(NC) 30/5/1/3/2/10202 MR

Boscia
ECOLOGICAL CONSULTING

ECOLOGICAL ASSESSMENT REPORT

Renaissance Resources (Pty) Ltd

Lanyon Vale Diamond Mining Operation

Boscia
ECOLOGICAL CONSULTING

Address:
PostNet Suite 0216
Private Bag X37
Lynnwood Ridge
0040

Tel: 082 992 1261
Email: BosciaEcology@gmail.com

Renaissance Resources (Pty) Ltd

Portion 15 and Portion 23 of the Farm Lanyon Vale 376

District of Hay

Northern Cape Province

Ecological Assessment Report in application for Environmental Authorisation related to a Mining Right Application ((NC) 30/5/1/3/2/ 10202 MR) that was lodged with the Department of Mineral Resources

October 2022

EXECUTIVE SUMMARY

Renaissance Resources (Pty) Ltd is proposing the mining of diamonds on Portion 15 and Portion 23 of the Farm Lanyon Vale 376. The mining right area is located within the Hay District of the Northern Cape Province. Renaissance Resources has submitted a Mining Right application, which triggers the requirement to apply for Environmental Authorisation. An ecological assessment is required 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 and biodiversity of the proposed mining 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 were performed to obtain ecological and biodiversity information for the proposed study area and identify the ecological characteristics and sensitivity of the site. Four habitats were identified on site, of which the Orange River, drainage lines and their riparian buffer zones are the most sensitive to mining. The shrublands on the calcrete plateau and tillite ridge slopes host a widespread occurrence of *Boscia albitrunca* and is considered to be of high sensitivity. Furthermore, the substrate of the open shrubland on alluvium poses high runoff and sedimentation risks to the adjacent watercourses and is therefore also considered to be of high sensitivity. The most profound impacts expected to be related to the proposed mining operation include cumulative loss of intact habitat and biodiversity on a landscape level, as well as potential loss in soil fertility and loss of *Boscia albitrunca* recruits. Saplings are rarely visible during clearance operations and therefore the younger populations often get wiped out completely. Permit applications need to be lodged with the Northern Cape Department of Environment and Nature Conservation three months prior to any removal of protected species. Similarly, a licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries three months prior to any potential disturbances to the *Boscia albitrunca* trees. If any of the watercourses will be impacted, then a general authorisation or water use license should be obtained from Department of Water and Sanitation, prior to such activities.

The destruction of the natural plant species and habitats is inevitable during mining operations, but the significance of the impacts will ultimately be affected by the success of the mitigation measures implemented during the mining operation. In my opinion, authorisation for the proposed operation can be granted. However, the applicant should commit to the strict adherence of effective avoidance, management, mitigation, and rehabilitation measures.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

1.1. Background information

Renaissance Resources (Pty) Ltd is proposing the mining of diamonds on Portion 15 and Portion 23 of the Farm Lanyon Vale 376 (from hereon referred to as Lanyon Vale). The mining right area is located within the Hay District of the Northern Cape Province. It lies approximately 57 km south-west of the town Douglas on a gravel road that turns off from the R370, leading to Niekerkshoop (Figure 1). The total extent of the mining right area is ± 4 346 ha, with its southern boundary lining the northern banks of the Orange River for ± 8 km.

Renaissance Resources has submitted a Mining Right application, which triggers the requirement for Environmental Authorisation. An ecological assessment is required 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 a desktop assessment and field investigation and provide an ecological assessment report.

This assessment report describes the characteristics of habitats in the proposed mining area, identifies the biodiversity and species of conservation concern, identifies invasive and encroaching species and their distribution, indicates the source of impacts from the mining 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 EMPR.

