiurus parvus (Lichtenstein, 1823)	African Palm-Swift	Least concern
Coliiformes	Coliidae	*Colius colius* (Linnaeus, 1766)	White-backed Mousebird	Least concern
		Colius striatus Gmelin, 1789	Speckled Mousebird	Least concern
		Urocolius indicus (Latham, 1790)	Red-faced Mousebird	Least concern
Coraciiformes	Cerylidae	*Ceryle rudis* (Linnaeus, 1758)	Pied Kingfisher	Least concern
	Alcedinidae	*Alcedo cristata* Pallas, 1764	Malachite Kingfisher	Least concern
	Meropidae	*Merops apiaster* Linnaeus, 1758	European Bee-eater	Least concern
		Merops pusillus Statius Muller, 1776	Little Bee-eater	Least concern
Upupiformes	Upupidae	*Upupa africana* Bechstein, 1811	African Hoopoe	Least concern
	Phoeniculdae	*Phoeniculus purpureus* (J.F. Miller, 1784)	Green Wood-Hoopoe	Least concern
	Rhinopomastidae	*Rhinopomastus cyanomelas* (Vieillot, 1819)	Common Scimitarbill	Least concern
Piciformes	Lybiidae	*Lybius torquatus* (Dumont, 1816)	Black-collared Barbet	Least concern
		Trachyphonus vaillantii Ranzani, 1821	Crested Barbet	Least concern
		Tricholaema leucomelas (Boddaert, 1783)	Acacia Pied Barbet	Least concern
	Indicatoridae	*Indicator minor* Stephens, 1815	Lesser Honeyguide	Least concern
Passeriformes	Alaudidae	*Calandrella cinerea* (J.F. Gmelin, 1789)	Red-capped Lark	Least concern
		Calendulauda sabota (A. Smith, 1836)	Sabota Lark	Least concern
		Chersomanes albofasciata (Lafresnaye, 1836)	Spike-heeled Lark	Least concern
		Eremopterix leucotis (Stanley, 1814)	Chestnut-backed Sparrow-Lark	Least concern
		Mirafra africana Smith, 1836	Rufous-naped Lark	Least concern
	Hirundinidae	*Hirundo albigularis* Strickland, 1849	White-throated Swallow	Least concern
		Hirundo cucullata Boddaert, 1783	Greater Striped Swallow	Least concern
		Hirundo fuligula Lichtenstein, 1842	Rock Martin	Least concern
		Hirundo rustica Linnaeus, 1758	Barn Swallow	Least concern
		Hirundo spilodera Sundevall, 1850	South African Cliff-Swallow	Least concern
		Riparia paludicola (Vieillot, 1817)	Brown-throated Martin	Least concern
	Corvidae	*Corvus albus* Müller, 1776	Pied Crow	Least concern

Section D

Table 7: Birds of the Q-degree grid 2626BD

Order	*Family*	*Genus species*	*English Name*	*Regional Status*
		Acrocephalus arundinaceus (Linnaeus, 1758)	Great Reed-Warbler	Least concern
		Acrocephalus gracilirostris (Hartlaub, 1864)	Lesser Swamp-Warbler	Least concern
	Sylviidae	*Bradypterus baboecala* (Vieillot, 1817)	Little Rush-Warbler	Least concern
		Phylloscopus trochilus (Linnaeus, 1758)	Willow Warbler	Least concern
		Sylvia subcaerulea Vieillot, 1817	Chestnut-vented Tit-Babbler	Least concern
	Pycnonotidae	*Pycnonotus nigricans* (Vieillot, 1818)	African Red-eyed Bulbul	Least concern
		Pycnonotus tricolor (Hartlaub, 1862)	Dark-capped Bulbul	Least concern
		Bradornis mariquensis Smith, 1847	Marico Flycatcher	Least concern
		Cercomela familiaris (Stephens, 1826)	Familiar Chat	Least concern
		Cossypha caffra (Linnaeus, 1771)	Cape Robin-Chat	Least concern
		Erythropygia leucophrys (Vieillot, 1817)	White-browed Scrub Robin	Least concern
		Erythropygia paena Smith, 1836	Kalahari Scrub-Robin	Least concern
	Muscicapidae	*Muscicapa striata* (Pallas, 1764)	Spotted Flycatcher	Least concern
		Myrmecocichla formicivora (Vieillot, 1818)	Anteating Chat	Least concern
		Oenanthe monticola Vieillot, 1818	Mountain Wheatear	Least concern
		Oenanthe pileata (J.F. Gmelin, 1789)	Capped Wheatear	Least concern
		Saxicola torquatus (Linnaeus, 1766)	African Stonechat	Least concern
		Sigelus silens (Shaw, 1809)	Fiscal Flycatcher	Least concern
		Turdus smithi Bonaparte, 1850	Thrush, Karoo	Least concern
		Cisticola aridulus Witherby, 1900	Desert Cisticola	Least concern
		Cisticola fulvicapilla (Vieillot, 1817)	Neddicky	Least concern
		Cisticola juncidis (Rafinesque, 1810)	Zitting Cisticola	Least concern
	Cisticolidae	*Cisticola textrix* (Vieillot, 1817)	Cloud Cisticola	Least concern
		Cisticola tinniens (Lichtenstein, 1842)	Levaillant's Cisticola	Least concern
		Prinia flavicans (Vieillot, 1820)	Black-chested Prinia	Least concern
		Prinia subflava (J.F. Gmelin, 1789)	Tawny-flanked Prinia	Least concern
	Monarchidae	*Terpsiphone viridis* (Müller, 1776)	African Paradise-flycatcher	Least concern
		Anthus cinnamomeus Rüppell, 1840	African Pipit	Least concern
	Motacillidae	*Macronyx capensis* (Linnaeus, 1766)	Cape Longclaw	Least concern
		Motacilla capensis Linnaeus, 1766	Cape Wagtail	Least concern
		Lanius collaris Linnaeus, 1766	Common Fiscal	Least concern
	Laniidae	*Lanius collurio* Linnaeus, 1758	Red-backed Shrike	Least concern
		Lanius minor J. F. Gmelin, 1788	Lesser Grey Shrike	Least concern
	Malaconotidae	*Batis molitor* (Kuster, 1836)	Chinspot Batis	Least concern
		Laniarius atrococcineus (Burchell, 1822)	Crimson-breasted Shrike	Least concern

Table 7: Birds of the Q-degree grid 2626BD

Order	*Family*	*Genus species*	*English Name*	*Regional Status*
		Nilaus afer (Latham, 1802)	Brubru	Least concern
		Tchagra australis (Smith, 1836)	Brown-crowned Tchagra	Least concern
		Telophorus zeylonus (Linnaeus, 1766)	Bokmakierie	Least concern
		Acridotheres tristis (Linnaeus, 1766)	Common Myna	Least concern
	Sturnidae	*Creatophora cinerea* (Meuschen, 1787)	Wattled Starling	Least concern
		Lamprotornis bicolor (Gmelin, 1789)	Pied Starling	Least concern
		Lamprotornis nitens (Linnaeus, 1766)	Cape Glossy Starling	Least concern
	Nectariniidae	*Chalcomitra amethystina* (Shaw, 1812)	Amethyst Sunbird	Least concern
		Cinnyris talatala A. Smith, 1836	White-bellied Sunbird	Least concern
	Zosteropidae	*Zosterops capensis* Sundevall, 1850	Cape White-eye	Least concern
		Zosterops pallidus Swainson, 1838	Orange River White-eye	Least concern
		Euplectes afer (J.F. Gmelin, 1789)	Yellow-crowned Bishop	Least concern
		Euplectes albonotatus (Cassin, 1848)	White-winged Widowbird	Least concern
		Euplectes ardens (Boddaert, 1783)	Red-collared Widowbird	Least concern
		Euplectes orix (Linnaeus, 1758)	Southern Red Bishop	Least concern
	Ploceidae	*Euplectes progne* (Boddaert, 1783)	Long-tailed Widowbird	Least concern
		Plocepasser mahali Smith, 1836	White-browed Sparrow-Weaver	Least concern
		Ploceus velatus Vieillot, 1819	Southern Masked-Weaver	Least concern
		Quelea quelea (Linnaeus, 1758)	Red-billed Quelea	Least concern
		Sporopipes squamifrons(Smith, 1836)	Scaly-feathered Weaver	Least concern
		Passer domesticus (Linnaeus, 1758)	House Sparrow	Least concern
	Passeridae	*Passer diffusus* (A. Smith, 1836)	Southern Grey-headed Sparrow	Least concern
		Passer melanurus (Müller, 1776)	Cape Sparrow	Least concern
		Amadina erythrocephala (Linnaeus, 1758)	Red-headed Finch	Least concern
		Amandava subflava (Vieillot, 1819)	Orange-breasted Waxbill	Least concern
		Estrilda astrild (Linnaeus, 1758)	Common Waxbill	Least concern
	Estrildidae	*Estrilda erythronotos* (Vieillot, 1817)	Black-faced Waxbill	Least concern
		Lagonosticta rhodopareia (Heuglin, 1868)	Jameson's Firefinch	Least concern
		Ortygospiza atricollis (Vieillot, 1817)	African Quailfinch	Least concern
		Pytilia melba (Linnaeus, 1758)	Green-winged Pytilia	Least concern
		Uraeginthus angolensis (Linnaeus, 1758)	Blue Waxbill	Least concern
		Vidua chalybeata (Müller, 1776)	Village Indigobird	Least concern
	Viduidae	*Vidua macroura* (Pallas, 1764)	Pin-tailed Whydah	Least concern
		Vidua paradisaea (Linnaeus, 1758)	Long-tailed Paradise Whydah	Least concern
	Fringillidae	*Emberiza tahapisi* A. Smith, 1836	Cinnamon-breasted Bunting	Least concern

Table 7: Birds of the Q-degree grid 2626BD				
Order	*Family*	*Genus species*	*English Name*	*Regional Status*
		Serinus atrogularis (A. Smith, 1836)	Black-throated Canary	Least concern
		Serinus flaviventris (Gmelin, 1789)	Yellow Canary	Least concern
		Serinus mozambicus (Statius Muller, 1776)	Yellow-fronted Canary	Least concern

