

Ecological Management Services Ecological Management Services

UPDATED BIODIVERSITY SURVEY REPORT FOR THE TSHIPI BORWA MINE IN SUPPORT OF THE EMP AMENDMENT PROCESS, HOTAZEL NORTHERN CAPE

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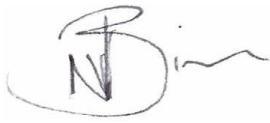
For
SLR Consulting (Africa) (Pty) Ltd (Pty)

February 2017

DECLARATION OF CONSULTANT

I Natalie Birch declare that I –

- act as the independent specialist in this study;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- do not have and will not have any vested interest in the activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- 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, 2014;
- will provide the competent authority with access to all information at my disposal regarding the study.



Natalie Birch Pr. Sci. Nat 400117/05

February 2017

TABLE OF CONTENTS

1. INTRODUCTION 5

 1.1. TERMS OF REFERENCE & SCOPE OF WORK..... 5

 1.2. DATA SOURCING AND REVIEW 6

 1.3. LIMITATIONS AND ASSUMPTIONS10

2. REGULATORY AND LEGISLATIVE OVERVIEW12

3. METHODOLOGY15

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE 17

 4.1. BROAD-SCALE VEGETATION PATTERNS 17

 4.2. PLANT COMMUNITY DESCRIPTION17

 4.3. POPULATIONS OF SENSITIVE AND/OR THREATENED PLANT SPECIES22

 4.4. CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES 23

 4.5. ALIEN/INVASIVE SPECIES25

 4.6. AREAS OF DISTURBANCE.....27

 4.7. POPULATIONS OF SENSITIVE AND/OR THREATENED FAUNAL SPECIES27

5. SITE SENSITIVITY.....30

6. POTENTIAL IMPACTS36

 6.1. VEGETATION AND FLORISTICS.....36

 6.2. FAUNA38

7. RECOMMENDATIONS AND CONCLUSION41

APPENDIX 146

 SPECIES LISTS.....46

APPENDIX 2 REGIONAL CONSERVATION PLANNING --- 55

APPENDIX 358

 DETAILS OF SPECIALIST58

ABBREVIATIONS

ADE	Aquifer Dependent Ecosystems
BGIS	Biodiversity Geographical Information System
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species
DAFF	The Department of Agriculture, Forestry and Fisheries
DENC	Department of Environment and Nature Conservation
EIA	Environmental Impact Assessment
EWT	Endangered Wildlife Trust
FEPA	Freshwater Ecosystem Priority Areas
GPS	Global Positioning System
GWC	Griqualand West Centre of Endemism
IUCN	International Union for Conservation of Nature
NCNCA	Northern Cape Nature Conservation Act
NEM: BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas assessment
NPAES	National Protected Areas Expansion Strategy
PESEIS	Present Ecological State, Ecological Importance & Ecological Sensitivity
QDS	Quarter Degree Squares
SABAP	South African Bird Atlas Project
IBA	Important Bird and Biodiversity Area
SABIF	South African Biodiversity Information Facility
SANBI	South African National Biodiversity Institute
SARCA	Southern African Reptile Conservation Assessment
SIBIS	SANBI' s Integrated Biodiversity Information System
TOPS	Threatened or Protected Species

1. INTRODUCTION

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) currently operates the Tshipi Borwa Mine located on the farms Mamatwan 331 (mining right and surface use areas) and Moab 700 (surface use area), approximately 18 km to the south of Hotazel in the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Tshipi is proposing to amend its approved Environmental Impact Assessment (EIA) and Environmental Management Programme Report (EMPr) to cater for changes to its approved infrastructure layout.

SLR has been appointed to conduct this process and has in turn, appointed Ecological Management Services to update the original biodiversity assessment. The original report and the updated version was compiled by Dr N.V. Birch Pr. Sci Nat. (reg no 400117/05). Details of the specialist are attached in Appendix 3

1.1 TERMS OF REFERENCE & SCOPE OF WORK

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) currently operates the Tshipi Borwa Mine located on the farms Mamatwan 331 (mining right and surface use areas) and Moab 700 (surface use area), approximately 18 km to the south of Hotazel in the John Taolo Gaetsewe District Municipality in the Northern Cape Province.

Tshipi currently holds a mining right (NC/30/5/1/2/2/0206MR) issued by the Department of Mineral Resources, as well as an approved Environmental Management Programme (EMP), and an environmental authorisation (EA) (NC/KGA/KATHU/37/2008) issued by the Department of Environment and Nature Conservation (DENC).

Tshipi is currently in the process of amending its approved Environmental Impact Assessment (EIA) and Environmental Management Programme Report (EMPr) to cater for changes to its approved infrastructure layout. In broad terms, this includes the following:

- An increase in the number, position, volume and layout of waste rock dumps
- Change to the design, capacity and position of the sewage treatment plant
- Change to the to the stormwater management system including additional storage
- Change to the potable water storage facilities capacity and position
- Change to the position of the office, plant, workshop and related infrastructure
- Change to the number, position, volume and layout of the ore stockpiles

- Change to the design of the railway line and an increase in length
- The establishment of an additional temporary run-off mine stockpile area
- The establishment of a tyre bays
- The establishment of additional weighbridges
- The establishment of an additional temporary topsoil stockpile area (No. 2)
- The change in the position of the secondary crushing and screening plant.

In addition to the above, additional proposed facilities include the expansion of the approved topsoil stockpile area (No. 1), the expansion of topsoil stockpile area (No. 2), the change in the position of the approved 78ML stormwater dam and the establishment of a clean and dirty water system. In addition to this, Tshipi is proposing on mining the barrier pillar between the Tshipi Borwa Mine and South 32 (Mamatwan Mine).

The original survey included;

- Desktop and field investigations to identify and map different habitats, concentrating on areas proposed for new infrastructure
- Assign species to each habitat through various sampling methods
- Rank each habitat type based on conservation importance (in terms of provincial biodiversity priorities and ecological sensitivity)
- Identify potential impacts (including cumulative) on ecology
- To have input, together with SLR, into project alternatives and ecology management measures going forward

Included in this updated report:

- Updated floral and faunal species of conservation concern status
- Comments concerning site sensitivity and biodiversity impact significance, with respect to the planned EMP amendments

12. DATA SOURCING AND REVIEW

The data sources consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS), was extracted from the SABIF/SIBIS database hosted by SANBI. This is a much larger extent than the study area, but the data was extracted from a larger area to account for the fact that the area has probably not been well

sampled in the past.

- The IUCN conservation status of the species in the list (Table 1.1) was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2011).
- Threatened Ecosystem data was extracted from the NEM:BA listed ecosystems layer (SANBI 2008).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases).
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- Bird species lists for the area were extracted from the SABAP 1 and SABAP 2 databases and Birdlife South Africa's Important Bird Areas was also consulted to ascertain if the site falls within the range of any range-restricted or globally threatened species.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site. For each species, the likelihood that it occurs at the site was rated according to the following scale:
 - Low: The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.
 - Medium: The habitat is broadly suitable or marginal and the species may occur at the site.
 - High: There is an abundance of suitable habitat at the site and it is highly probable that the species occurs there.
 - Definite: Species that were directly or indirectly (scat, characteristic diggings, burrows etc.) observed at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2012) (See Table 1) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of

which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

Table 1 . The IUCN Red List Categories for fauna and flora. Species that fall within the categories in red and orange below are of conservation concern.

IUCN Red List Category
Critically Endangered (CR)
Endangered (EN)
Vulnerable (VU)
Near Threatened (NT)
Critically Rare
Rare
Declining
Data Deficient - Insufficient Information (DDD)
Data Deficient - Taxonomically Problematic (DDT)
Least Concern

The following is provided in Accordance with NEMA Appendix 6,

Section	NEMA 2014 Regs – Appendix 6 (1) Requirement	Position in Report
1	A specialist report prepared in terms of these Regulations must contain—	
(a)	Details of -	
	(i) the specialist who prepared the report; and	Cover page
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 3
(b)	a declaration that the person is independent in a form as may be specified by the competent authority;	Page 2
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(d)	the date and season of the site investigation and the relevance of the season to the outcome of the	Section 3

	assessment;	
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 3
(f)	the specific identified sensitivities of the site related to the activity and its associated structures and infrastructure;	Section 4.3, 4.7 and Section 5
(g)	an identification of any areas to be avoided, including buffers;	Section 5
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitive of the site including areas to be avoided, including buffers;	Section 5
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 6 and 7
(k)	any mitigation measures for inclusion in the EMPr;	Section 7
(l)	any conditions for inclusion in the environmental authorization;	Section 7
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6 & 7
(n)	a reasoned opinion- <ul style="list-style-type: none"> (i) as to whether the proposed activity or portions thereof should be authorized and (ii) if the opinion is that the proposed activity of portion thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; 	Section 7
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 8
(p)	a summary and copies of any comments received during	Section 8

	any consultation process and where applicable all responses thereto; and	
(q)	any other information requested by the competent authority.	Section 4 &7

13. LIMITATIONS AND ASSUMPTIONS

The potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints. The information presented in this report represents the wet/summer season survey. A full plant species list was compiled for the site from the site visits, this was complemented by a list of any listed species which are known from other studies to occur in the broad vicinity of the site. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach that takes account of the study limitations.

The Tshipi Borwa Mine is not located in any know CBA's. No information is currently available on the fine scale distribution of ADEs, type of plant association, (singly, in stands or gallery forests), aquifer association, condition of vegetation etc and therefore a precautionary approach should be taken when developing in and around these systems until such time that the research data indicates whether or not they are in fact CBAs.

There is no quantitative analysis of the resource base for the protected trees (*Vachellia erioloba* and *Vachellia haematoxylon*) thus it is not know how many of the trees can be removed from an area without detrimentally affecting the overall population numbers.

No additional survey was undertaken as part of this updated report. The vegetation map presented in this report has therefore been compiled from the original survey, thus the areas that have subsequently been mined and developed have not been included. There

is a constraint with respect to reporting the effects of disturbance and additional impacts when the raw data is out of date. As the vegetation data has not been updated the report can only assess the area as if it had not been disturbed at all and express an opinion as to how the proposed changes may or may not affect the biodiversity based on the original data. It is important to note that impacts are unlikely to change as a result of the project, however additional management actions may be required based on the findings of the monitoring programme.

2. REGULATORY AND LEGISLATIVE OVERVIEW

A summary of the relevant portions of the Acts which govern the activities and potential impacts to the environment associated with the development are listed below. Provided that standard mitigation and impact avoidance measures are implemented, not all the activities listed in the Acts below would actually be triggered.

National Environmental Management Act (NEMA) (Act No 107 , 1998) :

NEMA requires that measures are taken that "prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied:
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

National Environmental Management: Biodiversity Act (NEM: BA) (Act 10 of 2004):

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur. However, all of the vegetation types within and surrounding the study site are classified as Least Threatened.

NEM:BA also deals with endangered, threatened and otherwise controlled species, under the TOPS Regulations (Threatened or Protected Species Regulations). The Act provides for listing of species as threatened or protected, under one of the following categories:

- Critically Endangered: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- Vulnerable: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A TOPS permit is required for any activities involving any TOPS listed species.

National Forests Act (No. 84 of 1998) :

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: *“no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated”*. A permit is required for the destruction or transplant or transport of any protected tree species.

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

The purpose of this Act is to prevent and combat veld, forest and mountain fires. The Act provides for a variety of institutions, methods and practices for achieving the purpose such as the formation of fire protection associations. It also places responsibility on landowners to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires in terms of equipment as well as suitably trained personnel.

Conservation of Agricultural Resources Act (Act 43 of 1983) :

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants and those listed under Category 1 are prohibited and must be controlled while those listed under Category 2 must be grown within a demarcated area under permit. Category 3 plants includes ornamental plants that may no longer be planted but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodline of water courses and wetlands.

Northern Cape Nature Conservation Act, No. 9 of 2009 (NCNCA):

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

Manipulation of boundary fences 19. No Person may –

(a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1. A permit is required for any activities which involve species listed under schedule 1 or 2. A permit obtainable from the DENC permit office in Kimberly would be required for the site clearing. A permit would also be required to destroy or translocate any nationally or provincially listed species from the site. A single permit, which covers all of these permitting requirements as well as meets TOPS regulations, is used.

3. METHODOLOGY

The site visit for the original report was conducted during November 2008. An additional site visit was not undertaken for the updated report.

During the site visit for the original report the following methodology was employed, the different biodiversity features, habitat, vegetation and landscape units present at the site were identified and mapped in the field. Walk-through-surveys were conducted across the site and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbor or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

Flora

Aerial photographs & Satellite images were used to identify homogenous vegetation/habitat units within the study area. These were then sampled on the ground with the aid of a GSP to navigate in order to characterise the species composition. The following quantitative data was collected:

- species composition,
- cover estimation of each species according to the Braun-Blanquet scale,
- vegetation height,
- amount of bare soil and rock cover,
- slope, aspect
- presence of biotic disturbances, e.g. grazing, animal burrows, etc.

Additional checklists of plant species were compiled by traversing a linear route and recording species as they were encountered. Searches for listed and protected plant species at the site were conducted and all listed plant species observed were recorded. This search was then repeated to update the information originally obtained.

Fauna

The faunal study was undertaken as a desktop / literature survey combined with a field survey for the original report. The tasks included in each are given below.

Desktop/literature survey:

A desktop survey was undertaken to determine the red data reptile, amphibian, mammalian and bird species occurring in the quarter degree square in which the mining area falls. The likelihood of red data species occurring on-site has been determined using the distribution maps in the red data reference books and ii) a comparison of the habitat described from the field survey. This process was repeated for the updated report.

Field survey:

The habitats on-site were assessed to compare with habitat requirements of red data species determined during the original literature survey. During the site visit for the original report the presence and identification of bird and mammal species was determined using the following methods / techniques:

- Identification by visual observation.
- Identification of bird and mammal calls.
- Identification of spoor.
- Identification of faeces.
- Presence of burrows and / or nests.

To update the report a number of databases and resources were consulted to revise the conservation status of all the species noted in the original report. The vegetation map was not updated the amendment layout has been overlaid on the original plant communities.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 BROAD-SCALE VEGETATION PATTERNS

The study area falls within the Kathu Bushveld (Mucina & Rutherford 2006). The Kathu Bushveld which is described as an open savannah with the Camel Thorn¹, *Vachellia erioloba* (formerly known as *Acacia erioloba*) and Shepards Tree, *Boscia albitrunca* as the prominent trees. The shrub layer contains the Grey Camel Thorn, *Vachellia haematoxylon* (formerly known as *Acacia haematoxylon*) Black thorn *Senegalia mellifera*, (formerly known as *Acacia mellifera*) Blue bush, *Diospyros lycioides* and River Honey-thorn, and *Lycium hirsutum*. The grass layer is vary variable.

