NC 30/5/1/1/2/12200 PR

Boscia
ECOLOGICAL CONSULTING

TERRESTRIAL ECOLOGICAL ASSESSMENT REPORT

KIMSWA MINING (Pty) Ltd

Rietfontein Diamond Prospecting Operation

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KIMSWA MINING (PTY) Ltd

Remaining Extent of Portion 9 and Portion 13 of the Farm Rietfontein 11

Districts of Prieska

Northern Cape Province

Terrestrial Ecological Assessment Report in application for Environmental Authorisation related to a Prospecting Right Application (Ref: NC 30/5/1/1/2/12200 PR) that was lodged with the Department of Mineral Resources

September 2019

EXECUTIVE SUMMARY

KIMSWA Mining (Pty) Ltd is proposing the prospecting of diamonds on the Remaining Extent of Portion 9 as well as Portion 13 of the Farm Rietfontein 11. The prospecting right area is located within the Prieska District Municipalities of the Northern Cape Province.

The company has submitted a Prospecting Right application, which triggers the requirement to apply for Environmental Authorisation. A terrestrial ecological assessment is required in order to consider the impacts that the proposed activities might have on the ecological integrity of the property. This terrestrial ecological assessment report describes the ecological characteristics of the proposed prospecting area, identifies the source of impacts from the operation, and assesses these impacts, as well as the residual impacts after closure.

A desktop study and field investigation was performed to obtain ecological information for the proposed study area and identify the ecological characteristics and sensitivity of the site. Six plant communities were identified on site of which the riparian woodland along with the ephemeral rivers, streams and drainage lines are considered to be of very high sensitivity due to their vital ecological and hydrological functionality and significance. The calcrete ridges and ironstone hilltops are also considered to be of very high sensitivity due to the dense population of listed *Aloidendron dichotomum* found here, along with high densities of nationally protected tree *Boscia albitrunca* and other species protected according to the NCNCA. The remaining study area, which comprises the shrubland on rocky ridges and sandy plains, is considered to be of high sensitivity primarily due to the high occurrences of species of conservation concern that occur widespread across these units.

The most profound impacts are expected to be related to the loss of plant species of conservation concern as well damages to the burrows of fossorial mammals that occur on the alluvial plains. The disruption of ecological corridors and the hydrological regime if any of the tributaries to the Orange River are cut off is also considered to be a major impact.

Species of conservation concern that are found in the prospecting area include *Ruschia intricata, Sarcostemma viminale, Aloe claviflora, Aloidendron dichotomum, Boscia albitrunca, Euphorbia avasmontana, E. gregaria* and *Olea europaea* subsp. *africana.* Similarly, the prospecting operation will result in the large-scale clearance of indigenous vegetation. Permit applications regarding protected flora as well as the harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation prior to any clearance of vegetation.

Similarly, if any of the *Boscia albitrunca* trees are to be affected, a licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries three months prior to any potential disturbances to these trees.

To conclude, it is clear that the destruction of the natural habitat within the study area is inevitable. The significance of the impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the prospecting area. In my opinion, authorisation can be granted if the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures. Furthermore, the application should only be granted if the applicant commits to exclude the areas where dense populations of *Aloidendron dichotomum* and *Boscia albitrunca* occur from the mining footprint.

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1. INTRODUCTION

1.1. Background information

KIMSWA Mining (Pty) Ltd is proposing the prospecting of diamonds on the Remaining Extent of Portion 9 and Portion 13 of the Farm Rietfontein 11 (from hereon referred to as Rietfontein). The prospecting right area is located within the Prieska District Municipalities of the Northern Cape Province. It lies approximately 70 km north-west of the town Prieska on a gravel road that turns from the N10, which connects Marydale in the west, with Prieska in the east. The property lines the southern banks of the Orange River for a distance of ± 4 km, in the north (Figure 1). The total extent of the prospecting right area is 6 613.2836 ha.

The company has submitted a Prospecting Right application, which triggers the requirement to apply for Environmental Authorisation. An ecological assessment is required in order to consider the impacts that the proposed activities might have on the ecological integrity of the property and therefore Boscia Ecological Consulting has been appointed by the applicant to conduct an assessment and provide an ecological assessment report.

This assessment report describes the characteristics of habitats in the proposed prospecting area, identifies species of conservation concern, identifies invasive and encroaching species and their distribution, indicates the source of impacts from the prospecting operation and assesses these impacts as well as the residual impacts after closure.

A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the operation. Ecological responsibilities pertaining to relevant conservation legislation are also indicated. These should all be included in the EMP.

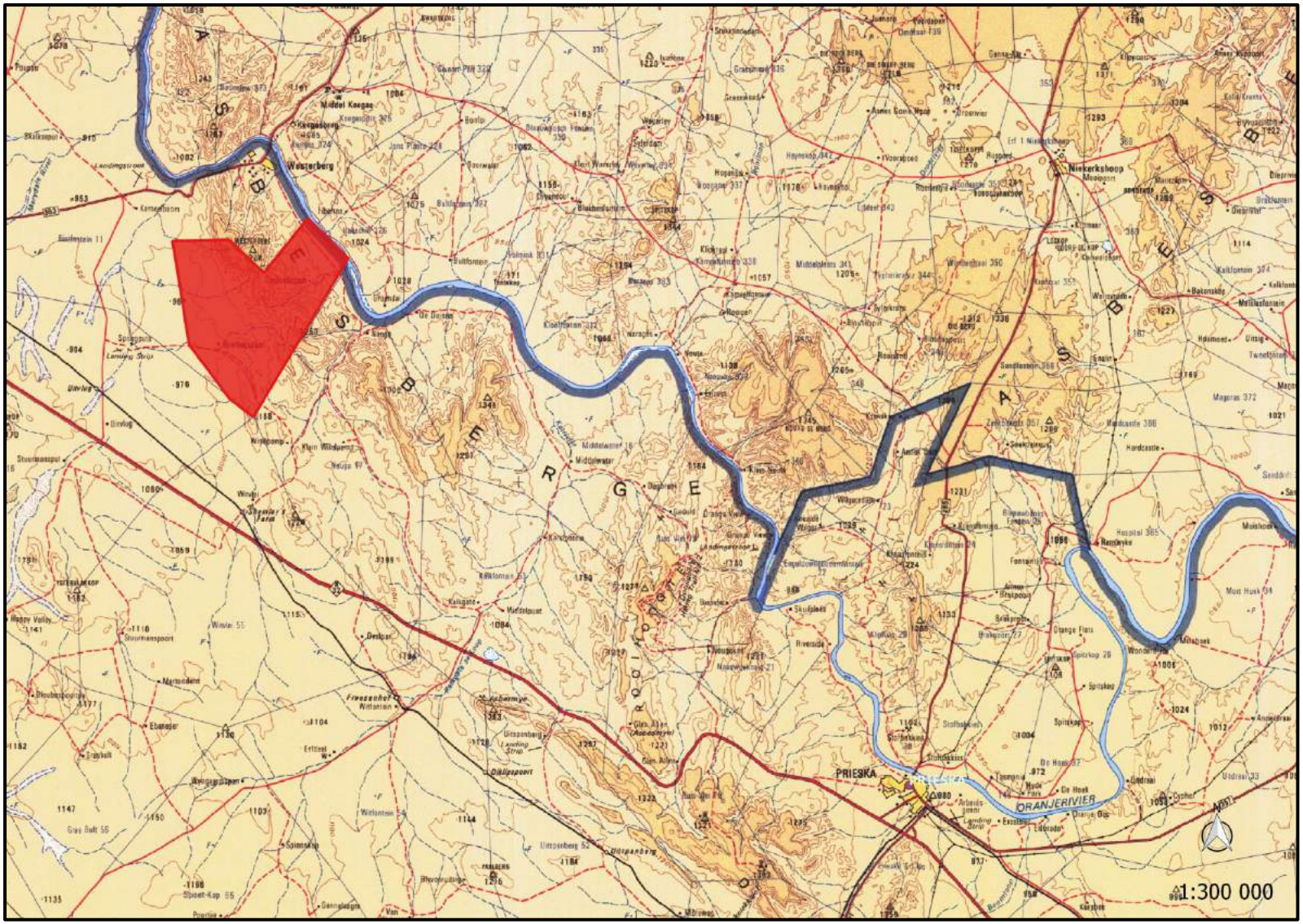


Figure 1. The location of the Rietfontein prospecting area is indicated in red.

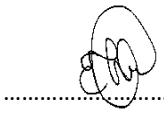
1.2. Scope of study

The specific terms of reference for the study include the following:

- conduct a desktop study and field investigation in order to identify and describe different ecological habitats and provide an inventory of communities/species/taxa and associated species of conservation concern within the environment that may be affected by the proposed activity;
- identify the relative ecological sensitivity of the project area;
- produce an assessment report that:
  - indicates identified habitats and fauna and flora species,
  - indicates the ecological sensitivity of habitats and conservation values of species,
  - determines the potential impacts of the project on the ecological integrity,
  - provides mitigation measures and recommendations to limit project impacts,
  - indicate ecological responsibilities pertaining to relevant conservation legislation.

1.3. Details of the specialist consultant

Company Name	Boscia Ecological Consulting cc	**Registration no:**	2011/048041/23
Address	PostNet Suite #194 Private Bag X2 Diamond 8305		
Contact Person	Dr Elizabeth (Betsie) Milne		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	PhD Botany (Nelson Mandela Metropolitan University), Masters Environmental Management (University of the Free State), BTech Nature Conservation (Tshwane University of Technology)		

Declaration of independence	I, Elizabeth (Betsie) Milne, owner of Boscia Ecological Consulting, declare that I: • act as the independent specialist in this application; • regard the information contained in this report as it relates to my • specialist input/study to be true and correct; • do not have, and will not have any financial interest in the undertaking of the activity; other than the remuneration of work performed in terms of the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act; • have and will not have any vested interest in the activity proceedings; • have no, and will not engage in conflicting interest in the undertaking of the activities; • undertake to disclose to the component 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 and any specific environmental management Act; • will provide the competent authority with access to all information at my disposal regarding the study.  ……

1.4. Description of the proposed activity

The prospecting operation is based on alluvial diamond deposits that are confined to the paleo river terraces (Figure 2). These deposits will be sampled in pits (2 m x 3 m) and trenches (100 m x 50 m) by means of an opencast method using heavy earthmoving machinery. Vegetated soil or overburden will be stripped and the underlying gravels will be excavated, screened and treated through a rotary plan plant before fed to an x-ray machine for final recovery. The rough diamond product will then be removed for further beneficiation. No ore processing reagents are required or used in the treatment of the ore. An estimated total volume of 250 000 m^3 will be processed over 5 years.

Prospecting activities will primarily make use of existing roads, but temporary infrastructure and additional haul roads will be created in order to access new prospecting pits. The proposed infrastructure and prospecting related footprint include access roads, office complexes, workshops, oil and diesel depot floors, wash bay floors, break test ramps, plant ramps, central processing plants, slimes dams, pipeline infrastructure for the transportation of water and slimes, open pits and trenches, overburden stockpiles and gravel stockpiles.

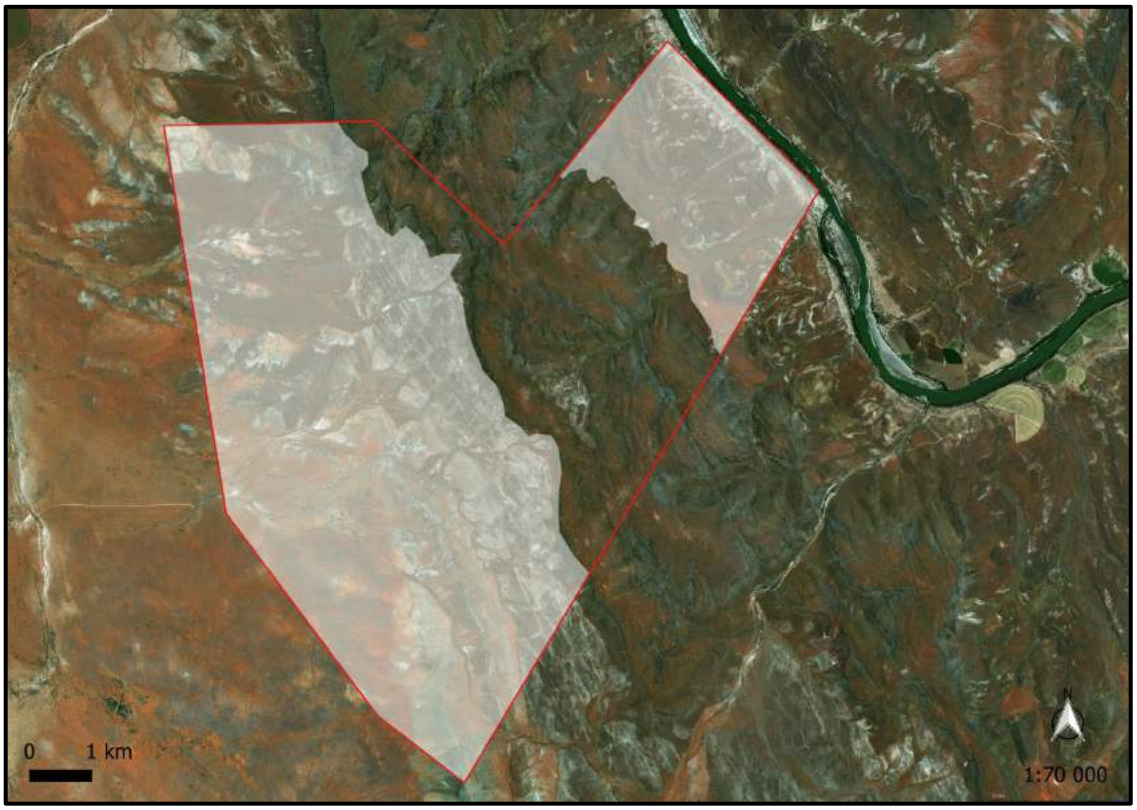


Figure 2. The proposed footprint of prospecting activities on Rietfontein, with the core prospecting areas indicated in white.

2. METHODOLOGY

2.1. Data collection

The study comprised a combination of field and desktop surveys for data collection on fauna and flora in order to obtain the most comprehensive data set for the assessment. The fieldwork component was conducted on 13 July 2019 and most data for the desktop component was obtained from the quarter degree square that includes the study area (2922AD).

2.2. Flora

2.2.1. Field survey

For the field work component, satellite images were used to identify homogenous vegetation units within the proposed prospecting area. Representative sampling plots were allocated in these units and sampled with the aid of a GPS in order to characterise the species composition. The following quantitative data was collected:

- Species composition
- Species percentage cover
- Amount of bare soil and rock cover
- Presence of biotic and anthropogenic disturbances

Additional checklists of plant species were compiled during the surveys by traversing a linear route and recording species as they were encountered in each unit.

2.2.2. Desktop survey

For the desktop component, the South African National Vegetation Map (Mucina and Rutherford 2006) was used to obtain data on broad scale vegetation types and their conservation status. The South African National Biodiversity Institute's (SANBI) BGIS database was also consulted to obtain information on biodiversity information for the Siyathemba Local Municipality (NC077), in which the study area falls.

Further searches were undertaken specifically for Red List plant species within the current study area. Historical occurrences of Red List plant species were obtained from the SANBI: POSA database for the quarter degree squares that include the study area. The IUCN conservation status of plants in the species list was also extracted from the SANBI database and is based on the Threatened Species Programme (SANBI 2017).

2.3. Fauna

2.3.1. Desktop survey

A desktop survey was undertaken to obtain lists of mammals, reptiles, amphibians, birds, fish and arthropods which are likely to occur in the study area. These were derived based on distribution records from the literature, including Friedmann and Daly (2004) and Stuart and Stuart (2015) for mammals, Alexander and Marais (2007) and Bates et al. (2014) for reptiles, Du Preez and Carruthers (2009) for amphibians, Gibbon (2006) for birds, Kleynhans (2007) for fish and Picker et al. (2004), Griffiths et al. (2015) and Thirion (2007) for invertebrates.

Additional information on faunal distribution was extracted from the various databases hosted by the ADU web portal, http://adu.org.za. A map of important bird areas (BirdLifeSA 2015) was also consulted. 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.

The likelihood of Red Data species occurring on site has been determined using the distribution maps in the Red Data reference books (Friedmann and Daly 2004; Bates et al. 2014; Taylor et al. 2015; ADU 2016) and comparing their habitat preferences with the habitat described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria (IUCN 2015) and/or the various red data books for the respective taxa.

2.3.2. Field survey

The faunal field survey was conducted concurrent with the vegetation survey. Habitats on site were assessed to compare with the habitat requirements of Red Data species. The presence of faunal species was determined using the following methods:

- Identification by visual observation,
- Identification of bird and mammal calls,
- Identification of signs (spoor, faeces, burrows and nests).

2.4. Assumptions and limitations

Due to the brief duration of the survey and the lack of seasonal coverage, the species list obtained during the site visit cannot be regarded as comprehensive. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant species present is captured. However, this is rarely possible due to time and cost constraints. The survey was nevertheless conducted in such a manner to ensure all representative communities are traversed and therefore is likely to have included the majority of the dominant and common species present.

The site visit for the study took place during winter and in a period of ongoing drought, which is not a favourable time for a botanical survey. Grasses were grazed to stubble and hardly any other plants were in flower. Consequently, the timing of the site visit is considered to be a major limiting factor, especially in terms of species of conservation concern possibly being overlooked.

Furthermore, not all areas of the property were fully accessible due to the rough terrain. However, those areas without restricted access were used as proxies for community descriptions based on geological similarities.

The complex geology of the hills and ridges in study area is vastly interwoven at a very small scale, which leads to numerous plant transitional zones. This challenged the fine-scale mapping, classification and delineation of plant communities. Although the communities presented here are more accurate than the current broad-scale vegetation map, they can still not be regarded as exact. Transitional areas were however not excluded from the surveys in order to maximise the chances of encountering species of conservation concern.

2.5. Sensitivity mapping and assessment

An ecological sensitivity map of the site was produced by integrating the information collected on site with the available ecological and biodiversity information available in the literature and various spatial databases.

The sensitivity mapping entails delineating different habitat units identified on the satellite images and assigning likely sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern, as well as their probability of being affected by proposed activities. The sensitivity of the different units identified in the mapping procedure increased with probability and was rated according to the following scale:

Low: Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and biodiversity. Most types of activities can proceed within these areas with little ecological impact.

Medium: Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Activities within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

High: Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Activities within these areas are undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

Very High: Critical and unique habitats that serve as habitat for species of conservation concern, or perform critical ecological roles. These areas are essentially no-go areas for activities and should be avoided as much as possible.

2.6. Impact assessment and mitigation

The criteria used to assess the significance of the impacts are shown in Table 1. The different project activities and associated infrastructure were identified and considered in order to identify and analyse the various possible impacts. The limits were defined in relation to project characteristics. Those for severity, extent, duration and probability are subjective, based on rule-of-thumb and experience. Natural and existing mitigation measures were considered. These natural mitigation measures were defined as natural conditions, conditions inherent in the project design and existing management measures, which alleviate impacts. The Consequence value of the impacts was calculated by using the following formula:

$$\underset{\text{(Severity + Spatial Scope + Duration)}}{\textit{CONSEQUENCE}} \; X \; \underset{\text{(Frequency of activity + Frequency of impact)}}{\textit{PROBABILITY}}$$

Consequence of impacts is defined as follows:

Very Low: Impact would be negligible. Almost no mitigation and/or remedial activity would be needed, and any minor steps which might be needed would be easy, cheap and simple.

Low: Impact would have little real effect. Mitigation and/or remedial activity would be either easily achieved or little would be required or both.

Low – Medium: Impact would be real but not substantial within the bounds of those which could occur. Mitigation and/or remedial activity would be both feasible and fairly easily possible.

Medium – High: Impact would be real and rather substantial within the bounds of those which could occur. Mitigation and/or remedial activity would be feasible, but not necessarily possible without difficulty.

High: Impacts of substantial order. Mitigation and/or remedial activity would be feasible but difficult, expensive, time consuming or some combination of these.

Very High: Of the highest order possible within the bounds of impacts which could occur.
There would be no possible mitigation and/or remedial activity to offset the impact at the spatial or time scale for which was predicted.

Table 1. Criteria used to assess the significance of the impacts.

Weight	Severity	Spatial scope (Extent)	Duration
5	Disastrous	Trans boundary effects	Permanent
4	Catastrophic / major	National / Severe environmental damage	Residual
3	High/ Critical / Serious	Regional effect	Decommissioning
2	Medium / slightly harmful	Immediate surroundings / local / outside mine fence	Life of operation
1	Minimal/potentially harmful	Slight permit deviation / on-site	Short term / construction (6 months – 1 yrs)
0	Insignificant / non-harmful	Activity specific / No effect / Controlled	Immediate (0 – 6 months)

Weight number		**1**	**2**	**3**	**4**	**5**
Frequency						
Probability	**Frequency of impact**	Highly unlikely	Rare	Low likelihood	Probable / possible	Certain
		Practically impossible	Conceivable but very unlikely	Only remotely possible	Unusual but possible	Definite
	Frequency of activity	Annually or less	6 monthly / temporarily	Infrequent	Frequently	Life of operation

CONSEQUENCE
(Severity + Spatial Scope + Duration)

PROBABILITY (Frequency of activity + Frequency of impact)															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
6	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
7	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
8	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
9	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
10	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Colour code	Significance rating	Value	**Negative impact** Management strategy	**Positive Impact** Management strategy
	VERY HIGH	126 – 150	Improve current management	Maintain current management
	HIGH	101 – 125	Improve current management	Maintain current management
	MEDIUM – HIGH	76 – 100	Improve current management	Maintain current management
	LOW – MEDIUM	51 – 75	Improve current management	Maintain current management
	LOW	26 – 50	Improve current management	Maintain current management
	VERY LOW	1 – 25	Improve current management	Maintain current management

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

Currently, major land uses in the region include activities related agriculture and, to a lesser extent, mining. The land capability for the majority of the study site is non-arable with low potential grazing land, with the mountainous sections on the property being classified as wilderness areas. The agricultural region is demarcated for sheep farming with a grazing capacity of 32 Ha/LSU, but extensive crop irrigation, i.e. cotton, lucerne, table grapes and sultanas occur on the deeper alluvial soils along the Orange River (Rumboll 2014). Apart from the KIMSWA diamond prospecting right application, the property was also subjected to asbestos and lead mining in the past (Figure 3). Currently, the farm is utilised for grazing by cattle, goat and sheep, while a portion along the river is used for crop irrigation (Figure 3). A number of homesteads on the farm are currently occupied by land owners, tenants and workers (Figure 3).