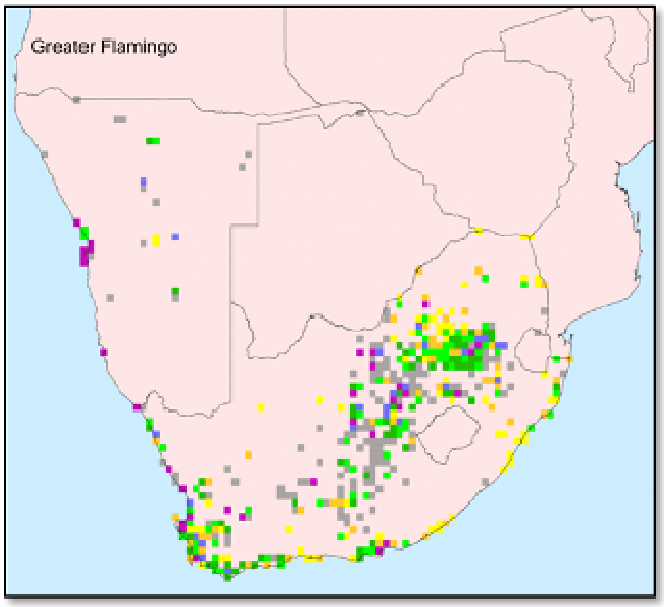
Table 8: Mammals of the Q-degree grid 2626BD				
Order	*Family*	*Genus species*	*English Name*	*Regional Status*
Primates	Cercopithecidae	*Chlorocebus pygerythrus* (F. Cuvier, 1821)	Vervet Monkey	Not listed
	Sciuridae	*Xerus inauris* (Zimmerman, 1780)	Cape Ground Squirrel	Least concern
Rodentia	Muridae	*Rhabdomys pumilio* (Sparrman, 1784)	Xeric Four-striped Grass Rat	Least concern
	Bathyergidae	*Cryptomys hottentotus* (Lesson, 1826)	Common Mole-rat	Least concern
Lagomorpha	Leporidae	*Lepus saxatilis* F. Cuvier, 1823	Scrub Hare	Least concern
Soricomorpha	Soricidae	*Crocidura mariquensis* (A. Smith, 1844)	Swamp Musk Shrew	Data deficient
	Hyaenidae	*Proteles cristatus* (Sparrman, 1783)	Aardwolf	Least concern
Carnivora	Herpestidae	*Atilax paludinosus* (G. [Baron] Cuvier, 1829)	Marsh Mongoose	Least concern
	Canidae	*Canis mesomelas* Schreber, 1775	Black-backed Jackal	Least concern

18 ANNOTATIONS ON RED DATA FAUNA TAXA OF THE REGION

18.1 The Greater Flamingo

The Greater Flamingo, *Phoenicopterus roseus* Pallas, 1811 (Ciconiiformes: Phoenicopteridae), is found from southern Europe across the Arabian Peninsula and Iran to India and Pakistan; also south along the African coast to Senegal in the west and south along the Red Sea coast and Rift Valley to coastal Angola and South Africa. The species is widespread in southern Africa, most common on the central plateau when breeding and at other times common along the west coast.

In southern Africa, the Greater Flamingo breeds at recently flooded, large, eutrophic, shallow saltpans. Otherwise, it is found at coastal mudflats, inland dams, sewage treatment works, small ephemeral pans and river mouths. It may be found in flocks numbering tens of thousands, often with Lesser Flamingos. The species wades in water up to belly depth, bill upside down, filtering small invertebrates from mud. It feeds on brine shrimps, brine flies, molluscs as well as diatoms. The species is monogamous, but changes mates between years; birds of the same age are most often paired. The species suffers from low reproductive success if exposed to disturbance at breeding colonies, or if water levels surrounding nest sites lower. The lowering of water levels in lakes can also lead to hyper-salinity, which may affect food resources.

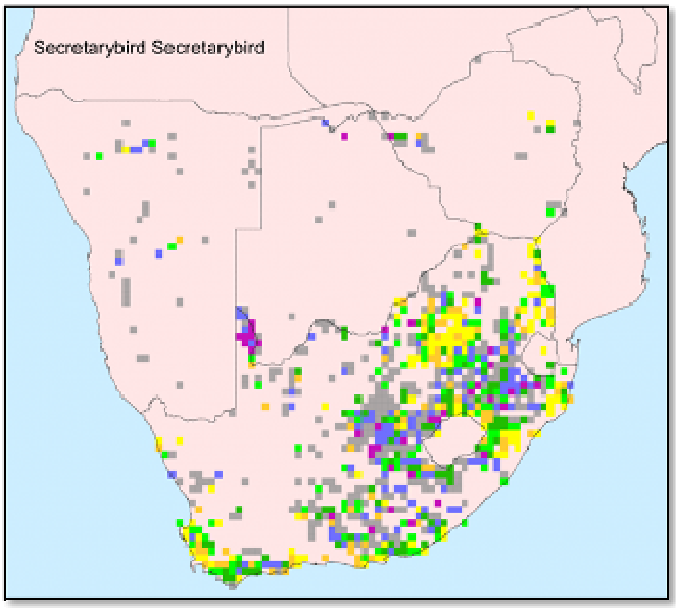


Other threats to the species' habitat include effluents from soda-ash mining, pollution from sewage and heavy metal effluents from industries. The species also suffers mortality from lead poisoning, collisions with fences and power lines and from diseases such as tuberculosis, septicaemia and avian botulism. Utilization in Egypt also affects the species; large numbers of adults are shot or captured to be sold in markets. Egg collection from colonies also occurs in some areas. The species is listed as Least Concern ver. 3.1 globally (www.iucnredlist.org/details/22697360/0) and Near Threatened regionally (sabap2.adu.org.za).

18.2 The Secretarybird

The Secretarybird, *Sagittarius serpentarius* (J.F. Miller, 1779) (Falconiformes: Sagittariidae), is found throughout sub-Saharan Africa, absent from forested western Africa, the DRC and Somalia; it is found sparsely in the dry west of southern Africa and southern Mozambique. The species is resident, but not sedentary; evidence exists that suggests dispersal over large areas.

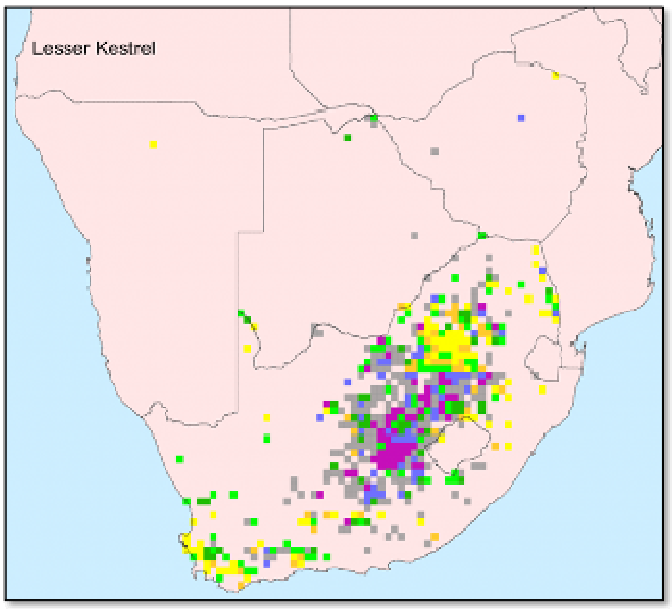
The species is found in open grassland with scattered trees, shrubland, open *Acacia* and *Combretum* savanna; it is absent from dense woodland and rocky hills. The Secretarybird feeds on a wide variety of animal prey, including large grasshoppers, amphibians, reptiles, birds, birds' eggs and rodents. Snake prey items include puff adder and cobra species.



Although the species may benefit from deforestation, such positive effects may be outweighed by the negative impacts of spreading cultivation and urbanization. The excessive burning of grasslands may suppress populations of prey species, whilst the intensive grazing of livestock is also probably degrading otherwise suitable habitat. Disturbance by humans, probably most often herders, is likely to negatively affect breeding. The species is captured and traded in apparently small numbers; however, it is unknown how many die in captivity and transit. Direct hunting and nest raiding for other uses and poisoning at waterholes are also potential threats. These human-induced threats may compound the effects of severe droughts in some areas. The species is globally listed as Vulnerable (A4acd ver. 3.1) (www.iucnredlist.org/details/22696221/0) and regionally (Red Data Book of Birds of South Africa, *in press*).

18.3 The Lesser Kestrel

The Lesser Kestrel, *Falco naumanni* Fleischer, 1818 (Falconiformes: Falconidae), breeds in northern Africa, southwest to eastern Europe, Asia Minor, Iran, Mongolia and northern China and winters in sub-Saharan Africa, especially in eastern and southern Africa. The species is locally common in the core area of the wintering range in South Africa, but scarce elsewhere. The Lesser Kestrel is found in warm, dry, open or lightly wooded environments.

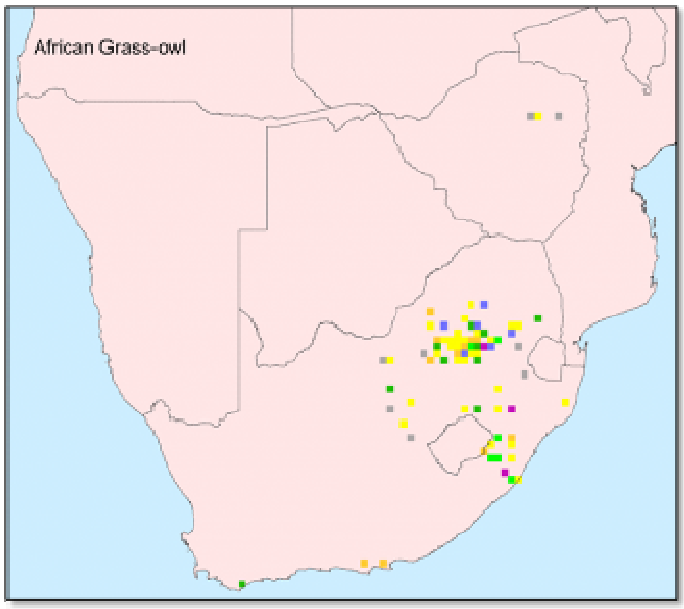


In South Africa, it is concentrated in the grassy Karoo and the western fringes of the grassland biome. The species generally avoids foraging in transformed habitat, but occurs in some agricultural areas. The species is highly gregarious, especially at a rich food source. The species feeds mostly on arthropods and occasionally on small vertebrates such as small rodents, birds and reptiles.

The main cause of its decline was habitat loss and degradation in its western Palearctic breeding grounds, primarily a result of agricultural intensification, but also afforestation and urbanization. In South Africa, key grasslands have been lost to agricultural intensification, afforestation and intensive pasture management. The use of pesticides may cause direct mortality, but is probably more important in reducing prey populations. The neglect or restoration of old buildings has resulted in the loss of nest-sites. The Lesser Kestrel is globally listed as Least Concern (ver. 3.1) (www.iucnredlist.org/details/22696357/0) and Vulnerable regionally (sabap2.adu.org.za).

18.4 The African Grass-owl

The African Grass-owl (*Tyto capensis*) is a breeding resident on the study area with at least one pair recorded during the brief site investigation. The Grass-owl has an extremely large distribution range in Africa (*c.* <20 000 km^2) and the current global population is not experiencing declines at a rate for it to be included as a globally Vulnerable species. Therefore, the global status of the species remains "Least Concern". However, it is regionally (in South Africa) threatened (Vulnerable) due to rapid habitat loss which suggested that the regional population has declined by 10 % in the last three generations and predicted to decline by a further 20 % in the next three generations (Barnes, 2000). Currently, the regional population size is less than 5 000 individuals (Barnes, 2000). Grass-owls are very susceptible to disturbances caused by livestock grazing and inappropriate burning regimes, which displace individuals from roosting and nesting sites. In addition, trampling by livestock and veld fires destroy nesting sites thereby altering the structure of their nesting and roosting habitat. Therefore, in terms of biodiversity monitoring and management, Grass-owls represents a good "umbrella" species for other fauna that also requires undisturbed wetland habitat, while typically avoiding degraded areas transformed by long-term and intensive grazing regimes and frequent fires.