The study area has been disturbed by the existing mine, the following vegetation description has been extracted from the original report and has not been updated to include the mine. The community distribution map below represents the area prior to any disturbance from mining.

4.2 PLANT COMMUNITY DESCRIPTION

The site consists of a mixture of vegetation that displays various slight structural changes and dominance in woody vegetation. Three distinct broad vegetation communities could be identified within the study area, these vegetation types are described in more detail below, and are presented on the map (Figure 4.1).

Mixed *Vachellia* Savannah

This vegetation is distinctive owing to the height of the tree layer which is mainly comprised of tall *Vachellia erioloba* trees. Three vegetation strata are evident within this vegetation unit. There is a prominent tree layer between 2.5m – 6m, a shrub layer, between 1.5m – 2.5m and a grass layer with an average height of 70cm. *Vachellia erioloba*, *V. haematoxylon*, and *V. hebeclada*, are prominent within this vegetation type, however *Ziziphus muconata*, *Grewia flava* and *V. mellifera* also occur. The grass layer contained species such as *Eragrostis lehmanniana*, *Stipagrostis uniplumis*, *Schmidtia kalihariensis*, *Aristida stipitata* and *Aristida congesta* were common. Other common species include, *Gnidia polycephala*, *Tribulus zeyheri*, *Chrysocoma ciliata* and *Walafrida geniculata*

¹ Unlike scientific names, common names are almost always different for speakers of different languages. They may also vary regionally within a language. Some floral species do not have recognized common names. The use of common names is therefore not generally used with respect to plant species.

Within this vegetation type there are areas that contain a significantly higher percentage of *Vachellia erioloba* trees. These areas form distinctive patches but have not been mapped as a separate vegetation unit as they cover relatively small areas and do not show a significantly different floristic composition



Plate 4 .1 : The Mixed *Acacia* Savannah vegetation type within the study area (c) is representative of areas where the density of the *Vachellia erioloba* trees are higher within this vegetation type.

Vachellia haematoxylon Savannah

This community has a moderate grass cover (50-60%), the shrub layer is moderately developed. *Vachellia haematoxylon* is the dominant shrub species. The tree layer is

poorly developed with individuals of *Vachellia erioloba* occurring within the community. Common grass species include, *Schmidtia pappophoroides* (dominant), *Eragrostis lehmanniana*, (Lehmans love grass), *Eragrostis micrantha* (Finessa grass), *Stipagrostis uniplumis* (Silky bushmans grass), *Aristida congesta* and *Aristida stipitata* (Long-awned Three awn). Other common species within this vegetation type include, *Acanthosicyos naudiniana*, *Tribulus zeyheri*, *Gnidia polycephala*, *Helichrysum argyrosphaerum* and *Monochema incanum*.



Plate 4.2: *Vachellia haematoxylon* Savannah within the study area.

Grewia f lava Scrub

This vegetation type is characterised by a high percentage occurrence of *Grewia flava*. This vegetation type is characteristically shorter although scattered individuals of taller

trees do occur. *Grewia flava* dominates the shrub stratum however *Vachellia haematoxylon*, *Lycium hirsutum* and *Senegalia mellifera* are also present within this community. The grass layer is very patchy, but in some areas it is moderately well developed. Species such as, *Schmidtia pappophoroides*, *Eragrostis lehmanniana*, *Pogonarthria squarrosa*, *Aristida meridionalis* and *Aristida congesta* were common



Plate 4 . 3 : The structure of the vegetation within the *Grewia flava* scrub is shorter than the other vegetation units in the area, the grass layer is patchy, in some areas it is moderately developed

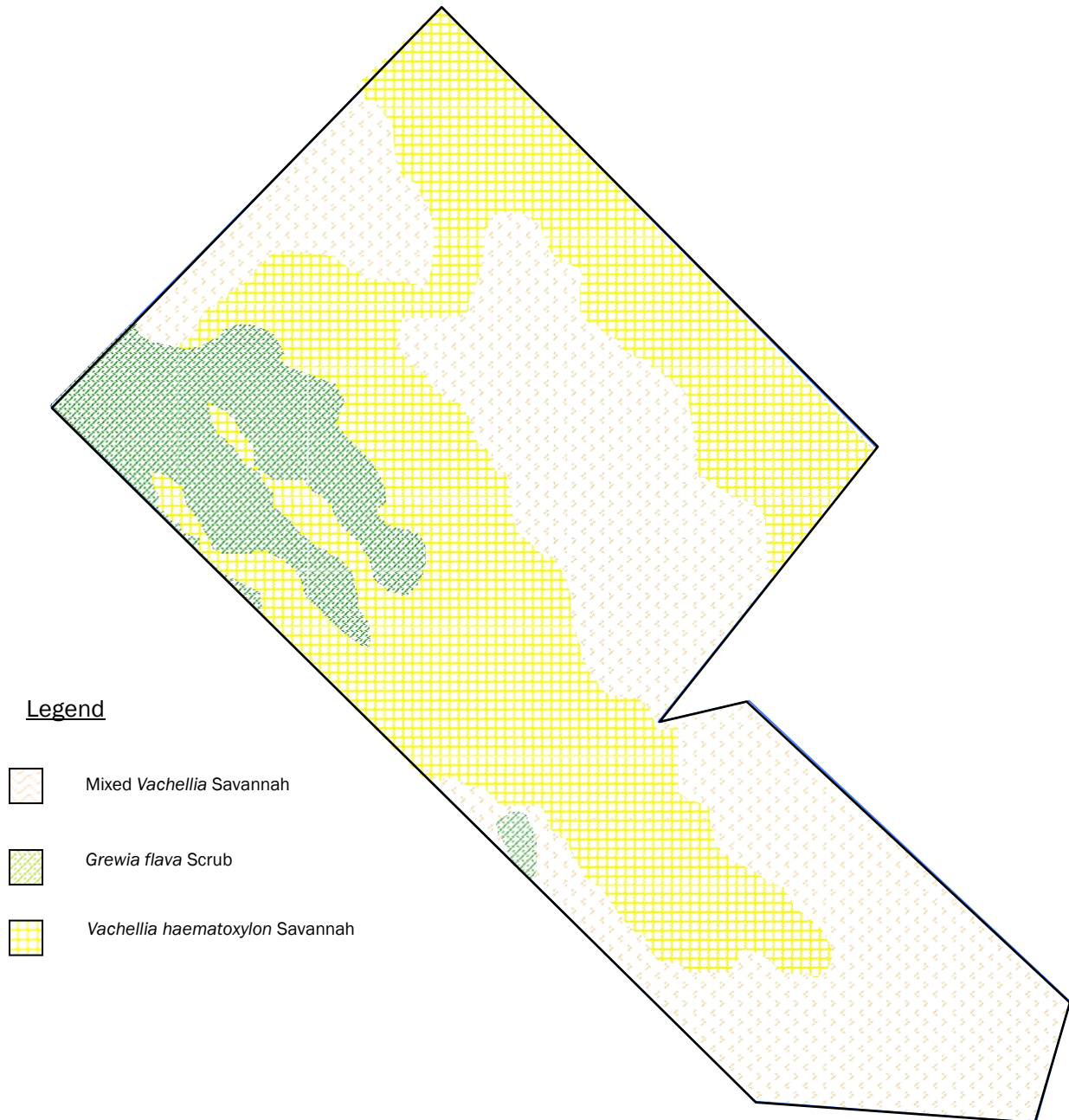


Figure 4 . 1 . Vegetation distribution map within the Mining Right Area prior to any disturbance from mining.

4.3. POPULATIONS OF SENSITIVE AND/OR THREATENED PLANT SPECIES

Historical records of Red List plant species were consulted in order to determine the likelihood of any such species occurring in the study area and these were searched for in the field during the original vegetation survey in 2008. A List of threatened plant species recorded in the quarter degree grid in which the study area is situated is listed in the table below. This list has been updated from the original report to include all updated legislation and status levels.

Species	Legislation	Conservation status	Present on site
<i>Vachellia erioloba</i>	National Forests Act 1998 Red List of South African plants	Protected Declining	Recorded on site
<i>Vachellia haematoxylon</i>	National Forests Act 1998	Protected	Recorded on site
<i>Moraea longistyla</i>	NCNCA	Schedule 2	Recorded on site
<i>Moraea pallida</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Babiana hypogaea</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Harpagophytum procumbens</i> Devil's claw	NCNCA	Schedule 1	Not recorded during field survey
<i>Boophone Disticha</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Brunsvigia radula</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Orthanthera jasminiflora</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Boscia albitrunca</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Crassula captella</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Kalanchoe brachyloba</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Ruschia griquensis</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Olea europaea</i>	NCNCA	Schedule 2	Not recorded during field survey
<i>Oxalis haedulipes</i>	NCNCA	Schedule 2	Not recorded during field survey

Table 4.1: Protected species that possibly occur on site.

Owing to the narrow temporal window of sampling the fact that some of these species were not encountered does not preclude them from occurring within the study site, it is therefore recommended that prior to any additional clearing a walk through is conducted. In order to remove these species during site clearing activities an integrated permit application will have to be made to the DENC to obtain the required permission to remove and/or translocate these species from site. An additional license to remove protected trees from the area will have to be obtained from the Department of Forestry.

4.4 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

Kathu bushveld is classified as least threatened (target 16%), however this vegetation type is not conserved in any statutory conservation areas and more than 1% has already been transformed, threats are from mining and to a lesser extent heavy grazing pressure.

The study area falls within the Griqualand West Centre of Endemism (GWC) (Van Wyk & Smith, 2001). A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. They are extremely vulnerable; relatively small disturbances in a centre of endemism may easily pose a serious threat to its many range-restricted species. The GWC is one of the 84 African centres of endemism and one of 14 centres in southern Africa, and these centres are of global conservation significance. The GWC is considered a priority in the Northern Cape, as the number of threats to the area is increasing rapidly and it has been little researched and is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority.

In terms of the mining and biodiversity guideline the study site does not fall into any biodiversity priority areas and is therefore not deemed a risk for mining (Appendix 2). However the river area north of the mine is considered to be of the highest biodiversity importance.

Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the

development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems.

The mining area does not fall within a NPAES focus area but is located more near an area identified as a potential protected area for the eastern Kalahari bushveld (appendix 2). The study area is not considered a NEM:BA threatened ecosystem and does not fall within a National Freshwater Ecosystem Priority Area. No fine-scale conservation planning has been conducted for this area, thus no critical biodiversity areas have been identified. A gap analysis undertaken for this area (EMS 2011) has revealed that information on an important ecosystem was lacking within the available biodiversity databases, namely information on the Aquifer Dependent Ecosystems (ADE), which occur within the area. ADEs particularly in arid ecosystems provide habitats for an array of species and are considered important in ecological processes and making available resources for the biodiversity in an area that would otherwise not be available. Thus ADEs could be considered critical biodiversity areas (CBA) for the study area, and thus would need to be mapped and assessed, even though ADEs are not specifically classified as a CBA in terms of SANBI databases. ADE's within the area that would be particularly critical are the terrestrial ADE's associated with species such as *Vachellia erioloba*, and *Vachellia haematoxylon*.

A study conducted by David Hoare Consulting (2013) showed that *Vachellia erioloba* occurred as scattered to more concentrated individuals throughout the region. However there appeared to be higher densities along the banks of the main channel of the Kuruman and Ga-Mogara Rivers in the area around Hotazel, and thus there would appear to be an ADE relationship associated with these non-perennial streams and the *Vachellia erioloba*. At present there is insufficient research data to determine whether these streams and their surrounding vegetation are in fact CBA and therefore a precautionary approach should be used until such time that the research data indicates that they are not CBA.

The study area does not fall within an Important Bird and Biodiversity Area (IBA). IBAs are sites of international significance for the conservation of the world's birds and other biodiversity.

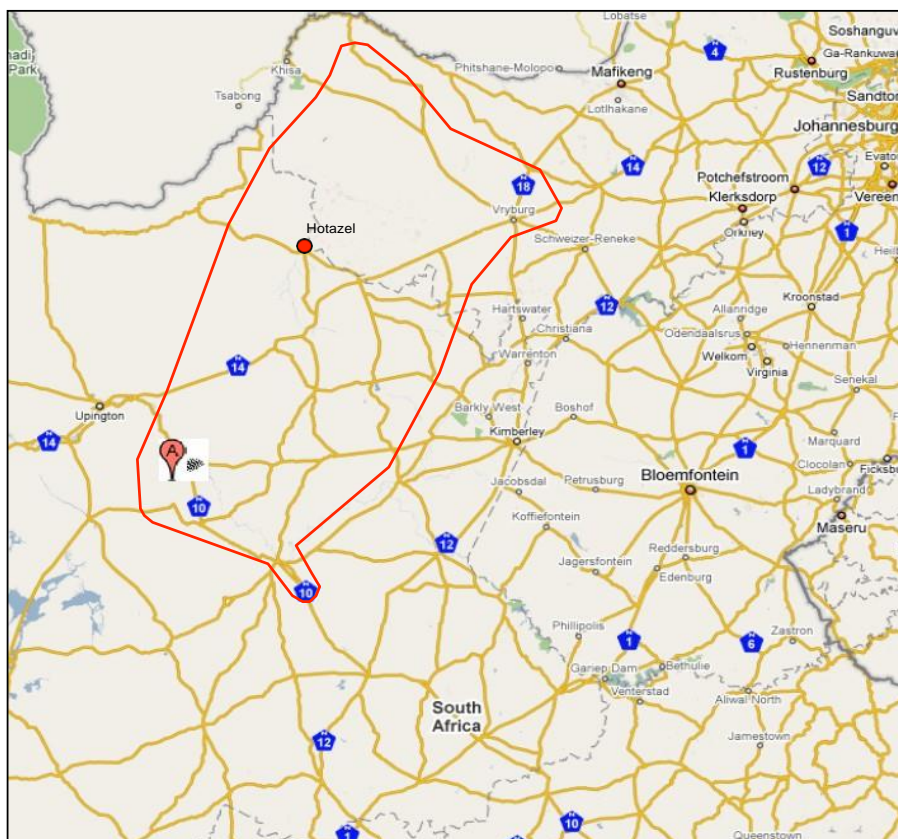


Figure 4.3: The approximate extent of the Griqualand West Center of Endemism (indicated in red).

4.5. ALIEN/INVASIVE SPECIES

Alien/invasive species are controlled in terms of National Environmental Management: Biodiversity Act 2004 (Act No. 10 Of 2004) Alien And Invasive Species Regulations, 2014 and Regulation 15 and Regulation 16 (R. 280 of 2001) of the Conservation of Agricultural Resources Act (No. 43 of 1993).