3.2. Geology, soils and topography

According to Thomas (1995) the geological features on Rietfontein are very complex and comprise Quaternary, Tertiary, Mokalian, Vaalian and Randian deposits (Figure 4). The Doringberg Fault also cuts through the property in the west (Figure 4). Alluvium is found along the Orange River, while the terraces in the east and west of the property is covered with scree and surface rubble. Red windblown sand and dunes cover a portion in the south-west among light-grey to pink, unfoliated, medium-grained porphyritic Skalkseput granite. Directly east of the Doringberg fault, in the south of the property, various deposits from the Vryburg Formation, Griqualand West Supergroup are found, i.e. white quartzite (Kalkput member), porphyritic andesite, tuff and calcareous sandstone (Geelbeksdam member) as well as quartzite, shale, grit and conglomerate. North-east of the fault, Campbell Rand dolomite and limestone of the Griqualand West Supergroup stretches south, along some calcrete deposits. The majority of the eastern half of the property comprises Kuruman banded iron-stone, with small pockets of finely laminated brown to red-brown shale (Buisvlei Bed) of the Asbestos Hills Formation. Pockets of blue riebeckitic jaspelite of the Daniëlskuil Formation as well as diabase intrusions are found among the scree and rubble west of the river (Figure 4).

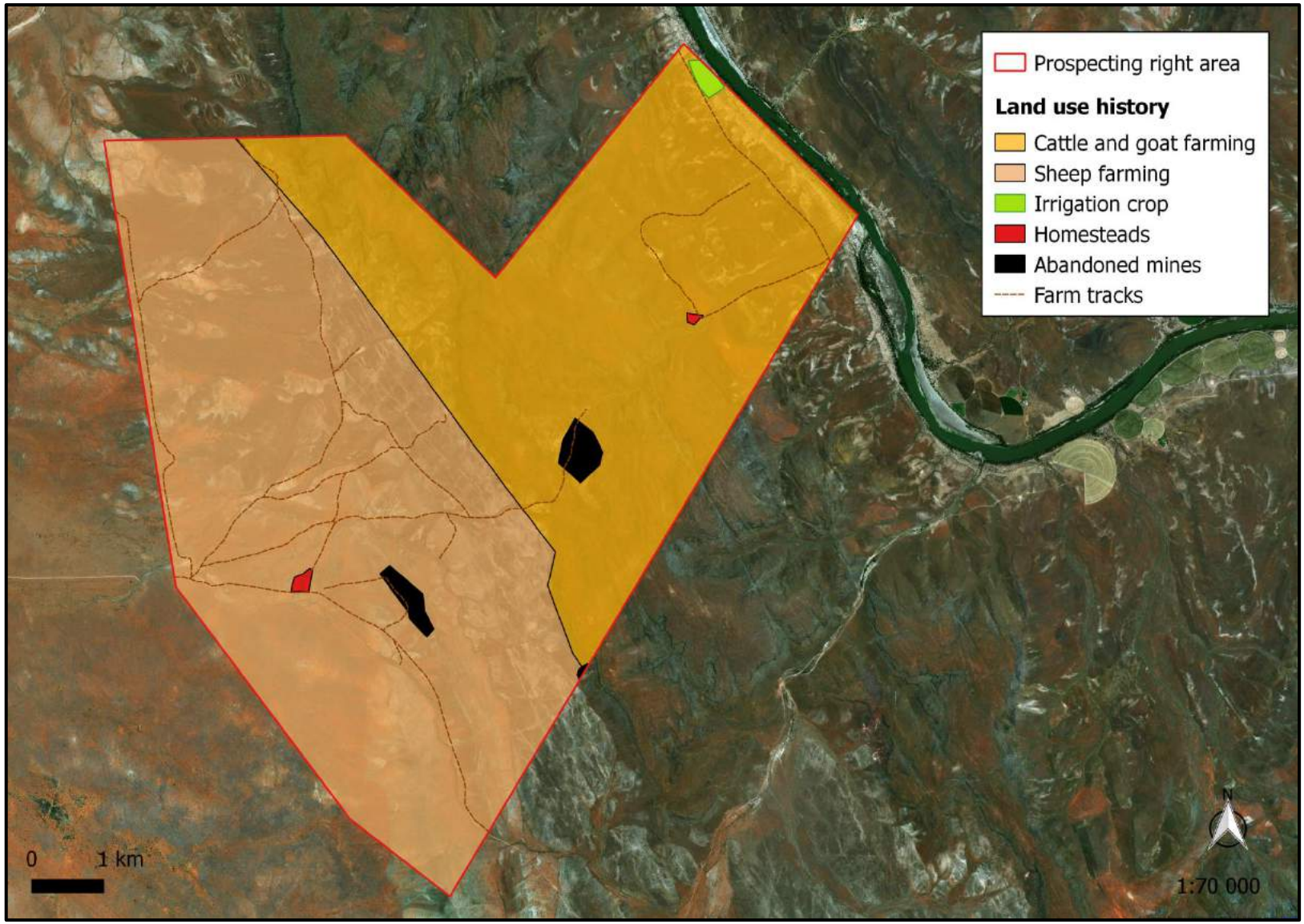


Figure 3. The land use history of the study area.

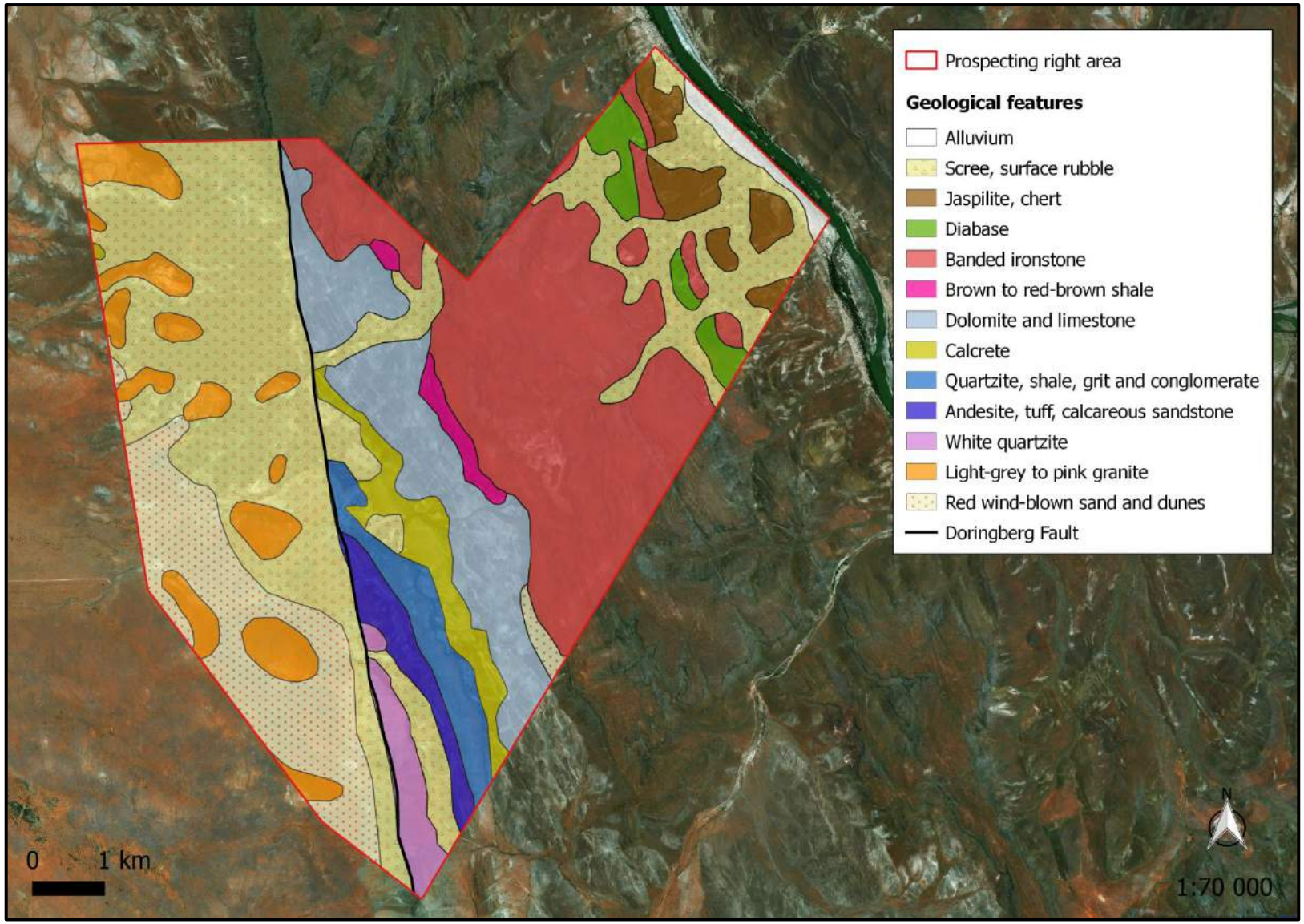


Figure 4. The distribution of geological features in the study area.

The alluvium deposits along the Orange River channel as well as those terraces occupied by scree and surface rubble will primarily be the focus of the prospecting operation.

The area is characterised by rugged terrain, with irregular hills and ridges that divide the property to slope west towards the plains and east towards the Orange River. Altitude ranges from 900 m along the river in the east and 970 on the ridges in the west, to 1 285 m above sea level on the hilltops in the centre of the property. The terrain is generally indicated by gentle slopes of 6 % running east towards the river and 3 % running west towards the plains, while steeper slopes of 30 - 50 % are found around the hilltops.

Land types found on the property include Ae275a, Fb378c, Fb383a, Fb388a, Ib340a and Ic152a (Figure 5). The Ib land types are typically rocky areas with miscellaneous soils, while the Ic types are very rocky with little to no soils. The Ae types are associated with red-yellow apedal, freely drained soils, red with high base status and more than 300 mm deep (no dunes). The core prospecting area is however closely associated with land type Fb (Figure 5). Here, Glenrosa and/or Mispah forms are primarily found with lime being rare or absent in upland soils but generally present in low-lying soils.

3.3. Vegetation

3.3.1. Broad-scale vegetation patterns

The study area falls within the Nama Karoo Biome (Mucina and Rutherford 2006). According to the vegetation map of Mucina and Rutherford (2012), the site is represented by two broad-scale vegetation units, i.e. Lower Gariep Broken Veld and Bushmanland Arid Grassland (Figure 6).

Lower Gariep Broken Veld is restricted to the Northern Cape Province. It comprises Hardeveld along the Orange River from Onseepkans in the west, to Prieska in the east. The unit varies in altitude from 400 to 1 200 m. The topography includes hills and mountains, slightly irregular plains with sparse vegetation dominated by shrubs and dwarf shrubs. Scattered *Aloidendron dichotomum* individuals grow on the slopes of koppies, while *Senegalia mellifera* is typically found on the sandy soils of foot slopes.

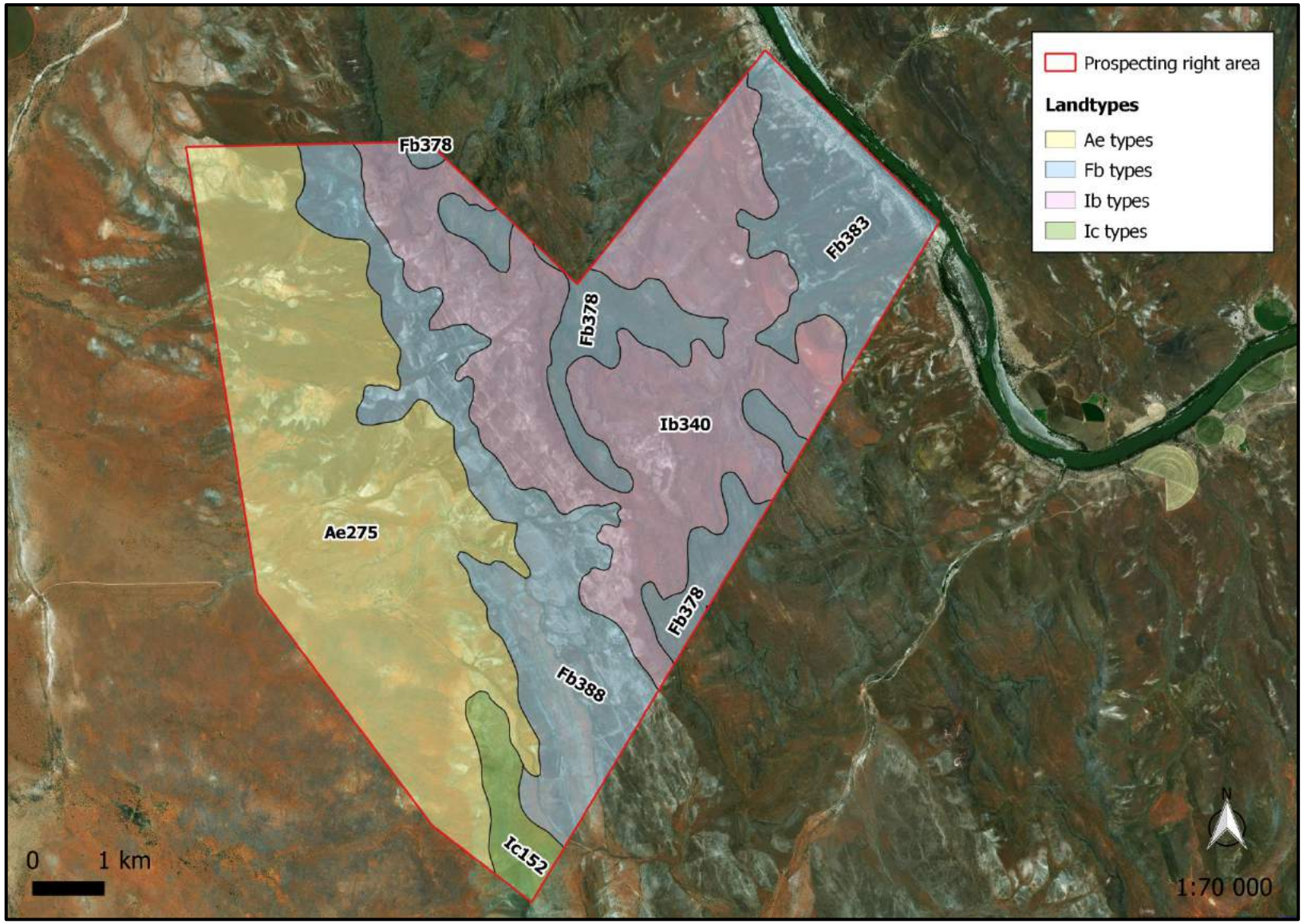


Figure 5. The distribution of land types at the study site.

The geology of this unit includes Banded iron formation and amphibolites of the Asbestos Hills Subgroup, carbonates and cherts of the Campbell Group, Metamorphic rocks in the form of quartzites and gneisses of the Korannaland Subgroup as well as Riemvasmaak gneiss. The Uitdraai Formation and metamorphosed sediments and outcrops of the Namaqualand Metamorphic Complex are also found. The soils are typically shallow and skeletal, with Mispah and Glenrosa soil forms being dominant. The land types include mainly Ib and Ic, but Fb is also found. The unit is classified as least threatened and only a very small part has been transformed. Erosion risk is regarded as low, very low and moderate. Approximately 4 % is conserved within the Augrabies Falls National Park and *Ruschia pungens* is the only endemic plant species that is known from this unit.

Bushmanland Arid Grassland is restricted to the Northern Cape Province. It spans from around Aggeneys in the west to Prieska in the east, with the boundary of the unit being defined by the edges of the Bushmanland Basin in the south, desert vegetation near Upington in the north and the edges of the Namaqualand hills in the west. Altitude varies from 600 to 1 200 m. The topography includes extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland, dominated by *Stipagrostis* spp. In places low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich display of annual herbs can be expected. A third of the geology of this unit comprises recent (Quaternary) alluvium and calcrete. Superficial deposits of the Kalahari Group are also present in the east. The extensive Palaeozoic diamictites of the Dwyka Group also outcrop in the area, along with gneisses and metasediments of Mokolian age. The soils are primarily red-yellow apedal soils, freely drained, with a high base status and < 300 mm deep. However, about a fifth of the area comprises soils deeper than 300 mm. The land types include mainly Ag and Ae. The unit is classified as least threatened with very little being transformed. Small portions are conserved within the Augrabies Falls National Park and Goegap Nature Reserve. Endemic plant species include *Dinteranthus pole-evansii, Larryleachia dinteri, L. marlothii, Ruschia kenhardtensis, Lotononis oligocephala* and *Nemesia maxii*.

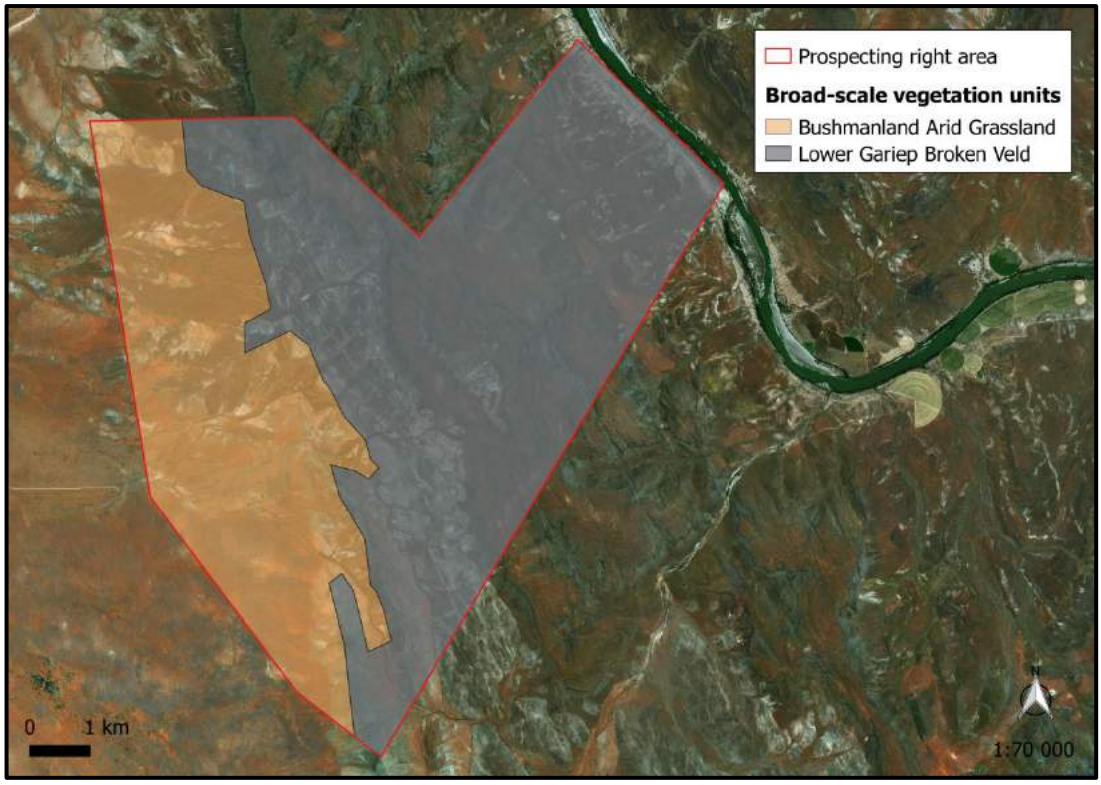


Figure 6. The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.

3.3.2. Fine-scale vegetation patterns

Plant communities in the study area are delineated according to plant species correspondences and changes in soil structure. They can be divided into six distinct units (Figure 7), which are described below. These descriptions include unique characteristics and the dominant species found in each unit. A complete plant species list, including those species likely to occur here is presented in Appendix 1.

i) *Aloidendron dichotomum - Boscia albitrunca* open woodland on ironstone hilltops

This community covers the central parts of the study area and is found on the ironstone hilltops south of the Orange River (Figure 7), where a bare rocky substrate constitute about 20 % of the ground cover. It is primarily presented as an open woodland where *Aloidendron dichotomum* dominates the tree layer, with stunted *Boscia albitrunca* shrubs scattered within the matrix (Figure 8).