Major threats of this species that need to be considered to make any management plan effective, include the following (ranked from most important to least):

- *Complete loss of habitat due to mining activities, agricultural activities and urbanisation*;
- *Incompatible grazing and fires leading to habitat modification and displacement*: As already mentioned, disturbances caused by trampling and heavy grazing pressures have a pronounced effect on the Grass-owl distribution. In addition, frequent fires prevent the development of dense rank grassland that is required by this species to breed successfully. On the other hand, overgrazing leads to wetland degradation and induce structural and floristic changes to the vegetation, which is often not optimal for Grass-owls to colonise. It should also be realised that wetland vegetation is highly palatable and attractive to large mammalian herbivores (cattle);
- *Changes to the hydrological regime*: Grass-owls frequently prefer moist dense grassland along wetland features. Therefore, any modification to the hydrological regime could bring changes to the vegetation structure. For example, too much run-off and an increase in wetness could lead to an increase in plant taxa such as *Phragmites australis* and *Typha capensis*, both unsuitable for Grass-owls;

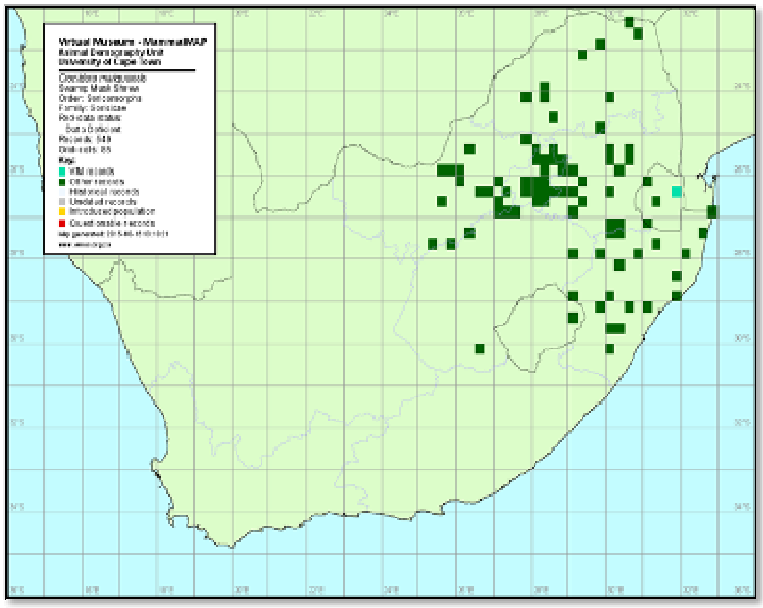
- *Invasion of wetland habitat by invader weed species*: Invader species such as Pom-pom weed (*Campuloclinium macrocephalum*) and Scottish Thistle (*Cirsium vulgare*) degrade wetland habitat and is unsuitable for Grass-owls to utilise; and
- *Road and fence mortalities*: Roads with heavy traffic in close proximity to Grass-owl habitat are often a significant cause of owl mortalities. This happens due to rodent prey feeding at roadside verges, which attract hunting owls, thereby increasing the risk of vehicle collisions. In addition, many owls frequently collide and are impaled by barbed wire fences. Although the effect on the population is unknown, it is regarded a potential risk.

Unfortunately, the localised and small *Imperata* habitat for the Grass-owls situated adjacent to the rehabilitation site appears to be subjected to annual burns and is highly accessible to grazing cattle, which are responsible for the displacement of owls from these areas. However, it is of the opinion that owls will return to these areas if grazing and burning is controlled.

18.5 The Swamp Musk Shrew

The Swamp Musk Shrew, *Crocidura mariquensis* (A. Smith, 1844) (Soricomorpha: Soricidae), a largely southern African species, ranges from southeastern Democratic Republic of Congo, south into Zambia, Angola, northeastern Namibia, northwest Botswana, Zimbabwe, southern Mozambique, Swaziland and eastern South Africa. It is a common species in suitable habitat but has highly specific habitat requirements.

The Swamp Musk Shrew occurs in close proximity to open water; it has a distinct preference for marshy ponds. The species also needs riverine and semi-aquatic vegetation such as reed beds. Nests of the Swamp Musk Shrew have been found in clumps of tussock grass and in debris about 300 mm above ground.



Predators of the species include Common Fiscal, Barn Owl and African Grass-owl. The species is mainly nocturnal, but may be active during daylight hours. It is a particularly active and agile shrew, but is not known to be an aggressive species.

There appear to be no major threats to this species as a whole; no direct conservation measures are in place for this species and it is unknown if the species is present within any protected areas. The Swamp Musk

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Shrew is listed as Least Concern ver. 3.1 globally (www.iucnredlist.org/details/41334/0) and as Data Deficient regionally (vmus.adu.org.za).

19 FAUNAL HABITAT DIVERSITY

The close relationship between vegetation units and specific faunal composition has been noted in several scientific studies. Broadly speaking, vegetation macro-habitats are representative of faunal habitat diversity for a given area; the preliminary macro-habitats described in this document (refer **Section 15**) are therefore regarded ecologically distinctive and descriptive of the faunal habitat diversity of the study area. Faunal habitats of varying levels of sensitivity were recorded in within the rehabilitation site and the immediate surrounds, namely:

- Transformed Faunal Habitat;
- Degraded Faunal Habitat; and
- Natural Faunal Habitat.

An illustration of the faunal habitat types, which is based on a delineation of the floristic habitat types, is presented in **Figure 12**.

19.1 Transformed Faunal Habitat Types

Significant fragments of the study area have been transformed because of the construction of the Rietspruit Dam. These transformed areas have lost the ecological ability to sustain any natural faunal assemblage or community; the lack of natural vegetation and absence of original ecological functions and processes has resulted in 'ecological wastelands' in these transformed fragments within the landscape. Due to the low biodiversity potential and poor ecological quality of the transformed faunal habitats of the study area, these fragments are considered to have very low faunal sensitivities regarding the potential and anticipated impacts associated with the proposed project. Transformed faunal habitats of the study area include:

- Dam infrastructure – Existing Wall;
- Dam infrastructure – Outlet;
- Dam infrastructure – Overflow Area; and
- Dam infrastructure – Road servitude.

All of the transformed faunal habitats of the study area are estimated to have a low faunal sensitivity (refer **Table 9**).

19.2 Deteriorated Faunal Habitat Types

Degraded faunal habitat types represent areas that still exhibit, to varying degrees, some of the original ecosystem characteristics, processes and functionality. These areas are not entirely transformed, as the original faunal habitats have not been entirely replaced by other, transformed land cover categories. The status is however degraded as only some, resilient characteristics, or limited functionality, remain. Crop agriculture and the construction of the Rietspruit Dam have led to the degradation of some of the faunal habitat fragments in the study area and surrounds.

Degraded faunal habitats of the study area include:

- Aquatic habitat – Rietspruit Dam;
- Deteriorated Grassland; and
- *Phragmites* Reed Stands.

None of the degraded faunal habitats included in this assessment exhibit high biodiversity or ecological values and is not considered highly sensitive (all degraded faunal habitats of the study area are ascribed medium faunal sensitivities, refer **Table 9**).

19.3 Natural Faunal Habitat

The natural faunal habitats of the study area are represented by:

- Floodplain & Drainage Channel Wetland Type habitats; and
- *Imperata cylindrica* Grassland patch.

These areas have retained most of its original ecological functionality and biodiversity elements. Degradation of the natural faunal habitats has been less significant than is evident for the degraded faunal habitats of the study area. These areas also exhibit significant red data species hosting abilities and are inherently sensitive (all natural faunal wetland habitats in the region are considered sensitive). Both habitats are ascribed high faunal sensitivities (refer **Table 9**).

20 FAUNAL HABITAT SENSITIVITY

Faunal habitat sensitivities area estimated based on the habitat status (ST), biodiversity present (DV), linkage to other faunal habitats (LN), red data hosting ability (RD) and inherent faunal sensitivity (SE). Faunal sensitivity is expressed as a percentage, with six sensitivity categories:

- Very low sensitivity: 0 – 15 %;
- Low sensitivity: 16 – 30 %;
- Medium-low sensitivity: 31 – 45 %;
- Medium sensitivity: 46 – 60 %;
- Medium-high sensitivity: 61 – 75 %; and
- High sensitivity: 76 – 100 %.

Results of the faunal habitat sensitivity calculations are presented in **Table 5** and illustrated in **Figure 13.**

Table 9: Faunal Habitat Estimations

Faunal Habitat Type		*ST*	*DV*	*LN*	*RD*	*SE*	*Ave (%)*	*Sens Class*
Transformed Habitat	Dam infrastructure – Existing Wall	2	2	1	1	2	16.0 %	**low**
	Dam infrastructure – Outlet	2	2	1	1	2	16.0 %	**low**
	Dam infrastructure – Overflow Area	2	2	1	1	2	16.0 %	**low**
	Dam infrastructure – Road servitude	2	2	2	1	2	18.0 %	**low**
Deteriorated Habitat	Aquatic habitat - Rietspruit Dam	4	3	4	1	3	30.0 %	**medium-low**
	Deteriorated Grassland	4	5	5	4	4	44.0 %	**medium -low**
	Phragmites Reed Stands	4	6	4	3	4	42.0 %	**medium -low**
Natural Habitat	Floodplain & Drainage Channel Wetland Type	7	8	8	7	8	76.0 %	**high**
	Imperata cylindrica Grassland Patch	8	7	7	10	9	82.0 %	**high**

Figure 12: Simplified illustration of the faunal habitat types of the study site and surrounds