These plants are divided into three categories as indicated below:

Category 1 (a & b) Declared weeds; alien species prohibited on any land or water surface in South Africa; must be controlled or eradicated where possible.

Category 2 Declared invaders (commercial and utility plants) alien species allowed only in demarcated areas providing there is a permit and that steps are taken to prevent their spread.

Category 3 Declared invaders (ornamentals) alien species that may no longer be planted; existing plants may remain provided that all reasonable steps are taken to prevent their spread; prohibited within the floodline of watercourses and wetlands.

Declared indicators of bush encroachment indigenous species that under certain circumstances (overgrazing) may cause bush densification; CARA prescribes management practices aimed at preventing bush encroachment, and at combating it where it already occurs.

Alien and alien invasive species recorded in and around the property are listed in the table below:

Species		Category
<i>Argemone mexicana</i>	Yellow flowered Mexican Poppy	1
<i>Atriplex nummularia</i>	Old Man Salt Bush	2
<i>Pennisetum setaceum</i>	Fountain Grass	1
<i>Prosopis cf. glandulosa</i>	Mesquite	2
<i>Opuntia humifusa</i>	Prickly pear	1
<i>Achyranthes aspera</i>	Bur weed	1
<i>Xanthium spinosum</i>	Spiny cocklebur	1
<i>Argemone ochroleuca</i>	White flowered Mexican poppy	1

Table 4.3: Alien invasive species that occur in and around the property



Plate 4 .4 : Stands of the Mexican poppy (*Argemone mexicana*) were found around disturbed sites such as artificial water points and cattle kraals.

4.6. AREAS OF DISTURBANCE

The area has an operational mine and therefore there are sections where the vegetation has been cleared and the area disturbed. These areas are noted by the presence of infrastructure and mining as per the approved infrastructure and mine layout figure (see Figure 5.1)

Other disturbance factors within the area includes the mining activity in the adjacent areas



Plate 4.5: The adjacent Mamatwan Mine is clearly visible from the mining area.

4.7. POPULATIONS OF SENSITIVE AND/OR THREATENED FAUNAL SPECIES

Disturbance factors such as mining activities and agricultural activities result in disturbances to the naturally occurring faunal species. The mining activity on site and farming practises and mining activity in the surrounding area, have already disturbed the local faunal population. Very few faunal species observations were made during the original site visit thus emphasis was rather placed on the habitat in order to determine potential occurrence of species

Reptiles Species of Conservation Concern

No red data terrapin, tortoises, snakes or lizards were identified as occurring in the quarter degree square 2722BD, based on the distribution maps available in the South African Red Data Book for reptiles (Branch, 1988 and Alexander and Marais (2007)) and

The Southern African Reptile Conservation Assessment (SARCA). The conservation status was cross checked on the IUCN website to determine most recent status listing for these species.

Amphibians of Conservation Concern

No red data amphibians were identified as occurring in the quarter degree squares 2722BD, based on the distribution maps available in the South African Red Data Book for amphibians (Minter *et al.*, 2004) Du Preez and Carruthers (2009) and the South African Frog Atlas project.

Birds of Conservation Concern

A list of all red data bird species occurring in the quarter degree square 2722BD, was extracted from the SABAP 1 and SABAP 2 databases and Birdlife South Africa's Important Bird Areas and from the Red Data Book of Birds (Taylor *et al* 2015) with the distribution being confirmed in Roberts – Birds of Southern Africa, 7th edition (Hockey *et al.*, 2005). The IUCN 3.1. status is also presented in the table. Based on an evaluation of the habitat requirements for these red data species, the potential of these species occurring either on-site or within 500m of the property boundary is provided in Table 4.4 below.

Table 4 . 4 : Bird species of conservation concern identified as occurring in and around the quarter degree squares and the potential for occurrence on site prior to the mining activity.

Common Name	Scientific Name	Conservation Status (Regional*, Global)	Suitable Habitat requirements ²	Potential for Occurrence On-site prior to the mining activity ³
Martial Eagle	<i>Polemaetus bellicosus</i>	Endangered, Vulnerable	Woodland, savannah or grassland with clumps of large trees or power pylons for nest sites	High – Nesting habitat in the Mixed Savannah
Secretarybird	<i>Sagittarius serpentarius</i>	Vulnerable, Vulnerable	Requires open grassland with scattered trees, shrubland, open Mixed Savannah.	High – Patches of open savannah will accommodate this species.
Ludwig's Bustard	<i>Neotis ludwigii</i>	Endangered, Endangered	Requires semi-arid dwarf shrublands, occasionally visiting the southern Kalahari	Medium – Moderate to high shrub density throughout the sit

Mammals of Conservation Concern

² Habitat requirements determined using the following reference material: Harrison *et al.*, 1997a; Harrison *et al.*, 1997b; ; Hockey *et al.*, 2005

³ As no follow up survey has been conducted for this updated report only the potential for occurrence on site prior to the mining activity can be noted. It is assumed that the current mining activity would lessen the potential for occurrence from what was originally predicted.

*The 2014 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland

A list of all red data mammal species occurring in the quarter degree squares 2722BD, was extrapolated from the Red Data Book for Mammals (EWT, 2012). Based on an evaluation of the habitat requirements for these red data species (EWT, 2012; Skinner and Chimimba, 2005), the potential of these species occurring either on-site or within 500m of the property boundary is provided in Table 4.5 below.

Table 4 . 5 : Mammal species of conservation concern identified as occurring in and around the quarter degree squares and the potential for occurrence on the study site.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS ⁴	SUITABLE HABITAT ON- SITE ⁵	POTENTIAL FOR OCCURRENCE ON- SITE
Dent's Horseshoe Bat	<i>Rhinolophus denti</i>	Near threatened	Limited – Requires <i>substantial</i> cover such as caves and rock crevices.	Very little – Roosting habitat in the form of rock crevices may be available in the old mining area adjacent to the site. However, as the landscape in the area is flat sand veld and does not offer suitable roosting habitat for this species, it is unlikely that this species would have colonised the adjacent mining areas.
Honey badger	<i>Mellivora capensis</i>	Least Concern (protected -TOPS)	High – As they are catholic in habitat requirements, they are likely to occur on-site.	High – Suitable habitat within the study area.
South African Hedgehog	<i>Atelerix frontalis</i>	Near threatened (protected TOPS)	High – Require ample groundcover and dry places for nesting.	High to Medium – Suitable habitat available.

⁴ National Red List Status 2016

⁵ Habitat requirements determined using the following reference material: Skinner and Smithers, 1990; EWT,2012 ; Skinner and Chimimba, 2005

5. SITE SENSITIVITY

The classification of areas into different sensitivity classes is based on information collected at various levels. This includes the national conservation status of the vegetation, the presence of species of special concern and the condition of the vegetation

Vegetation types can be categorised according to their conservation status, which is in turn, assessed according to the degree of the transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the national vegetation map (Mucina & Rutherford 2006) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 5.1 as determined by best available scientific approaches.

habitat remaining (%)	80-100	Least threatened	LT
	60-80	vulnerable	VU
	*BT -60	endangered	EN
	0-*BT	Critically endangered	CR

Table 5 . 1 : Determining ecosystem status (from Driver *et al* 2005).

*BT = *biodiversity target (minimum conservation required)*

The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al* 2005).

The national status is based on 1996 National Landcover data (Fairbanks *et al* 2000) and is, therefore out of date. Additional transformation has taken place since 1996 and it is for this reason updated transformation information is often required to improve the conservation assessment. Although it is listed that 1% of Kathu Bushveld has been transformed (this figure is probably higher given the threats from mining) and this vegetation type is not statutorily conserved however it is classified as Least Threatened.

On a local scale the various habitat types or vegetation communities may have varying degrees of sensitivity or conservation value owing to their particular species composition of habitat structure.

Sensitivity of habitats and sites within the study area were assessed using a combination of criteria as follows:

	Criterion	Definition
1	Conservation status of untransformed habitats occurring in the study area	The extent of each vegetation type occurring within the study area that is conserved and/or transformed relative to a targeted amount required for conservation
2	Presence and number of Red Data species and other species of special concern	Presence or potential presence of Red Data species within habitats
3	Within-habitat species richness of flora and the between-habitat (beta) diversity of the site	Presence or potential presence of Red Data Species within habitats.
4	The type or nature of topography of the site, ie presence of ridges koppies etc	Steepness and/or nature of topography in the study area.
5	The type and nature of important ecological processes on site, especially hydrological processes, ie wetlands drainage lines etc.	Habitats and/or terrain features that represent ecological processes such as water-flow migration routes etc.

The first two of these criteria are the most commonly used criteria for assessing the conservation value of a site and also constitute the criterion most commonly employed to justify the conservation of a site.

Overall the study area is uniform in terms of topography, habitat structure and the types and nature of ecological processes that occur. However two of the described vegetation communities can be considered to have a slightly higher conservation priority and have been classified as a high sensitivity area. This is attributed to the higher density of the protected trees species that occur within them, these communities are the Mixed *Vachellia* Savannah and the *Vachellia haematoxylon* Savannah.

Vachellia haematoxylon is classified as a protected species under the National Forests Act of 1998 (Act 84 of 1998), and has a narrow distribution range (its distribution is shown below in green). The *V. haematoxylon* woodlands in the area around Kuruman are

not well conserved and are under threat from activities such as mining thus the loss of these woodlands has a significant impact.

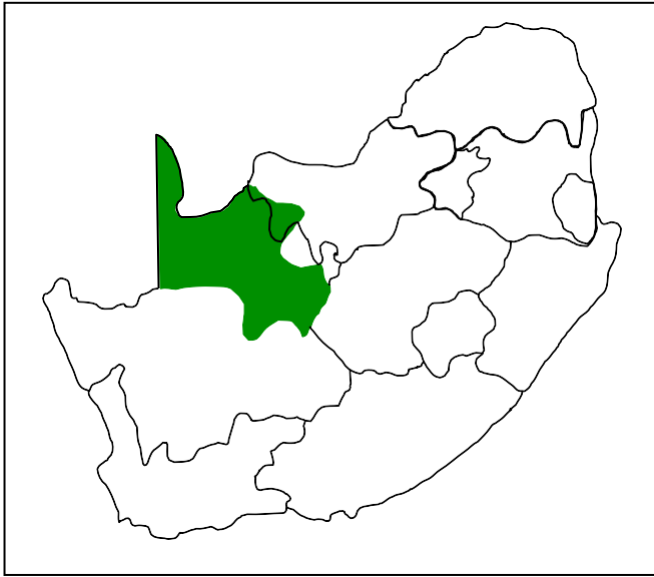


Figure 5 . 2 : The distribution range of *Vachellia haematoxylon*

Within the Mixed *Acacia* Savannah the areas of high *Vachellia erioloba* density are also a conservation concern. The *Vachellia erioloba* is also protected species under the National Forests Act of 1998 (Act 84 of 1998). No very large expansive trees were noted during the survey however the *Vachellia erioloba* within the study area typically occur in cohorts, these assemblages create very important microhabitats. Larger trees are important as nesting and as perching sites but the groups of smaller trees provide a unique habitat acting as a nursery for other plant species and creating important habitats for faunal species.

In order to assess changes in impact to the biodiversity by the changes in the infrastructure layout, the approved layout and the new layout have been overlaid with the original vegetation distribution map, for comparison purposes.

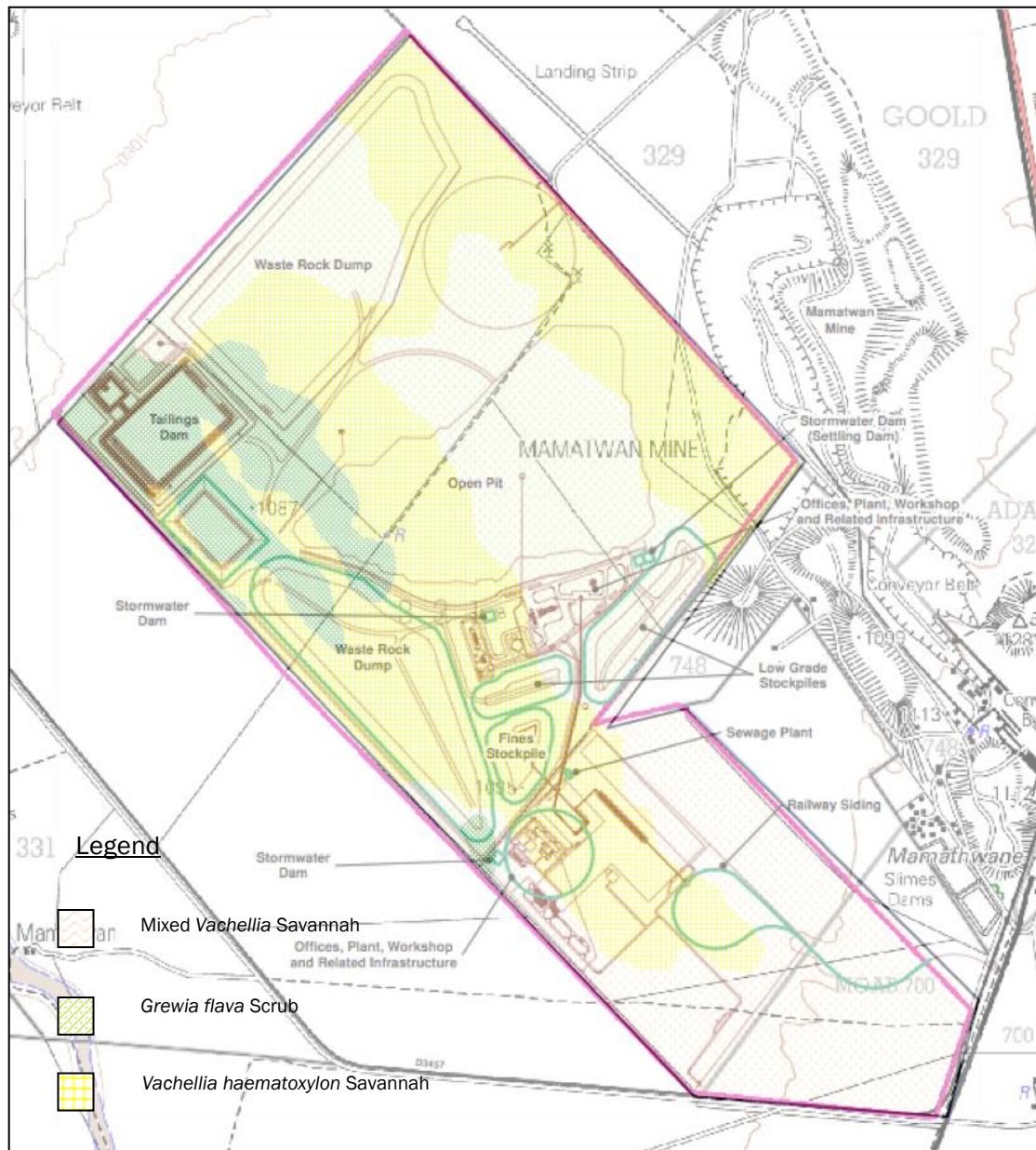


Figure 5 . 1 : The approve infrastructure layout overlaid with the vegetation distribution map.