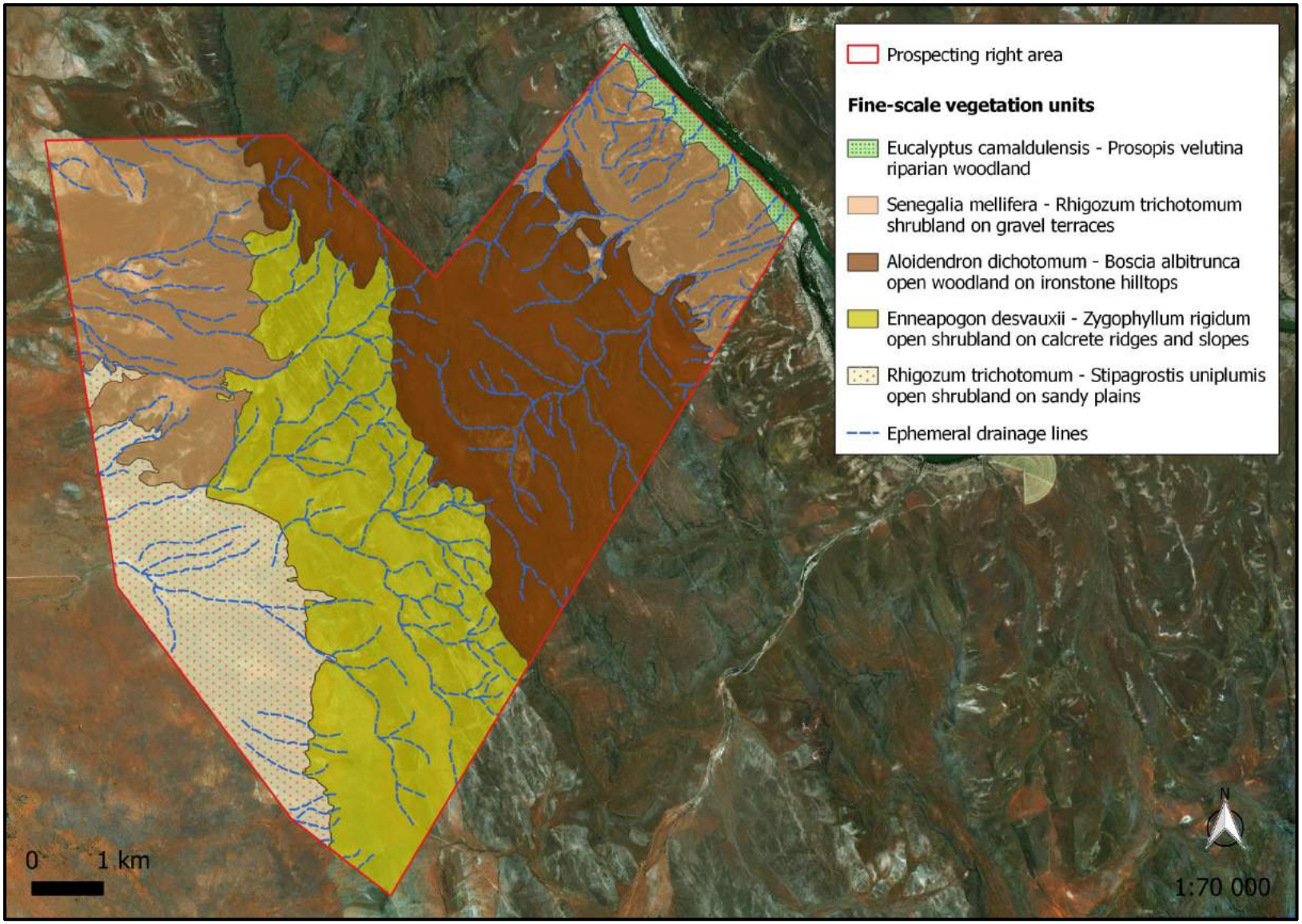


Figure 7. The distribution of fine-scale plant communities in the study area.

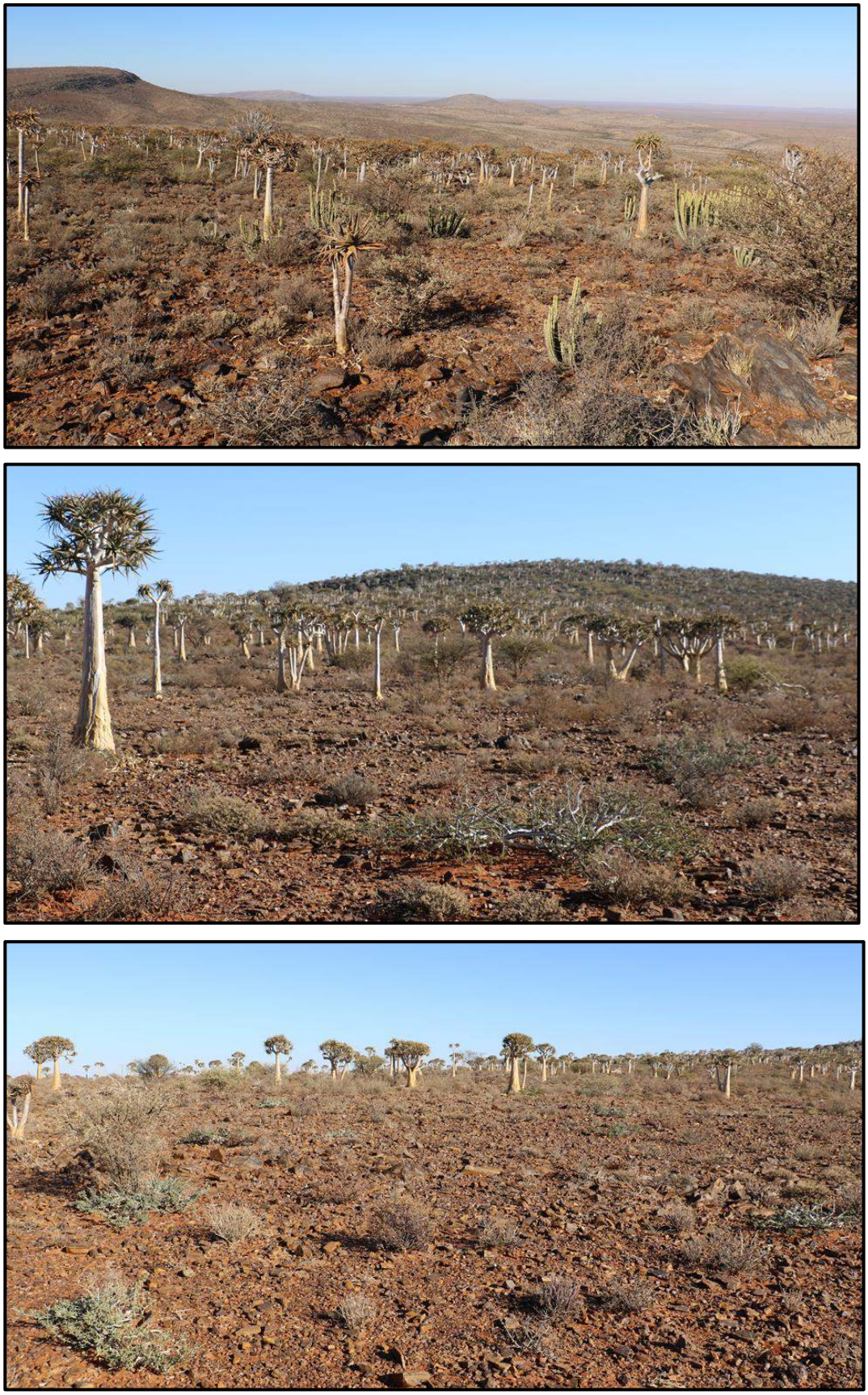


Figure 8. The open woodland on ironstone hilltops hosts a dense population of *Aloidendron dichotomum* trees, with stunted *Boscia albitrunca* shrubs scattered within the matrix.

Other common tall shrubs include *Rhigozum obovatum, Senegalia mellifera* and the succulent shrub *Euphorbia avasmontana*. The lower and dwarf shrub layer includes *Rhigozum trichotomum, Zygophyllum rigidum, Phaeoptilum spinosum, Aptosimum marlothii, A. albomarginatum, Pteronia mucronata, Kleinia longiflora, Monechma spartioides, Euphorbia gregaria, Cadaba aphylla, Sarcostemma viminale, Blepharis mitrata, Ruschia intricata, Asparagus* sp., *Lycium* sp., *Eriocephalus* sp. and *Pentzia* sp.

The grass layer was not identifiable during the time of the field visit, due to the drought conditions. Herbs found here include *Geigeria ornativa, Sansevieria aethiopica* and *Anacampseros baeseckei*.

ii) *Enneapogon desvauxii* - *Zygophyllum rigidum* open shrubland on calcrete ridges and slopes

The open shrubland on calcrete ridges and slopes is found on calcrete, intermixed with sand, which constitute about 10% of the ground cover. The plant community is defined by the monotonous short grass layer, dominated by *Enneapogon desvauxii,* but *Stipagrostis uniplumis* is also common Figure 9.

The surrounding shrub layer is dominated by dwarf shrubs on the lower slopes, but taller shrubs and trees become more dominant higher up towards the steeper slopes. Along the higher ridges in the east, where this community forms a transitional zone with the ironstone slopes, *Aloidendron dichotomum* becomes particularly conspicuous and forms very dense populations, as on the hilltops. Other common tall shrubs include *Senegalia mellifera, Rhigozum obovatum* and *Boscia albitrunca*.

Zygophyllum rigidum dominates the low shrub layer, but other low shrubs include *Pteronia mucronata, Barleria rigida, Monechma spartioides, Pentzia incana, Aptosimum marlothii, Euphorbia gregaria, Rhigozum trichotomum, Kleinia longiflora, Aloe claviflora, Asparagus* sp. and *Lycium* sp.

Figure 9. The open shrubland on calcrete ridges and slopes occurs as a sparse shrubland dominated by *Zygophyllum rigidum* among a short grass matrix dominated by *Enneapogon desvauxii*. *Aloidendron dichotomum* is also very conspicuously scattered across this unit.

iii) *Senegalia mellifera - Rhigozum trichotomum* shrubland on gravel terraces

The shrubland on gravel terraces occurs as two disjunct communities on Rietfontein (Figure 7), i.e. one in the north-west and another in the north-east. They are separated by the hills and mainly occur on the footslopes of the hills on rocky soils that constitute ± 40 % of the ground cover (Figure 10).

The tall shrub layer is significantly dominated by *Senegalia mellifera,* but trees such as *Boscia albitrunca* and *Aloidendron dichotomum* are widespread as well. The low shrub layer is dominated by *Rhigozum trichotomum*, with *Zygophyllum rigidum* and *Psilocaulon coriarium* also being common. Other shrubs found here include *Euphorbia gregaria, Cadaba aphylla* and *Monechma divaricatum.*

The herbaceous layer is not well developed, with grasses being scarce or grazed beyond recognition. However, the herb *Chascanum garipense* occurs here.

Figure 10. The shrubland on gravel terraces is dominated by a dense population of *Senegalia mellifera* and *Rhigozum trichotomum* shrubs.

iv) *Rhigozum trichotomum - Stipagrostis uniplumis* open shrubland on sandy plains

The open shrubland on sandy plains is found in the south-west corner of the study site (Figure 7) where it occurs on red wind-blown sand which constitute ± 30 % of the ground cover (Figure 11). *Boscia albitrunca* occurs widespread and scattered within a matrix dominated by the low shrub *Rhigozum trichotomum* (Figure 11). *Senegalia mellifera, Phaeoptilum spinosum* and *Lycium* sp. are also common. Other low shrubs found here include *Ruschia intricata, Monechma incanum, Aptosimum marlothii* and *Aloe claviflora.*

Stipagrostis uniplumis dominates the graminoid layer, but the grass stratum was evidently dry during the time of the site visit.

The fungus *Podaxis pistillaris* is common, but was restricted to termitaria (Figure 11).

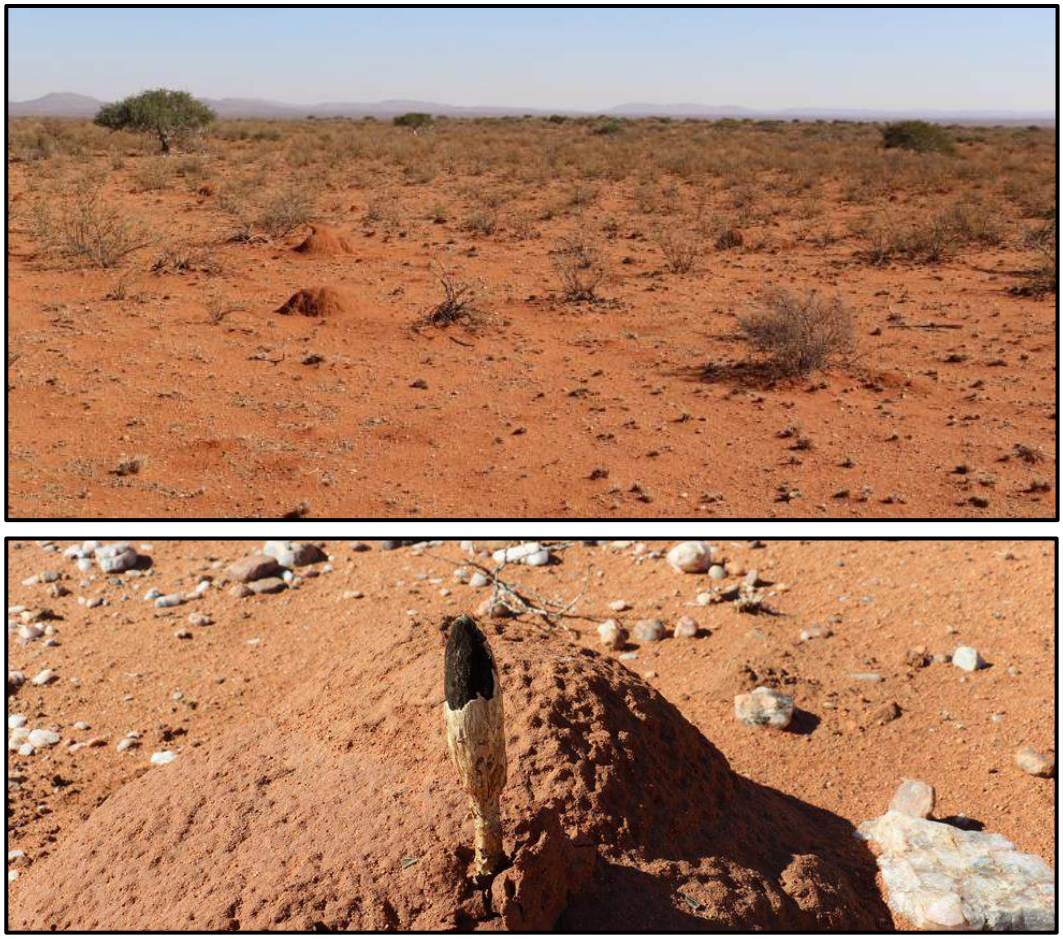


Figure 11. The plant community on sandy plains is found on red sand, where it is presented as an open shrubland, with a grassy matrix and *Boscia albitrunca* trees scattered across the unit (top). The fungus *Podaxis pistillaris* is frequently found on Termitaria (bottom).

v) *Eucalyptus camaldulensis - Prosopis velutina* riparian woodland

The riparian woodland lines the immediate banks of the Orange River on deep alluvial sand (Figure 7), with an open canopy comprising tall trees, dominated by invasive species such as *Eucalyptus camaldulensis* and *Prosopis velutina* (Figure 12). This suggests heavy disturbance in the past. However, common indigenous species include *Senegalia mellifera, Vachellia karroo, Searsia lancea, Ziziphus mucronata* and *Tamarix usneoides.* Low shrubs *Psilocaulon coriarium* and *Lycium* sp. are widespread. *Phragmites australis* occurs on the edge of the river bank in some places.

Figure 12. The riparian woodland occurs along the immediate banks of the Orange River and comprises a canopy of tall trees, primarily invasive species.

vi) Ephemeral rivers, streams and drainage lines

An extensive network of drainage lines occurs across the site (Figure 7). These water courses are typically distinguishable by their rocky channels that cut through the landscape (Figure 13). Trees and tall shrubs typically line their banks, including species such as *Senegalia mellifera, Olea europaea* subsp. *africana, Ziziphus mucronata, Ehretia rigida, Boscia albitrunca, Aloidendron dichotomum, Searsia burchellii, Phaeoptilum spinosum* and *Asparagus* sp. Common graminoids include *Cenchrus ciliaris* and *Fingerhuthia africana*.

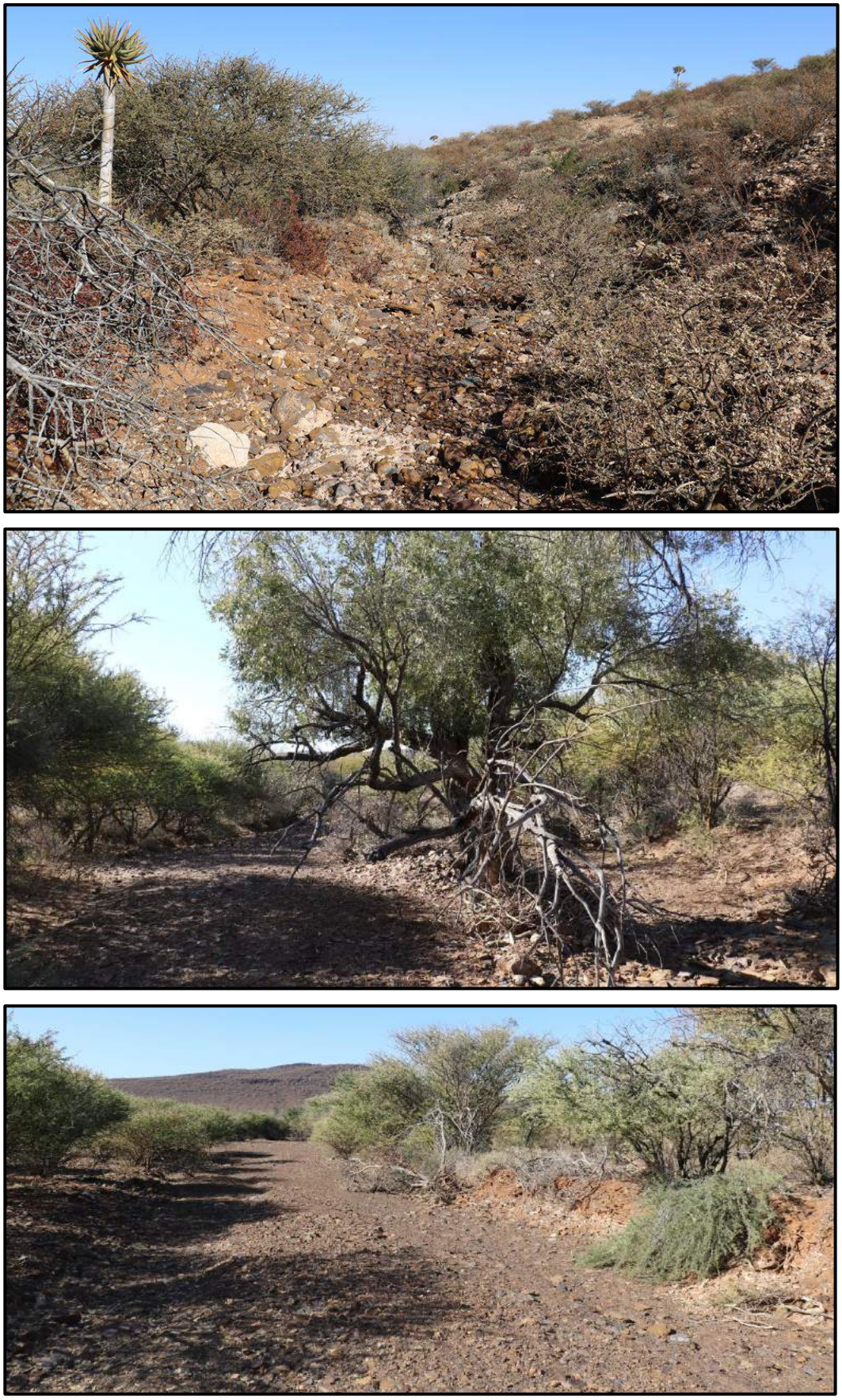


Figure 13. The ephemeral drainage lines are distinguishable by their rocky channels that cut through the landscape, with their banks lined with trees and tall shrubs.

3.3.3. Population of sensitive, threatened and protected plant species

The SANBI Red List provides information on the national conservation status of South Africa's indigenous plants, while the National Forests Act (No. 84 of 1998) (NFA) and the Northern Cape Nature Conservation Act (Act No. 9 of 2009) (NCNCA) restricts activities regarding sensitive plant species. Section 15 of the NFA prevents any person to cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister. Section 49 (1) and 50 (1) of the NCNCA states that no person may, without a permit pick, transport, possess, or trade in a specimen of a specially protected (Schedule 1) or protected (Schedule 2) plants. Furthermore, Section 51(2) states that no person may, without a permit, pick an indigenous plant (Schedule 3) in such manner that it constitutes large-scale harvesting.

Most species recorded in the area are classified as least concern; a category which includes widespread and abundant taxa (Table 2). However, one species, i.e. *Aloidendron dichotomum* (**Vulnerable**) is listed. This species occurs across the study site, except on the sandy plains and in the riparian woodland. It is especially significant on the hilltops and higher slopes of the calcrete ridges. Not only do they occur here at very high densities of ± 40 – 80 individuals per hectare, but all age classes are represented; from juveniles to senescent adults as well as dead trees (Figure 14). The major threat to this species is climate change. Models project a 36 % range decline in 100 years if dispersal into new suitable areas occurs. However, no colonization of such areas yet has happened, so a 73 % decline in 100 years is expected.

Species protected in terms of the National Forests (NFA) Act No 84 of 1998 includes *Boscia albitrunca* (Table 2). It is common and widespread across the study area (Figure 14), but absent from the riparian woodland. On the hilltops they occur at high densities (12/ha) primarily as stunted individuals (1.2 – 3 m (w) x 40 cm – 1 m (h)). On the calcrete ridges they are found at densities of six individuals per hectare, from young individuals (40 cm (w) x 20 cm (h)) to stunted or small trees (80 cm - 3 m (w) x 1.5 m (h)). On the gravel ridges and sandy plains they occur scattered (3 - 5 ind/ha), primarily as trees of up to 5 m (w) x 3 m (h), but juveniles (50 cm (w) x 20 cm (h)) and stunted trees (3 m (w) x 1 m (h)) are also common. In order to damage or remove any *B. albitrunca* individuals an application must be submitted to the Northern Cape Department of Agriculture, Forestry and Fisheries (DAFF) at least three months prior to such activities and a licence must be issued by DAFF.