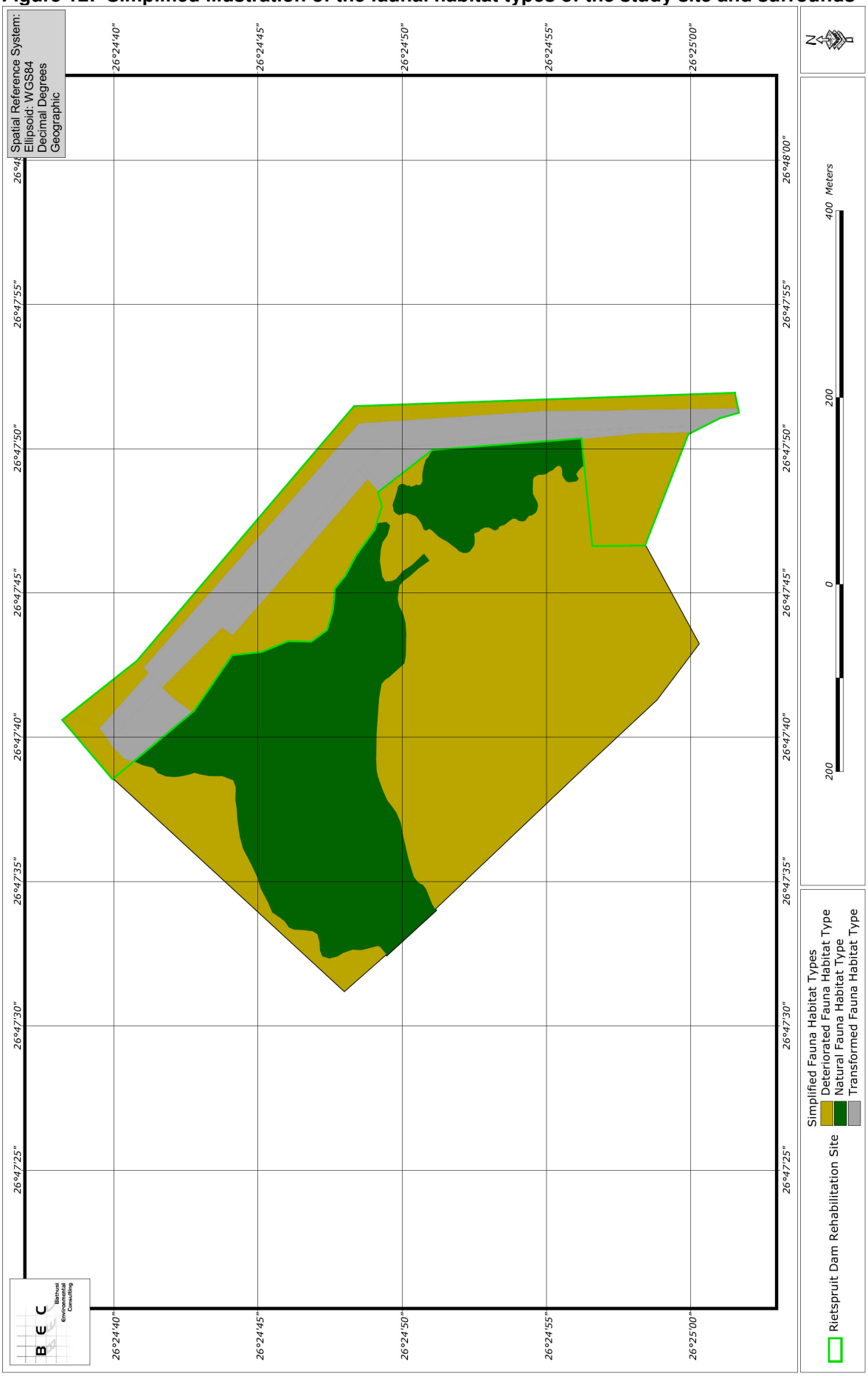

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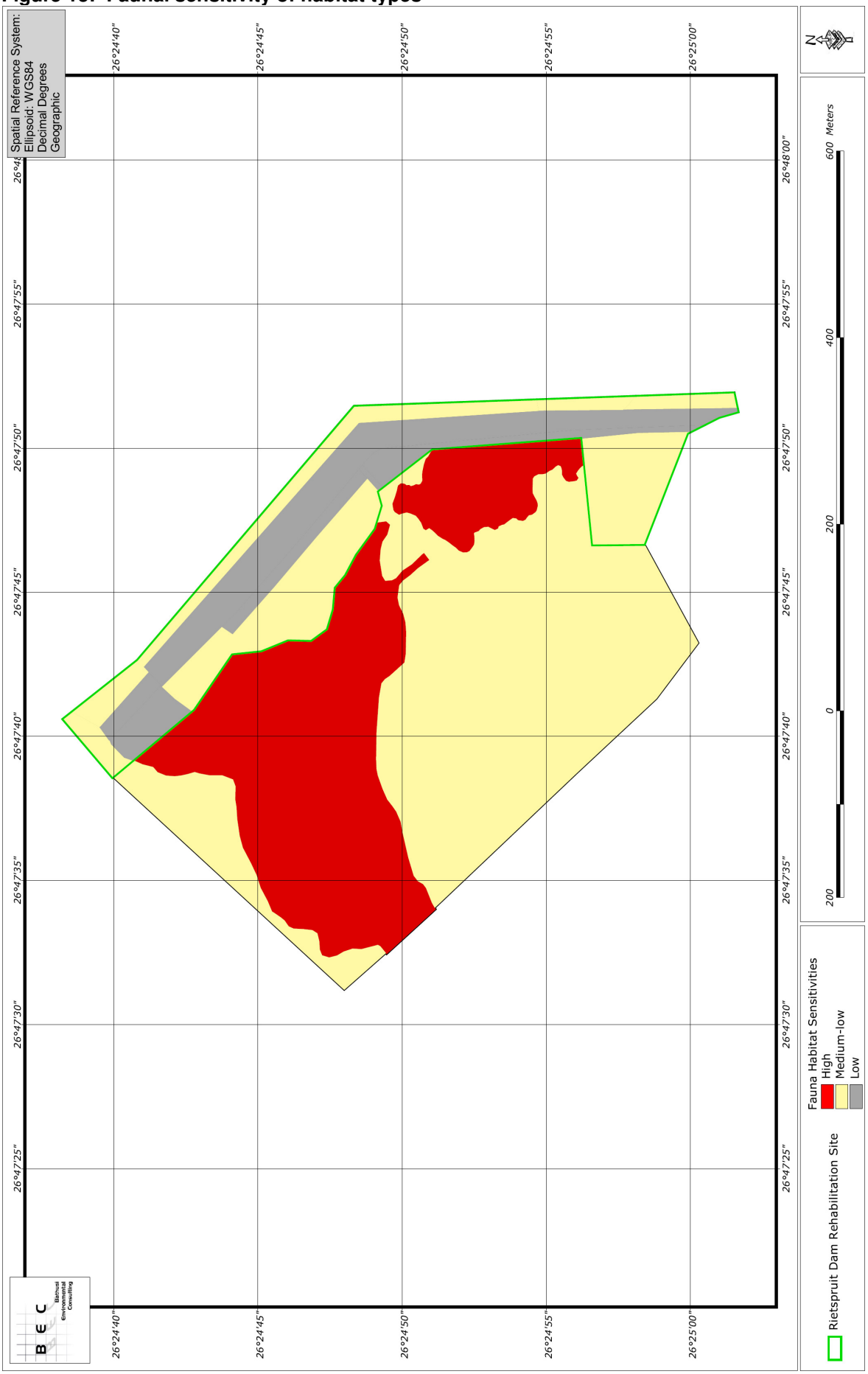
Figure 13: Faunal sensitivity of habitat types



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SECTION E – BASIC IMPACT ASSESSMENT, MITIGATION AND EMPR CONTRIBUTION & CONCLUDING REMARKS

21 POTENTIAL AND LIKELY IMPACTS ON THE BIODIVERSITY RECEIVING ENVIRONMENT

While the proposed activity is likely to result in minimal loss of natural habitat, no impacts of a beneficial nature on the biological/ biophysical environment are likely to result without significant mitigation intervention. Based on a generic list of impacts associated with this type of development, three categories of impacts are likely to result, namely, direct impacts, indirect impacts and impacts of a cumulative nature. A list of anticipated and likely impacts was compiled, based on the following activities:

- Infilling and deposition of approximately 10 000 m³ of borrow material to stabilise the downstream face of the dam embankment;
- Approximately 100 m³ of silt to be dredged from the reservoir in order to open the river outlet valve's inlet;
- Widening the cross section footprint of the dam by 3.5 to 7 m along the length of the dam wall. The total increase in the footprint of the dam will be approximately 4 000 m².
- The footprint of the earth dam embankment will be increased by approximately 6 m in width, but the length will be unaltered; and
- Infill material will be sourced commercially from Witpoort Sand & Stone Quarry, which is approximately 18.5 km southeast from the Rietspruit Dam.

21.1 Nature of Anticipated and Likely Impacts

21.1.1 Direct Impacts

The largest extent of impacts within the biological environment is likely to result due to direct (physical) effects of land clearing activities and habitat loss. Direct impacts include any effect on the various habitat types, including locally endemic species, populations or individual species of conservation importance, as well as on overall species richness, diversity and abundance. These impacts include effects on genetic variability, population dynamics, overall species existence or health and on habitats important for species of conservation consideration. Loss of sensitive, restricted or protected habitat types are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are immediately visible and can be determined to an acceptable level of certainty. Impacts of a direct nature include the following:

- Loss of plant taxa of conservation importance concern;
- Loss/ displacement of animal taxa of conservation importance;
- Loss of habitat associated with plant and animal taxa of conservation importance;
- Local depletion of plant taxa and reduction of phytodiversity;
- Local depletion/ displacement of faunal species and reduction of animal diversity;
- Loss of atypical, sensitive, conservation important habitat types or ecosystems of restricted abundance; and
- Loss and alteration of ecological processes and ecosystem services

21.1.2 Indirect Impacts

In contrast, indirect impacts are not always immediately evident and can consequently not be measured at a specific moment in time; 'spill-over effects' are spatially and temporally removed from the actual activity and manifestations are typically subtle. The extent of the effect is frequently at a scale that is larger than the actual site of impact, but usually restricted to a local scale (and not regional). A measure of estimation, extrapolation, or interpretation is therefore required to evaluate the importance of these impacts and is usually a factor of the sensitivity of the receiving surrounding environment. This type of impact typically results in adverse effects or deterioration of surrounding areas due to uncontrolled, development related activities.

In addition, the ecological functionality of the immediate and surrounding area could be adversely affected by development, with particular reference to the ecological interaction between plants and animals. The aesthetic appeal of the region, although a personal and highly debatable attribute, is regarded a potential receiver of landscape changes through the addition of industrial plants, ashing facilities, linear infrastructures, etc. Lastly, one of the most important impacts of indirect measures is represented by the alteration of biophysical characteristics of the surrounding areas through the introduction and proliferation of plants with an exotic nature or encroachment characteristics. Impacts of an indirect nature include the following:

- Impacts on habitat types that are associated with plants and animals of conservation importance (decreased habitat quality of surrounding areas due to peripheral impacts such as spillages, litter, increased erosion, contaminants, etc.);
- Alteration of faunal assemblages and community structures in surrounding areas (temporary displacement);
- Altered quality and ecological functionality (including fire, erosion) of surrounding natural habitat;
- Decreased aesthetic appeal of the landscape; and
- Exacerbated encroachment of invasive, exotic and encroacher plant species.