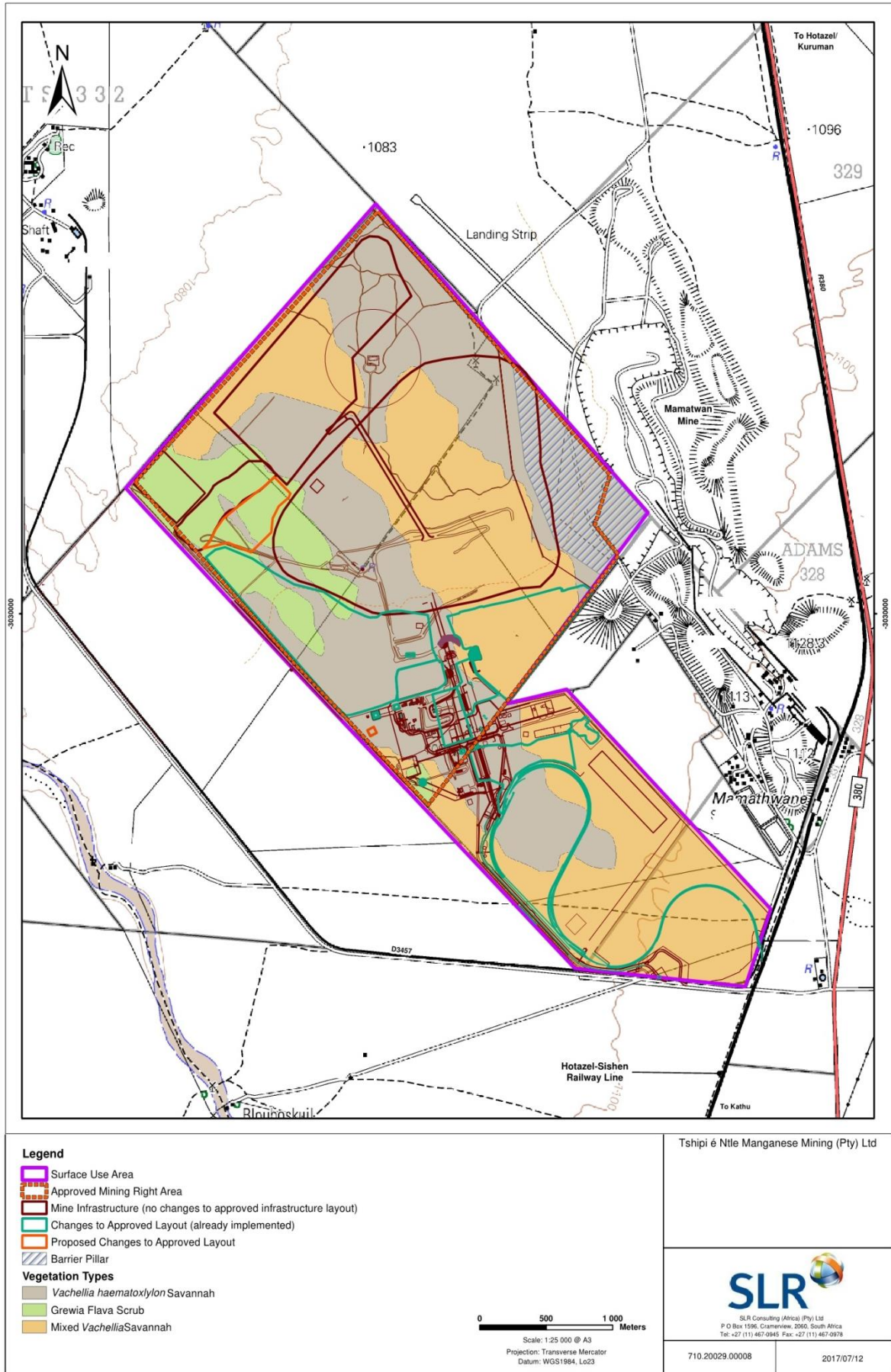


Figure 5.2: The proposed infrastructure layout overlaid within the vegetation distribution map.

The re-arrangement of the infrastructure in the new layout will not significantly change the overall loss of protected trees from the development area. Although some of the infrastructure changes will result in changes to the removal of individual trees, it is unlikely that these changes will result in an overall significant change in the number of protected trees lost. This is largely owing to the homogeneity of the plant community distribution across the area. The changes to the layout don't exclude or include different plant communities from the development area. Both layouts require vegetation clearing within sensitive plant communities and the removal of protected trees. However any additional surface area clearing, as a result of changes to the infrastructure and increasing the number of waste rocks dumps and topsoil stockpiles, will however result in additional protected trees being lost from the area. The density of these protected trees varies greatly within the areas, but can be as high as 20 trees/ha for Mixed *Vachellia* Savannah and up to 45 trees/ha for *Vachellia haematoxylon*. Thus for every additional 100ha that is cleared as part of the extended mining area, an additional loss of 2000 protected *V. erioloba* trees and 4500 protected *V haematoxylon* trees could result, depending on the plant community and relative density. Therefore the proposed mine expansion will result in the additional loss of a significant amount of protected trees.

Both rivers and wetlands are listed as types of watercourses and are afforded appropriate protection under the National Water Act and associated regulations. Thus no development should take place within riparian systems unless exemption from the regulation is applied for and obtained. The National Freshwater Ecosystem Priority Areas (NFEPA) (2011), database was consulted to define the aquatic ecology of the river systems close to or within the study area that may be of ecological importance. According to this database the study site is classified as an upstream management area (appendix 2). Upstream Management Areas, are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.

Aquifer Dependent Ecosystems (ADEs) occur throughout the South African landscape in areas where aquifer flows and discharge influence ecological patterns and processes. They are ecosystems, which require groundwater from aquifers for all or part of their life-cycle. A study conducted by David Hoare Consulting (2013) showed that there would appear to be an ADE relationship associated with the non-perennial streams in the area, such as the Ga-Moraga. At present there is insufficient research data to determine whether these streams and their surrounding vegetation are in fact Critical Biodiversity Areas (CBA). No information is currently available on the fine scale distribution of ADEs, type of plant association, (singly, in stands or gallery forests), aquifer association, condition of vegetation etc and therefore a precautionary approach should be taken

when developing in and around these streams until such time that the research data indicates whether or not they are in fact CBAs and how these areas are impacted by development.

6. POTENTIAL IMPACTS

These impacts relate to the expansion of the mining area and changes to the infrastructural layout.

6.1 VEGETATION AND FLORISTICS

6.1.1. Loss of natural vegetation

Project phase:

Construction Operational Decommissioning Closure

Description of impact:

Vegetation clearing will occur as a result of mining and changes to the infrastructure. This will cause additional fragmentation and habitat disturbance in the landscape. This disturbance destroys primary vegetation and allows secondary pioneer species or invasive plants to enter and re-colonise disturbed areas. As primary vegetation is more functional in an ecosystem, this could irreversibly transform the vegetation characteristics in the area. Mitigation measures such as comprehensive rehabilitation of disturbed areas, a search and rescue operation prior to additional clearing, strict adherence to disturbing only the mining footprint area and conservation of ecological corridors can help reduce the significance of this impact.

6.1.2. Loss of sensitive habitats and protected floral species

Project phase:

Construction Operational Decommissioning Closure

Description of impact:

The additional clearing of vegetation will result in the direct loss of a significant amount of protected trees. The removal of *Vachellia erioloba* (Camel Thorn) and *Vachellia haematoxylon* (Grey Camel Thorn) trees not only results in a loss of the species richness in the area but has impacts on the ecosystem function of the area.

This proposed site falls within the Griqualand West Centre of Endemism. A significant amount of mining is taking place within this centre of endemism which is a cause for concern as this centre of endemism is under researched and not well understood thus vital aspects may be lost or disturbed because of a lack of fundamental knowledge which could assist in protecting this centre of endemism. The cumulative impacts of mining in

this area exacerbates the potential risk of losing information and/or ecosystem function owing to a lack of basic research information within this area.

Some mining impacts do not result in the immediate loss of natural habitat and important species but are cumulative on the structure and function of individual plants and ecosystems, and in some cases could ultimately result in permanent loss of species and natural habitat.

These impacts are an indirect result of mining activities within the mine footprint and include:

- Dust generation and fallout from all activities;
- Groundwater draw down associated with the pit

Dust may cause physical injury to tree leaves and bark, reduced fruit setting and cause a general reduction in growth. Dewatering as a result of mining would have the greatest negative impact on large trees within the study area and that these negative impacts would be exacerbated during periods of drought which could result in large scale mortalities of large trees in particular.

These impacts affect the ecological functioning of ecosystems and may result in deterioration of habitats and loss of sensitive species.

The impact could be temporary and reverse on mine closure (e.g. dust from roads) or could be permanent resulting in permanent changes in the ecosystem (e.g. ground-water dewatering, although ground water levels may recover over time after mining, important ecosystems, such as ADE's would have been lost). While the activities causing the impacts happen on the site, they could result in offsite impacts and regional effects, (eg important vegetation habitat loss on site could result in the loss of important faunal species from the greater area). The increase in the mining activity in the area increases the significance of this impact as the cumulative effects of these impacts increases.

6.1.3. Introduction or spread of alien species

Project phase:

Construction Operational Decommissioning Closure

Description of impact:

The disturbance associated with surface clearing, mining and infrastructure construction may lead to the introduction of alien plants species or the further spread of existing alien species within the area. Invasive species are now regarded as the second-leading threat to imperiled species, behind only habitat destruction. Land use in surrounding areas (eg mining & farming practises) is already causing the spread of alien plant species and the further disturbance of the landscape may exacerbate this problem within localised areas. A comprehensive alien eradication programme would assist in ensuring that the risk of spreading alien species is minimized.

6.2. FAUNA

6.2.1. Fragmentation of habitat

Project phase:

Construction Operational

Description of impact:

Termite mounds, burrows, nests and vegetation on which small mammals, insects, amphibians and reptiles are heavily reliant will be destroyed during clearing activities associated with mining, causing the permanent displacement of these animals.

Clearing of additional surface areas has the effect of creating unnatural open spaces through the vegetation and the matrix of the landscape. Due to this cleared open space, some species that habitually seek out protective cover for movement across the landscape may be prevented from moving across this open space due to the fear of predation. For smaller species, it limits movement and restricts access to foraging sites. This results in reduced population density of prey species (invertebrates and/or smaller birds and/or smaller mammals and/or herpetofauna) which then reduces the food availability for predators (invertebrates and/or smaller birds and/or smaller mammals and/or herpetofauna). The area surrounding the Tshipi Borwa Mine site has already been disturbed and altered and the removal of more natural vegetation results in a cumulative impact which significantly increases the significance of habitat fragmentation. Mitigation measures such as comprehensive rehabilitation of disturbed areas, strict

adherence to disturbing only the mining footprint area and conservation of ecological corridors can help reduce the significance of this impact. The implementation of a Biodiversity Action Plan will also assist in conserving the undeveloped areas within the property, which will aid in mitigating the impact of habitat fragmentation.

6.2.4. Loss of faunal species of conservation concern

Project phase:

Construction Operational Decommissioning Closure

Description of impact:

Some faunal species of conservation concern have the potential to occur in the area and the additional loss of habitat could result in a further reduction in number or loss of the species from the area. Although important habitat for these animals would still remain within the surrounding area the increase in the loss of natural vegetation and habitat fragmentation from surrounding mining results in a cumulative impact which significantly increases the magnitude of this potential impact.

6.2.5. Intentional/ accidental killing of fauna including the young of ground nesting birds

Project phase:

Construction Operational Decommissioning

Smaller fauna will inevitably be killed during land clearing activities, as these activities will destroy their habitat. In addition to unintentional killing of fauna, some faunal species, particularly herpetofaunal species, are often intentionally killed as they are thought to be dangerous. Large exposed excavations could result in some faunal species falling in and being killed or being unable to escape from the excavation ultimately leading to death.

6.2.6. .Anthropogenic

disturbances Project phase:

Construction Operational

Anthropogenic disturbances include aspects such as the on-site waste generation, vibrations caused by earth moving equipment, campfires and illumination of the site and camps. These aspects will impact on invertebrate species more than any other faunal species. These anthropogenic disturbances impact on the way invertebrates forage. For

example; some invertebrates use vibrations caused by their prey to locate and catch them. Vibrations caused by earth moving equipment will make this impossible.

7. RECOMMENDATIONS AND CONCLUSION

Changes to the infrastructure layout and the expansion of waste rock dumps and stockpile areas will result in the clearing of additional vegetation and the further destruction of the natural habitat within the study area. The significance of these impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the mine.

The Tshipi Borwa Mine mine has a direct impact to the surface biodiversity, however the indirect loss of species and habitat as a result from issues such as dust and lowering of the water table further increases the significance of the impact to the biodiversity. These impacts may have a much wider consequence to the surface biodiversity owing to the cumulative effect of increased mining in the broader area.

The impact of the loss of vegetation and consequently habitat from an area can be mitigated through the process of a comprehensive rehabilitation programme and to a lesser extent, preventing disturbance outside the mine footprint. To be effective the rehabilitation process must result in a landscape that is similar to its pre-mining state. Should the rehabilitation not be undertaken correctly and comprehensively the ability of the mitigation measures to reduce the significance of the impact of vegetation loss and habitat fragmentation would be greatly reduced.

The re-arrangement of the infrastructure layout will not significantly change the overall loss of protected trees from the development area. Although some of the infrastructure changes will result in changes to the removal of individual trees, it is unlikely that these changes will result in an overall significant change in the number of protected trees lost. This is largely owing to the homogeneity of the plant community distribution across the development area. The proposed changes to the layout, of the infrastructure, doesn't exclude or include different plant communities from the development area. Both layouts require vegetation clearing within sensitive plant communities and the removal of protected trees.

However any additional surface area clearing, as a result of changes to the infrastructure and increasing the number of waste rocks dumps and topsoil stockpiles, will result in additional protected trees being lost from the area, which increases the significance of this impact.