1.2. Scope of study

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

- conduct a desktop study and field investigation to identify and describe different ecological habitats and provide an inventory of biodiversity, i.e., 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

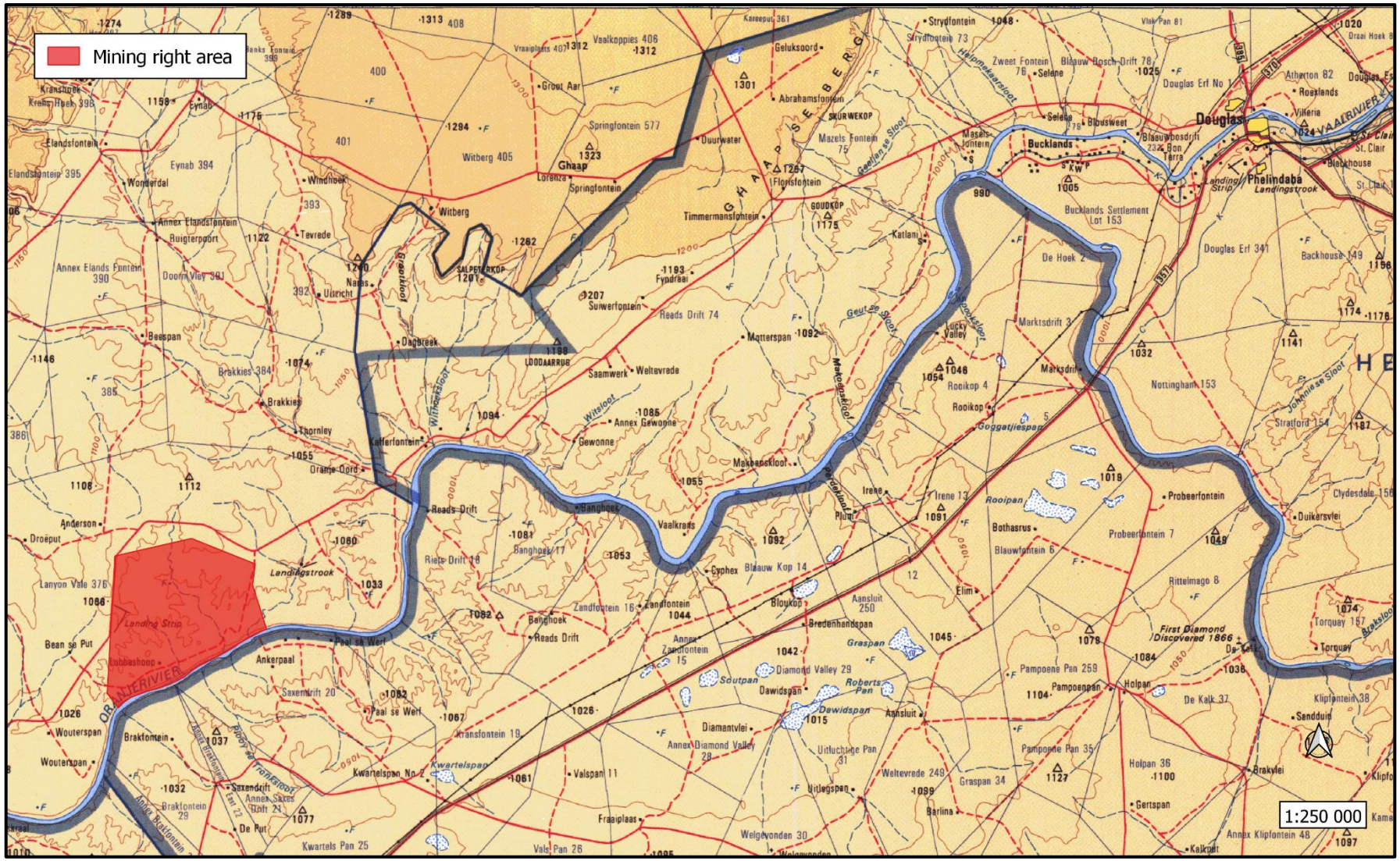
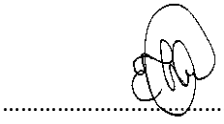


Figure 1. The location of the Lanyon Vale mining area in relation to the nearest town.

- 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 0216 Private Bag X37 Lynnwood Ridge 0040		
Contact Person	Dr Elizabeth (Betsie) Milne (Pr. Sci. Nat)		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	Professional Natural Scientist - Ecological Science (Registration No: 131395) 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 mining operation is primarily based on alluvial diamond deposits that are restricted to the lower-, intermediate- and higher alluvial terraces of the Orange River (Figure 2). Deposits will be sampled 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 a sorting plant 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. Approximately 350 ha of surface area will be cleared for mining purposes over 10 years.