Table 2. Plant species found in the region that are of conservation concern.

FAMILY	Scientific name	Status	NFA	NCNCA
AIZOACEAE	*Aridaria noctiflora* subsp. *straminea*	LC		S2
	Mesembryanthemum coriarium	LC		S2
	Mesembryanthemum crystallinum	LC		S2
	Ruschia intricata	LC		S2
AMARYLLIDACEAE	*Nerine laticoma*	LC		S2
APOCYNACEAE	*Sarcostemma viminale*	LC		S2
ASPHODELACEAE	*Aloe claviflora*	LC		S2
	Aloidendron dichotomum	**VU**		**S1**
	Bulbine abyssinica	LC		S2
	Haworthiopsis nigra var. *diversifolia*	LC		S2
	Trachyandra karrooica	LC		S2
BRASSICACEAE	*Boscia albitrunca*	LC	X	S2
EUPHORBIACEAE	*Euphorbia avasmontana*	LC		S2
	Euphorbia crassipes	LC		S2
	Euphorbia gregaria	LC		S2
IRIDACEAE	*Gladiolus permeabilis* subsp. *edulis*	LC		S2
	Lapeirousia plicata subsp. *plicata*	LC		S2
MELIACEAE	*Nymania capensis*	LC		S2
OLEACEAE	*Olea europaea* subsp. *africana*	LC		S2
OXALIDACEAE	*Oxalis lawsonii*	LC		S2

Protected species in terms of Schedule 1 and 2 of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009, known from the region, is listed in Table 2. Those that were encountered in the study area include specially protected species (Schedule 1), *Aloidendron dichotomum* as well as protected species (Schedule 2) i.e. *Olea europaea* subsp. *africana, Psilocaulon coriarium, Boscia albitrunca, Aloe claviflora, Euphorbia avasmontana*, *E. gregaria, Sarcostemma viminale, Psilocaulon coriarium* and *Ruschia intricata*.

A projection for species of conservation concern is presented in Table 3 and a photographic guide to those species encountered during the survey is attached as Appendix 3. Please note that the projections are only rough estimates to provide some form if indication as a guideline for species to be affected. It is not possible to confirm at this stage exactly where the project activities will take place. In addition to those protected species listed above; according to Section 51(2) of NCNCA, a permit is required from the Northern Cape, Department of Environment and Nature Conservation (DENC) for any large-scale clearance of all indigenous (Schedule 3) vegetation, before such activities commence.

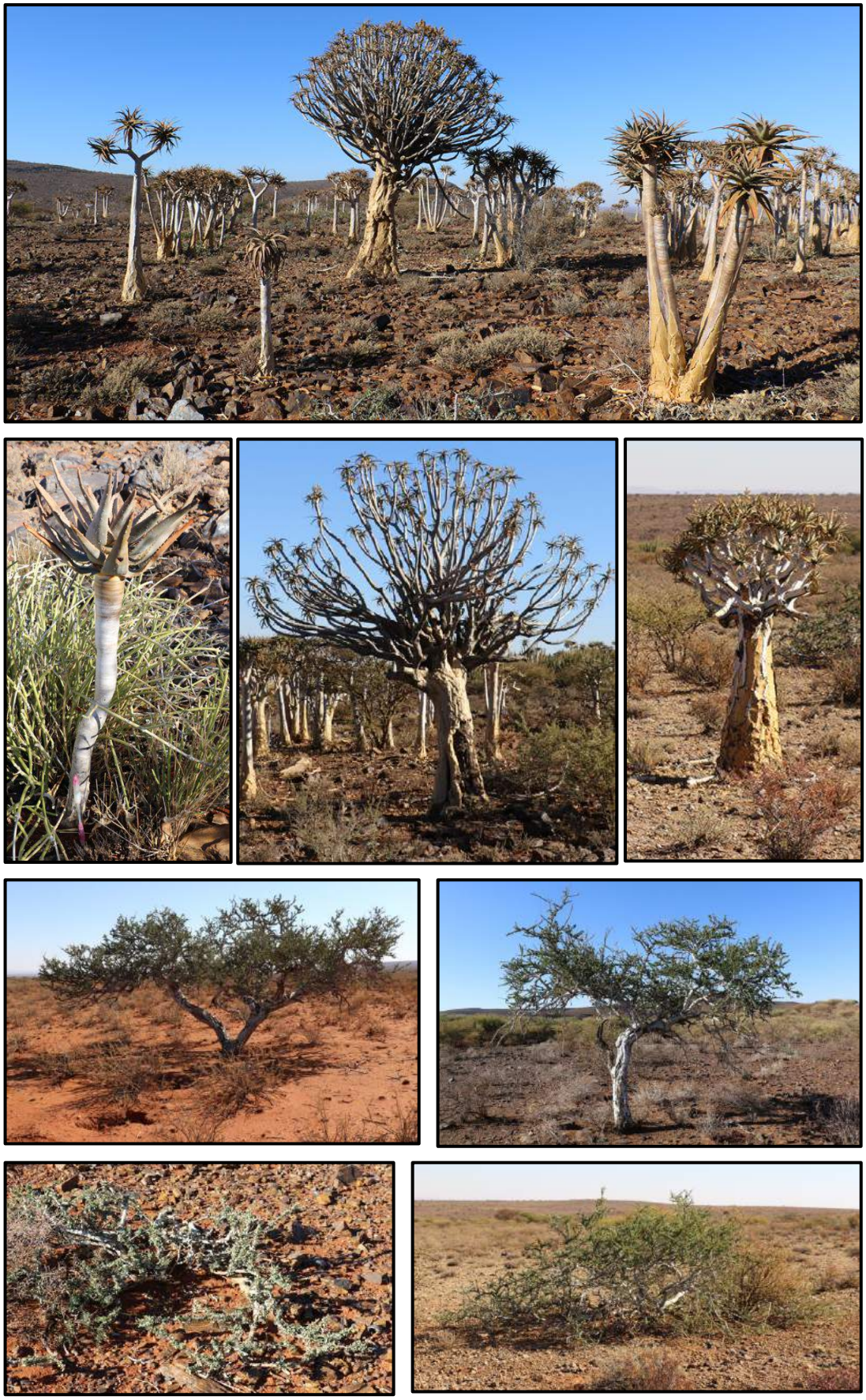


Figure 14. The listed (NEMBA) tree *Aloidendron dichotomum* (top) and the nationally protected tree (NFA) *Boscia albitrunca* are widespread across most of the study area (bottom).

Table 3. A projection of community sizes and species of conservation concern found in the study area.

Communities	Total size	Predicted extent to be affected	Associated species of conservation concern	Population density (ind/ha)	Estimated population to be affected
Aloidendron dichotomum - Boscia albitrunca open woodland on ironstone hilltops	± 1 800 ha	Not yet known	*Aloidendron dichotomum* *Boscia albitrunca* *Euphorbia avasmontana* *Ruschia intricata* *Sarcostemma viminale* *Euphorbia gregaria*	± 50 ± 12 ± 3 ± 1 < 1 < 1	Still to be determined
Enneapogon desvauxii - Zygophyllum rigidum open shrubland on calcrete ridges and slopes	± 1 800 ha	Not yet known	*Boscia albitrunca* *Aloidendron dichotomum* *Aloe claviflora* *Euphorbia gregaria*	± 6 ± 4 ± 1 ± 1	Still to be determined
Senegalia mellifera - Rhigozum trichotomum shrubland on gravel terraces	± 1 700 ha	Not yet known	*Boscia albitrunca* *Psilocaulon coriarium* *Aloidendron dichotomum*	± 3 ± 2 ± 1	Still to be determined
Rhigozum trichotomum - Stipagrostis uniplumis open shrubland on sandy plains	± 800 ha	Not yet known	*Boscia albitrunca* *Aloe claviflora* *Ruschia intricata*	± 4 ± 1 ± 1	Still to be determined
Eucalyptus camaldulensis - Prosopis velutina riparian woodland	± 100 ha	Not yet known	*Psilocaulon coriarium*	± 1	Still to be determined
Ephemeral rivers, streams and drainage lines	± 400 ha	Not yet known	*Olea europaea* subsp. *africana* *Boscia albitrunca* *Aloidendron dichotomum*	± 1 ± 1 ± 1	Still to be determined

3.3.4. Weeds and invader plant species

Weeds and invasive species are controlled in terms of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004, the Conservation of Agricultural Resources (CARA) Act 43 of 1993, as well as the NCNCA (Schedule 6). These are species that do not naturally occur in a given area and exhibit tendencies to invade that area, and others; at the cost of locally indigenous species. To govern the control of such species, NEMBA and CARA have divided weeds and invader species into categories (see Table 4). All declared weeds and invasive species recorded in and around the study area are listed in Table 5, along with their categories according to CARA, NEMBA and NCNCA.

Table 4. The categorisation of weeds and invader plant species, according to NEMBA and CARA.

NEMBA	CARA
1a Listed invasive species that must be combatted or eradicated.	**1** Plant species that must be removed and destroyed immediately. These plants serve no economic purpose and possess characteristics that are harmful to humans, animals and the environment.
1b Listed invasive species that must be controlled.	**2** Plant species that may be grown under controlled conditions. These plants have certain useful qualities and are allowed in demarcated areas. In other areas they must be eradicated and controlled.
2 Listed invasive species that require a permit to carry out a restricted activity within an area.	**3** Plant species that may no longer be planted. These are alien plants that have escaped from, or are growing in gardens and are proven to be invaders. No further planting is allowed. Existing plants may remain (except those within the flood line, 30 m from a watercourse, or in a wetland) and must be prevented from spreading.
3 Listed invasive species that are subject to exemptions and prohibitions	

Table 5. A list of declared weeds and invasive species recorded in the study area.

Scientific name	Common name	CARA	NEMBA	NCNCA
Eucalyptus camaldulensis	Red river gum	2	1b	S6
Prosopis velutina	Velvet mesquite	2	3	S6

3.3.5. Indicators of bush encroachment

Bush encroacher species are controlled in terms of Regulation 16 of CARA; where land users of an area in which natural vegetation occurs and that contains communities of encroacher indicator plants are required to follow sound practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs. Declared indicators of bush encroachment in the Northern Cape, which were recorded in and around the study area, are listed in Table 6.

Table 6. A list of declared indicators of bush encroachment in the Northern Cape recorded in the study area.

Scientific name	Common name
Senegalia mellifera	Black thorn
Rhigozum trichotomum	Three-thorn rhigozum

3.4. Faunal communities

According to Section 3(a) and 4(a) of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009, no person may, without a permit by any means hunt, kill, poison, capture, disturb, or injure any protected or specially protected animals. Furthermore, Section 12 (1) of NCNCA states that no person may, on a land of which he or she is not the owner, hunt a wild animal without the written permission from the landowner.

The many landscape features on Rietfontein provide diverse habitat opportunities to faunal communities. Animals likely to be found in the study area are discussed in their respective faunal groups below.

3.4.1. Mammals

As many as 60 terrestrial mammals and seven bat species have been recorded in the region (see Appendix 2), of which many signs of fossorial mammal activities were especially evident in the riparian woodland and on the sandy plain (Figure 15).

Nine listed terrestrial mammal species and four listed bat species potentially occur in the area (Table 7). The African Straw-coloured Fruit-bat, Geoffroy's Horseshoe Bat and Honey Badger have a high chance of occurring across the site, given their wide habitat tolerances. The Dassie Rat and Littledale's whistling rat both have a high potential of occurring on site based on their preferences for rocky and open shrubland habitat, respectively. The Cape Clawless Otter has a high potential to occur in the vicinity of the Orange River due to their preference for aquatic habitats. On the other hand, the Bushveld Gerbil and Lesser Dwarf Shrew have a moderate potential of occurring in the more grassy areas on site, while the South African Hedgehog and Black-footed cat may potentially occur on site on account of their preferences for arid areas. They are both however rather skittish and therefore they will most likely be found very seldomly. The Brown Hyaena has a low potential to be found on site mainly based on the fact that farm fences are restricting their occurrences across their natural distribution range. The Dent's Horseshoe Bat and Darling's Horseshoe Bat also have a low chance to be found on site due to their preference for savanna habitat.

Table 7. A list of mammal species found in the study area, which are of conservation concern in terms of the international (IUCN) Red List and the South African Red Data Book (SA RDB). Their respective NCNCA schedule numbers are indicated in superscript.

Scientific name	Common name	IUCN Status	SA RDB Status
[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	NT	*Not listed*
[2]*Rhinolophus denti*	Dent's Horseshoe Bat	LC	NT
[2]*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	LC	NT
[2]*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC	NT
[2]*Petromus typicus*	Dassie rat	LC	NT
[2]*Parotomys littledalei*	Littledale's whistling rat	LC	NT
[2]*Gerbilliscus leucogaster*	Bushveld Gerbil	LC	DD
[2]*Suncus varilla*	Lesser Dwarf Shrew	LC	DD
[1]*Atelerix frontalis*	South African Hedgehog	LC	NT
[1]*Felis nigripes*	Black-footed cat	VU	LC
[2]*Aonyx capensis*	Cape Clawless Otter	NT	LC
[1]*Hyaena brunnea*	Brown Hyena	NT	NT
[1]*Mellivora capensis*	Honey Badger	LC	NT

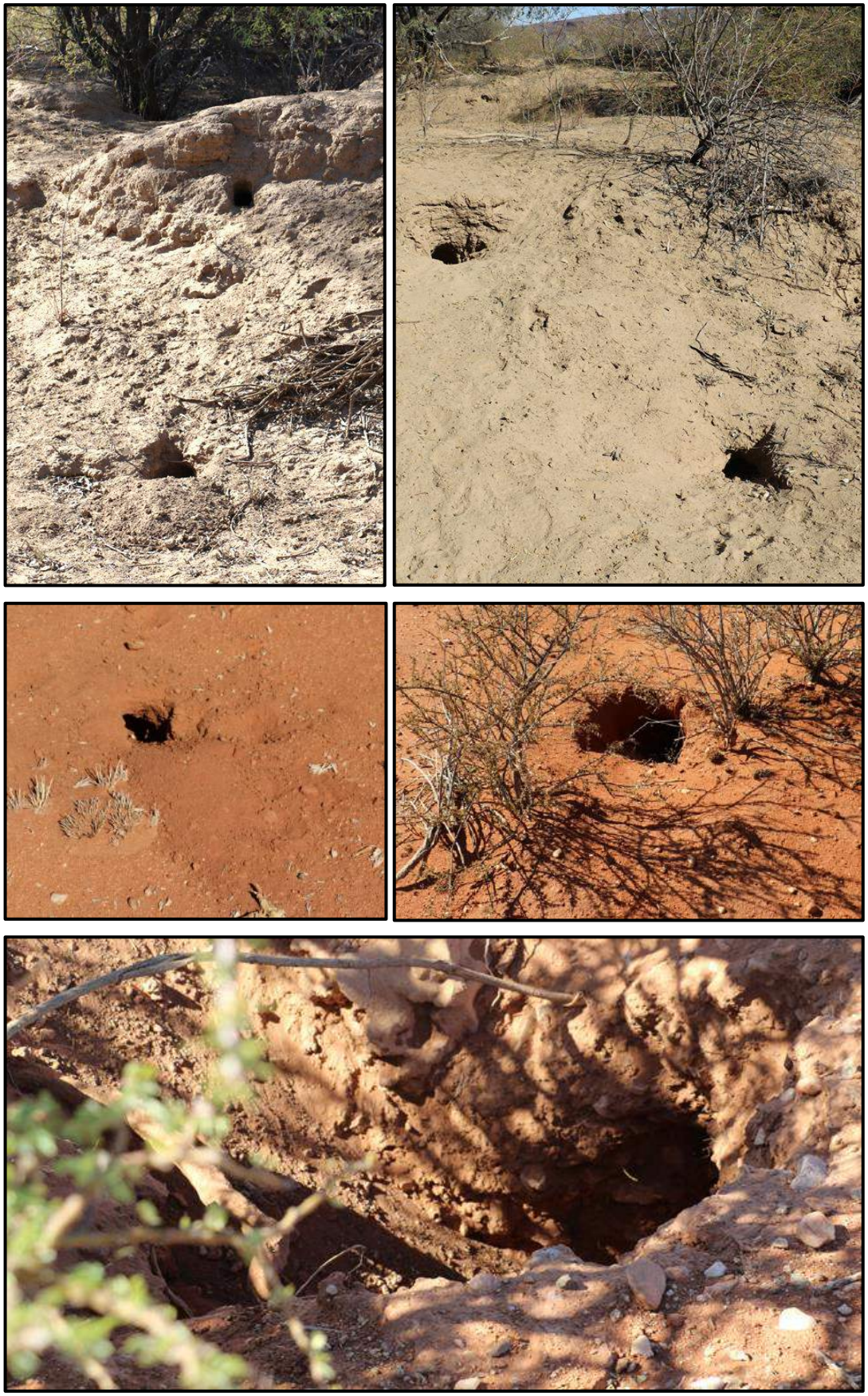


Figure 15. Signs of fossorial mammal activities were especially evident in the riparian woodland (top) and the sandy plains (middle and bottom).

Virtually all mammals of the study area are protected; either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected include Aardvark, South African Hedgehog, Aardwolf, African Wild Cat, Black-footed cat, Cape Fox, Brown hyena, Bat-eared Fox, Striped Polecat and Honey Badger. Problem animals (Schedule 4) include Black-backed Jackal, Vervet Monkey, Chacma Baboon and Caracal.

It is not clear where the core prospecting activities will take place yet, but all fauna associated with those habitats that fall within the core area will be affected. Listed mammals that are most likely to be impacted in the form of species- and/or habitat loss resulting from the prospecting activities include Aardvark. If any Aardvark burrows occur in the core area, then they will most likely be destroyed. Any disturbances to the Aardvark burrows will displace this protected species locally and there is a risk of individuals being killed during excavation activities. Littledale's whistling rat and Bushveld Gerbil can also potentially be found in the sandy habitats and could accidentally be disturbed or killed during prospecting activities.

3.4.2. Reptiles

Rietfontein lies within the distribution range of at least 51 reptile species (see Appendix 2), of which none are of international or national conservation concern. One species is endemic to South Africa, i.e. *Acontias gracilicauda* (Thin-tailed Legless Skink), while most other reptiles are protected either according to Schedule 1, 2 or 3 of NCNCA, except for agamas, geckos and skinks (see Appendix 2). Specially protected species include *Karusasaurus polyzonus* (Southern Karusa Lizard) and *Chamaeleo dilepis dilepis* (Namaqua Chamaeleon).

The habitat diversity for reptiles in the study area is high and includes the aquatic and riparian zones, rocky hills and ridges, sandy plain and ephemeral drainage lines. Impacts by the proposed prospecting operations will depend on the extent of the operation, but includes habitat destruction, local disturbances through noise as well as killing them accidentally or intentionally. Monitoring during the prospecting operation is vital in order to ensure no or low impact.

3.4.3. Amphibians

Fourteen amphibian species are known from the region (Appendix 2). Low amphibian diversity is normal for an arid area, but is likely to increase within the aquatic and wetland ecosystem of the Orange River and ephemeral streams. As a result, higher amphibian diversity is most likely to be found in these habitats, while only those species which are relatively independent of water are likely to be common in the terrestrial habitats.

Pyxicephalus adspersus (Giant Bull Frog) is the amphibian species of conservation concern that potentially occur in the study area. It is listed as Near Threatened in terms of the Red Data Book of Frogs and is protected according to Schedule 1 of the NCNCA. They are primarily associated with temporary pans or vleis and therefore have a low potential to be found on site. All other amphibians of the study area are protected according to Schedule 2 of NCNCA (see Appendix 2). Impacts on amphibians are likely to be low if no prospecting activities are planned in any of the aquatic or riparian habitats.

3.4.4. Avifauna

The study site does not fall within or near (< 100 km) any of the Important Bird Areas (IBA) defined by Birdlife South Africa. A total number of 247 bird species have been recorded from the region and all of these species are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2).

Seventeen listed bird species are known from the region, all of which are classified as Vulnerable, Near Threatened or Endangered (Table 8). The Verreaux's Eagle (Vulnerable) is confirmed to occur on site. One individual was seen soaring over the hills and ridges during the site visit. They nest in rocky habitats and on cliffs, but might be found in the other habitats when hunting. The remaining listed species could occur in the core areas either by occasionally passing over or foraging on the alluvial plains. Flamingos and Chestnut-banded Plovers are however not expected to occur here as they prefer saline wetland habitats.

Sociable Weaver nests are found in some of the *Aloidendron dichotomum* trees on the hills (Figure 16). These community nests have a high ecological importance, because they provide shelter and shade for a large diversity of birds and other fauna. These birds are also protected according to Schedule 2 of the NCNCA.

Table 8. Bird species found in the study area that are of conservation concern.