21.1.3 Cumulative Impacts

Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities in the region. Impacts of a cumulative nature typically adversely affect the local and regional conservation status of plant and animal taxa and protected habitat types as well as local and regional fragmentation levels, but also issues such as increased exploitation due to the exacerbation of anthropogenic activities on a local scale. These impacts are notoriously problematic to control or prevent and frequently require huge financial commitments to mitigate. Impacts of a cumulative nature typically include the following:

- Increased plundering of natural resources due to increased human encroachment;
- Exacerbation of existing levels of habitat fragmentation and isolation; and
- Cumulative impacts on local/ regional and national conservation targets and obligations (loss of natural grassland habitat).

22 BASIC IMPACT ASSESSMENT

22.1 Method Statement

The following method is applied in estimating the significance of impacts within the natural (biological and biophysical) receiving environment.

Table 10: Impact Assessment Descriptive Criteria		
Nature	**Brief annotation on the impact**	
Probability	Categories 1 – 5	
	1	Improbable (less than 24% chance of occurring)
	2	Probable (25 – 49%)
	3	Likely (50 – 69%)
	4	Very likely (70 – 89%)
	5	Definite (90 – 100%)
Frequency	Categories 1 – 5	
	1	Very rare to remote (once or twice a decade)
	2	Unusual to occasional (once or twice every 5 years)
	3	Frequent (a few times a month)
	4	Very frequent (a few times a week, to daily)
	5	Continuous (daily to a significant percentage of every day)
Extent	Categories 1 – 5	
	1	Footprint / site
	2	Local
	3	Regional
	4	National
	5	International (trans-boundary)
Duration	Categories 1 – 5	
	1	Short (few days to a few months, less than a phase)
	2	Short (few months, or less than a phase in total)
	3	Medium (a few years, significant part of a phase)
	4	Long (lifespan of development (i.e. all of operation))
	5	Permanent
Intensity	Categories 1 – 5	
	1	Very low – natural processes not affected
	2	Low – natural processes slightly affected
	3	Medium – natural processes continue but in a modified manner
	4	Medium-high – natural processes are modified significantly
	5	High – natural processes disturbed significantly so that they cease to occur (temporarily / permanently)
Significance	**Significance = P + F + E + D + I**	
	Minimum value of 5, maximum of 25	
	Status determines if positive / negative	
	Any positive value	**No impact** **1.** High to low consequence, probability not an issue as positive, **no mitigation required**
	1– 5	**Low** **2.** Low consequence, probably, **minimal mitigation may be required**
	6 to 10	**Medium** **3.** Medium consequence, probably, **mitigation is advised / preferred**
	11 to 15	**Medium–high** **4.** Medium to high consequence, probably to very probable, **mitigation is necessary**
	16 to 20	**High** **5.** High consequence, probably / definite, **mitigation is essential**
	21 to 25	**Extreme** **6.** Very high consequence, definite, **fatal flaw!**

22.2 Impact Evaluation

22.2.1 Direct Impacts

Nature	Direct loss of plant taxa of conservation importance concern	
	Before Mitigation	After Mitigation
Probability	5	1
Frequency	2	2
Extent	2	1
Duration	3	2
Intensity	4	1
Significance	16	7
Nature	Loss/ displacement of animal taxa of conservation importance	
	Before Mitigation	After Mitigation
Probability	5	2
Frequency	4	4
Extent	3	2
Duration	4	3
Intensity	5	4
Significance	21	15
Nature	Direct loss of habitat associated with plant and animal taxa of conservation importance	
	Before Mitigation	After Mitigation
Probability	2	1
Frequency	4	2
Extent	1	1
Duration	3	3
Intensity	3	2
Significance	13	9
Nature	Local depletion of plant taxa and reduction of phytodiversity	
	Before Mitigation	After Mitigation
Probability	1	1
Frequency	3	3
Extent	1	1
Duration	2	2
Intensity	1	1
Significance	8	8
Nature	Local depletion/ displacement of faunal species and reduction of animal diversity	
	Before Mitigation	After Mitigation
Probability	1	1
Frequency	3	3
Extent	1	1
Duration	2	2
Intensity	1	1
Significance	8	8
Nature	Loss of atypical, sensitive, conservation important habitat types or ecosystems of restricted abundance	
	Before Mitigation	After Mitigation
Probability	1	1
Frequency	3	2
Extent	1	1
Duration	2	2
Intensity	1	1
Significance	8	7
Nature	Loss and alteration of ecological processes and ecosystem services	

	Before Mitigation	After Mitigation
Probability	2	1
Frequency	3	2
Extent	1	1
Duration	2	2
Intensity	2	1
Significance	**10**	**7**

22.2.2 Indirect Impacts

Nature	**Impacts on habitat types that are associated with plants and animals of conservation importance**	
	Before Mitigation	**After Mitigation**
Probability	5	3
Frequency	4	4
Extent	2	2
Duration	4	3
Intensity	2	3
Significance	**17**	**15**
Nature	**Alteration of faunal assemblages and community structures in surrounding areas**	
	Before Mitigation	**After Mitigation**
Probability	3	2
Frequency	4	4
Extent	2	2
Duration	4	3
Intensity	2	2
Significance	**15**	**13**
Nature	**Altered quality and ecological functionality (including fire, erosion) of surrounding natural habitat**	
	Before Mitigation	**After Mitigation**
Probability	3	2
Frequency	4	2
Extent	2	2
Duration	4	2
Intensity	2	1
Significance	**15**	**9**
Nature	**Decreased aesthetic appeal of the landscape**	
	Before Mitigation	**After Mitigation**
Probability	4	2
Frequency	2	1
Extent	2	2
Duration	5	2
Intensity	2	1
Significance	**15**	**8**
Nature	**Exacerbated encroachment of invasive, exotic and encroacher plant species**	
	Before Mitigation	**After Mitigation**
Probability	4	2
Frequency	4	4
Extent	2	2
Duration	5	2
Intensity	3	1
Significance	**18**	**11**

22.2.3 Cumulative Impacts

Nature	Increased plundering of natural resources due to increased human encroachment	
	Before Mitigation	After Mitigation
Probability	4	2
Frequency	3	2
Extent	2	2
Duration	5	3
Intensity	4	2
Significance	18	11
Nature	Exacerbation of existing levels of habitat fragmentation and isolation	
	Before Mitigation	After Mitigation
Probability	2	1
Frequency	5	2
Extent	2	1
Duration	5	2
Intensity	1	1
Significance	15	7
Nature	Cumulative impacts on local/ regional and national conservation targets and obligations	
	Before Mitigation	After Mitigation
Probability	3	1
Frequency	5	2
Extent	2	1
Duration	5	2
Intensity	1	1
Significance	16	7

23 MITIGATION STRATEGIES & EMPR CONTRIBUTIONS

23.1 Mitigation Hierarchy Background

The mitigation of negative impacts on biodiversity and ecosystem services is a legal requirement for authorisation purposes and must take on different forms depending on the significance of the impact and the area being affected. Mitigation requires proactive planning that is enabled by following the mitigation hierarchy, illustrated in **Figure 14**. Its application, is intended to strive to first avoid disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided altogether, to minimise, rehabilitate, and then finally offset any remaining significant residual negative impacts on biodiversity, where:

Avoiding or preventing impacts – refers to considering options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services, and people. This is the best option, but is not always possible if mining is to take place. However, there are areas where the environmental and social constraints are too high and mining should not take place. Such areas are best identified early in the mining life cycle, so that impacts can be avoided and authorisations refused. In the case of areas where environmental constraints might be limiting, this includes some ecosystems, habitats, ecological corridors, or areas that provide essential ecosystem services and are of such significant conservation value or importance that their loss cannot be compensated for (i.e. there is no substitute). In such areas, it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation hierarchy (e.g. rehabilitating or offsetting impacts) to provide effective remedy for impacts on biodiversity or ecosystem services. Information about the location of many such areas is available, often making it possible to avoid them.

Minimising impacts – refers to considering alternatives in the project location, siting, scale, layout, technology and phasing that would minimise impacts on biodiversity and ecosystem services. Even in areas where the environmental and social constraints are not particularly high for mining to proceed/take place every effort should still be made to minimise impacts.

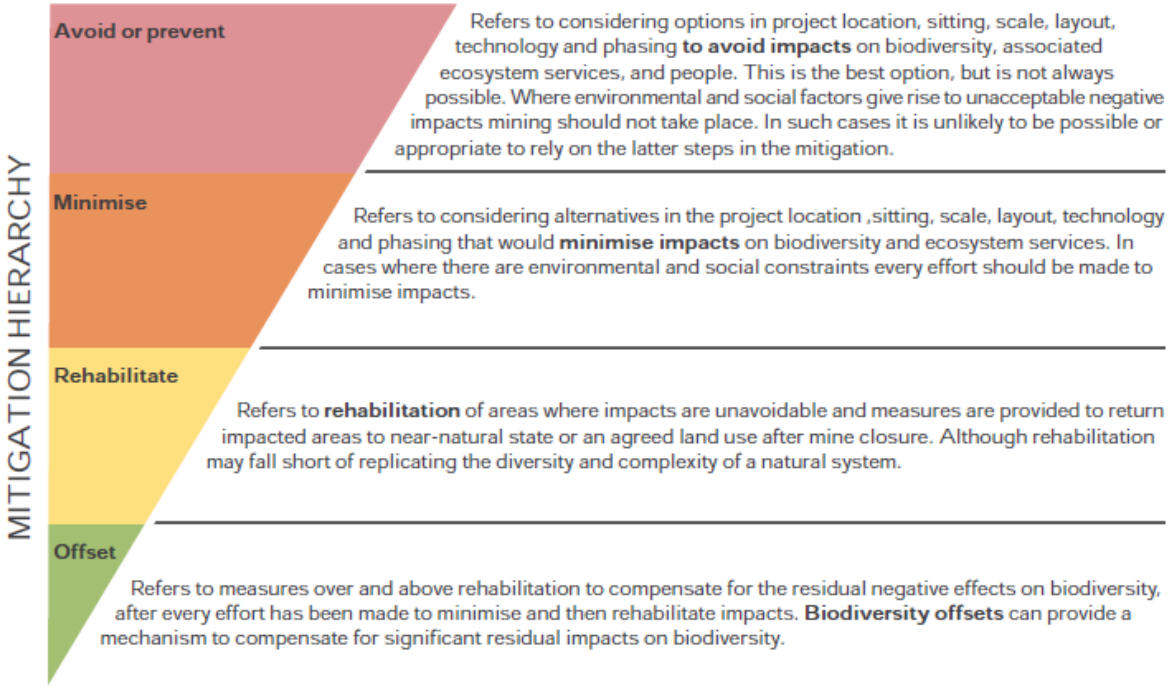
Rehabilitate impacts – refers to the rehabilitation of areas where impacts were unavoidable and measures are taken to return impacted areas to a condition ecologically similar to their 'pre-mining natural state' or an agreed land use after mine closure. Although rehabilitation is important and necessary, unfortunately even with significant resources and effort, rehabilitation is a limited process that usually falls short of replicating the diversity and complexity of a natural system. Instead, rehabilitation helps to restore some resemblance of ecological functioning in an impacted landscape, to avoid on-going negative impacts, and/or to provide some sort of aesthetic fix for a landscape. Rehabilitation should occur concurrently or progressively with the proposed activity, and/or on cessation of the activity.