The continued clearing of *Vachellia erioloba* and *Vachellia haematoxylon* woodlands in the region is a cause for concern as the exact extent of this resource is unknown. Thus it is unclear as to how much development this vegetation type can sustain without being irreversibly damaged resulting in a loss of biodiversity within the Northern Cape. The cumulative effects of development in this area exacerbates the potential risk of losing information and/or ecosystem function owing to a lack of basic research information within this area. Given the amount of protected tree species the area contains and the potential loss of these species from both direct and indirect impacts an offset will likely be required in order to ensure no net loss of these protected species

Recommendations to mitigate the impacts to the ecology include

- Preconstruction surveys, of areas to be cleared, for species suitable to search and rescue operations.
- All cleared areas should be re-seeded once the topsoil has been replaced with a seed mixture reflecting the natural vegetation as is currently found (harvesting of seed from similar areas within the study area should be undertaken). This may be used in conjunction with a commercially available mix as this will ensure a good vegetation coverage and soil stability. Species such as *Stipagrostis* are good sand binders and aid in stabilising the substrate and are present within the study area.
- Pods of *Vachellia erioloba*, and *Vachellia haematoxylon* should be collected from the area in order to aid in the re-establishment of these species. These seeds do however require artificial scarring/acid washing in order to aid in germination. The establishment of these trees will form a pivotal part in the rehabilitation of this area post mining as *V. erioloba* increases habitat heterogeneity. *V. erioloba* increases species richness by providing habitats and services for a variety of plants, reptiles, birds and mammals. Evidence also suggests that *V. erioloba* obtains nitrogen from deep ground water and then cycles nutrients from great depths, making them available above ground. High nutrient levels and shade of the subcanopy microhabitat increase survivorship of shade tolerant fleshy fruited plants. This microhabitat enables a suite of species, not adapted to conditions, to exist in this environment, thus enriching overall biodiversity. These plants provide a valuable food resource for a number of bird and mammal species.
- Prior to the clearing of the protected floral species the relevant permits must be obtained from the relevant authorities (see section 3.2).
- A comprehensive monitoring programme of the protected trees within the area must be undertaken. This monitoring will need to be conducted on an individual

tree basis as well as monitoring at a community level. A suitability qualified professional should assist in developing such a monitoring programme.

Depending on the results of the monitoring programme, additional management actions can be recommended by the qualified specialist.

- Disturbing the smallest area possible should be enforced. A long-term comprehensive alien eradication programme should be compiled by a relevant specialist and implemented, this process will need to be continuously monitored and updated.

8. Issues and concerns raised by IAPs

As part of the environmental management programme amendment process, a public consultation process was undertaken. Comments and concerns raised by interested and affected parties during the consultation process are tabulated below.

IAP	Comment raised	Response
<p>Andrew Pyper on 30 July 2013 at the general public meeting</p>	<p>Vegetation is susceptible to both diesel fumes as well as diesel spills. Some sort of investigation should be undertaken in which the issue is studied from a grazing perspective and the impact that this will have on livestock. Tshipi should take remedial measures to avoid or lessen the impact that such spills and emissions have on surrounding flora.</p> <p>In the Kalahari, when the surface is disturbed, this takes years and years to recover. To establish even a small amount of vegetation takes up to 20 years and during this time only the pioneer species will recover. The better grasses and shrub species may take much longer. Existing farming activities have already resulted in the disturbance of naturally occurring grass species and, due to overgrazing and mismanagement, many species have become threatened. Each time there is some sort of disturbance relating to mining, this existing effect is compounded.</p>	<p>Vegetation that is contaminated by diesel will die. It is also highly unlikely that livestock will consume vegetation that has been contaminated. With regards to diesel spills it is important to note that the potential for diesel spills is limited to within the Tshipi Borwa Mine area and along roads leading out of the mine site to connect with the R380. No livestock is located within the Tshipi Borwa Mine area or along these roads. Management actions focus on avoiding spills, rehabilitation and fast reactions to any spillage events. With regards to diesel fumes, as part of the approved EMPr (Metago, May 2009), an independent specialist was appointed to undertake an air quality assessment. The main emissions of concern that were identified for the mine include inhalable particulate matter less than 10 microns in size (PM₁₀), larger total suspended particulates (TSP) that relate to dust fallout, Mn concentrations, SO₂, NO₂ and gaseous emissions mainly from vehicles and generators. Vehicle and generator emissions are unlikely to exceed the guidelines. Management actions focus on the implementation of emission control measures and monitoring.</p> <p>As part of the management actions identified for the mine, Tshipi is committed to limit the removal of vegetation to the mine infrastructure footprint area. In addition to this, as part of rehabilitation, Tshipi is committed to implement a rehabilitation plan which will aid in ensuring that the correct species are able to re-establish. Further to this and the land will be rehabilitated to achieve an end use of wilderness and grazing. Due to the arid nature of the Kalahari, the re-establishment of vegetation is known to take longer than areas that are associated with heavy rainfall. Further to this, grass species are known to re-establish much quicker than tress species. It is for this reason that management actions are focused on collecting pods of the Camel Thorn and Grey Camel Thorn in order to aid in the re-establishment of these species.</p>
<p>Thulani Mthombeni on 21 February 2017 at the commenting authorities meeting</p>	<p>If any of these protected plants are found on site, the permit to remove it must be obtained via DENC.</p>	<p>Where any protect trees and/or plants need to be removed as a result of the project the necessary permits will be obtained from DAFF and/or DENC. It is understood from Tshipi that were infrastructure changes have already taken place; the necessary permits have been obtained.</p>
<p>Jacoline Mans on 07 September 2015 via email</p>	<p>It is not clear how the proposed changes to the approved EIA will affect the natural vegetation and animal life, and specifically protected trees. It was indicated that no further specialist investigation are required (fauna and flora). May you please indicate how the changes will affect protected trees and what additional impacts will be on the natural vegetation?</p> <p>Additional impacts on the natural vegetation may require amendments and/or new Flora permit and NFA licences for disturbance of protected plants and trees.</p> <p>Efforts should be made to minimize impacts on slow growing protected trees, by avoiding such trees as far as possible. It is not given that this Department will issue a licence for removal of protected tree. We may request an environmental offset (if deemed necessary) to compensate for the unavoidable loss of protected trees which may take decades to replace.</p> <p>Kindly provide copies of the relevant documentation to this office for comments and a copy of the amended EMPr outlining how impacts on protected trees will be mitigated.</p>	<p>As part of the approved EMPr (Metago, May 2009), a biodiversity study was undertaken. As part of the project an independent biodiversity specialist was appointed to update this study.</p> <p>The approved EMPr (Metago, May) made provision for the disturbance of 950ha. Although the establishment of additional facilities and activities forms part of the approved 950ha area of disturbance, these will require clearing of vegetation and could result in the loss of additional protected trees such as the Camel Thorn (<i>Vachellia erioloba</i>), Grey Camel Thorn (<i>Vachellia haematoxylon</i>) and Goldblatt (<i>Moraea longistyla</i>).</p> <p>Further to this, Tshipi is aware that should the DAFF request an offset then that will need to be implemented by Tshipi with input from DAFF.</p>

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APPENDIX 1

SPECIES LISTS

PLANT SPECIES LIST

FAMILY	SPECIES	IUCN	NCNC
ACANTHACEAE	<i>Monechma genistifolium</i> (Engl.) C.B.Clarke subsp. australe (P.G.Mey.) Munday	LC	
	<i>Monechma incanum</i> (Nees) C.B.Clarke	LC	
	<i>Barleria rigida</i> Nees	LC	
	<i>Barleria macrostegia</i> Nees	LC	
	<i>Blepharis integrifolia</i> (L.f.) E.Mey. ex Schinz var. <i>integrifolia</i>	LC	
	<i>Justicia protracta</i> (Nees) T.Anderson subsp. <i>protracta</i>	LC	
AMARANTHACEAE	<i>Hermibstaedtia fleckii</i> (Schinz) Baker & C.B.Clarke	LC	
	<i>Pupalia lappacea</i> (L.) A.Juss. var. <i>lappacea</i>	LC	
	<i>Sericorema remotiflora</i> (Hook.f.) Lopr.	LC	
	<i>Achyranthes aspera</i> L. var. <i>aspera</i> [NE naturalised	
	<i>Alternanthera pungens</i> Kunth	NE naturalised	
	<i>Alternanthera sessilis</i> (L.) DC.	NE naturalised	
	<i>Amaranthus thunbergii</i> Moq.	LC	
AMARYLLIDACEAE	<i>Kyphocarpa angustifolia</i> (Moq.) Lopr	LC	
	<i>Boophone disticha</i> (L.f.) Herb	Declining	Schedule 2
ANACARDIACEAE	<i>Brunsvigia radula</i> (Jacq.) Aiton	Vulnerable	Schedule 2
	<i>Searsia dregeana</i> (Sond.) Moffett	LC	
ANACARDIACEAE	<i>Searsia erosa</i> (Thunb.) Moffett	LC	
	<i>Searsia lancea</i> (L.f.) F.A.Barkley	LC	
	<i>Searsia tenuinervis</i> (Engl.) Moffett	LC	
	<i>Searsia undulata</i> (Jacq.) T.S.Yi, A.J.Mill. & J.Wen	LC	
	<i>Searsia tridactyla</i> (Burch.) Moffett	LC	
	<i>Trachyanthera asperata</i> var. <i>macowanii</i>	LC	
ANTHERICACEAE:			
ASCLEPIADACEAE	<i>Asclepias burchellii</i> Schlechter	NE naturalised	
ASPARAGACEAE	<i>Asparagus africanus</i> Lam	LC	
	<i>Asparagus laricinus</i> Burch.	LC	
	<i>Asparagus retrofractus</i> L.	LC	
	<i>Asparagus suaveolens</i> Burch.	LC	
APOCYNACEAE	<i>Orthanthera jasminiflora</i> (Decne.) Schinz	LC	Schedule 2
	<i>Pentarrhinum insipidum</i> E.Mey.	LC	
ASTERACEAE	<i>Berkheya ferox</i> O.Hoffm. var. <i>tomentosa</i> Roessler	LC	
	<i>Chrysocoma ciliata</i> L	LC	
	<i>Gazania krebsiana</i> Less. subsp. <i>krebsiana</i>	LC	
	<i>Dimorphotheca zeyheri</i> Sond.	LC	
	<i>Geigeria ornativa</i> O.Hoffm. subsp. <i>ornativa</i>	LC	
	<i>Geigeria brevifolia</i> (DC.) Harv.	LC	
	<i>Helichrysum argyrosphaerum</i> DC	LC	
	<i>Helichrysum dregeanum</i> Sond. & Harv	LC	
	<i>Helichrysum zeyheri</i> Less.	LC	

	<i>Nidorella hottentotica</i> DC	LC	
	<i>Nidorella resedifolia</i> DC. subsp. <i>resedifolia</i>	LC	
	<i>Nolletia ciliaris</i> (DC.) Steetz		
	<i>Pentzia calcarea</i> Kies	LC	
	<i>Pentzia incana</i> (Thunb.) Kuntze	LC	
	<i>Pegolettia retrofracta</i> (Thunb.) Kies	LC	
	<i>Pteronia glauca</i> Thunb. subsp. <i>arcuata</i> (Dinter) Merxm.	LC	
	<i>Dicoma macrocephala</i> DC. [LC	
	<i>Dicoma schinzii</i> O.Hoffm.	LC	
	<i>Felicia muricata</i> (Thunb.) Nees subsp. <i>muricata</i> [LC	
	<i>Senecio burchellii</i> DC.	LC	
	<i>Senecio glutinarius</i> DC.	LC	
	<i>Tripteris aghillana</i> DC. var. <i>aghillana</i>	LC	
	<i>Tarchonanthus camphoratus</i> L	LC	
	<i>Tagetes minuta</i> L	NE Naturalised	
	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook. var. <i>encelioides</i>	NE Naturalised	
	<i>Xanthium spinosum</i> L	NE Naturalised	
BIGNONIACEAE	<i>Rhigozum trichotomum</i> Burch	LC	
BORAGINACEAE	<i>Ehretia rigida</i> (Thunb.) Druce subsp. <i>rigida</i>	LC	
BRASSICACEAE	<i>Lepidium africanum</i> (Burm.f.) DC. subsp. <i>africanum</i>	LC	
BUDDLEJACEAE	<i>Buddleja saligna</i> Willd.	LC	
CAPPARACEAE	<i>Cleome angustifolia</i> Forssk. subsp. <i>diandra</i> (Burch.) Kers	LC	
	<i>Cleome monophylla</i> L.	LC	
	<i>Boscia albitrunca</i> (Burch.) Gilg & Gilg-Ben.	LC	Schedule 2
	<i>Cadaba aphylla</i> (Thunb.) Wild	LC	
CACTACEAE	<i>Opuntia humifusa</i> (Raf.) Raf.	NE	
CELASTRACEAE	<i>Putterlickia pyracantha</i> (L.) Szyszyl..	LC	
	<i>Gymnosporia heterophylla</i> (Eckl. & Zeyh.) Loes	LC	
CHENOPODIACEAE	<i>Salsola kali</i> L.	NE Naturalised	
	<i>Salsola tuberculata</i> (Moq.) Fenzl.	LC	
	<i>Atriplex nummularia</i> Lindl. subsp. <i>nummularia</i>	NE Naturalised	
	<i>Chenopodium album</i> L.	NE Naturalised	
	<i>Chenopodium multifidum</i> L.	NE Naturalised	
COLCHICACEAE	<i>Ornithoglossum viride</i> (L.f.) Aiton	LC	
COMBRETACEAE	<i>Terminalia sericea</i> Burch. ex DC.	LC	
COMMELINACEAE	<i>Commelina africana</i> L. var. <i>africana</i>	LC	
CONVOLVULACEAE	<i>Merremia verecunda</i> Rendle	LC	
	<i>Evolvulus alsinoides</i> (L.) L.	LC	
	<i>Ipomoea bolusiana</i> Schinz	LC	
	<i>Ipomoea obscura</i> (L.) Ker Gawl. var. <i>obscura</i>	LC	
	<i>Seddera capensis</i> (E.Mey. ex Choisy) Hallier f.	LC	
CRASSULACEAE	<i>Crassula capitella</i> Thunb. subsp. <i>thyrsoiflora</i> (Thunb.) Toelken	LC	Schedule 2
	<i>Kalanchoe brachyloba</i> Welw. ex Britten	LC	Schedule 2
CUCURBITACEAE	<i>Acanthosicyos naudinianus</i> (Sond.) C.Jeffrey	LC	
	<i>Cucumis africanus</i> L.f.	LC	
CYPERACEAE	<i>Cyperus margaritaceus</i> Vahl var. <i>margaritaceus</i> .	LC	
	<i>Cyperus bellus</i> Kunth	LC	