Scientific name	Common name	Status
Aquila rapax	Tawny Eagle	EN
Gyps africanus	White-backed Vulture	EN
Neotis ludwigii	Ludwig's Bustard	EN
Polemaetus bellicosus	Martial Eagle	EN
Anthropoides paradisea	Blue Crane	NT
Ardeotis kori	Kori Bustard	NT
Charadrius pallidus	Chestnut-banded Plover	NT
Ciconia abdimii	Abdim's Stork	NT
Eupodotis vigorsii	Karoo Korhaan	NT
Leptoptilos crumeniferus	Marabou Stork	NT
Oxyura maccoa	Maccoa Duck	NT
Phoenicopterus minor	Lesser Flamingo	NT
Phoenicopterus ruber	Greater Flamingo	NT
Spizocorys sclateri	Sclater's Lark	NT
Aquila verreauxii	Verreaux's Eagle	VU
Circus maurus	Black Harrier	VU
Falco biarmicus	Lanner Falcon	VU

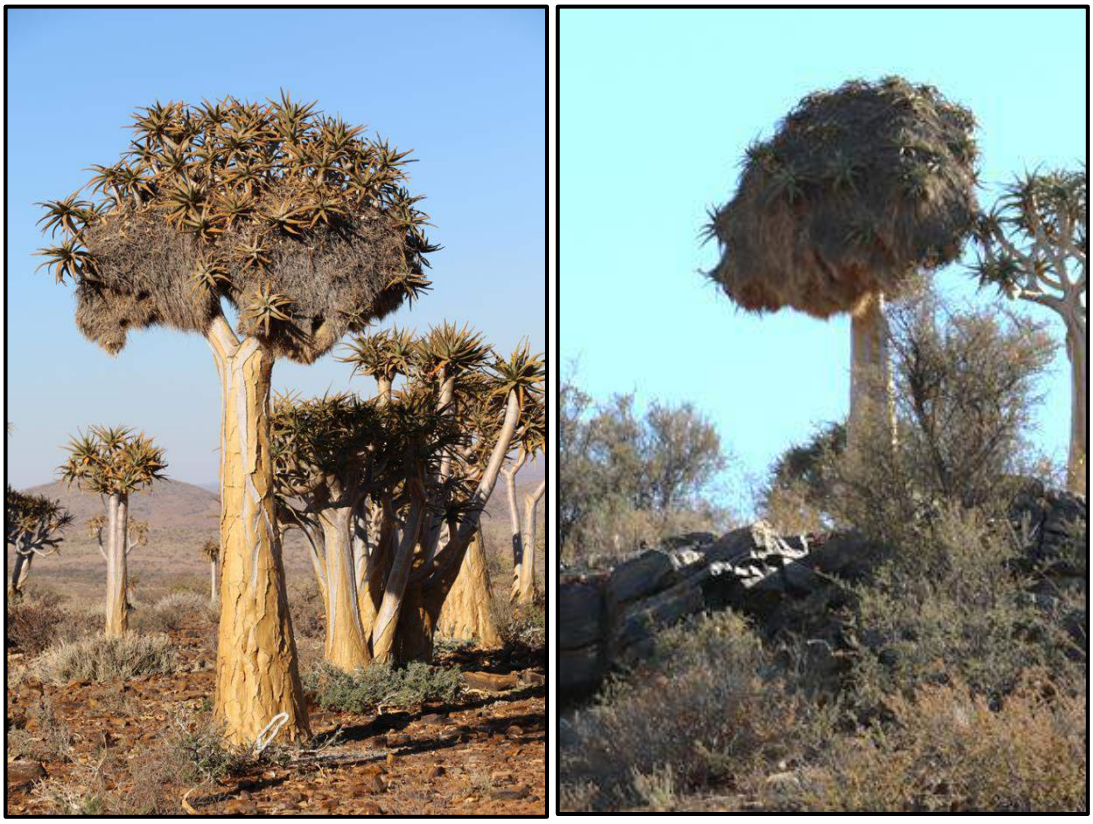


Figure 16. Sociable Weaver nests were found in several *Aloidendron dichotomum* trees on the hills.

It is not foreseen that any of these nests would be affected, but if any activities are to be planned in the vicinity of these nests, or if there is a likelihood that they are to be disturbed by any related activities; a permit from DENC is required before such disturbance takes place.

In general, bird species of the study area are likely to experience disturbances as a result of the Rietfontein prospecting activities. The most significant impacts are expected to be in the form of habitat destruction in the core area. This will especially impact those species that rely on this habitat for breeding, nesting and foraging. Terrestrial birds are likely to experience local disturbances, where habitat loss will be confined to the footprint of core sites and their activities will cause disturbances in the form of noise and movement. Birds are however highly mobile and are expected to move to similar adjacent habitats, if necessary. Therefore, the prospecting activities would not constitute a significant loss that would compromise the available habitat for any of the terrestrial resident bird species.

Apart from general disturbances and habitat loss, other potential impacts would come from the accidental or intentional killing of birds. Monitoring during the prospecting operation is vital in order to ensure no or low impact.

3.4.5. Fish

Fish species expected to occur in the active channel of the Orange River is listed in Table 9, along with their IUCN status and sensitivity to physico-chemical and no-flow conditions. The Largemouth Yellowfish is endemic to the Orange-Senqu and Vaal River systems in the Orange-Senqu River Basin. It is also listed an Near Threatened (IUCN 2015) due to the continuous decline in water quality in most rivers and streams in its geographic range, the destruction of suitable spawning beds due to erosion, as well as their slow growth rate, late maturing and low fecundity.

No prospecting activities are planned near the river and therefore the Rietfontein operation is not expected to have any impacts on the fish communities.

Table 9. Fish species expected to occur in the active channel of the Orange River, along with their IUCN status and sensitivity to physico-chemical and no-flow conditions.

Scientific Name	Common name	IUCN	Phys-Chem sensitivity	No-Flow sensitivity
Austroglanis sclateri	Rock Catfish	LC	Moderate	High
Barbus anoplus	Chubbyhead Barb	LC	Moderate	Moderate
Barbus paludinosus	Straightfin Barb	LC	Tolerant	Moderate
Barbus trimaculatus	Threespot barb	LC	Tolerant	Moderate
Labeobarbus aeneus	Vaal-orange Smallmouth Yellowfish	LC	Moderate	High
Labeobarbus kimberleyensis	Largemouth Yellowfish	**NT**	Moderate	Moderate
Clarias gariepinus	African Catfish	LC	Low	Low
Labeo capensis	Orange River Mudfish	LC	Moderate	High
Labeo umbratus	Moggel	LC	Low	Moderate
Pseudocrenilabrus philander	Southern Mouthbrooder	-	Low	Low
Tilapia sparrmanii	Banded Tilapia	LC	Low	Low

3.4.6. Invertebrates

Invertebrates dominate inland habitats and play a significant role in the overall function of the ecosystem (Kremen et al. 1993; Weisser and Siemann 2004). Their immense species diversity makes it almost impossible to list all species that may possibly occur on site. Nevertheless, key morphospecies as well as species of conservation concern are discussed here.

Eight invertebrate species of the Northern Cape appear on the IUCN Red Data list of threatened species and are listed in Table 10, along with species that are specially protected according to Schedule 1 of the NCNCA. All other invertebrates from the class Insecta and Arachnida are protected either according to Schedule 2 or 3 of the NCNCA.

Two major habitats delimit possible invertebrate communities on site, i.e. the perennial Orange River and a variety of terrestrial habitats collectively classified as Karoo vegetation for insect preference, according to Picker et al. (2004).

Table 10. Invertebrate species found in the Northern Cape that are of conservation concern.

CLASS	ORDER	Scientific Name	Common name	Status
ARACHNIDA	MYGALOMORPHAE	*Ceratogyrus* spp.	Horned Baboon Spiders	S1
		Harpactira spp.	Common Baboon Spiders	S1
		Pterinochilus spp.	Goldenbrown Baboon Spiders	S1
INSECTA	COLEOPTERA	*Circellium bacchus*	Cape Dung Beetle	S1
		Colophon spp.	All Stag Beetles	S1
	LEPIDOPTERA	*Lepidochrysops penningtoni*	Pennington's Blue	**DD**
	ORTHOPTERA	*Africariola longicauda*	Richtersveld Katydid	**VU**
		Alfredectes browni	Brown's Shieldback	**DD**
		Brinckiella serricauda	Serrated Winter Katydid	**DD**
		Brinckiella arboricola	Tree Winter Katydid	**EN**
		Brinckiella aptera	Mute Winter Katydid	**VU**
		Brinckiella karooensis	Karoo Winter Katydid	**VU**
		Brinckiella mauerbergerorum	Mauerberger's Winter Katydid	**VU**
ONYCHOPHORA			Velvet worms	S1

i. Perennial Orange River

Invertebrates expected to be associated with the Orange River include Flatworms, earthworms, leeches, freshwater crabs and shrimps, mayflies, damselflies, dragonflies, moths, giant water bugs, boatmen, water striders, marsh treaders, creeping water bugs, water specs, water mites, spunges, waterscorpions, backswimmers, riffle bugs, caddisflies, diving beetles, riffle beetles, whirligig beetles, small water beetles, water scavenger beetles, water snipe flies, midges, house flies, black flies, hoverflies, horseflies, crane flies and freshwater limpets, snails, clams and mussels. The prospecting operation does not envisage altering the active channel of the Orange River and is therefore not expected to have any impacts on the river invertebrate communities.

ii. Karoo vegetation

Invertebrate communities associated with the karoo vegetation represent unique species assemblages, with an above-average representation of beetles, grasshoppers, flies, wasps and lacewings. Insects in general are widely distributed and extremely diverse. Therefore, it is not possible to list specialised communities that occur here without a dedicated study. However, those species of conservation concern listed in Table 10 are most likely to be associated with this invertebrate habitat. Of all invertebrates on Rietfontein, those occurring in the core area will be most affected. The most profound impacts will be in the form of habitat loss and the inevitable death of those that occur in the path of prospecting activities. These impacts are however expected to be largely local.

3.6. Critical biodiversity areas and broad-scale processes

The proposed prospecting site falls within critical biodiversity areas, as defined by the Northern Cape Critical Biodiversity Areas Map (Holness and Oosthuysen 2016). This map identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole. The majority of the study site comprise of Ecological Support areas, while the Orange River is classified as Critical Biodiversity Area One and a small section on the hills as Critical Biodiversity Area Two (Figure 17). No protected areas occur in or near the study site.

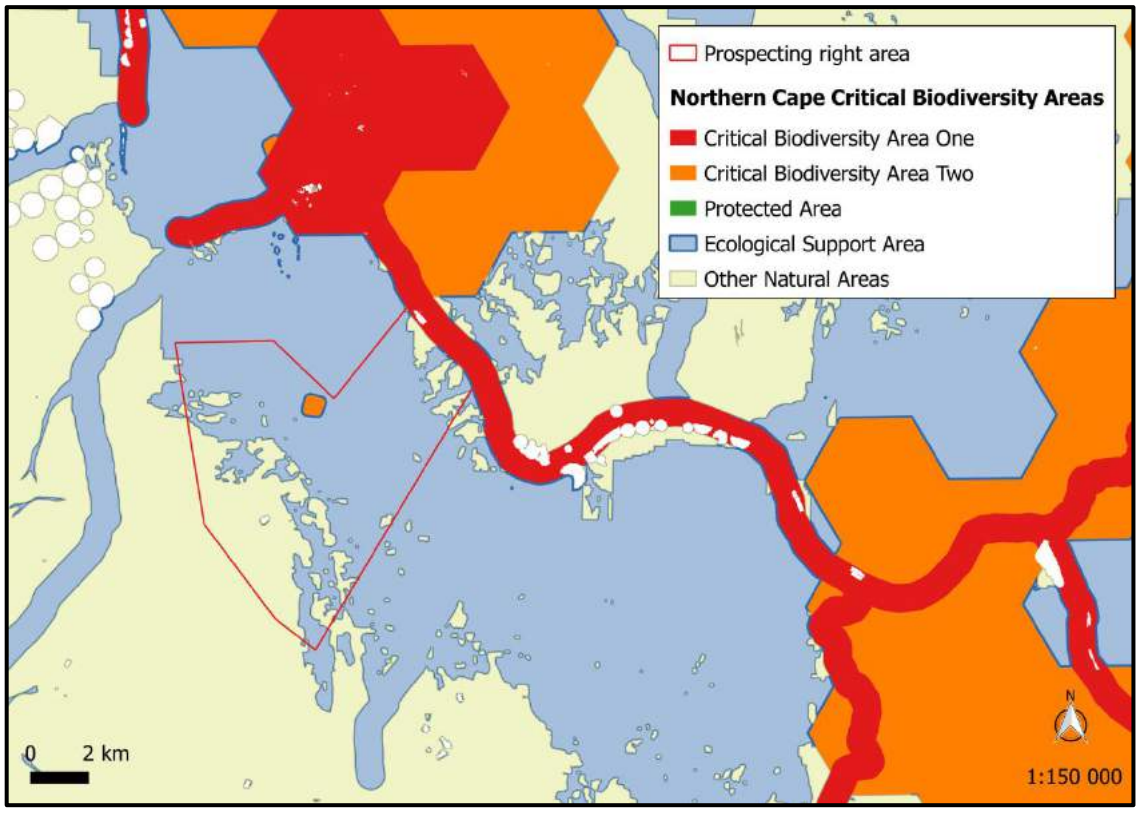


Figure 17. The study area in relation to the Northern Cape Critical Biodiversity areas.

Similarly, the Mining and Biodiversity Guidelines (DENC et al. 2013) also classifies the Orange River and its buffer zone to have Highest Biodiversity Importance, which constitute the highest risk for mining. The same area on the hills is also categorised as having High Biodiversity Importance and a high risk for mining (Figure 18). This is most likely due to the population of Quiver trees found here.

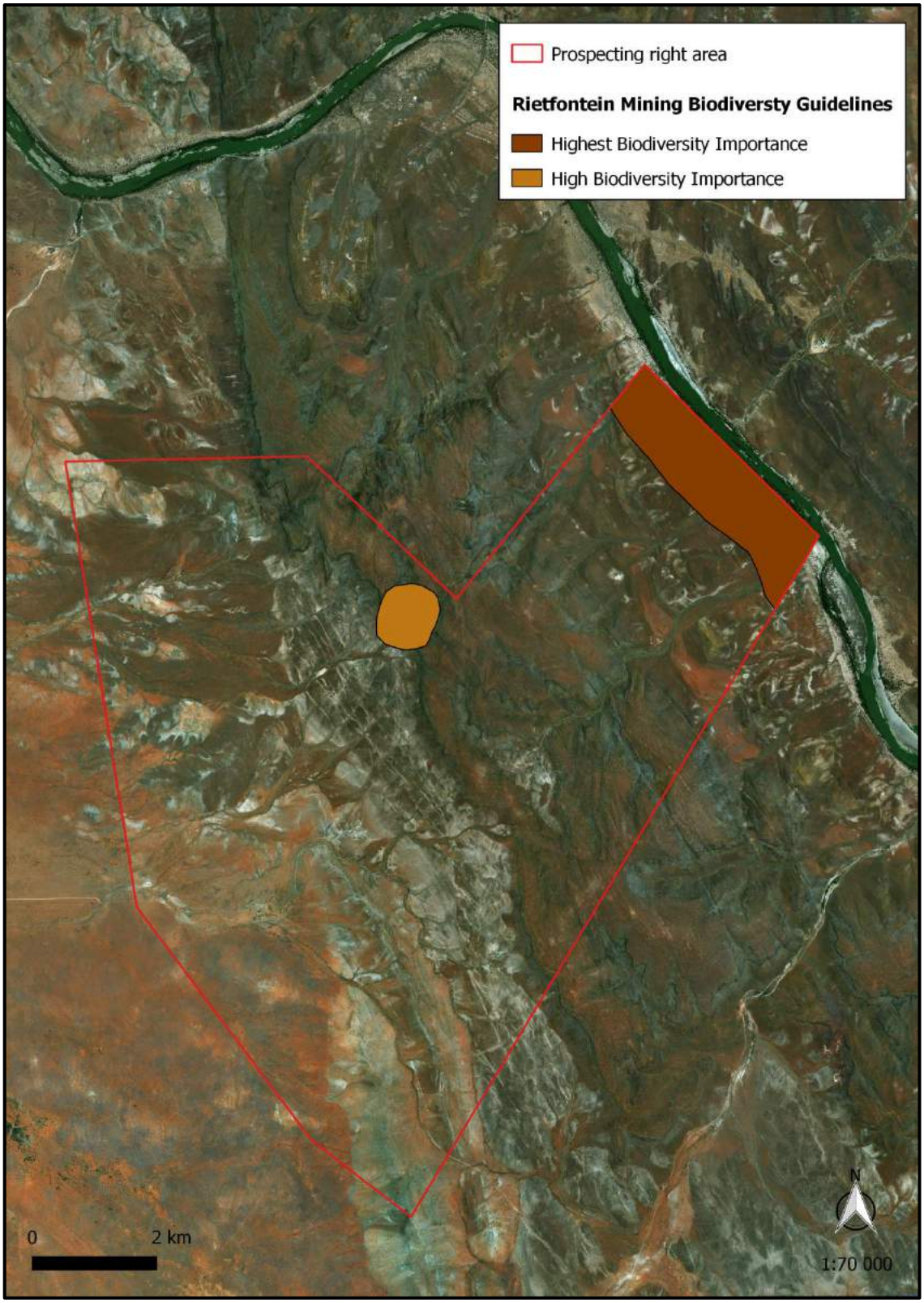


Figure 18. The study area in relation to the Mining and Biodiversity Guidelines.

These guidelines were developed to identify biodiversity priority areas sensitive to the impacts of mining, to support mainstreaming of biodiversity issues in decision making in the mining sector.

All rivers (ephemeral and perennial), their riverbeds and associated 100 m buffers have been identified as ecological corridors within the Pixley Ka Seme District Municipality (Rumboll 2014). Here, special care must be taken with mining and agricultural practises so as to avoid water pollution and over extraction. These should be maintained to limit the potential impact of development on the water resources.

Furthermore, the proposed prospecting area falls within the Griqualand West Centre of Endemism (Van Wyk and Smith 2001), as does many other mining operations. A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics. 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 (Figure 19) is considered a priority in the Northern Cape, because the number of threats to the area is increasing rapidly. This is a cause of concern, because the GWC is still greatly misunderstood and under researched. Important elements might therefore be lost or disturbed due to a lack of knowledge, which could assist in protecting its fundamental processes. The cumulative effect of prospecting in this region exacerbate the potential risk of losing information on ecosystem function owing to the lack of basic research information within this area.

The Rietfontein operation itself is expected to cause habitat transformation through the excavation of open pits, and will thereby contribute to cumulative habitat loss and the disruption of the broad-scale landscape connectivity in the region. The study area falls within a zone where one of South Africa's largest economically most important alluvial deposits of diamonds are found. The primary secondary source of alluvial diamond deposits in the Northern Cape extends along the Orange and Vaal Rivers (Gresse 2003), while the most significant crop irrigation in the Northern Cape also stretches along these rivers (Durand 2006). The cumulative impacts in the vicinity of the study area are therefore considered to be moderately high.

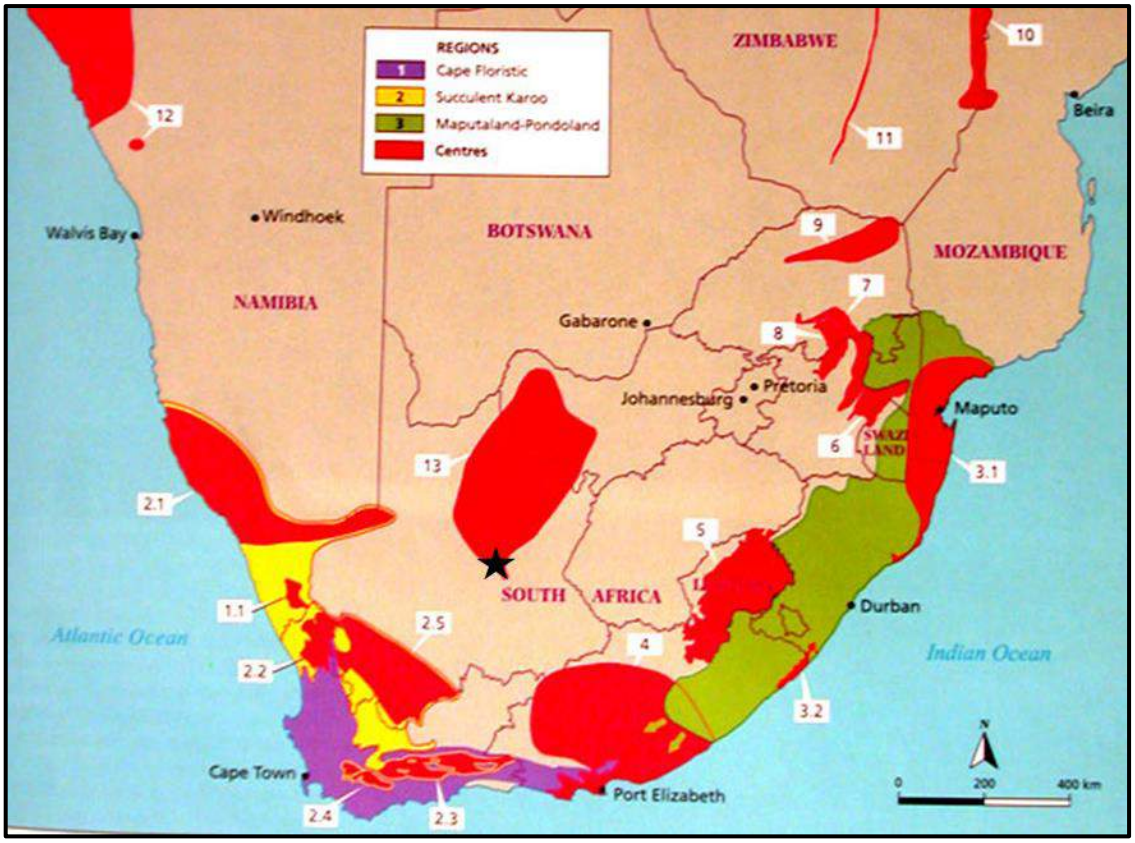


Figure 19. A map indicating the regions of floristic endemism in southern Africa, according to Van Wyk and Smith (2001), with the study site locality indicated by the black star.

3.7. Site sensitivity

The sensitivity map for Rietfontein is illustrated in Figure 20. The riparian woodland along with the ephemeral rivers, streams and drainage lines are considered to be of **very high** sensitivity due to their vital ecological and hydrological functionality and significance. All watercourses are protected in terms of the National Water Act (Act No 36 of 1998). These units are essentially no-go areas. Although the riparian woodland is infested with declared invasive species, it falls within the buffer zone of the Orange River and is classified as high risk areas by the Mining and Biodiversity Guidelines as well as the Northern Cape CBA map. Erosion risks after disturbances of watercourses and their associated riparian zones are also high.