Offset impacts –refers to compensating for remaining and unavoidable negative effects on biodiversity. When every effort has been made to minimise and then rehabilitate remaining impacts to a degree of no net loss of biodiversity against biodiversity targets, biodiversity offsets can provide a mechanism to compensate for significant residual negative impacts on biodiversity.

The mitigation hierarchy is inherently proactive, requiring the on-going and iterative consideration of alternatives of project location, siting, scale, layout, technology and phasing until the proposed development best 'suits' and can be accommodated without significant negative impacts in the receiving environment. In cases where the receiving environment cannot support the development (*e.g.* where the project will destroy the natural resources on which local communities are wholly dependent for their livelihoods or eradicate unique biodiversity), the development may not be feasible. Where biodiversity impacts can be severe, the guiding principle should be "anticipate and prevent" rather than "assess and repair". The proper application of the mitigation hierarchy is essential and requires a team of people with the relevant skills and knowledge

(including consulting with specialists who might sit outside of a core project team) asking the right questions and applying the appropriate science and methods.

Figure 14: Mitigation hierarchy for dealing with negative impacts on biodiversity



23.2 Floristic Mitigation Recommendations & EMPr Contributions

Mitigation Measure 1 - Avoid any surface disturbances within areas of high and medium-high floristic sensitive habitat types. In particular, the *Imperata cylindrica* Grassland Patch and the Floodplain & Drainage Channel Wetland Types are regarded particularly sensitive and any surface disturbances should be avoided at all cost;

Mitigation Measure 2 - Laydown areas, stockpiles, vehicle parking areas, road infrastructure, access roads, turning circles, maintenance areas, etc., should be planned and operated within areas of low sensitivity, also situated away from sensitive biodiversity areas and receptors;

Mitigation Measure 3 - Demarcate areas of high and medium-high floristic sensitivity by means of semi-permanent means (fencing). Demarcation should be periodically inspected by the ECO in order to ensure that fencing remain intact and should lastly be removed subsequent to the cessation of construction activities;

Mitigation Measure 4 - Identify and relocate all plants of conservation concern activities that will be adversely affected prior to the commencement of construction activities. It is emphasised that the removal and/ or relocation of any conservation important plant is subject to provincial permitting obligations;

Mitigation Measure 5 - Compile and implement a botanical monitoring plan that aims to establish the success, and build on, implemented mitigation measures. This monitoring protocol should be effected at least biannually (early summer, late summer) in order to identify impacts, recommend actions and ensure compliance;

Mitigation Measure 6 - Disturbance of vegetation must be limited only to areas of construction;

Mitigation Measure 7 - Removal of vegetation/ plants within natural habitat shall be avoided until such time as soil stripping is required;

Mitigation Measure 8 - The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with, unless agreed to by the ECO;

Mitigation Measure 9 - Exposed surfaces must be re-vegetated or stabilised as soon as is practically possible by means of a typical rehabilitation plant mixture that blends in with the surrounding environment. The grass mix should consist of indigenous grasses adapted to the local environmental/ climatic conditions;

Mitigation Measure 10 - Revegetated areas should be temporarily fenced to prevent damage by grazing animals;

Mitigation Measure 11 - Re-vegetated areas showing inadequate surface coverage (less than 30 % within eight months after re-vegetation) should be prepared and re-vegetated from scratch;

Mitigation Measure 12 - Damage to re-vegetated areas should be repaired promptly;

Mitigation Measure 13 - Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by the Conservation of Agricultural Resources Act (No 43 of 1983) and must be addressed on a continual basis, through an alien vegetation control and monitoring programme;

Mitigation Measure 14 - Prevent contamination of natural grassland and/ or wetlands from activities or any source of pollution;

Mitigation Measure 15 - The landowner must immediately take steps to remove alien vegetation as per Conservation of Agricultural Resource Act, namely:

- Uprooting, felling or cutting;
- Treatment of weeds and invasive species by means of herbicides and chemicals is not recommended as a result of the proximity to a wetland area;
- The application of control measures regarding livestock reduction or removal of animals in terms of regulations 10 and 11 of the Act;
- Any other method or strategy that may be applicable and that is specified by the executive officer by means of a directive.

23.3 Faunal Mitigation Recommendations & EMPr Contributions

Mitigation Measure 16 - Avoid any surface disturbances within areas of high and medium-high faunal sensitivity habitat types. It must be ensured that none of the construction activities influence the natural faunal habitats of the study area – the Wetland Area and African Grass-Owl Habitat present in the study area must be excluded from all construction activities and associated impacts;

Mitigation Measure 17 - The natural faunal habitats of the study area must be clearly demarcated to ensure that no unauthorized entry occurs;

Mitigation Measure 18 - All activities must be limited to daylight hours to mitigate impacts on sensitive nocturnal faunal assemblages;

Mitigation Measure 19 - No trapping, snaring or otherwise killing of animals should be allowed on or near the construction site; it is the responsibility of the construction site manager to ensure that this is enforced;

Mitigation Measure 20 - Compile a graphic list of potentially dangerous animals and present this to all workers as part of site induction;

Mitigation Measure 21 - Ensure that a competent snake handler and capturing equipment is available at all times to remove snakes from the site and release captured animals in nearby suitable habitat;

Mitigation Measure 22 - Compile a list of knowledgeable persons/ specialists/ doctors that can avail the necessary knowledge with regards to the treatment of snakebites and other human-animal conflict situations;

Mitigation Measure 23 - No pets are allowed on the construction sites; species such as cats are known to decimate small animal populations;

Mitigation Measure 24 - Due care must be taken to ensure that no leakages of foreign materials (diesel, fuel, oil, etc.) occur, with particular reference to the Wetland Areas and *Imperata cylindrica* grassland patch;

Mitigation Measure 25 - The ECO should ensure continual record keeping of all animal observations on site, with particular reference to Grass-owls, Lesser Kestrels, snakes, aquatic mammals and other conservation important animals;

Mitigation Measure 26 - Compile and implement a faunal monitoring programme, the protocol of which should be effected at least biannually (early summer, late summer) in order to establish the continued persistence of animals on the adjacent sensitive areas, adherence to EMP guidelines, the identification of impacts and guidance for mitigation measures;

Mitigation Measure 27 - Fencing and delineation of exclusion zones - the perimeter of sensitive sites must be fenced to prevent livestock access to these areas. No grazing, burning or agricultural activities are allowed within any of these areas without prior monitoring (see section below dealing with monitoring). Ideally, a buffer zone should also be included within the perimeter.

Mitigation Measure 28 - Burning - as general rule, burning (veld fires) is NOT allowed, especially during the Grass-owl breeding season between March and June. However, the vegetation structure and composition should be monitored on an annual basis to determine if the habitat meets the breeding requirements of Grass-owls. If the habitat is found to be sub-optimal or moribund and only when the area is not utilised by owls, it is recommended that the site be burned in spring after the first rains (to promote a cold burn of the graminoid cover). This should planned and collaborated with an ecologist and an avifaunal specialist;

Mitigation Measure 29 - Alien and invasive weeds – The area site should be monitored for the presence of alien and invasive weed species (such as *Acacia mearnsii, Melia azedarach, Opuntia ficus-indica, Eucapyptus* species, and *Cirsium vulgare*). All individuals of these species should be eradicated by means of manual labour and appropriate removal methods.

23.4 General Biodiversity Mitigation Recommendations & EMPr Contributions

Mitigation Measure 30 - Appropriate dust control measures must be in place to limit the effects of dust pollution on the surrounding areas to acceptable levels, with particular reference to the adjacent *Imperata cylindrica* grassland patch;

Mitigation Measure 31 - A road management plan should be compiled prior to the commencement of construction activities;

Mitigation Measure 32 - Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted;

Mitigation Measure 33 - Access to the site should take cognisance of the presence of sensitive habitat types, preferably placing access roads as far as possible from these areas;

Mitigation Measure 34 - No roads should be allowed within ecologically sensitive areas;

Mitigation Measure 35 - Existing roads must be used to transport the material needed from the Witpoort and Sandstone quarry to the Rietspruit Dam wall; no new roads may be constructed to be utilised during the construction process;

Mitigation Measure 36 - Areas subjected to land clearance must be kept to a minimum;

Mitigation Measure 37 - Appoint an Environmental Control Officer (ECO) prior to commencement of construction. Responsibilities should include, but not necessarily be limited to, ensuring adherence to authorisation requirements, EMP guidelines, guidance of activities, planning, reporting;

Mitigation Measure 38 - The ECO must convey contents of the EMP relevant to sensitive biodiversity aspects of the site and surround to the site staff and discuss the contents in detail with the Project Manager and Contractors;

Mitigation Measure 39 - The ECO must take appropriate action if the specifications contained in the EMP are not followed;

Mitigation Measure 40 - No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required;

Mitigation Measure 41 - Where possible, implement a suitable buffer zone (at least 30 m) between the edge of biodiversity sensitive (high and medium-high sensitivity) areas and any type of development or surface disturbance. Cognisance should also be taken of recommendations presented in the wetland specialist report, with particular reference to buffer zones around wetland areas;

Mitigation Measure 42 - The Project team will compile a Fire Management Plan (FMP) and Contractors directed by the ECO will submit a FMP. The Project FMP shall be include, *inter alia,* aspects such as relevant training, equipment on site, prevention, response, rehabilitation and compliance to the National Veld and Forest Fire Act, Act No. 101 1998;

Mitigation Measure 43 - Prevent all open fires;

Mitigation Measure 44 - Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited;

Mitigation Measure 45 - The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard and should be guided by safe practice guidelines;

Mitigation Measure 46 - The use of fire as a management tool in ecologically sensitive areas should be guided and instructed by a qualified ecologist and based on results and recommendations of a biodiversity monitoring protocol;

Mitigation Measure 47 - Provide demarcated fire-safe zones, facilities and suitable fire control measures;

Mitigation Measure 48 - Cleared vegetation and debris that has not been utilised will be collected and disposed of to a suitable waste disposal site; it will not be burned on site;

Mitigation Measure 49 - Remove and store topsoil separately in areas where excavation/ degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate regrowth of species that occur naturally in the area;

Mitigation Measure 50 - Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting;

Mitigation Measure 51 - No spoil material will be dumped outside the defined site;

Mitigation Measure 52 - Provide temporary on-site ablution, sanitation, litter and waste management and hazardous materials management facilities;

Mitigation Measure 53 - Abluting anywhere other than in provided toilets shall not be permitted. Under no circumstances shall use of the veld be permitted;

Mitigation Measure 54 - Prevent any and all defacement of natural features, no permanent markings (paint, concrete, etc) shall be allowed. Temporary markings should be environmentally-friendly;

Mitigation Measure 55 - Develop and implement a dedicated hydro-carbon spill action plan, which shall include prevention (drip trays, remote refilling, bunding, etc.) and reactionary (spill kits, biological cleaning agents, etc.).