	<i>Cyperus squarrosus</i> L.	LC	
	<i>Cyperus austro-africanus</i> C.Archer & Goetgh.	LC	
EBENACEAE	<i>Diospyros lycioides</i> Desf. subsp. <i>lycioides</i>	LC	
	<i>Diospyros pallens</i> (Thunb.) F.White	LC	
EUPHORBIACEAE	<i>Euphorbia mauritanica</i> L.	LC	
FABACEAE	<i>Crotalaria virgultalis</i> Burch. ex DC.	LC	
	<i>Crotalaria spartioides</i> DC	LC	
	<i>Chamaecrista mimosoides</i> (L.) Greene	LC	
	<i>Cullen tomentosum</i> (Thunb.) J.W.Grimes	LC	
	<i>Calobota cuspidosa</i> (Burch.) Boatwr. & B.-E.van Wyk	LC	
	<i>Dichrostachys cinerea</i> (L.) Wight & Arn. subsp. <i>africana</i>	LC	
	<i>Elephantorrhiza elephantina</i> (Burch.) Skeels	LC	
	<i>Lessertia macrostachya</i> DC. var. <i>macrostachya</i>	LC	
	<i>Lotononis crumanina</i> Burch. ex Benth.	LC	
	<i>Melolobium candicans</i> (E.Mey.) Eckl. & Zeyh.	LC	
	<i>Melolobium humile</i> Eckl. & Zeyh.	LC	
	<i>Pomaria burchellii</i> (DC.) B.B.Simpson & G.P.Lewis subsp. <i>burchellii</i>	LC	
	<i>Prosopis glandulosa</i> Torr. var. <i>glandulosa</i>	NE naturalised	
	<i>Prosopis velutina</i> Wooton	NE naturalised	
	<i>Tephrosia burchellii</i> Burt Davy	LC	
	<i>Tephrosia elongata</i> E.Mey. var. <i>elongata</i>	LC	
	<i>Vachellia erioloba</i> E.Mey	Declining	
	<i>Vachellia haematoxylon</i> Willd.	LC	
	<i>Vachellia hebeclada</i> DC. subsp. <i>hebeclada</i>	LC	
	<i>Vachellia karroo</i> Hayne	LC	
	<i>Senegalia mellifera</i>	LC	
	<i>Senna italica</i> Mill. subsp. <i>micrantha</i> (Brenan) Lock	LC	
	<i>Indigofera alternans</i> DC. var. <i>alternans</i>	LC	
	<i>Indigofera daleoides</i> Benth. ex Harv. var. <i>daleoides</i>	LC	
	<i>Indigofera cryptantha</i> Benth. ex Harv. var. <i>cryptantha</i>	LC	
	<i>Indigofera velutina</i> E.Mey	LC	
	<i>Indigofera vicioides</i> Jaub. & Spach var. <i>vicioides</i>	LC	
	<i>Otoptera burchellii</i> DC.	LC	
	<i>Rhynchosia confusa</i> Burt Davy	LC	
	<i>Rhynchosia totta</i> (Thunb.) DC. var. <i>totta</i>	LC	
	<i>Indigastrum argyraeum</i>	LC	
	<i>Indigofera hololeuca</i>	LC	
	<i>Tylosema esculentum</i> (Burch.) A.Schreib.	LC	
GENTIANACEAE	<i>Sebaea exigua</i> (Oliv.) Schinz	LC	
	<i>Exochaenium grande</i> (E.Mey.) Griseb.	LC	
GISEKIACEAE	<i>Gisekia pharnacioides</i> L. var. <i>pharnacioides</i>	LC	
IRIDACEAE	<i>Moraea longistyla</i> (Goldblatt) Goldblatt	LC	Schedule 2
	<i>Moraea pallida</i> (Baker) Goldblatt	LC	Schedule 2
	<i>Babiana hypogaea</i> Burch.	LC	Schedule 2
LAMIACEAE	<i>Stachys spathulata</i> Burch. ex Benth.	LC	
	<i>Salvia verbenaca</i> L.	LC	

	<i>Acrotome inflata</i> Benth	LC	
	<i>Leucas capensis</i> (Benth.) Engl	LC	
LOPHIOPACEAE	<i>Corbichonia rubriovata</i> (Friedrich) C.Jeffrey	LC	
	<i>Lophiocarpus polystachyus</i> Turcz	LC	
MALPIGHIACEAE	<i>Triaspis hypericoides</i> (DC.) Burch. subsp. <i>hypericoides</i>	LC	
MALVACEAE	<i>Grewia flava</i> DC.	LC	
	<i>Hermannia comosa</i> Burch. ex DC.	LC	
	<i>Hermannia jacobifolia</i> (Turcz.) R.A.Dyer	LC	
	<i>Hermannia tomentosa</i> (Turcz.) Schinz ex Engl.	LC	
	<i>Hibiscus pusillus</i> Thunb.	LC	
	<i>Hibiscus elliottiae</i> Harv..	LC	
	<i>Melhania didyma</i> Eckl. & Zeyh	LC	
	<i>Melhania rehmannii</i> Szyszyl.	LC	
	<i>Pavonia burchellii</i> (DC.) R.A.Dyer	LC	
	<i>Sida dregei</i> Burt Davy	LC	
	<i>Sida cordifolia</i> L. subsp. <i>cordifolia</i>	LC	
	<i>Waltheria indica</i> L	LC	
MENISPERMACEAE	<i>Antizoma angustifolia</i> (Burch.) Miers ex Harv	LC	
MESEMBRYANTHEACEAE	<i>Ruschia griquensis</i> (L.Bolus) Schwantes [LC	Schedule 2
	<i>Limeum viscosum</i> (J.Gay) Fenzl subsp. <i>viscosum</i> var. <i>viscosum</i>	LC	
MOLLUGINACEAE	<i>Olea europaea</i> L. subsp. <i>africana</i> (Mill.) P.S.Green	LC	Schedule 2
OLEACEAE	<i>Striga gesnerioides</i> (Willd.) Vatke	LC	
OROBANCHACEAE	<i>Striga asiatica</i> (L.) Kuntze	LC	
OXALIDACEAE	<i>Oxalis haedulipes</i> T.M.Salter	LC	Schedule 2
PAPAVERACEAE	<i>Argemone mexicana</i> L.	NE naturalised	
	<i>Argemone ochroleuca</i>	NE naturalised	
PEDALIACEAE	<i>Harpagophytum procumbens</i>		Schedule 1
	<i>Sesamum capense</i> Burm.f.	LC	
	<i>Ceratotheca triloba</i> (Bernh.) Hook.f.	LC	
PLUMBAGINACEAE	<i>Plumbago auriculata</i> Lam.	LC	
PHYLLANTHACEAE	<i>Phyllanthus maderaspatensis</i> L.	LC	
	<i>Phyllanthus parvulus</i> Sond. var. <i>garipensis</i> (E.Mey. ex Drllge) Radcl.-Sm.	LC	
POACEAE	<i>Aristida adscensionis</i> L.	LC	
	<i>Aristida diffusa</i> Trin. subsp. <i>diffusa</i>	LC	
	<i>Aristida meridionalis</i> Henrard	LC	
	<i>Andropogon chinensis</i> (Nees) Merr	LC	
	<i>Diheteropogon amplexans</i> (Nees) Clayton var. <i>amplexans</i>	LC	
	<i>Centropodia glauca</i> (Nees) Cope.	LC	
	<i>Chrysopogon serrulatus</i> Trin.	LC	
	<i>Enneapogon cenchroides</i> (Licht. ex Roem. & Schult.) C.E.Hubb.	LC	
	<i>Elionurus muticus</i> (Spreng.) Kunth	LC	
	<i>Hyparrhenia hirta</i> (L.) Stapf	LC	
	<i>Megaloprotachne albescens</i> C.E.Hubb.	LC	
	<i>Melinis repens</i> (Willd.) Zizka subsp. <i>grandiflora</i> (Hochst.) Zizka	LC	
	<i>Tricholaena monachne</i> (Trin.) Stapf & C.E.Hubb.	LC	

	<i>Trichoneura grandiglumis</i> (Nees) Ekman	LC
	<i>Schmidtia kalahariensis</i> Stent	LC
	<i>Schmidtia pappophoroides</i> Steud.	LC
	<i>Setaria verticillata</i> (L.) P.Beauv.	LC
	<i>Stipagrostis ciliata</i> (Desf.) De Winter var. <i>capensis</i> (Trin. & Rupr.) De Winter	LC
	<i>Stipagrostis uniplumis</i> (Licht.) De Winter var. <i>uniplumis</i>	LC
	<i>Schizachyrium sanguineum</i> (Retz.) Alston	LC
	<i>Themeda triandra</i> Forssk	LC
	<i>Tragus berteronianus</i> Schult	LC
	<i>Tragus koelerioides</i> Asch	LC
	<i>Anthephora argentea</i> Gooss.	LC
	<i>Anthephora pubescens</i> Nees	LC
	<i>Aristida congesta</i> Roem. & Schult. subsp. <i>congesta</i>	LC
	<i>Aristida stipitata</i> Hack. subsp. <i>spicata</i> (De Winter) Melderis	LC
	<i>Aristida vestita</i> Thunb.	LC
	<i>Brachiaria marlothii</i> (Hack.) Stent	LC
	<i>Brachiaria nigropedata</i> (Ficalho & Hiern) Stapf	LC
	<i>Cenchrus ciliaris</i> L.	LC
	<i>Coelachyrum yemenicum</i> (Schweinf.) S.M.Phillips	LC
	<i>Cymbopogon pospischilii</i> (K.Schum.) C.E.Hubb.	NE naturalised
	<i>Cynodon dactylon</i> (L.) Pers.	LC
	<i>Digitaria eriantha</i> Steud.	LC
	<i>Digitaria polyphylla</i> Henrard	LC
	<i>Enneapogon desvauxii</i> P.Beauv.	LC
	<i>Eragrostis echinocloidea</i> Stapf	LC
	<i>Eragrostis lehmanniana</i> Nees var. <i>lehmanniana</i>	LC
	<i>Eragrostis micrantha</i> Hack.	LC
	<i>Eragrostis obtusa</i> Munro ex Ficalho & Hiern	LC
	<i>Eragrostis chloromelas</i> Steud	LC
	<i>Eragrostis curvula</i> (Schrud.) Nees	LC
	<i>Eragrostis pallens</i> Hack. [LC
	<i>Eragrostis trichophora</i> Coss. & Durieu	LC
	<i>Eustachys paspaloides</i> (Vahl) Lanza & Mattei	LC
	<i>Fingerhuthia africana</i> Lehm.	LC
	<i>Heteropogon contortus</i> (L.) Roem. & Schult.	LC
	<i>Leptochloa fusca</i> (L.) Kunth	LC
	<i>Panicum maximum</i> Jacq.	LC
	<i>Pogonarthria squarrosa</i> (Roem. & Schult.) Pilg.	LC
	<i>Pennisetum setaceum</i> (Forssk.) Chiov	NE
	<i>Schmidtia pappophoroides</i> Steud.	LC
	<i>Sporobolus fimbriatus</i> (Trin.) Nees	LC
	<i>Stipagrostis obtusa</i> (Delile) Nees	LC
	<i>Stipagrostis uniplumis</i> (Licht.) De Winter var. <i>uniplumis</i>	LC
	<i>Triraphis andropogonoides</i> (Steud.) E.Phillips	LC
POLYGALACEAE	<i>Polygala leptophylla</i> Burch. var. <i>leptophylla</i>	LC
	<i>Polygala seminuda</i> Harv.	LC

	<i>Oxygonum delagoense</i> Kuntze	LC	
PORTULACACEAE	<i>Talinum caffrum</i> (Thunb.) Eckl. & Zeyh	LC	
RHAMNACEAE	<i>Ziziphus mucronata</i> Willd. subsp. <i>mucronata</i>	LC	
	<i>Helinus spartioides</i> (Engl.) Schinz ex Engl. [LC	
RICCIACEAE	<i>Riccia albolimbata</i> S.W.Arnell	LC	
RUBIACEAE	<i>Anthospermum rigidum</i> Eckl. & Zeyh. subsp. <i>rigidum</i>	LC	
SANTALACEAE	<i>Thesium hystericoides</i> A.W.Hill	LC	
	<i>Thesium hystrix</i> A.W.Hill	LC	
	<i>Viscum rotundifolium</i> L.f.	LC	
SCROPHULARIACEAE	<i>Selago mixta</i> Hilliard	LC	
	<i>Aptosimum elongatum</i> Engl.	LC	
	<i>Aptosimum junceum</i> (Hiern) Philcox	LC	
	<i>Aptosimum lineare</i> Marloth & Engl. var. <i>lineare</i>	LC	
	<i>Peliostomum leucorrhizum</i> E.Mey. ex Benth.	LC	
	<i>Jamesbrittenia crassicaulis</i> (Benth.) Hilliard	LC	Schedule 2
	<i>Sutera griquensis</i> Hiern	LC	
	<i>Selago geniculata</i> L.f.	LC	
	<i>Selago densiflora</i> Rolfe	LC	
	<i>Chaenostoma halimifolium</i> Benth.	LC	
	<i>Selago alopecuroides</i> Rolfe	LC	
	<i>Selago saxatilis</i> E.Mey. [LC	
SOLANACEAE	<i>Lycium oxycarpum</i> Dunal	LC	
	<i>Lycium hirsutum</i> Dunal	LC	
	<i>Solanum capense</i> L	LC	
	<i>Solanum lichtensteinii</i> Willd	LC	
	<i>Solanum campylacanthum</i> subsp. <i>panduriforme</i>	LC	
	<i>Solanum supinum</i> Dunal var. <i>supinum</i>	LC	
THYMELAEACEAE	<i>Gnidia polycephala</i> (C.A.Mey.) Gilg	LC	
VAHLIACEAE	<i>Vahlia capensis</i> (L.f.) Thunb. subsp. <i>vulgaris</i> Bridson var. <i>linearis</i> E.Mey. ex Bridson	LC	
VERBENACEAE	<i>Chascanum hederaceum</i> (Sond.) Moldenke var. <i>hederaceum</i>	LC	
	<i>Chascanum incisum</i> (H.Pearson) Moldenke	LC	
	<i>Lantana rugosa</i> Thunb.	LC	
ZYGOPHYLLACEAE	<i>Tribulus terrestris</i> L.	LC	
	<i>Tribulus zeyheri</i> Sond. subsp. <i>zeyheri</i>	LC	