The calcrete ridges and ironstone hilltops are also considered to be of **very high** sensitivity due to the dense population of listed *Aloidendron dichotomum* found here, along with high densities of nationally protected tree *Boscia albitrunca* and other species protected according to the NCNCA.

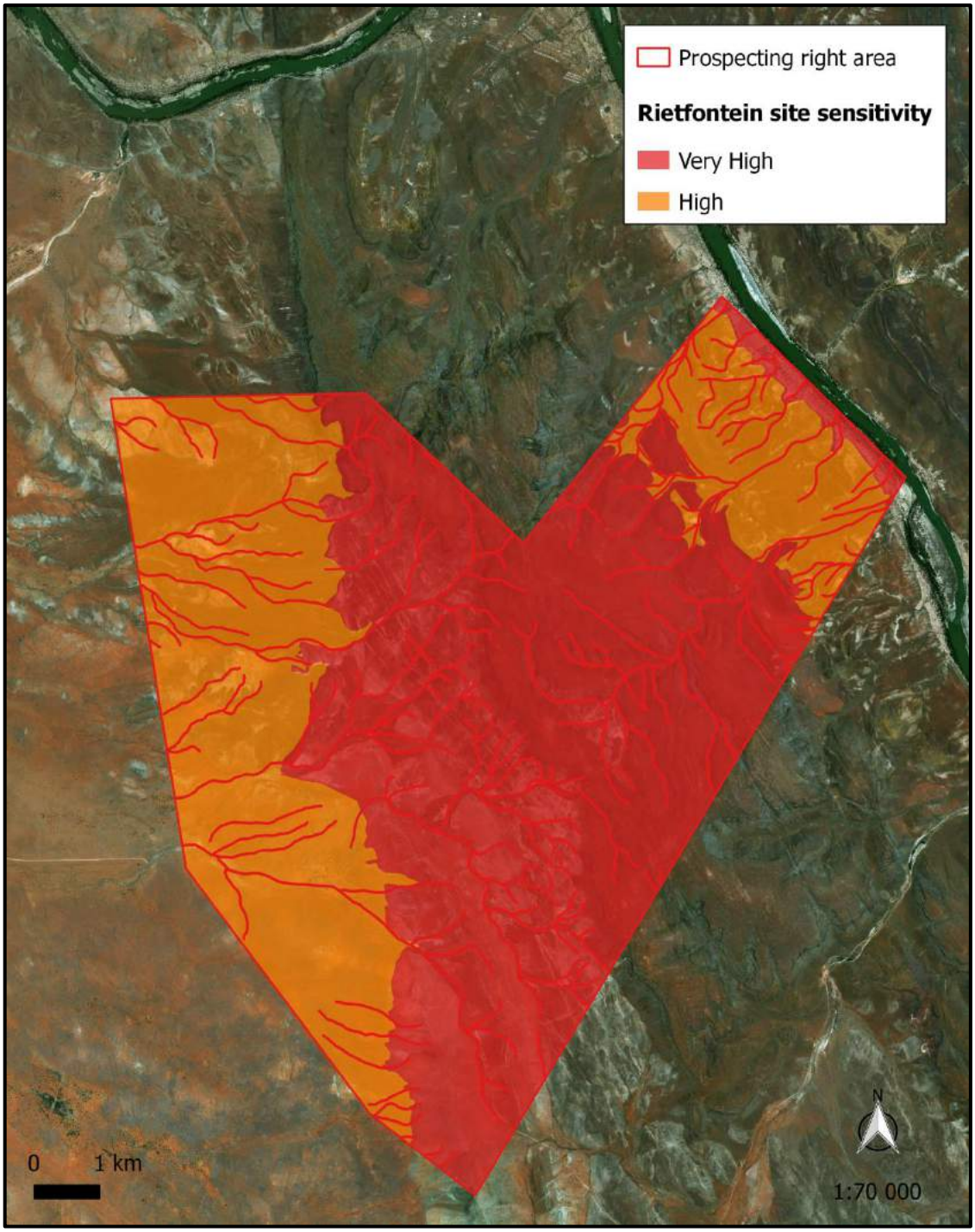


Figure 20. A sensitivity map for the Rietfontein prospecting area.

The remaining study area, which comprises the shrubland on rocky ridges and sandy plains, is considered to be of **high** sensitivity primarily due to the high occurrences of species of conservation concern that occur widespread across these units. Although these units are not regarded as no-go areas, activities should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, the potential impacts and associated risk factors that may be generated by the KIMSWA prospecting operation are identified and described. A detailed analysis of each impact is provided in Table 11. The impacts are assessed in terms of the relevant ecological aspects and each impact is associated with an outline of specific mitigation measures, which with proper implementation, monitoring and auditing, will serve to reduce the significance of the impact. In order to ensure that the impacts identified are broadly applicable and inclusive, all the likely or potential impacts that may be associated with the prospecting activities are listed.

4.1. Topography, soil erosion and associated degradation of landscapes

4.1.1. Loss of soil fertility

Source of the impact

During the removal of topsoil; stockpiling.

Description of the impact

Improper stockpiling and soil compaction can result in soil sterilisation. Leaching can also occur, resulting in the loss of nutrients. When soil becomes infertile it will be challenging to rehabilitate the affected areas towards natural vegetation and this will decrease the value of the property in terms of land use, especially the grazing capacity.

Mitigation and monitoring

- Topsoil stockpiles must be kept as small as possible in order to prevent compaction and the formation of anaerobic conditions.
- Topsoil must be stockpiled for the shortest possible timeframes in order to ensure that the quality of the topsoil is not impaired.
- Topsoil must not be handled when the moisture content exceeds 12 %.
- Topsoil stockpiles must be kept separate from sub-soils.
- The topsoil should be replaced as soon as possible on to the backfilled areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.

Table 11. A detailed analysis of ecological impacts identified for the KIMSWA prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Landscape	Loss of soil fertility	✓	✓	✓	On-site (1)	Permanent (5)	High (3)	Possible for life of operation (9)	Medium - High (81)	Low-Medium
	Increase in soil erosion	✓	✓	✓	On-site (1)	Permanent (5)	High (3)	Certain, frequently (9)	Medium - High (81)	Low-Medium
Flora	Loss of indigenous vegetation	✓	✓	✓	On-site (1)	Residual (4)	Medium (2)	Certain for life of operation (10)	Low - Medium (70)	Low
	Loss of Red data and/or protected floral species	✓	✓		On-site (1)	Residual (4)	High (3)	Possible for life of operation (9)	Low - Medium (72)	Low
	Introduction or spread of alien species	✓	✓	✓	Local (2)	Residual (4)	High (3)	Possible, temporarily (6)	Low-Medium (54)	Low
	Bush encroachment			✓	On-site (1)	Residual (4)	Medium (2)	Possible, temporarily (6)	Low (42)	Very low

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Fauna	Habitat fragmentation	✓	✓	✓	Regional (3)	Residual (4)	Major (4)	Certain for life of operation (10)	High (110)	Low-Medium
	Disturbance, displacement and killing of fauna	✓	✓		On-site (2)	Decommissioning (3)	Medium (2)	Certain, frequently (9)	Low-Medium (63)	Low
Ecological Processes	Compromise of ecological processes	✓	✓		Regional (3)	Residual (4)	Major (4)	Certain for life of operation (10)	High (110)	Medium - High

4.1.2. Soil erosion

Source of the impact

Infrastructure; excavations.

Description of the impact

Vegetation will be stripped in preparation for placement of infrastructure and excavations, and therefore the areas will be bare and susceptible to erosion. Topsoil and overburden that is stripped and piled on surrounding areas can be eroded by wind, rain and flooding. The soil/sediments will be carried away during runoff. The affected areas will be rehabilitated, but full restoration might only occur over a number of years, subsequent to the re-establishment of vegetation and hydrological regime. The deep sand associated with the riparian woodland as well is most susceptible to erosion and the effect will be most pronounced if eroded soil is transported into the river channel or if the natural channels of the ephemeral drainage lines are altered.

Mitigation and monitoring

- Re-establishment of plant cover on disturbed areas must take place as soon as possible, once activities in the area have ceased.
- Ground exposure should be minimised in terms of the surface area and duration.
- The operation must co-ordinate different activities in order to optimise the excavated trenches and thereby prevent repeated and unnecessary excavations.
- Construction/excavations during the rainy season (November to March) should be monitored and controlled.
- Run-off from exposed ground should be controlled with flow retarding barriers.
- All stockpiles must be kept as small as possible, with gentle slopes (18 degrees) in order to avoid excessive erosional induced losses.
- Excavated and stockpiled soil material are to be stored on the higher lying areas of the footprint area and not in any storm water run-off channels or any other areas where it is likely to cause erosion, or where water would naturally accumulate.
- Regular audits carried out to identify areas where erosion is occurring (incl. linear activities such as roads and pipelines); followed by appropriate remedial actions.
- Effective rehabilitation of any watercourse diversions should take place.

4.2. Vegetation and floristics

4.2.1. Loss of indigenous vegetation

Source of the impact

Construction of roads and other necessary infrastructure; the placement of stockpiles; and the clearing of vegetation for excavations, materials storage and topsoil stockpiles; vehicular movement.

Description of the impact

Construction and prospecting activities on site will reduce the natural habitat for ecological systems to continue their functionality. It is not expected that the areas of high ecological function will rehabilitate following disturbance events. Vehicle traffic generates lots of dust which can further reduce the growth success and seed dispersal of many small plant species.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of excavated areas, by effective backfilling.
- Encourage the growth of natural plant species by sowing indigenous seeds or by planting seedlings.
- Ensure measures for the adherence to the speed limit to minimise dust plumes.

4.2.2. Loss of Red data and/or protected floral species

Source of the impact

Removal of listed or protected plant species; during the construction of roads and other necessary infrastructure; the placement of stockpiles; and the clearing of vegetation for excavations.

Description of the impact

There are a number of SOC present, i.e. *Ruschia intricate, Sarcostemma viminale, Aloe claviflora, Aloidendron dichotomum, Boscia albitrunca, Euphorbia avasmontana, E. gregaria* and *Olea europaea* subsp. *africana.* It is not clear what the exact extent of the mining footprint will be, but it is likely that some of these species might be damaged or

removed during the construction or widening of access roads that lead to the main site. Those species that are feared to be most affected include the NEMBA listed *Aloidendron dichotomum* and nationally protected tree *Boscia albitrunca*. Furthermore, any illegal fire wood collection or illegal harvesting of the plants for trade or medicinal use by staff, contractors or secondary land users could potentially have a negative impact on the population of these species. It is almost certain that prospecting activities will destroy protected species and other species of conservation concern.

Mitigation and monitoring

- Footprint areas of the prospecting activities must be scanned for Red Listed and protected plant species prior to excavations.
- It is recommended that these plants are identified and marked prior to intended activity.
- These plants should ideally be incorporated into the design layout and left in situ.
- However, if threatened by destruction, these plants should be removed (with the relevant permits from DAFF and/or DENC) and relocated if possible.
- A management plan should be implemented to ensure proper establishment of ex situ individuals, and should include a monitoring programme for at least two years after re-establishment in order to ensure successful translocation.
- The appointment of a full-time ECO must render guidance to the staff and contractors with respect to suitable areas for all related disturbance, and must ensure that all contractors and workers undergo Environmental Induction prior to commencing with work on site. The environmental induction should occur in the appropriate languages for the workers who may require translation.
- All those working on site must be educated about the conservation importance of the flora occurring on site.

4.2.3. Introduction or spread of alien species

Source of the impact

Clearing of vegetation; prospecting activities.

Description of the impact

The extent of alien invasive species in the area shows low levels of past disturbance interference in the natural ecosystem. While general clearing of the area and excavation activities destroy natural vegetation, invasive plants can increase due to their opportunistic nature in disturbed areas. If invasive plants establish in disturbed areas, it may cause an impact beyond the boundaries of the prospecting site. These alien invasive species are thus a threat to surrounding natural vegetation and can result in the decrease of biodiversity as well as the ecological and agricultural value of the area. Therefore, if alien invasive species are not controlled and managed, their propagation into new areas could have a high impact on the surrounding natural vegetation in the long term. With proper mitigation, the impacts can be substantially reduced.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of excavated areas.
- Encourage the growth of natural plant species.
- Mechanical methods of control to be implemented extensively.
- Annual follow-up operations to be implemented.

4.2.4. Encouraging bush encroachment

Source of the impact

Clearing of vegetation; disturbances through prospecting activities.

Description of the impact

The extent of bush encroaching species on site shows the moderately high levels of past disturbance interference in the natural ecosystem, primarily through grazing practises. While general clearing of the area and prospecting activities destroy natural vegetation, bush encroaching plants can increase due to their opportunistic nature in disturbed areas. If encroaching plants establish in disturbed areas, it may the lower potential for future land use and decrease biodiversity. With proper mitigation, the impacts can be substantially reduced.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of disturbed areas.
- Encourage the growth of a diverse selection of natural plant species.
- Mechanical methods of control to be implemented selectively.
- Annual follow-up monitoring to be implemented.

4.3. Fauna

4.3.1. Habitat fragmentation

Source of the impact

Clearance of vegetation; prospecting activities.

Description of the impact

Prospecting activities and associated infrastructure will result in the loss of connectivity and fragmentation of natural habitat. Fragmentation of habitat will lead to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This results in a subsequent loss of genetic variability between meta-populations occurring within the study site. Pockets of fragmented natural habitats hinder the growth and development of populations.

Mitigation and monitoring

- All activities associated with the prospecting operation must be planned, where possible in order to encourage faunal dispersal and should minimise dissection or fragmentation of any important faunal habitat type.
- The extent of the earmarked area should be demarcated on site layout plans. No staff, contractors or vehicles may leave the demarcated area except those authorised to do so.
- Those pristine areas surrounding the earmarked area that are not part of the demarcated area should be considered as a no go zone for employees, machinery or even visitors.
- Employ sound rehabilitation measures to restore the characteristics of the affected aquatic and riparian habitats.

4.3.2. Disturbance, displacement and killing of fauna

Source of the impact

Vegetation clearing; excavations; increase in noise and vibration; human and vehicular movement on site resulting from prospecting activities.

Description of the impact

The transformation of natural habitats will result in the loss of habitat, affecting individual species and ecological processes. This will result in the displacement of faunal species that depend on such habitats. For example: sociable weaver nests will be destroyed with the removal of niche trees and excavations may destroy burrows of the fossorial mammals. Increased noise and vibration will also disturb and possibly displace birds and other wildlife. Fast moving vehicles cause road kills of small mammals, birds, reptiles, amphibians and a large number of invertebrates. Intentional killing of snakes, reptiles, vultures and owls will negatively affect the local populations.

Mitigation and monitoring

- Careful planning of the operation is needed in order to avoid the destruction of pristine habitats and minimise the overall disturbance footprint.
- The extent of the prospecting activities should be demarcated on site layout plans, and no personnel or vehicles may leave the demarcated area except if authorised to do so. Areas surrounding the earmarked site that are not part of the demarcated area should be considered as a no go zone.
- However, if any of the protected species are threatened by destruction, the relevant permits from DENC should be obtained followed by the relevant mitigation procedures stipulated in the permits.
- A full-time ECO must render guidance to the staff and contractors with respect to suitable areas for all related disturbance.
- Everyone on site must undergo environmental induction for awareness on not harming or collecting species that are often persecuted out of superstition and to be educated about the conservation importance of the fauna occurring on site.
- Reptiles and amphibians that are exposed during the clearing operations should be captured for later release or translocation by a qualified expert.
- Employ measures that ensure adherence to the speed limit.

4.4. Broad-scale ecological processes

Source of the impact

The construction of roads, plant site, as well as other necessary infrastructure; the clearing of vegetation for excavations and the actual excavations.

Description of the impact

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. The fragmentation of ephemeral drainage lines will destroy connectivity of vital ecological corridors and it will disrupt the hydrological regime if any of the tributaries to the Orange River is cut. Furthermore, the alluvial plains along the Orange River are typically exploited for irrigation farming and mining. Due to the amount of mining and agriculture along the Orange River in the region the cumulative impact for the proposed prospecting operation is high.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of affected areas.
- Encourage the growth of natural plant species.
- Encourage the preservation of ecological corridors.
- Employ sound rehabilitation measures to restore the characteristics of the affected watercourses.

5. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Six plant communities were identified on site of which the riparian woodland along with the ephemeral rivers, streams and drainage lines are considered to be of very high sensitivity due to their vital ecological and hydrological functionality and significance. The calcrete ridges and ironstone hilltops are also considered to be of very high sensitivity due to the dense population of listed *Aloidendron dichotomum* found here, along with high densities of nationally protected tree *Boscia albitrunca* and other species protected according to the NCNCA. The remaining study area, which comprises the shrubland on rocky ridges and sandy plains, is considered to be of high sensitivity primarily due to the high occurrences of species of conservation concern that occur widespread across these units.

The most profound impacts are expected to be related to the loss of plant species of conservation concern as well damages to the burrows of fossorial mammals that occur on the alluvial plains. The disruption of ecological corridors and the hydrological regime if any of the tributaries to the Orange River are cut off is also considered to be a major impact.

Species of conservation concern that are found in the prospecting area include *Ruschia intricata, Sarcostemma viminale, Aloe claviflora, Aloidendron dichotomum, Boscia albitrunca, Euphorbia avasmontana, E. gregaria* and *Olea europaea* subsp. *africana.* Similarly, the prospecting operation will result in the large-scale clearance of indigenous vegetation. Permit applications regarding protected flora as well as the harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation prior to any clearance of vegetation.

Similarly, if any of the *Boscia albitrunca* trees are to be affected, a licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries three months prior to any potential disturbances to these trees.

To conclude, it is clear that the destruction of the natural habitat within the study area is inevitable. The significance of the impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the prospecting area. In my opinion, authorisation can be granted if the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures. Furthermore, the application should only be granted if the applicant commits to exclude the areas where dense populations of *Aloidendron dichotomum* and *Boscia albitrunca* occur from the mining footprint.

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Boscia
ECOLOGICAL CONSULTING