23.5 Monitoring Protocol for African Grass-owls (*Tyto capensis*)[3]

The two major objectives of the African Grass-owl monitoring protocol will be to focus on obtaining information regarding evidence of roosting and breeding of Grass-owls within the *Imperata cylindrica* patch adjacent to the rehabilitation site as well as providing relevant input pertaining to mitigation and intervention strategies to limit impacts of construction/ rehabilitation activities on these animals. The Grass-owl monitoring programme should entail, but not necessarily be limited to, the following:

1. An initial assessment of the relevant area by a qualified avifaunal specialist should be conducted **PRIOR** to the commencement of the construction process, also corresponding to the onset of the breeding season (late February to March) in order to establish:
   a. The presence and persistence of Grass-owls within the *Imperata cylindrica* patch adjacent to the rehabilitation site;
   b. To establish/ confirm potential breeding patterns of African Grass-owls within the demarcated area;
2. All evidence of Grass-owl occupancy (including confirmed individuals or nests) should be noted (by means of a GPS) and mapped accordingly along with the date of the observation, photographic evidence (*e.g.* roosting site, nests, feathers and regurgitated pellets) and the name of the observer. The data should be stored into a database and will be used to estimate local movements of owl individuals, density and nesting behaviour. In the event that a nest is located, the observer should record the number of eggs, nestlings and the date of the observation;
3. During the construction phase, monthly visits are recommended to monitor the status of birds within the demarcated area until construction/ rehabilitation is completed:
4. The monitoring protocol should follow the procedures as described under Note 2 (see above), but should also evaluate the status of the vegetation structure and composition. The status of the vegetation should be indicated by (1) species richness, (2) species composition, (3) species dominance, (4) cover abundance, (5) vegetation height and (6) presence of invasive weeds are estimated as well as the (7) degree of moribundness of the graminoid cover. The information will be correlated with the occupancy and frequency of owl records at the site to make informed decisions regarding burning and grazing frequency. Monitoring should be continued for at least two additional surveys subsequent to the completion of rehabilitation/ construction activities.
5. It is highly recommended that potentially suitable sites in the immediate surrounds (app. 10 km radius) of the study region be screened for suitable breeding and roosting habitat as well as the potential presence of Grass-owls. It is possible that additional areas could be available for colonisation of Grass-owls. Therefore, part of the monitoring protocol as defined under Note 4 should allocate effort to screen part of the surrounding area in a systematic manner.

23.6 African Grass-Owl Mitigation Measures

It is recommended that the following mitigation measures be implemented irrespective of the breeding activities of African Grass-owls adjacent to the rehabilitation site.

Mitigation Measure 56 - Implement a Grass-owl monitoring programme as part of the faunal monitoring protocol, as per **Section 23.5**;

Mitigation Measure 57 - Where possible, construction activities should not overlap with the peak breeding season of the owls. Tarboton, *et al.* (1987) gives the main egg-laying period in the (previous) Transvaal region as March to April. Allowing approximately one month for incubation and another month to six

[3] As confirmed and presented by avifaunal specialist Mr. L. Niemand (Pachnoda Consulting cc)

weeks for chicks to fledge (at about six weeks), the peak breeding season can be estimated to be a four month period between March and June[4];

Mitigation Measure 58 - Avoid any surface disturbances within areas of African Grass-Owl habitat;

Mitigation Measure 59 - All construction activities must be limited to daylight hours to mitigate the impacts on Grass-owls;

Mitigation Measure 60 - Signage & information boards - signage should be applied to the fences to inform the public and contractors that the fenced area is set aside as breeding habitat for Grass-owls. Therefore, the information should portray a general message that the area is classified as "sensitive" and access to the area is "restricted" in order to keep disturbances to a minimum;

Mitigation Measure 61 - Landowner and stakeholder agreements - the proposed sites coincide with farmland and are currently managed by private owners (assumed). A collaborative conservation effort between the proponent and the farmers should be investigated so that these areas will be managed as exclusion areas (*as areas where grazing and agricultural activities are prohibited*) for the sole purpose to benefit the long-term survival of Grass-owls in the area;

Mitigation Measure 62 - No grazing should be allowed within sensitive areas, especially at areas where Grass-owls are roosting or breeding. Grazing is only allowed prior to the burning of the area (depending on the outcome monitoring results, the breeding status of owls and the vegetation structure and composition – see section dealing with the monitoring programme below).

Mitigation Measure 63 - Fencing and delineation of exclusion zones – demarcated Grass-owl habitat must be *permanently fenced* to prevent livestock access to these areas. The top wire of the fence should not be of the barbed-type to prevent accidental collisions/mortalities when individual birds attempt to fly over the fence structure. An additional allowance of approximately 15 m should be allowed wherever possible;

Mitigation Measure 64 - No grazing should be allowed within sensitive areas, especially at areas where Grass-owls are roosting or breeding. Grazing is only allowed prior to the burning of the area (depending on the outcome monitoring results, the breeding status of owls and the vegetation structure and composition – see section dealing with the monitoring programme below).

Mitigation Measure 65 - No fires, laydown or construction camps are allowed within proximity of any suitable breeding/roosting habitat;

Mitigation Measure 66 - Road calming structures (e.g. speed humps) should be applied to roads in close proximity to optimal breeding or roosting habitat (e.g. where the road is within 50 m of the habitat);

Mitigation Measure 67 - Continual dust supersession is advised to control the possible settling of dust on optimal breeding/roosting habitat.

[4] It has been indicated that construction will unfortunately commence within the main breeding period of African Grass-owls, hence the recommendation to implement mitigation measures irrespective of breeding confirmation at this site.

24 CONCLUDING REMARKS

The area, on a regional scale, represents grassland habitat with the typical variations and biodiversity attributes associated with the Vaal-Vet Sandy Grassland ecological type. The conservation status of the habitat is Endangered, mostly because of a high agricultural utilisation factor and smaller areas of habitat loss associated with anthropogenic transformation, hence the categorisation of the site as part of a Critical Biodiversity Area by the West Province Biodiversity Conservation Assessment. On a local scale, agriculture accounts for the largest extent of habitat loss. In spite of a paucity of accurate biological data on a local and regional scale, a moderate sensitivity level is indicated to the region, implying that the likely presence of biological attributes of special conservation concern. Due to the small size of the proposed rehabilitation activity, no additional habitat losses are expected provided the effective and timely implementation of all recommended mitigation measures.

Floristic attributes of the areas surrounding the rehabilitation site comprehends the typical terrestrial grassland and wetland variations of the Vaal-Vet Sandy Grassland. A high floristic diversity is indicated, although belied by the poor sampling records on a local scale. Results of a brief site investigation revealed a number of relative small and isolated floristic variations. The status of these variations is largely determined by the anthropogenic influences, comprising mostly of transformed and natural types. Importantly, within the proposed rehabilitation area, no area of particular floristic or faunal sensitivity was recorded, rendering the potential for significant impacts on biodiversity related attributes relatively low. The presence of the Declining geophyte *Crinum bulbispermum* was recorded within the rehabilitation area and the timely removal of all individuals and relocation to the nearby wetland habitat downstream of the Rietspruit Dam is advised. It should be noted that the removal and relocation of protected plants are subjected to permitting requirements. The proximity of sensitive floristic variations, with particular reference to the *Imperata cylindrica* grassland patch and Floodplain & Drainage Channel Wetland Types, require the implementation of severe and strict mitigation measures.

Delineated floristic habitat types also proved accurate and relevant in terms of faunal habitat types. Similar to results of the floristic assessment, the status of these variations is largely determined by the anthropogenic influences, comprising mostly of transformed and natural types that render most of the rehabilitation are low in terms of faunal sensitivity. However, the spatial presence of areas of significantly sensitive faunal habitat directly adjacent to the proposed rehabilitation area was recorded; also confirmed by the observation of breeding Grass-owls. If unmitigated, the proposed rehabilitation activities will undoubtedly result in severe and permanent impacts within these areas as well as on sensitive faunal receptors. The implementation of severe and significant mitigation measures in order to prevent all impacts within these habitat types is strongly recommended.

All construction and rehabilitation activities should be guided by a comprehensive EMPr that takes cognisance of mitigation measures and recommendations presented in this report. The guidance and implementation of mitigation measures should be the responsibility with a well-versed Environmental Control Officer, in collaboration with recommendations compiled by a periodic biodiversity monitoring protocol. In particular, the implementation of a Grass-owl monitoring protocol and a potential conservation collaboration with landowners is strongly recommended. It is the conclusion of this report that, with the successful and timely implementation of recommended, and other generic, mitigation measures, the proposed rehabilitation project of the Rietspruit Dam containment wall is unlikely to result in significant and permanent impacts on sensitive biodiversity receptors of the rehabilitation area and the immediate surrounds. Disruption of ecological processes is likely to be of short duration, and subsequently recovering to a normal status.

25 PHOTOGRAPHIC RECORDS

Photo 1: Artificial habitat below the dam wall (road servitude)

Photo 2: Example of Deteriorated Grassland habitat

Photo 3: Example of *Imperata cylindrica* grassland patch, critical habitat for the Grass-owl

Photo 4: Example of *Imperata cylindrica* grassland patch, critical habitat for the Grass-owl

Photo 5: Extent of the *Imperata cylindrica* grassland area, view from the dam wall

Photo 6: Example of artificial habitat on the dam wall, note *Phragmites* reedbeds to the right

Photo 7: Example of *Phragmites* reedbeds

Photo 8: Example of the Declining *Crinum bulbispermum*

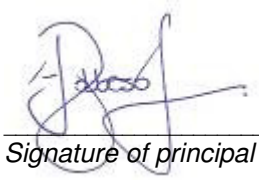
Photo 9: Example of the wetland habitat types below the dam wall

Photo 9: Example of a Grass-owl

26 DECLARATION OF INDEPENDENCE

Individual declarations attached as addendums. All specialist investigators, project investigators and members of companies employed for conducting this biodiversity investigation declare that:

- We act as independent specialist consultants conducting the assessment and compiling the report;
- We consider ourselves bound to the rules and ethics of the South African council for natural scientific professions;
- Bathusi Environmental Consulting cc is not a subsidiary, legally or financially, of either the proponent (The Department of Water and Sanitation, North-West Province) or Royal HaskoningDHV);
- At the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development or activity as outlined in this document, other than fair financial compensation for work performed in a professional capacity;
- We will not be affected in any manner by the outcome of the environmental process of which this assessment forms part of, other than being part of the general public;
- We do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience;
- We do not have any influence over decisions made by the governing authorities;
- We undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2005;
- We undertake to provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not;
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.