FAUNAL SPECIES CHECK LIST FOR THE AREA

REPTILES		
Family Name	Species Name	Common Name
Agamidae	<i>Agama aculeata</i> subsp. <i>aculeata</i>	Ground agama
Lacertidae	<i>Heliobolus lugubris</i>	Bushveld Lizard
Lacertidae	<i>Pedioplanis lineocellata</i>	Spotted Sand lizard
Gekkonidae	<i>Chondrodactylus bibronii</i>	Bibron's Gecko
Lacertidae	<i>Heliobolus lugubris</i>	Bushveld Lizard
Lacertidae	<i>Pedioplanis lineocellata</i>	Spotted Sand Lizard
Lacertidae	<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard
AMPHIBIANS		

Family Name	Species Name	Common Name
Bufoidea	<i>Amietophrynus poweri</i>	Power's Toad
Hyperoliidae	<i>Kassina senegalensis</i>	Senegal kassina
Pyxicephalidae	<i>Cacosternum boettgeri</i>	Common Dainty Frog
Pyxicephalidae	<i>Tomopterna cryptotis</i>	Common Sand Frog
BIRDS		
Family Name	Species Name	Common Name
Alaudidae	<i>Calendulauda africanooides</i>	Fawn-coloured Lark
Alaudidae	<i>Calendulauda sabota</i>	Sabota Lark
Alaudidae	<i>Chersomanes albofasciata</i>	Spike-heeled Lark
Alaudidae	<i>Eremopterix verticalis</i>	Grey-backed Sparrowlark
Alaudidae	<i>Mirafrapa apiata</i>	Cape Clapper Lark
Anatidae	<i>Anas erythrorhyncha</i>	Red-billed Teal
Anatidae	<i>Anas undulata</i>	Yellow-billed Duck
Anatidae	<i>Dendrocygna viduata</i>	White-faced Duck
Apodidae	<i>Apus affinis</i>	Little Swift
Bucerotidae	<i>Tockus leucomelas</i>	Southern Yellow-billed Hornbill
Bucerotidae	<i>Tockus nasutus</i>	African Grey Hornbill
Burhinidae	<i>Burhinus capensis</i>	Spotted Thick-knee
Capitonidae	<i>Tricholaema leucomelas</i>	Acacia Pied Barbet
Charadriidae	<i>Charadrius tricollaris</i>	Three-banded Plover
Charadriidae	<i>Vanellus armatus</i>	Blacksmith Lapwing
Charadriidae	<i>Vanellus coronatus</i>	Crowned Lapwing
Coliidae	<i>Colius colius</i>	White-backed Mousebird
Coliidae	<i>Urocolius indicus</i>	Red-faced Mousebird
Coraciidae	<i>Coracias caudatus</i>	Lilac-breasted Roller
Coraciidae	<i>Coracias naevius</i>	Purple Roller
Cuculidae	<i>Chrysococcyx caprius</i>	Diderick Cuckoo
Dicruridae	<i>Dicrurus adsimilis</i>	Fork-tailed Drongo
Estrildidae	<i>Amadina erythrocephala</i>	Red-headed Finch
Estrildidae	<i>Estrilda astrild</i>	Common Waxbill
Estrildidae	<i>Estrilda erythronotos</i>	Black-faced Waxbill
Estrildidae	<i>Granatina granatina</i>	Violet-eared Waxbill
Estrildidae	<i>Pytilia melba</i>	Green-winged Pytilia
Fringillidae	<i>Crithagra atrogularis</i>	Black-throated Canary
Fringillidae	<i>Crithagra flaviventris</i>	Yellow Canary
Fringillidae	<i>Emberiza flaviventris</i>	Golden-breasted Bunting
Fringillidae	<i>Emberiza impetuanii</i>	Lark-like Bunting
Glareolidae	<i>Cursorius rufus</i>	Burchell's Courser
Halcyonidae	<i>Alcedo cristata</i>	Malachite Kingfisher
Hirundinidae	<i>Hirundo albicularis</i>	White-throated Swallow
Hirundinidae	<i>Hirundo cucullata</i>	Greater Striped Swallow
Hirundinidae	<i>Hirundo fuligula</i>	Rock Martin
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow
Hirundinidae	<i>Hirundo semirufa</i>	Red-breasted Swallow
Hirundinidae	<i>Hirundo spilodera</i>	South African Cliff-Swallow
Hirundinidae	<i>Riparia paludicola</i>	Brown-throated Martin
Laniidae	<i>Lanius collaris</i>	Common Fiscal
Laniidae	<i>Lanius collurio</i>	Red-backed Shrike
Laniidae	<i>Lanius minor</i>	Lesser Grey Shrike
Malaconotidae	<i>Laniarius atrococcineus</i>	Crimson-breasted Shrike
Malaconotidae	<i>Tchagra australis</i>	Brown-crowned Tchagra
Malaconotidae	<i>Telophorus zeylonus</i>	Bokmakierie
Meropidae	<i>Merops apiaster</i>	European Bee-eater
Meropidae	<i>Merops hirundineus</i>	Swallow-tailed Bee-eater

Motacillidae	<i>Anthus cinnamomeus</i>	African Pipit
Motacillidae	<i>Motacilla capensis</i>	Cape Wagtail
Muscicapidae	<i>Batis pririt</i>	Pirit Batis
Muscicapidae	<i>Bradornis infuscatus</i>	Chat Flycatcher
Muscicapidae	<i>Bradornis mariquensis</i>	Marico Flycatcher
Muscicapidae	<i>Sigelus silens</i>	Fiscal Flycatcher
Nectariniidae	<i>Cinnyris mariquensis</i>	Marico Sunbird
Numididae	<i>Numida meleagris</i>	Helmeted Guineafowl
Otididae	<i>Eupodotis afra</i>	Southern Black Korhaan
Otididae	<i>Lophotis ruficrista</i>	Red-crested Korhaan
Otididae	<i>Neotis ludwigii</i>	Ludwigii Bustard
Paridae	<i>Parus cinerascens</i>	Ashy Tit
Phalacrocoracidae	<i>Phalacrocorax africanus</i>	Reed Cormorant
Phasianidae	<i>Pternistis adspersus</i>	Red-billed Spurfowl
Phoeniculidae	<i>Rhinopomastus cyanomelas</i>	Common Scimitarbill
Plataleidae	<i>Platalea alba</i>	African Spoonbill
Plataleidae	<i>Plegadis falcinellus</i>	Glossy Ibis
Plataleidae	<i>Threskiornis aethiopicus</i>	African Sacred Ibis
Podicipedidae	<i>Tachybaptus ruficollis</i>	Little Grebe
Pteroclididae	<i>Pterocles bicinctus</i>	Double-banded Sandgrouse
Pteroclididae	<i>Pterocles burchelli</i>	Burchell's Sandgrouse
Pteroclididae	<i>Pterocles namaqua</i>	Namaqua Sandgrouse
Pycnonotidae	<i>Pycnonotus nigricans</i>	African Red-eyed Bulbul
Rallidae	<i>Fulica cristata</i>	Red-knobbed Coot
Rallidae	<i>Gallinula chloropus</i>	Common Moorhen
Sagittariidae	<i>Sagittarius serpentarius</i>	Secretarybird
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
Scolopacidae	<i>Calidris ferruginea</i>	Curlew Sandpiper
Scolopacidae	<i>Gallinago nigripennis</i>	African Snipe
Scopidae	<i>Scopus umbretta</i>	Hamerkop
Strigidae	<i>Bubo lacteus</i>	Verreaux's Eagle-Owl
Strigidae	<i>Glaucidium perlatum</i>	Pearl-spotted Owlet
Struthionidae	<i>Struthio camelus</i>	Common Ostrich
Sturnidae	<i>Creatophora cinerea</i>	Wattled Starling
Sturnidae	<i>Lamprotornis nitens</i>	Cape Glossy Starling
Sturnidae	<i>Onychognathus naboroup</i>	Pale-winged Starling
Timaliidae	<i>Turdoides bicolor</i>	Southern Pied Babbler
Viduidae	<i>Vidua regia</i>	Shaft-tailed Whydah
Sylviidae	<i>Acrocephalus baeticatus</i>	African Reed-Warbler
Turdidae	<i>Cercomela familiaris</i>	Familiar Chat
Turdidae	<i>Cercotrichas paena</i>	Kalahari Scrub-Robin
Sylviidae	<i>Cisticola aridulus</i>	Desert Cisticola
Sylviidae	<i>Cisticola tinniens</i>	Levaillant's Cisticola
Columbidae	<i>Columba guinea</i>	Speckled Pigeon
Ardeidae	<i>Egretta garzetta</i>	Little Egret
Accipitridae	<i>Elanus caeruleus</i>	Black-shouldered Kite
Sylviidae	<i>Eremomela icteropygialis</i>	Yellow-bellied Eremomela
Falconidae	<i>Falco rupicolus</i>	Rock Kestrel
Accipitridae	<i>Melierax canorus</i>	Southern Pale Chanting Goshawk
Accipitridae	<i>Melierax gabar</i>	Gabar Goshawk
Turdidae	<i>Myrmecocichla formicivora</i>	Ant-eating Chat
Ardeidae	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron
Columbidae	<i>Oena capensis</i>	Namaqua Dove
Turdidae	<i>Oenanthe pileata</i>	Capped Wheatear
Sylviidae	<i>Parisoma subcaeruleum</i>	Chestnut-vented Tit-Babbler

Ploceidae	<i>Passer diffusus</i>	Southern Grey-headed Sparrow
Ploceidae	<i>Passer domesticus</i>	House Sparrow
Ploceidae	<i>Passer melanurus</i>	Cape Sparrow
Ploceidae	<i>Philetairus socius</i>	Sociable Weaver
Ploceidae	<i>Plocepasser mahali</i>	White-browed Sparrow-Weaver
Ploceidae	<i>Ploceus velatus</i>	Southern Masked-Weaver
Accipitridae	<i>Polemaetus bellicosus</i>	Martial Eagle
Sylviidae	<i>Prinia flavicans</i>	Black-chested Prinia
Ploceidae	<i>Quelea quelea</i>	Red-billed Quelea
Ploceidae	<i>Sporopipes squamifrons</i>	Scaly-feathered Finch
Columbidae	<i>Streptopelia capicola</i>	Cape Turtle-Dove
Columbidae	<i>Streptopelia senegalensis</i>	Laughing Dove
Sylviidae	<i>Sylvia borin</i>	Garden Warbler
Sylviidae	<i>Sylvietta rufescens</i>	Long-billed Crombec

INVERTEBRATES

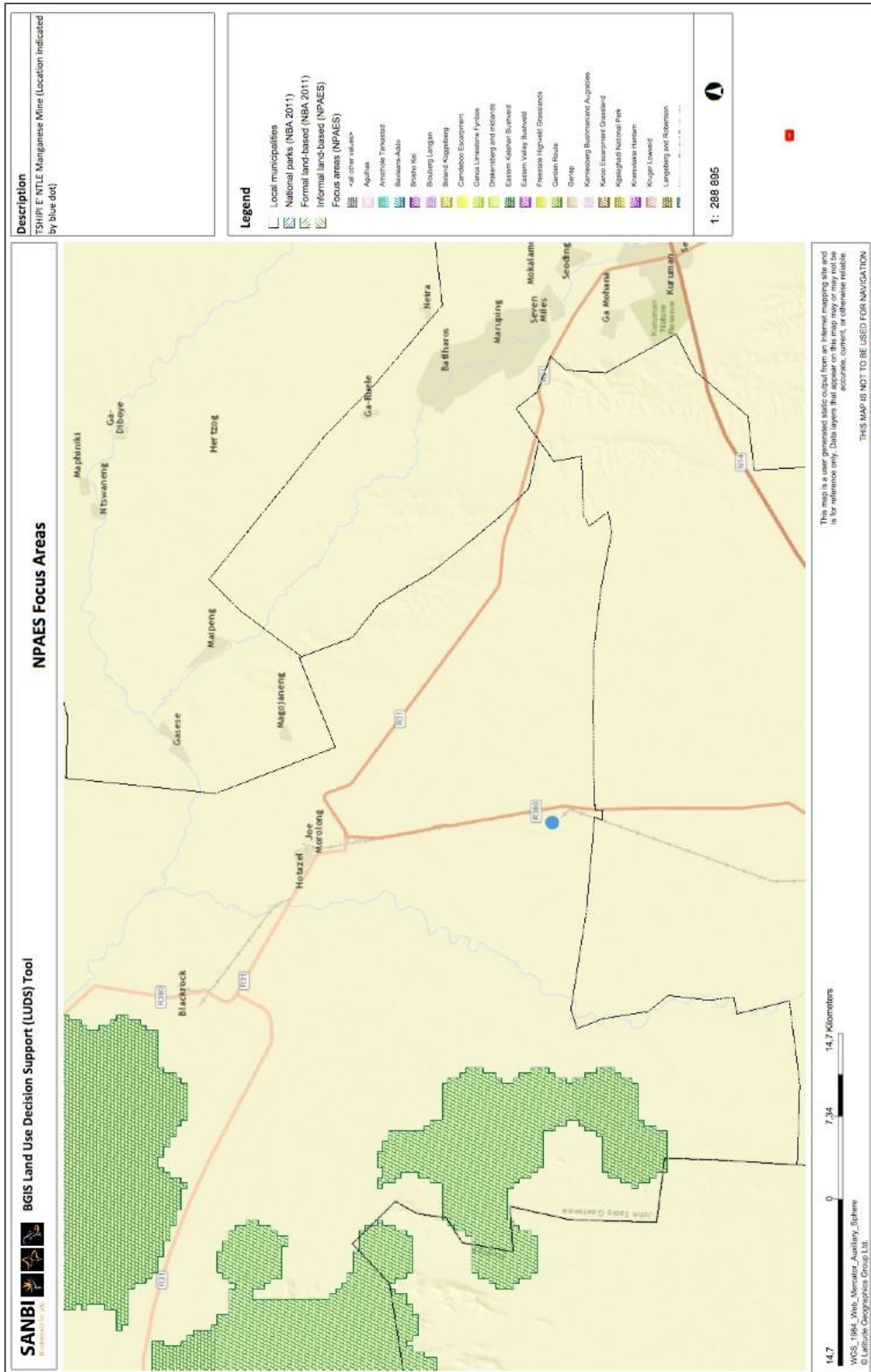
Family Name	Species Name	Common Name
Hesperiidae	<i>Leucochitonea levubu</i>	White-cloaked Skipper butterfly
Hesperiidae	<i>Pelopidas mathias</i>	Lesser Millets Skipper butterfly
Lycaenidae	<i>Azonus jesus jesus</i>	Topaz spotted blue butterfly
Lycaenidae	<i>Cigaritis phanes</i>	Silver bar butterfly
Pieridae	<i>Catopsilia florella</i>	African Migrant butterfly
Pieridae	<i>Colotis agoye bowkeri</i>	Speckled Sulphur tip butterfly
	<i>Colotis subfasciatus</i>	
Pieridae	<i>subfasciatus</i>	Lemon tip butterfly
Lycaenidae	<i>Aloeides gowani</i>	Gowan's copper butterfly
Pieridae	<i>Eurema brigitta subsp. brigitta</i>	Small grass yellow butterfly