APPENDICES

APPENDIX 1

Plant species list

FAMILY	SPECIES	STATUS	NFA	NCNCA
ACANTHACEAE	*Barleria lichtensteiniana*	LC		
	Barleria rigida	LC		
	Blepharis mitrata	LC		
	Monechma divaricatum	LC		
	Monechma incanum	LC		
	Monechma spartioides	LC		
AGARICACEAE	*Podaxis pistillaris*	-		
AIZOACEAE	*Aizoon asbestinum*	LC		
	Aizoon schellenbergii	LC		
	Aridaria noctiflora subsp. straminea	LC		S2
	Galenia africana	LC		
	Mesembryanthemum coriarium	LC		S2
	Mesembryanthemum crystallinum	LC		S2
	Plinthus cryptocarpus	LC		
	Psilocaulon coriarium	LC		
	Ruschia intricata	LC		S2
	Tetragonia reduplicata	LC		
AMARANTHACEAE	*Salsola aphylla*	LC		
AMARYLLIDACEAE	*Nerine laticoma*	LC		S2
ANACAMPSEROTACEAE	*Anacampseros baeseckei*	LC		
ANACARDIACEAE	*Searsia burchellii*	LC		
	Searsia pendulina	LC		
APOCYNACEAE	*Sarcostemma viminale*	LC		S2
ASPARAGACEAE	*Asparagus exuvialis*	LC		
ASPHODELACEAE	*Aloe claviflora*	LC		S2
	Aloidendron dichotomum	VU		S1
	Bulbine abyssinica	LC		S2
	Haworthiopsis nigra var. diversifolia	LC		S2
	Trachyandra karrooica	LC		S2
ASTERACEAE	*Eriocephalus pauperrimus*	LC		
	Felicia burkei	LC		
	Felicia ovata	LC		
	Garuleum schinzii subsp. schinzii	LC		
	Geigeria ornativa subsp. ornativa	LC		
	Helichrysum herniarioides	LC		
	Helichrysum zeyheri	LC		
	Ifloga glomerata	LC		
	Kleinia longiflora	LC		
	Osteospermum leptolobum	LC		
	Pegolettia retrofracta	LC		
	Pentzia globosa	LC		
	Pentzia incana	LC		
	Pentzia spinescens	LC		
	Phymaspermum aciculare	LC		
	Pteronia mucronata	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
ASTERACEAE	*Senecio consanguineus*	LC		
BIGNONIACEAE	*Rhigozum obovatum*	LC		
	Rhigozum trichotomum	Bush encr.		
BORAGINACEAE	*Ehretia rigida subsp. nervifolia*	LC		
	Heliotropium lineare	LC		
	Trichodesma africanum	LC		
BRASSICACEAE	*Boscia albitrunca*	LC	**X**	S2
	Cadaba aphylla	LC		
CARYOPHYLLACEAE	*Scleranthus annuus*	Nat. Exotic		
CLEOMACEAE	*Cleome angustifolia subsp. diandra*	LC		
	Cleome gynandra	LC		
	Cleome monophylla	LC		
	Cleome rubella	LC		
CONVOLVULACEAE	*Convolvulus ocellatus var. ocellatus*	LC		
CUCURBITACEAE	*Acanthosicyos naudinianus*	LC		
	Corallocarpus schinzii	LC		
	Trochomeria debilis	LC		
EUPHORBIACEAE	*Euphorbia avasmontana*	LC		S2
	Euphorbia crassipes	LC		S2
	Euphorbia gregaria	LC		S2
FABACEAE	*Crotalaria burkeana*	LC		
	Indigofera alternans var. alternans	LC		
	Indigofera damarana	LC		
	Indigofera heterotricha	LC		
	Leobordea platycarpa	LC		
	Melolobium canescens	LC		
	Melolobium macrocalyx var. macrocalyx	LC		
	Parkinsonia africana	LC		
	Prosopis velutina	Alien Inv.		S6
	Senegalia mellifera	Bush encr.		
FRANKENIACEAE	*Frankenia pulverulenta*	LC		
GERANIACEAE	*Monsonia burkeana*	LC		
GISEKIACEAE	*Gisekia africana var. africana*	LC		
HYACINTHACEAE	*Albuca cooperi*	LC		
IRIDACEAE	*Gladiolus permeabilis subsp. edulis*	LC		S2
	Lapeirousia plicata subsp. plicata	LC		S2
LAMIACEAE	*Leonotis pentadentata*	LC		
LIMEACEAE	*Limeum arenicolum*	LC		
	Limeum myosotis var. myosotis	LC		
LOASACEAE	*Kissenia capensis*	LC		
MALVACEAE	*Corchorus asplenifolius*	LC		
	Hermannia abrotanoides	LC		
	Hermannia modesta	LC		
	Hermannia spinosa	LC		
	Hibiscus elliottiae	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
MELIACEAE	*Nymania capensis*	LC		S2
AIZOACEAE	*Psilocaulon articulatum*	LC		
MORACEAE	*Ficus cordata subsp. cordata*	LC		
MYRTACEAE	*Eucalyptus camaldulensis*	Alien Inv.		S6
NYCTAGINACEAE	*Phaeoptilum spinosum*	LC		
OLEACEAE	*Olea europaea subsp. africana*	LC		S2
OXALIDACEAE	*Oxalis lawsonii*	LC		S2
PEDALIACEAE	*Rogeria longiflora*	LC		
POACEAE	*Anthephora pubescens*	LC		
	Aristida congesta subsp. congesta	LC		
	Brachiaria marlothii	LC		
	Cenchrus ciliaris	LC		
	Coelachyrum yemenicum	LC		
	Digitaria sanguinalis	Nat. Exotic		
	Enneapogon cenchroides	LC		
	Enneapogon desvauxii	LC		
	Enneapogon scaber	LC		
	Eragrostis annulata	LC		
	Eragrostis brizantha	LC		
	Eragrostis macrochlamys var. macrochlamys	LC		
	Eragrostis nindensis	LC		
	Eragrostis porosa	LC		
	Fingerhuthia africana	LC		
	Hemarthria altissima	LC		
	Panicum gilvum	LC		
	Panicum schinzii	LC		
	Phalaris minor	Nat. Exotic		
	Schismus barbatus	LC		
	Schmidtia kalahariensis	LC		
	Sporobolus ioclados	LC		
	Sporobolus nebulosus	LC		
	Stipagrostis anomala	LC		
	Stipagrostis ciliata var. capensis	LC		
	Stipagrostis namaquensis	LC		
	Stipagrostis obtusa	LC		
	Stipagrostis uniplumis	LC		
	Tragus racemosus	LC		
	Tricholaena capensis subsp. capensis	LC		
POLYGALACEAE	*Polygala pungens*	LC		
RHAMNACEAE	*Ziziphus mucronata*	LC		
RUBIACEAE	*Anthospermum rigidum subsp. rigidum*	LC		
RUSCACEAE	*Sansevieria aethiopica*	LC		
SALICACEAE	*Salix mucronata subsp. mucronata*	LC		
SANTALACEAE	*Thesium lineata*	LC		
SAPINDACEAE	*Pappea capensis*	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
SCROPHULARIACEAE	*Aptosimum albomarginatum*	LC		
	Aptosimum marlothii	LC		
	Aptosimum spinescens	LC		
	Chaenostoma halimifolium	LC		
	Limosella africana var. africana	LC		
	Selago albida	LC		
	Selago centralis	LC		
	Sutera griquensis	LC		
SOLANACEAE	*Lycium cinereum*	LC		
	Lycium horridum	LC		
	Solanum triflorum	Nat. Exotic		
TAMARICACEAE	*Tamarix usneoides*	LC		
THYMELAEACEAE	*Lasiosiphon polycephalus*	LC		
URTICACEAE	*Forsskaolea candida*	LC		
VERBENACEAE	*Chascanum garipense*	LC		
ZYGOPHYLLACEAE	*Tribulus zeyheri subsp. zeyheri*	LC		
	Zygophyllum microcarpum	LC		
	Zygophyllum rigidum	LC		
	Zygophyllum simplex	LC		

APPENDIX 2

Fauna species list

LIST OF MAMMALS

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CHIROPTERA	[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	**NT**	*Not listed*	Wide habitat tolerance.	High
	[2]*Neoromicia capensis*	Cape Bat	LC	LC	Wide habitat tolerance, but often found in arid areas, grassland, bushveld and *Acacia* woodland. Animals roost under the bark of trees and similar vegetation.	High
	[2]*Nycteris thebaica*	Common Slit-faced Bat	LC	LC	Savanna species with wide habitat tolerance. Roosts in caves, mine adits, aardvark holes, rock crevices and hollow trees in open savanna woodland.	High
	[2]*Rhinolophus denti*	Dent's Horseshoe Bat	LC	**NT**	Savanna habitats.	Low
	[2]*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	LC	**NT**	Wide habitat tolerance.	High
	[2]*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC	**NT**	Savanna habitats.	Low
	[2]*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	LC	LC	Wide habitat tolerance.	High

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
MACROSCELIDIDAE	[2]*Macroscelides proboscideus*	Roundeared elephantshrew	LC	LC	Occupies gravel plains associated with alluvial plains and relatively flat areas between higher elevation areas such as outcrops, scarps, hills, and mountains with sparsely vegetated bunch grasses and widely spaced small bushes.	High
	[2]*Elephantulus rupestris*	Western rock elephantshrew	LC	LC	Arid habitats, including deserts, dry savannas, and dry shrublands. It is typically associated with rocky ridges, outcrops or koppies (rocky hills), and boulder fields at the bases of mountains.	High
TUBULENTATA	[1]*Orycteropus afer*	Aardvark	LC	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil.	High
HYRACOIDEA	[2]*Procavia capensis*	Rock Hyrax	LC	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies.	High

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
LAGOMORPHA	[2]*Lepus capensis*	Cape Hare	LC	LC	Dry, open regions, with palatable bush and grass.	High
	[2]*Lepus saxatilis*	Scrub Hare	LC	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Moderate
	[2]*Pronolagus rupestris*	Smith's Red Rock Rabbit	LC	LC	Rocky habitats, from isolated outcrops to mountain ranges; in high and low rainfall areas, but absent from true desert.	Confirmed
RODENTIA	[2]*Hystrix africaeaustralis*	Cape Porcupine	LC	LC	Catholic in habitat requirements.	High
	[2]*Xerus inauris*	South African Ground Squirrel	LC	LC	Open terrain with a sparse bush cover and hard substrate.	High
	[2]*Pedetes capensis*	Springhare	LC	LC	Occurs widespread: open sandy ground, sandy scrub, overgrazed grassland, edges of vleis and dry river beds.	High
	[2]*Graphiurus ocularis*	Spectacled Dormouse	LC	LC	Rocky habitats, but also trees.	High

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
RODENTIA	[2]*Petromus typicus*	Dassie rat	LC	**NT**	Restricted to rocky areas and isolated rocky outcrops.	High
	[2]*Saccostomus campestris*	Pouched Mouse	LC	LC	Wide habitat tolerance; prefers soft, sandy soils; open and dense vegetation; rocky areas; annual rainfall of 250 - 1 200 mm.	High
	[2]*Malacothrix typica*	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	High
	[2]*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	LC	Essentially a grassland species; occurs in wide variety of habitats where there is good grass cover.	High
	[2]*Mus minutoides*	Pygmy Mouse	LC	LC	Wide habitat tolerance.	High
	[3]*Mus musculus*	House Mouse	LC	*Not listed*	Wide habitat tolerance.	High
	[2]*Thallomys nigricauda*	Blacktailed tree rat	LC	LC	Arboreal species, generally associated with Acacia bushland habitats.	High
	[2]*Mastomys coucha*	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	[2]*Micaelamys namaquensis*	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	High

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
RODENTIA	[6]*Rattus rattus*	House rat	LC	*Not listed*	Primarily commensal, but also found in a variety of natural and semi-natural habitats.	High
	[2]*Parotomys brantsii*	Brants' whistling rat	LC	LC	Restricted to consolidated sands in semi-desert. They can also occur in pastureland.	Moderate
	[2]*Parotomys littledalei*	Littledale's whistling rat	LC	**NT**	Occurs in shrubland.	High
	[2]*Myotomys unisulcatus*	Bush Karoo Rat	LC	LC	Shrub and fynbos associations in areas with rocky outcrops. Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	High
	[2]*Petromyscus monticularis*	Brukkaros pygmy rock mouse	LC	*Not listed*	It is found in rocky areas in semi-desert shrubland.	High
	[2]*Desmodillus auricularis*	Cape Short-tailed Gerbil	LC	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	High

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
RODENTIA	[2]*Gerbillurus paeba*	Pygmy Hairy-footed Gerbil	LC	LC	Associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover.	High
	[2]*Gerbilliscus leucogaster*	Bushveld Gerbil	LC	**DD**	Sandy soils; wooded and more open grassland; areas of cultivation.	Moderate
	[2]*Gerbilliscus brantsii*	Highveld Gerbil	LC	LC	Sandy soils; wooded and more open grassland; areas of cultivation.	Moderate
PRIMATES	[4]*Papio ursinus*	Chacma Baboon	LC	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High
	[4]*Chlorocebus pygerythrus*	Vervet Monkey	LC	LC	Woodland savanna, riverine woodland, isolated stands of trees along river courses.	High

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
EULIPOTYPHLA	[2]*Crocidura cyanea*	Reddish-Grey Musk Shrew	LC	DD	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
	[2]*Suncus varilla*	Lesser Dwarf Shrew	LC	**DD**	Generally associated with termite mounds, grassland habitat.	Moderate
	[1]*Atelerix frontalis*	South African Hedgehog	LC	**NT**	Generally found in semi-arid and sub-temperate environments with ample ground cover.	Moderate
CARNIVORA	[1]*Proteles cristata*	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes.	High
	[4]*Caracal caracal*	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High
	[1]*Felis silvestris*	African Wild Cat	LC	LC	Wide habitat tolerance.	High
	[1]*Felis nigripes*	Black-footed cat	**VU**	LC	Associated with arid country, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	Moderate

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CARNIVORA	[2]*Genetta genetta*	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	High
	[2]*Suricata suricatta*	Suricate	LC	LC	Open arid country with hard and stony substrate. Occur in Nama- and Succulent Karoo but also fynbos.	High
	[2]*Cynictis penicillata*	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	High
	[2]*Galerella pulverulenta*	Cape (Small) Grey Mongoose	LC	LC	Wide habitat tolerance.	High
	[2]*Galerella sanguinea*	Slender Mongoose	LC	LC	Wide habitat tolerance, but areas with adequate cover.	High
	[2]*Atilax paludinosus*	Water (Marsh) Mongoose	LC	LC	Associated with well-watered areas, along rivers and streams, around dams, lakes, estuaries and swamps wherever there is cover.	High
	[1]*Vulpes chama*	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	Moderate
	[4]*Canis mesomelas*	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High
	[2]*Aonyx capensis*	Cape Clawless Otter	**NT**	LC	Rivers, marshes, dams and lakes; dry stream beds if pools of water exist.	High

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CARNIVORA	[1]*Hyaena brunnea*	Brown Hyena	**NT**	**NT**	Found in dry areas, generally with annual rainfall of 100 - 700 mm, particularly along the coast, semi-desert, open scrub and open woodland savanna.	Low
	[1]*Otocyon megalotis*	Bat-eared Fox	LC	LC	Open country with mean annual rainfall of 100-600 mm.	High
	[1]*Ictonyx striatus*	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	[1]*Mellivora capensis*	Honey Badger	LC	**NT**	Wide habitat tolerance.	High
SUIFORMES	[2]*Phacochoerus africanus*	Common Warthog	LC	LC	Open country, lightly wooded areas and savanna; also penetrates otherwise unsuitable country along watercourses.	Low

LIST OF MAMMALS (cont.)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CETARTIODACTYLA	[2]*Tragelaphus strepsiceros*	Greater Kudu	LC	LC	Wooded savanna and arid areas where there are stands of bush; wooded watercourses, acacia woodland and rocky hill country.	High
	[2]*Oryx gazella*	Gemsbok	LC	LC	Semi-arid and arid bushland and grassland of the Kalahari and Karoo and adjoining regions of Southern Africa.	Low
	[2]*Connochaetes gnou*	Black Wildebeest	LC	LC	Open plains grasslands and karoo shrublands of South Africa and Lesotho.	Low
	[2]*Alcelaphus caama*	Red Hartebeest	LC	LC	Open savanna country and open woodland.	Low
	[2]*Antidorcas marsupialis*	Springbok	LC	LC	Open arid plains with short vegetation.	Low
	[2]*Oreotragus oreotragus*	Klipspringer	LC	LC	Dependent on rocky and mountainous terrain.	High
	[2]*Raphicerus campestris*	Steenbok	LC	LC	Inhabits open country.	High
	[2]*Sylvicapra grimmia*	Common Duiker	LC	LC	Presence of bushes is important.	High

LIST OF REPTILES

Reptiles protected according to NCNCA are indicated with their respective Schedule no. in superscript.

Family	Scientific name	Common name	IUCN status
TESTUDINIDAE	[2]*Psammobates oculifer*	Serrated Tent Tortoise	LC
	[2]*Psammobates tentorius*	Tent Tortoise	LC
	[2]*Stigmochelys pardalis*	Leopard Tortoise	LC
GEKKONIDAE	*Chondrodactylus angulifer angulifer*	Common Giant Gecko	LC
	Chondrodactylus bibronii	Bibron's Gecko	LC
	Pachydactylus capensis	Cape Gecko	LC
	Pachydactylus latirostris	Quartz Gecko	LC
	Pachydactylus purcelli	Purcell's Gecko	LC
	Pachydactylus rugosus	Common Rough Gecko	LC
	Ptenopus garrulus garrulus	Common Barking Gecko	LC
	Ptenopus garrulus maculatus	Spotted Barking Gecko	LC
AMPHISBAENIDAE	*Monopeltis infuscata*	Dusky Worm Lizard	LC
LACERTIDAE	[2]*Heliobolus lugubris*	Bushveld Lizard	LC
	[2]*Meroles suborbitalis*	Spotted desert Lizard	LC
	[2]*Nucras tessellata*	Western Sandveld Lizard	LC
	[2]*Pedioplanis inornata*	Plain Sand Lizard	LC
	[2]*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	LC
	[2]*Pedioplanis lineoocellata pulchella*	Common Sand Lizard	LC
	[2]*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC
CORDYLIDAE	[1]*Karusasaurus polyzonus*	Southern Karusa Lizard	LC
SCINCIDAE	*Acontias gracilicauda*	Thin-tailed Legless Skink	LC
	Acontias lineatus	Striped Dwarf Legless Skink	LC
	Trachylepis capensis	Cape Skink	LC
	Trachylepis occidentalis	Western Three-striped Skink	LC
	Trachylepis sparsa	Karasberg Tree Skink	LC
	Trachylepis spilogaster	Kalahari Tree Skink	LC
	Trachylepis sulcata sulcata	Western Rock Skink	LC
	Trachylepis variegata	Variegated Skink	LC
VARANIDAE	[2]*Varanus albigularis albigularis*	Southern Rock Monitor	LC
	[2]*Varanus niloticus*	Nile Monitor	LC
CHAMAELEONIDAE	[1]*Chamaeleo dilepis dilepis*	Common Flap-neck Chameleon	LC
AGAMIDAE	*Agama aculeata aculeata*	Western Ground Agama	LC
	Agama anchietae	Anchieta's Agama	LC
	Agama atra	Southern rock Agama	LC

LIST OF REPTILES (cont.)

Reptiles protected according to NCNCA are indicated with their respective Schedule no. in superscript.

Family	Scientific name	Common name	IUCN status
TYPHLOPIDAE	[3]*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	LC
	[3] *Rhinotyphlops schinzi*	Schinz's Beaked Blind Snake	LC
LEPTOTYPHLOPIDAE	[3]*Leptotyphlops scutifrons*	Peter's Thread Snake	LC
VIPERIDAE	[3]*Bitis arietans arietans*	Puff Adder	LC
	[3] *Bitis caudalis*	Horned Adder	LC
LAMPROPHIIDAE	[3]*Atractaspis bibronii*	Bibron's Stiletto Snake	LC
	[2]*Boaedon capensis*	Brown House Snake	LC
	[3]*Dipsina multimaculata*	Dwarf Beaked Snake	LC
	[3]*Psammophis notostictus*	Karoo Sand Snake	LC
	[2]*Pseudaspis cana*	Mole Snake	LC
ELAPIDAE	[3]*Aspidelaps lubricus lubricus*	Coral Shield Cobra	LC
	[3]*Elapsoidea sundevallii media*	Sundevall's Garter Snake	LC
	[3]*Naja nigricincta woodi*	Black Spitting Cobra	LC
	[3]*Naja nivea*	Cape Cobra	LC
COLUBRIDAE	[2]*Dasypeltis scabra*	Rhombic Egg-eater	LC
	[2]*Philothamnus semivariegatus*	Spotted Bush Snake	LC
	[3]*Telescopus beetzii*	Beetz's Tiger Snake	LC

LIST OF AMPHIBIANS

Amphibians protected according to NCNCA are indicated with their respective Schedule no. in superscript.

Family	Scientific name	Common name	IUCN status
BREVICIPITIDAE	[2]*Breviceps adspersus*	Bushveld Rain Frog	LC
BUFONIDAE	[2]*Amietophrynus poweri*	Western Olive Toad	LC
	[2]*Amietophrynus rangeri*	Raucous Toad	LC
	[2]*Amietophrynus gutturalis*	Guttural Toad	LC
	[2]*Poyntonophrynus vertebralis*	Southern Pygmy Toad	LC
	[2]*Vandijkophrynus gariepensis*	Karoo Toad	LC
HYPEROLIIDAE	[2]*Kassina senegalensis*	Bubbling Kassina	LC
PIPIDAE	[2]*Xenopus laevis*	Common Platanna	LC
PYXICEPHALIDAE	[2]*Cacosternum boettgeri*	Boettger's Caco	LC
	[2]*Amietia quecketti*	Common River Frog	LC
	[2]*Amietia fuscigula*	Cape River Frog	LC
	[1]*Pyxicephalus adspersus*	Giant Bullfrog	**NT**
	[2]*Tomopterna cryptotis*	Tremolo Sand Frog	LC
	[2]*Tomopterna tandyi*	Tandy's Sand Frog	LC

LIST OF BIRDS

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	Status
2	*Acrocephalus baeticatus*	African Reed-Warbler	LC
2	*Acrocephalus gracilirostris*	Lesser Swamp-Warbler	LC
2	*Actitis hypoleucos*	Common Sandpiper	LC
2	*Alario alario*	Black-headed Canary	LC
3	*Alario leucolaema*	Damara Canary	Not listed
2	*Alcedo cristata*	Malachite Kingfisher	LC
2	*Alopochen aegyptiacus*	Egyptian Goose	LC
2	*Amadina erythrocephala*	Red-headed Finch	LC
2	*Anas capensis*	Cape Teal	LC
2	*Anas erythrorhyncha*	Red-billed Teal	LC
2	*Anas hottentota*	Hottentot Teal	LC
2	*Anas smithii*	Cape Shoveler	LC
2	*Anas sparsa*	African Black Duck	LC
2	*Anas undulata*	Yellow-billed Duck	LC
2	*Anhinga rufa*	African Darter	LC
2	*Anthoscopus minutus*	Cape Penduline-Tit	LC
2	*Anthropoides paradisea*	Blue Crane	**NT**
2	*Anthus cinnamomeus*	African Pipit	LC
2	*Anthus vaalensis*	Buffy Pipit	LC
2	*Apus affinis*	Little Swift	LC
2	*Apus apus*	Common Swift	LC
2	*Apus bradfieldi*	Bradfield's Swift	LC
2	*Apus caffer*	White-rumped Swift	LC
2	*Apus horus*	Horus Swift	LC
2	*Aquila rapax*	Tawny Eagle	**EN**
2	*Aquila verreauxii*	Verreaux's Eagle	**VU**
2	*Ardea cinerea*	Grey Heron	LC
2	*Ardea goliath*	Goliath Heron	LC
2	*Ardea melanocephala*	Black-headed Heron	LC
2	*Ardea purpurea*	Purple Heron	LC
2	*Ardeola ralloides*	Squacco Heron	LC
2	*Ardeotis kori*	Kori Bustard	**NT**
2	*Batis pririt*	Pririt Batis	LC
2	*Bostrychia hagedash*	Hadeda Ibis	LC
2	*Bradornis infuscatus*	Chat Flycatcher	LC
2	*Bradornis mariquensis*	Marico Flycatcher	LC