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Signature of principal ecologist:

Bathusi Environmental Consulting cc (CK1999/052182/23)

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Name of company:

4th November 2015

_____

Date:

27 APPENDIX 1: INVENTORY OF PLANTS RECORDED WITHIN THE STUDY SITE

*** denotes a plant taxa of conservation concern**
**** denotes an alien and invasive plant species**

Biological Name	Family	Growth Form	Status/ Uses	Common Name
Acacia karroo Hayne	Fabaceae	Tree	Edible parts, dyes and tans, medicinal uses, firewood	Sweet Thorn (e), Soetdoring (a)
Acacia mearnsii De Wild. **	Fabaceae	Tree	Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014), Invader Species, Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998)	Black Wattle (e), Swartwattel (a)
Albuca species	Liliaceae	Geophyte	None	--
Aloe greatheadii	Asphodelaceae	Succulent	Protected Plant, Schedule 11 (Mpumalanga Nature Conservation Act 10 of 1998)	Spotted Aloe (e), Transvaalaalwyn (a)
Alysicarpus rugosus	Fabaceae	Forb	None	--
Aristida species	Poaceae	Grass	None	--
Asparagus laricinus Burch.	Liliaceae	Shrub	Edible parts	Cluster-leaved Asparagus (e), Bergkatbos (a)
Asparagus suaveolens Burch.	Liliaceae	Shrub	None	Bushveld Asparagus (e), Gewonekatbos (a)
Berkheya carlinopsis	Asteraceae	Forb	Weed	Regopdissel (a)
Berkheya setifera DC.	Asteraceae	Forb	Weed, widespread	Rasperdisseldoring (a)
Bidens pilosa L. **	Asteraceae	Forb	Naturalised exotic, edible parts, Invader Species, Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998)	Black-jack (e), Knapsekêrel (a)
Brachystelma species	Apocynaceae		Protected Plant, Schedule 11 (Mpumalanga Nature Conservation Act 10 of 1998)	--
Bulbine abyssinica A. Rich.	Liliaceae	Succulent	None	
Bulbine narcissifolia	Liliaceae	Succulent	Medicinal uses	Wild Kopieva (e), Wildekopieva (a)
Chaetacanthus costatus Nees	Acanthaceae	Forb	None	--
Ciclospermum leptophyllum (Pers.) Eichler **	Apiaceae	Forb	Exotic weed (S America)	Lawn Celery (e), Wilde Seldery (a)
Cirsium vulgare (Savi) Ten. **	Asteraceae	Forb	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014), Invader Species, Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998)	Scottish thistle (e), Skotse dissel (a)
Crabbea acaulis N.E.Br.	Acanthaceae	Forb	None	--
Crinum bulbispermum (Burm.f.) Milne-Redh. & Schweick. *	Amaryllidaceae	Geophyte	Declining Status, medicinal uses, indicator of moist conditions, Protected Plant , Schedule 11 (Mpumalanga Nature Conservation Act 10 of 1998)	Orange River Lily (e), Oranjerivierlelie (a)
Cucumis hirsutus Sond.	Cucurbitaceae	Prostrate herb	None	--
Cymbopogon pospischilii	Poaceae	Grass	Aromatic grass, unpalatable, Increaser I	Narrow-leaved Turpentine Grass (e), Smalblaarterpentyngras (a)

Cynodon dactylon (L.) Pers.	Poaceae	Grass	Indicator of disturbed areas, grazing potential	Common Couch Grass (e), Gewone kweekgras (a)
Cyperus marginatus Thunb.	Cyperaceae	Sedge	None	--
Cyperus rupestris	Cyperaceae	Sedge	None	--
Cyperus species 1	Cyperaceae	Sedge	None	--
Cyperus species 2	Cyperaceae	Sedge	None	--
Cyperus species 3	Cyperaceae	Sedge	None	--
Denekia capensis	Asteraceae	Prostrate herb	Indicator of moist conditions	--
Dicoma capensis	Asteraceae	Dwarf shrub	Medicinal uses	Koorsbossie (a)
Diospyros austro-africana	Ebenaceae	Small tree	None	Fire-sticks (e), Jakkalsbessie (a)
Diospyros lycioides	Ebenaceae	Small tree	Medicinal uses, edible parts, dyes	Star Apple (e), Bloubessie (a)
Dipcadi species	Liliaceae	Geophyte	None	--
Eragrostis capensis (Thunb.) Trin.	Poaceae	Grass	Moderate grazing potential	Heart-seed love grass (e), Hartjiesgras (a)
Eragrostis chloromelas Steud.	Poaceae	Grass	Edible parts, Increaser IIB	Curly leaf (e), Krulblaar (a)
Eragrostis curvula (Schrad.) Nees	Poaceae	Grass	Edible parts, indicator of degraded areas	Weeping love grass (e), Oulandsgras (a)
Eucalyptus species **	Myrsinaceae	Tree	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014) (see act for detail), Invader Species, Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998)	Eucaluptus gum tree (e), Bloekomboom (a)
Felicia muricata	Asteraceae	Forb	None	Wild Aster (e), Blouheuning (a)
Gazania krebsiana	Asteraceae	Forb	Medicinal uses, food source	Butter flower (e), Botterblom (a)
Gomphocarpus fruticosus (L.) Aiton f.	Apocynaceae	Shrub	Medicinal uses	Milkweed (e), Melkbos (a)
Grewia flava DC.	Tiliaceae	Shrub	Edible parts, weaving, traditional uses, declared indicator of encroachment	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Guilleminea densa	Amaranthaceae	Prostrate herb	None	--
Helichrysum nudifolium (L.) Less.	Asteraceae	Forb	None	Hottentot's tea (e), Hottentotstee (a)
Helichrysum rugulosum Less.	Asteraceae	Forb	None	--
Helichrysum species	Asteraceae	Forb	None	--
Hermannia depressa N.E.Br.	Malvaceae	Prostrate herb	Medicinal uses	Rooiopslag (a)
Hermannia transvaalensis Schinz	Malvaceae	Prostrate herb	None	--
Heteropogon contortus (L.) Roem. & Schult.	Poaceae	Grass	Moderate grazing potential, irritant	Spear grass (e), Assegaaigras (a)
Hilliardiella oligocephala	Asteraceae	Forb	Medicinal uses	Bitterbossie (a) (previous Vernonia oligocephala)
Hyparrhenia hirta (L.) Stapf	Poaceae	Grass	Thatching & weaving	Thatch Grass (e), Dekgras (a)
Hyparrhenia tamba (Steud.) Stapf	Poaceae	Grass	None	Berggras (a)
Hypoxis iridifolia Baker	Hypoxidaceae	Geophyte	None	--
Imperata cylindrica (L.) Raeusch.	Poaceae	Grass	Thatching & weaving, Increaser I	Cottonwool Grass (e), Donsgras (a)
Indigofera hilaris Eckl. & Zeyh.	Fabaceae	Forb	None	--
Jamesbrittanea aurantiaca	Scrophulariaceae	Forb	Colours & dyes	Cape Saffron (e), Saffraanbossie (a)

Lactuca inermis Forssk.	Asteraceae	Forb	None	--
Lantana rugosa Thunb.	Verbenaceae	Dwarf shrub	None	Bird's Brandy (e), Voëlbrandewyn (a)
Media azedarach **	Meliaceae	Tree	Declared Invader - Category 1B. Category 3 in urban areas (NEM:BA, 2004. AIP, 2014), Invader Species, Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998)	Seringa (e), Gewone sering (a)
Melinis repens	Poaceae	Grass	Poor grazing potential, Increaser IIc	Natal Red Top (e), Natal-rooipluim (a)
Oenothera rosea L'H,r. ex Aiton	Onagraceae	Forb	Weed (S. America), moist & degraded places	Rose evening primrose (e), Pienkaandblom (a)
Oenothera tetraptera Cav.	Onagraceae	Forb	Weed (Mexico)	White evening primrose (e), Witaandblom (a)
Opuntia ficus-indica (L.) Mill. **	Cactaceae	Succulent	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014), Invader Species, Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998), edible parts	Prickley pear (e), Turksvy (a)
Oxalis species	Oxalidaceae	Geophyte	Edible parts	Bobbejaanuintjie (a)
Pellaea calomelanos	Adianthaceae	Fern	Medicinal properties	Hard Fern (e), Hardevaring (a)
Pennisetum clandestinum Chiov. **	Poaceae	Grass	Declared Invader - Category 1B in protected areas and wetlands (NEM:BA, 2004. AIP, 2014)	Kikuyu Grass (e), Kikoejoegras (a)
Pentarrhinum insipidum E.Mey.	Apocynaceae	Climber	Edible parts, Non endemic	African Heartvine (e), Donkieperske (a)
Phragmites australis (Cav.) Steud.	Poaceae	Hydrophilic	Thatching, traditional uses, medicinal properties	Common Reed (e), Fluitjiesriet (a)
Plantago lanceolata L.	Plantaginaceae	Forb	Weed (Europe)	Buckhorn Plantain (e), Oorpynhoutjie (a)
Pollichia campestris Aiton	Illebracaceae	Dwarf shrub	Edible parts	Waxberry (e), Teesuiker (a)
Polygala hottentotta C.Presl	Polygalaceae	Forb	None	--
Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burtt	Asteraceae	Forb	Weed (Europe)	Jersey Cudweed (e), Roerkruid (a)
Ranunculus multifidus Forssk.	Ranunculaceae	Hydrophilic	Indicator of moist conditions	Buttercup (e), Botterblom (a)
Searsia lancea L.f.	Anacardiaceae	Tree	Edible parts, tanning	Common Karree (e), Gewone Karree (a)
Searsia leptodictya Diels	Anacardiaceae	Small tree	None	Mountain Karee (e), Bergkaree (a)
Searsia pyroides	Anacardiaceae	Small tree	Edible parts, Medicinal uses	Common wild currant (e), Gewone taaibos (a)
Senecio erubescens	Asteraceae	Forb	None	--
Seriphium plumosum	Asteraceae	Shrub	Invasive properties	Bankrupt bush (e), Bankrotbos (a)
Setaria species	Poaceae	Grass	None	Bristle grass (e), Mannagras (a)
Sium repandum Welw. ex Hiern	Anacardiaceae	Hydrophilic	None	
Tagetes minuta L.	Asteraceae	Forb	Essential oils, colours & dyes	Khaki Weed (e), Kakiebos (a)
Tephrosia species	Fabaceae	Forb	None	--
Themeda triandra Forssk.	Poaceae	Grass	Palatable grazing, Decreaser	Red grass (e), Rooigras (a)
Tribulus terrestris L.	Zygophyllaceae	Prostrate herb	Medicinal uses	Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Tripteris aghillana	Asteraceae	Dwarf shrub	None	Bietou (a)
Turbina oenotheroides	Convolulaceae	Prostrate Herb	None	Krismisblom (a)
Typha capensis (Rohrb.) N.E.Br.	Typhaceae	Hydrophilic	Cosmopolitan weed, edible parts, medicinal uses	Bulrush (e), Papkuil (a)

Verbena brasiliensis Vell. **	Verbenaceae	Forb	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014), Weed (S. America)	Brazilian verbena
Ziziphus mucronata	Rhamnaceae	Small tree	Edible parts, medicinal uses	Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)

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