MAMMALS

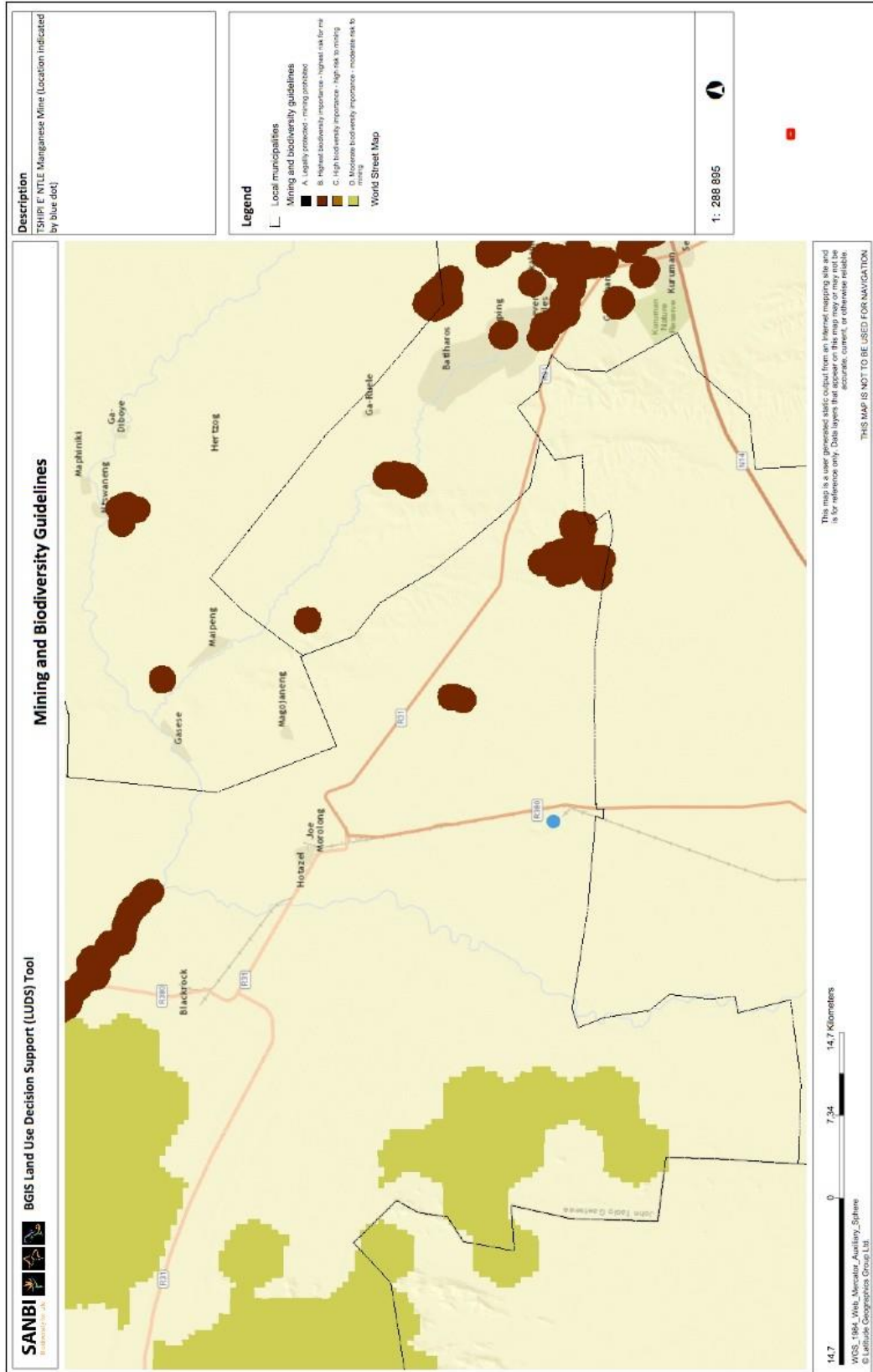
Family Name	Species Name	Common Name
Suidae	<i>Phacochoerus africanus</i>	Warthog
Bovidae	<i>Raphicerus campestris</i>	Steenbok
Hespestidae	<i>Cynictis penicillata</i>	Yellow Mongoose
Orycteropodidae	<i>Orycteropus afer</i>	Aardvark
Muridae	<i>Thallomys nigricauda</i>	Black tailed tree rat
Rhinolophidae	<i>Rhinolophus denti</i>	Dent's horseshoe bat
Miniopteridae.	<i>Miniopterus schreibersii</i>	Schreibers' long-fingered bat
Mustelidae	<i>Mellivorinae capensis</i>	Honey Badger
Erinaceidae	<i>Atelerix frontalis</i>	South Africa Hedgehog

APPENDIX 2 REGIONAL CONSERVATION PLANNING --

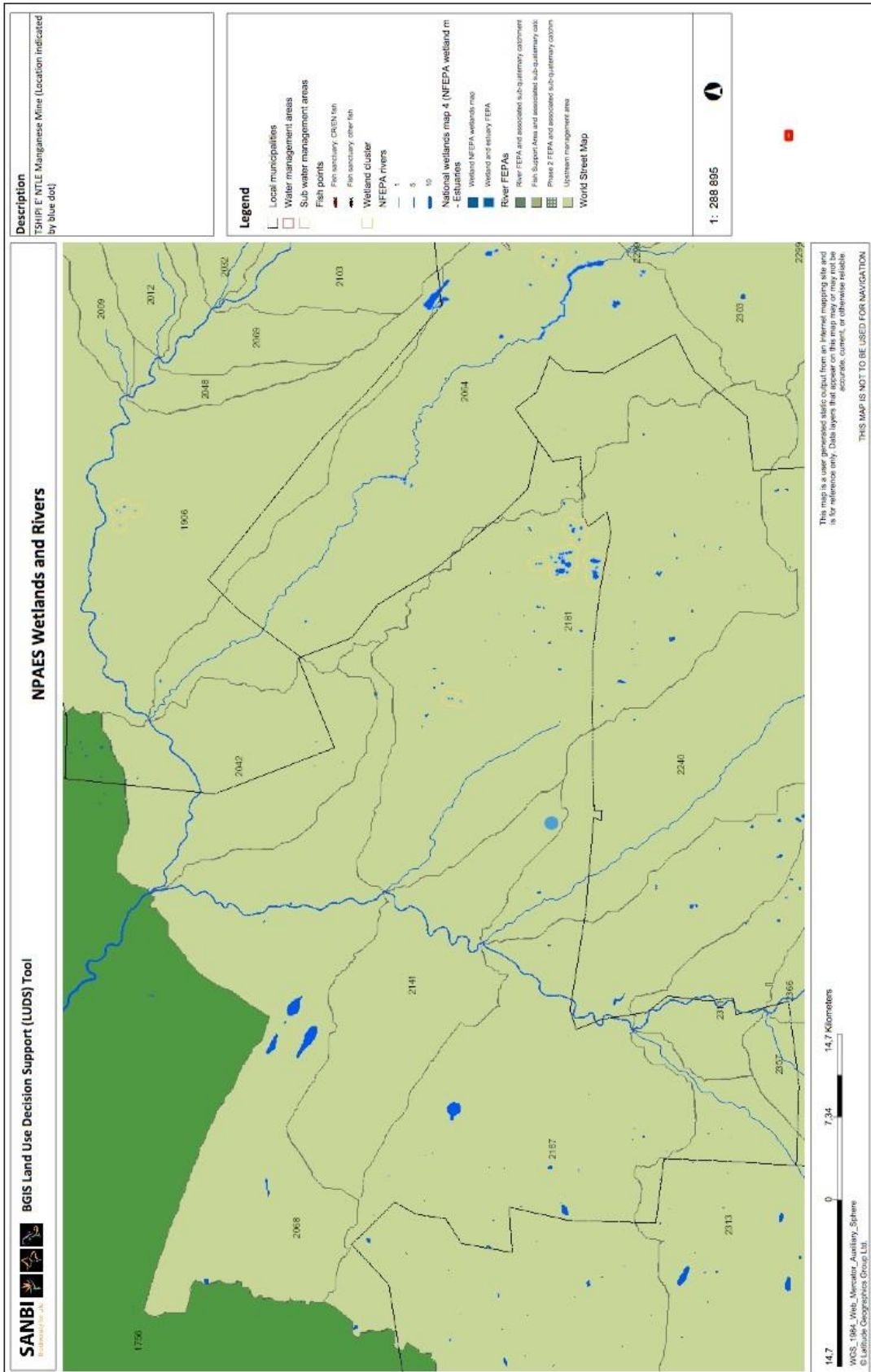
NPAES focus areas



MINING AND BIODIVERSITY GUIDELINES



NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS - RIVERS



APPENDIX 3

DETAILS OF SPECIALIST

ABRIDGED CURRICULUM VITA

NATALIE VIVIENNE BIRCH

Date of birth: 21 August 1972

QUALIFICATIONS

BSc (Rhodes University) – Botany and Zoology

BSc (Hons) Wildlife Management, Pretoria University

PhD (Rhodes University)

PHD DISSERTATION

Vegetation potential of natural rangelands in the mid Fish River Valley. Towards a sustainable and acceptable management system.

RESEARCH INTERESTS

My academic interests cover various areas dealing with ecological functioning, and wildlife management, with a special interest in the functioning and management of arid and semi arid rangelands.

ACADEMIC AWARD

Awarded a medal in 2001 by the Grassland Society of Southern Africa for: Outstanding Student in Range and Forage Science

PROFESSIONAL EXPERIENCE

1999 – 2000	<u>Eastern Cape Parks Board</u>	Ecologist
2000 -2002	<u>Coastal & Environmental Services</u>	Consultant
2003 – present	<u>Ecological Management Services</u>	Owner/Consultant

I am a founding member of Ecological Management Services, which is based in Kimberley, and we specialise in ecological management and impact assessment. Although we are based in Kimberley we cover most of South Africa and have projects in the Eastern Cape, Free State, North West Province, Northern Cape and Gauteng. We have undertaken impact assessments for various types of developments including urban

and rural developments, agricultural developments, as well as developments within the mining sector. We also provide specialist input to various types of projects and have formulated biodiversity offset studies required to offset impacts from large developments.

A selection of recent work is as follows:

- Department of Agriculture Northern Cape—Hopetown Piggery
- Department of Agriculture Northern Cape—Phillipstown Piggery
- Department of Agriculture Northern Cape—Chikiana Piggery
- Department of Agriculture Northern Cape—De Aar Hydroponics
- Sidi Parani—Fertilizer granulation plant in Christiana
- Tiva Enviro Services - Biodiversity study for De Aar Hospital
- Ghaap Ostrich Abattoir—Biodiversity Study
- Amakhala Nature Reserve—Development of lodge facilities
- IG van der Merwe Trust—Residential development, Douglas
- Valrena Trust—Residential development along Vaal River
- Idstone Pty Ltd—Development of irrigation ground for seed potatoes production
- Tiaan Trust—Development of irrigation ground
- C F Scholtz & Seuns - Development of irrigation ground for growing of crops
- Kosie Smith Trust - Development of irrigation ground for growing seed potatoes
- Bakgat Trust—Development of irrigation ground for growing of crops
- Mount Carmel (pty) Ltd—Development of irrigation ground for growing of crops
- Koppieskraal Plase Rietrivier Beperk—Development of irrigation ground for seed potatoes production
- Genade Boerdery (PTY) Ltd—Development of irrigation ground for growing of crops
- Santarose Investments (Pty) Ltd - Development of irrigation ground for seed potatoes production
- Valrena Trust—Development of irrigation ground for growing of crops
- Middeldrift Dairy Trust—Establishment of Dairy
- Eliweni Wildlife (Pty) Ltd - Lodge Development on Amakhala Nature Reserve
- Idstone Pty Ltd—Development of irrigation ground for the growing of seed potatoes
- Trisa Trust—Development of irrigation ground for the growing of seed potatoes
- GWK Pty Ltd—Development of irrigation pivots and vineyards
- Blair Athol Golf course development
- Rolfontein Nature Reserve lodge development
- SLR—Ecological Specialist survey for Kudumane Mine
- Biodiversity offset plan—UMK mine
- Biodiversity Action Plan for UMK mine
- Biodiversity offset Kudumane Mine
- IDC—Ecological Management & Business Plan: Siyancuma Women in Game Initiative
- Swanvest 123 Pty Ltd—Wolverfontein Breeding Facility
- De Beers—Ecological Evaluation and Management Plan for Kleinsee Game Farm
- Kalahari Oryx Game Reserve—Risk Assessment introduction of Lion
- Department of Land Affairs—Ecological Management and Business plan for Thwane Commonage

- Mauricedale Game Ranch—Paardefontein Specialist Vegetation Survey
- Santrosa Investments Pty Ltd—Olie Rivier Game Farm HA
- Manzi Safaris Habitat Assessment
- Thuru Lodge—Risk Assessment & Habitat Analysis
- Dugmore brothers—Habitat assessment Hartebeesthoek
- Schutte Boerdery Trust—Habitat Assessment Glenfrere
- F G. Taljaard—Habitat Assessment Namakwari Game Reserve
- Rivierfront Wild - Doornfontein Habitat Assessment
- Sjobbolet Trust—Hartsvally Habitat Assessment
- Raltefontein Habitat Assessment
- Kalahari Oryx Game Reserve—Specialist Vegetation survey

PROFESSIONAL ASSOCIATIONS

Grassland Society of Southern Africa

South African Council for Natural scientific Professions Registration number 400117/05

RESEARCH PUBLICATIONS

Evans, N.V., Avis, A.M. and Palmer, A.R. 1997. Changes to the vegetation of the mid-Fish River valley, Eastern Cape South Africa, in response to land-use, as revealed by a direct gradient analysis. *African Journal of Range & Forage science*, 14 (2): 68-74.

Birch N.V., Avis, A.M. and Palmer, A.R. (1999) The Effect Of Land-Use On The Vegetation Communities Along A Topo-Moisture Gradient In The Mid-Fish River Valley, South Africa. *African Journal of Range & Forage science*, 16(1): 1-8

Birch, N.V., Avis, A.M. and Palmer, A.R. 1999. Changes to the vegetation communities of natural rangelands in response to land-use in the mid-Fish River valley, South Africa. *People and Rangelands Building the Future* (Eds D. Eldridge & D. Freudenberger) pp.319-320 vol 1. Proceeding of the VI International Rangeland Congress, Townsville, Queensland, Australia