LIST OF BIRDS (cont.)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	Status
1	*Bubo africanus*	Spotted Eagle-Owl	LC
1	*Bubo capensis*	Cape Eagle-Owl	LC
1	*Bubo lacteus*	Verreaux's Eagle-Owl	LC
2	*Bubulcus ibis*	Cattle Egret	LC
2	*Burhinus capensis*	Spotted Thick-knee	LC
1	*Buteo rufofuscus*	Jackal Buzzard	LC
1	*Buteo vulpinus*	Steppe Buzzard	LC
2	*Calandrella cinerea*	Red-capped Lark	LC
2	*Calendulauda africanoides*	Fawn-coloured Lark	LC
2	*Calendulauda bradfieldi*	Bradfield's Lark	Not listed
2	*Calidris alba*	Sanderling	LC
2	*Calidris ferruginea*	Curlew Sandpiper	LC
2	*Calidris minuta*	Little Stint	LC
2	*Campethera abingoni*	Golden-tailed Woodpecker	LC
1	*Caprimulgus europaeus*	European Nightjar	LC
1	*Caprimulgus pectoralis*	Fiery-necked Nightjar	Not listed
1	*Caprimulgus rufigena*	Rufous-cheeked Nightjar	LC
1	*Caprimulgus tristigma*	Freckled Nightjar	Not listed
2	*Centropus burchellii*	Burchell's Coucal	LC
2	*Cercomela familiaris*	Familiar Chat	LC
2	*Cercomela schlegelii*	Karoo Chat	LC
2	*Cercomela sinuata*	Sickle-winged Chat	LC
2	*Cercomela tractrac*	Tractrac Chat	LC
2	*Cercotrichas coryphoeus*	Karoo Scrub-Robin	LC
2	*Cercotrichas paena*	Kalahari Scrub-Robin	LC
2	*Certhilauda subcoronata*	Karoo Long-billed Lark	LC
2	*Ceryle rudis*	Pied Kingfisher	LC
2	*Charadrius asiaticus*	Caspian Plover	LC
2	*Charadrius hiaticula*	Common Ringed Plover	LC
1	*Charadrius pallidus*	Chestnut-banded Plover	**NT**
2	*Charadrius pecuarius*	Kittlitz's Plover	LC
2	*Charadrius tricollaris*	Three-banded Plover	LC
2	*Chersomanes albofasciata*	Spike-heeled Lark	LC
2	*Chlidonias hybridus*	Whiskered Tern	LC
2	*Chlidonias leucopterus*	White-winged Tern	LC
2	*Chrysococcyx caprius*	Diderick Cuckoo	LC
2	*Ciconia abdimii*	Abdim's Stork	**NT**
2	*Ciconia ciconia*	White Stork	LC
1	*Ciconia nigra*	Black Stork	LC
2	*Cinnyris fusca*	Dusky Sunbird	LC

LIST OF BIRDS (cont.)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	Status
1	*Circaetus pectoralis*	Black-chested Snake-Eagle	LC
1	*Circus maurus*	Black Harrier	**VU**
1	*Circus pygargus*	Montagu's Harrier	LC
2	*Cisticola aridulus*	Desert Cisticola	LC
2	*Cisticola juncidis*	Zitting Cisticola	LC
2	*Cisticola subruficapillus*	Grey-backed Cisticola	LC
2	*Cisticola tinniens*	Levaillant's Cisticola	LC
2	*Clamator jacobinus*	Jacobin Cuckoo	LC
3	*Colius colius*	White-backed Mousebird	LC
2	*Columba guinea*	Speckled Pigeon	LC
2	*Columba livia*	Rock Dove	LC
2	*Coracias garrulus*	European Roller	LC
3	*Corvus albus*	Pied Crow	LC
3	*Corvus capensis*	Cape Crow	LC
2	*Cossypha caffra*	Cape Robin-Chat	LC
2	*Coturnix coturnix*	Common Quail	LC
2	*Creatophora cinerea*	Wattled Starling	LC
2	*Cursorius rufus*	Burchell's Courser	LC
2	*Cursorius temminckii*	Temminck's Courser	LC
2	*Cypsiurus parvus*	African Palm-Swift	LC
2	*Dendropicos fuscescens*	Cardinal Woodpecker	LC
2	*Dicrurus adsimilis*	Fork-tailed Drongo	LC
2	*Egretta garzetta*	Little Egret	LC
1	*Elanus caeruleus*	Black-shouldered Kite	LC
2	*Emberiza capensis*	Cape Bunting	LC
2	*Emberiza impetuani*	Lark-like Bunting	LC
2	*Emberiza tahapisi*	Cinnamon-breasted Bunting	LC
2	*Eremomela icteropygialis*	Yellow-bellied Eremomela	LC
2	*Eremopterix australis*	Black-eared Sparrowlark	LC
2	*Eremopterix verticalis*	Grey-backed Sparrowlark	LC
2	*Estrilda astrild*	Common Waxbill	LC
2	*Estrilda erythronotos*	Black-faced Waxbill	LC
3	*Euplectes orix*	Southern Red Bishop	LC
2	*Eupodotis afraoides*	Northern Black Korhaan	LC
2	*Eupodotis ruficrista*	Red-crested Korhaan	LC
2	*Eupodotis vigorsii*	Karoo Korhaan	**NT**
1	*Falco biarmicus*	Lanner Falcon	**VU**
1	*Falco naumanni*	Lesser Kestrel	LC
1	*Falco peregrinus*	Peregrine Falcon	LC
1	*Falco rupicolis*	Rock Kestrel	LC

LIST OF BIRDS (cont.)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	Status
1	*Falco rupicoloides*	Greater Kestrel	LC
2	*Fulica cristata*	Red-knobbed Coot	LC
2	*Galerida magnirostris*	Large-billed Lark	LC
2	*Gallinago nigripennis*	African Snipe	LC
2	*Gallinula chloropus*	Common Moorhen	LC
1	*Glaucidium perlatum*	Pearl-spotted Owlet	LC
2	*Granatina granatina*	Violet-eared Waxbill	LC
1	*Gyps africanus*	White-backed Vulture	**EN**
1	*Haliaeetus vocifer*	African Fish-Eagle	LC
2	*Hieraaetus pennatus*	Booted Eagle	LC
2	*Himantopus himantopus*	Black-winged Stilt	LC
2	*Hirundo albigularis*	White-throated Swallow	LC
2	*Hirundo cucullata*	Greater Striped Swallow	LC
2	*Hirundo dimidiata*	Pearl-breasted Swallow	LC
2	*Hirundo fuligula*	Rock Martin	LC
2	*Hirundo rustica*	Barn Swallow	LC
2	*Hirundo semirufa*	Red-breasted Swallow	LC
2	*Hirundo spilodera*	South African Cliff-Swallow	LC
2	*Indicator indicator*	Greater Honeyguide	LC
2	*Indicator minor*	Lesser Honeyguide	LC
2	*Ixobrychus minutus*	Little Bittern	LC
2	*Lagonosticta senegala*	Red-billed Firefinch	LC
2	*Lamprotornis nitens*	Cape Glossy Starling	LC
2	*Laniarius atrococcineus*	Crimson-breasted Shrike	LC
2	*Lanius collaris*	Common Fiscal	LC
2	*Lanius collurio*	Red-backed Shrike	LC
2	*Lanius minor*	Lesser Grey Shrike	LC
2	*Larus cirrocephalus*	Grey-headed Gull	LC
1	*Leptoptilos crumeniferus*	Marabou Stork	**NT**
2	*Malcorus pectoralis*	Rufous-eared Warbler	LC
2	*Megaceryle maxima*	Giant Kingfisher	LC
1	*Melierax canorus*	Southern Pale Chanting Goshawk	LC
2	*Merops apiaster*	European Bee-eater	LC
2	*Merops hirundineus*	Swallow-tailed Bee-eater	LC
2	*Milvus aegyptius*	Yellow-billed Kite	Not listed
1	*Milvus migrans*	Black Kite	LC
2	*Mirafra fasciolata*	Eastern Clapper Lark	LC
2	*Monticola brevipes*	Short-toed Rock-Thrush	LC
2	*Motacilla aguimp*	African Pied Wagtail	LC
2	*Motacilla capensis*	Cape Wagtail	LC

LIST OF BIRDS (cont.)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	Status
2	*Muscicapa striata*	Spotted Flycatcher	LC
2	*Myrmecocichla formicivora*	Anteating Chat	LC
1	*Neotis ludwigii*	Ludwig's Bustard	**EN**
2	*Netta erythrophthalma*	Southern Pochard	LC
2	*Nilaus afer*	Brubru	LC
2	*Numenius phaeopus*	Common Whimbrel	LC
2	*Numida meleagris*	Helmeted Guineafowl	LC
2	*Nycticorax nycticorax*	Black-crowned Night-Heron	LC
2	*Oena capensis*	Namaqua Dove	LC
2	*Oenanthe monticola*	Mountain Wheatear	LC
2	*Oenanthe pileata*	Capped Wheatear	LC
2	*Onychognathus nabouroup*	Pale-winged Starling	LC
2	*Oriolus oriolus*	Eurasian Golden Oriole	LC
2	*Ortygospiza atricollis*	African Quailfinch	LC
2	*Oxyura maccoa*	Maccoa Duck	**NT**
2	*Parisoma layardi*	Layard's Tit-Babbler	LC
2	*Parisoma subcaeruleum*	Chestnut-vented Tit-Babbler	LC
2	*Parus cinerascens*	Ashy Tit	LC
2	*Passer diffusus*	Southern Grey-headed Sparrow	LC
3	*Passer domesticus*	House Sparrow	LC
2	*Passer melanurus*	Cape Sparrow	LC
2	*Passer motitensis*	Great Sparrow	LC
2	*Phalacrocorax africanus*	Reed Cormorant	LC
2	*Phalacrocorax lucidus*	White-breasted Cormorant	LC
2	*Philetairus socius*	Sociable Weaver	LC
2	*Philomachus pugnax*	Ruff	LC
1	*Phoenicopterus minor*	Lesser Flamingo	**NT**
1	*Phoenicopterus ruber*	Greater Flamingo	**NT**
2	*Phragmacia substriata*	Namaqua Warbler	LC
2	*Phylloscopus trochilus*	Willow Warbler	LC
2	*Platalea alba*	African Spoonbill	LC
2	*Plectropterus gambensis*	Spur-winged Goose	LC
2	*Plegadis falcinellus*	Glossy Ibis	LC
2	*Plocepasser mahali*	White-browed Sparrow-Weaver	LC
3	*Ploceus velatus*	Southern Masked-Weaver	LC
2	*Podiceps nigricollis*	Black-necked Grebe	LC
1	*Polemaetus bellicosus*	Martial Eagle	**EN**
1	*Polihierax semitorquatus*	Pygmy Falcon	LC
1	*Polyboroides typus*	African Harrier-Hawk	LC

LIST OF BIRDS (cont.)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript.

	Scientific name	Common name	Status
2	*Prinia flavicans*	Black-chested Prinia	LC
2	*Pternistis capensis*	Cape Francolin	LC
2	*Pterocles burchelli*	Burchell's Sandgrouse	LC
2	*Pterocles namaqua*	Namaqua Sandgrouse	LC
1	*Ptilopsus granti*	Southern White-faced Scops-Owl	LC
3	*Pycnonotus nigricans*	African Red-eyed Bulbul	LC
2	*Pytilia melba*	Green-winged Pytilia	LC
3	*Quelea quelea*	Red-billed Quelea	LC
2	*Rallus caerulescens*	African Rail	LC
2	*Recurvirostra avosetta*	Pied Avocet	LC
2	*Rhinopomastus cyanomelas*	Common Scimitarbill	LC
2	*Rhinoptilus africanus*	Double-banded Courser	LC
2	*Riparia paludicola*	Brown-throated Martin	LC
2	*Riparia riparia*	Sand Martin	LC
1	*Rostratula benghalensis*	Greater Painted-snipe	VU
1	*Sagittarius serpentarius*	Secretarybird	VU
2	*Scleroptila levaillantoides*	Orange River Francolin	LC
2	*Scopus umbretta*	Hamerkop	LC
2	*Serinus albogularis*	White-throated Canary	LC
2	*Serinus atrogularis*	Black-throated Canary	LC
2	*Serinus flaviventris*	Yellow Canary	LC
2	*Sigelus silens*	Fiscal Flycatcher	LC
2	*Spizocorys conirostris*	Pink-billed Lark	LC
1	*Spizocorys sclateri*	Sclater's Lark	**NT**
2	*Spizocorys starki*	Stark's Lark	LC
2	*Sporopipes squamifrons*	Scaly-feathered Finch	LC
2	*Spreo bicolor*	Pied Starling	LC
2	*Stenostira scita*	Fairy Flycatcher	LC
2	*Streptopelia capicola*	Cape Turtle-Dove	LC
2	*Streptopelia semitorquata*	Red-eyed Dove	LC
2	*Streptopelia senegalensis*	Laughing Dove	LC
2	*Struthio camelus*	Common Ostrich	LC
2	*Sylvia borin*	Garden Warbler	LC
2	*Sylvia communis*	Common Whitethroat	LC
2	*Sylvietta rufescens*	Long-billed Crombec	LC
2	*Tachybaptus ruficollis*	Little Grebe	LC
2	*Tachymarptis melba*	Alpine Swift	LC
2	*Tadorna cana*	South African Shelduck	LC
2	*Telophorus zeylonus*	Bokmakierie	LC

LIST OF BIRDS (cont.)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript.

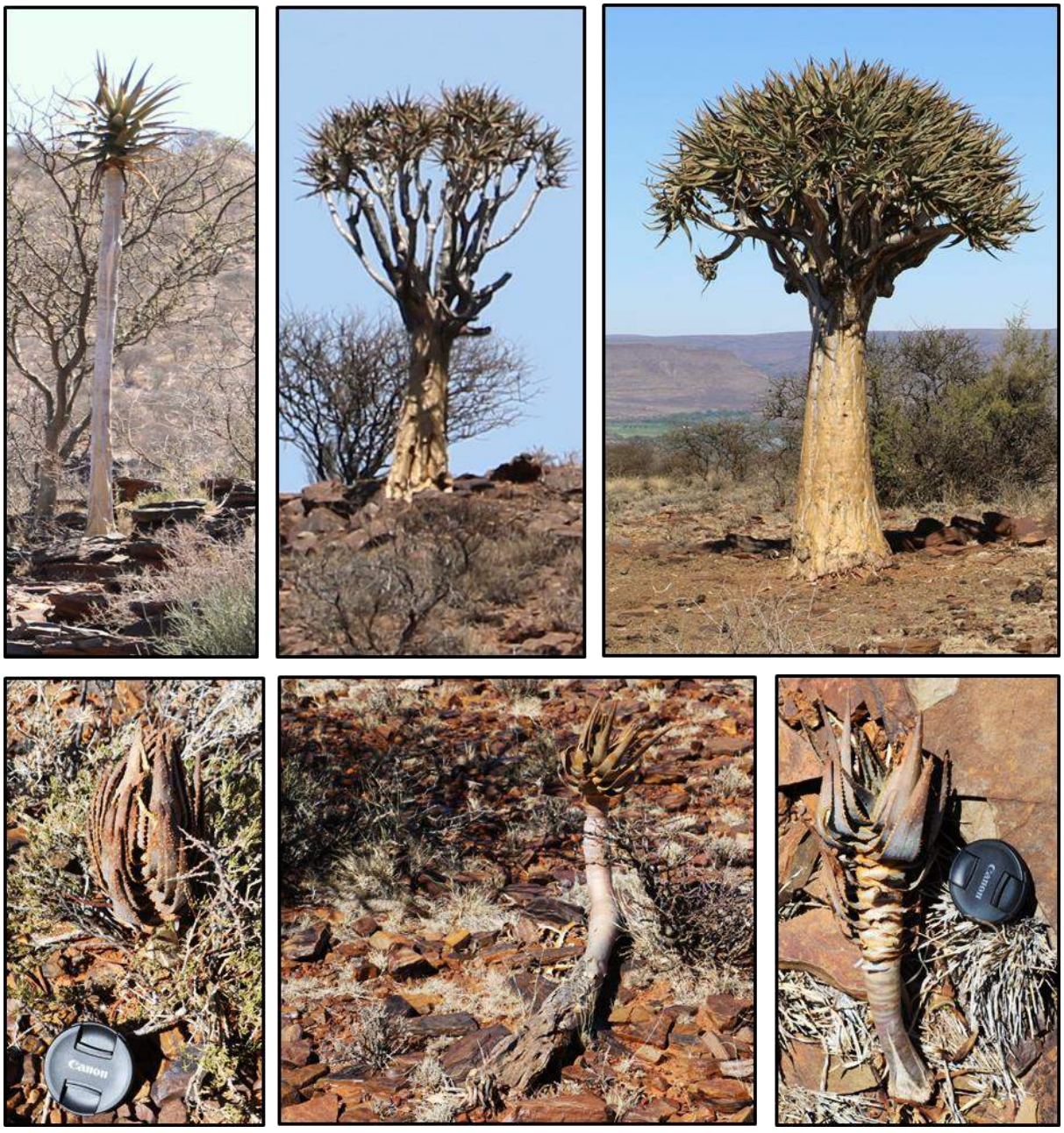
	Scientific name	Common name	Status
2	*Threskiornis aethiopicus*	African Sacred Ibis	LC
2	*Tockus nasutus*	African Grey Hornbill	LC
2	*Trachyphonus vaillantii*	Crested Barbet	LC
2	*Tricholaema leucomelas*	Acacia Pied Barbet	LC
2	*Tringa glareola*	Wood Sandpiper	LC
2	*Tringa nebularia*	Common Greenshank	LC
2	*Tringa stagnatilis*	Marsh Sandpiper	LC
2	*Turdus smithi*	Karoo Thrush	LC
2	*Turnix sylvatica*	Small Buttonquail	LC
1	*Tyto alba*	Barn Owl	LC
2	*Upupa africana*	African Hoopoe	LC
3	*Urocolius indicus*	Red-faced Mousebird	LC
2	*Vanellus armatus*	Blacksmith Lapwing	LC
2	*Vanellus coronatus*	Crowned Lapwing	LC
2	*Vidua chalybeata*	Village Indigobird	LC
2	*Vidua macroura*	Pin-tailed Whydah	LC
2	*Vidua paradisaea*	Long-tailed Paradise-Whydah	LC
2	*Vidua regia*	Shaft-tailed Whydah	LC
2	*Zosterops pallidus*	Orange River White-eye	LC

APPENDIX 3

A photographic guide for species of conservation concern that were encountered on site

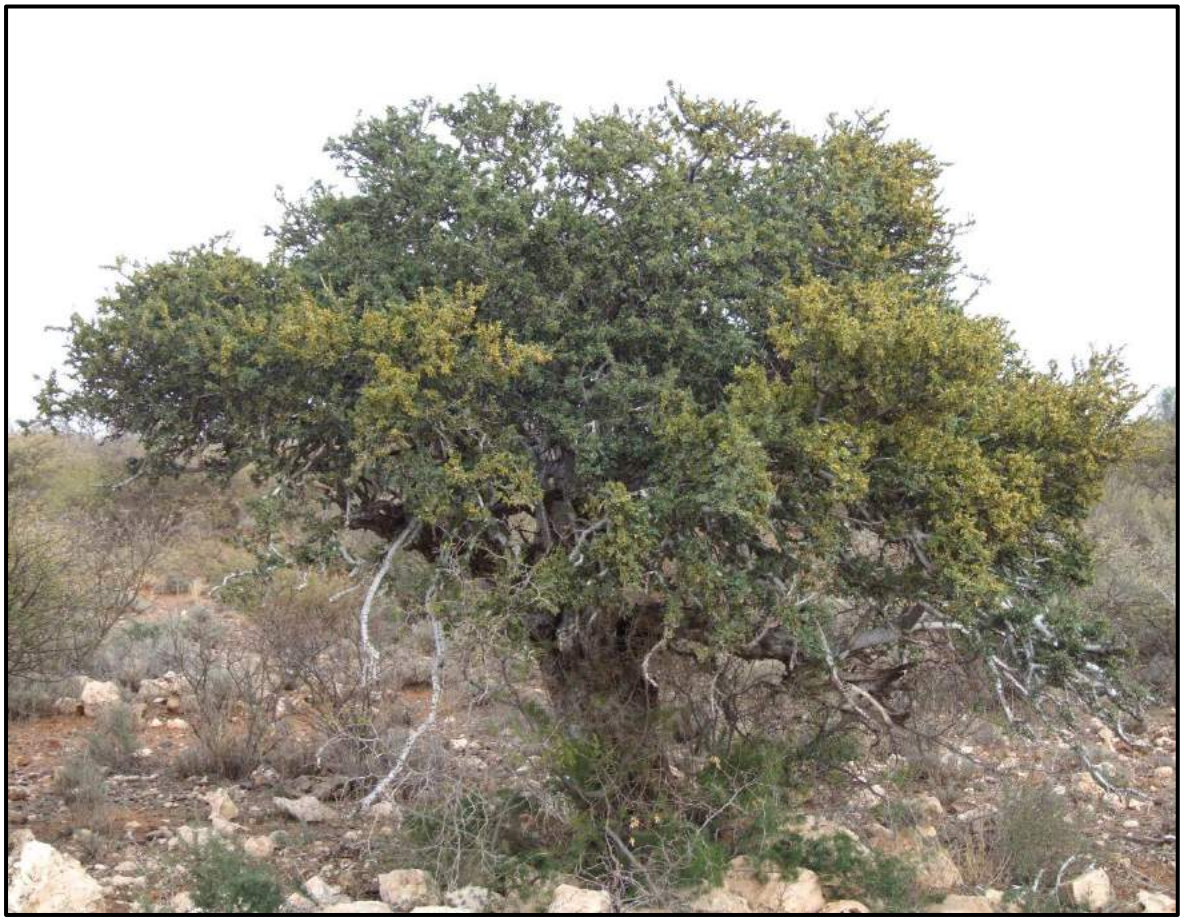
Aloidendron dichotomum

(Listed as Vulnerable and Protected in terms of Schedule 1 of the NCNCA)



Boscia albitrunca

(Protected under the NFA and Schedule 2 of the NCNCA)



Olea europaea* subsp*. africana
(Protected under Schedule 2 of the NCNCA)

Aloe claviflora
(Protected under Schedule 2 of the NCNCA)

Euphorbia avasmontana
(Protected under Schedule 2 of the NCNCA)

Euphorbia gregaria
(Protected under Schedule 2 of the NCNCA)

Sarcostemma viminale
(Protected under Schedule 2 of the NCNCA)

Ruschia intricata

(Protected under Schedule 2 of the NCNCA)