Mining activities will make use of existing roads where possible, but haul roads will also be created to access the mining areas. Supporting infrastructure include temporary office, workshop and ablution facilities with chemical toilets, storm water control berms, water tanks, fuel storage facility, wash bay, salvage yard, waste disposal site, a central processing plant and pipeline infrastructure.

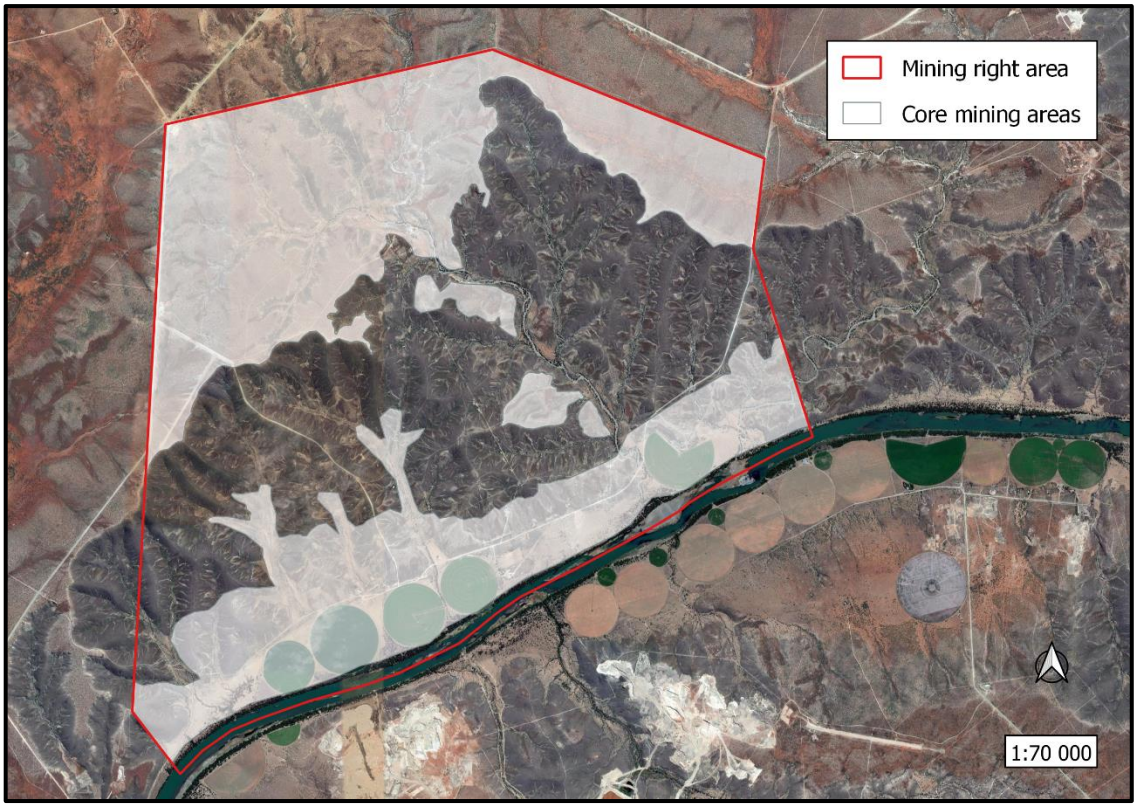


Figure 2. The proposed core footprint area for mining activities on Lanyon Vale.

2. METHODOLOGY

2.1. Data collection

The study comprised a combination of field and desktop surveys for data collection on fauna and flora to obtain a relatively comprehensive data set for the assessment.

The fieldwork component was conducted on 16 August 2022 and most data for the desktop assessment was obtained from the quarter degree squares that includes the study area (2923AA, 2923AB, 2923AC, 2923AD).

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 mining area. Representative sampling plots were allocated in these units and sampled with the aid of a GPS 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, associated species 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 (NC077) Local Municipality - Pixley ka Seme District Municipality, 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 broad geographical area that includes the study site (Figure 3). 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 2020).

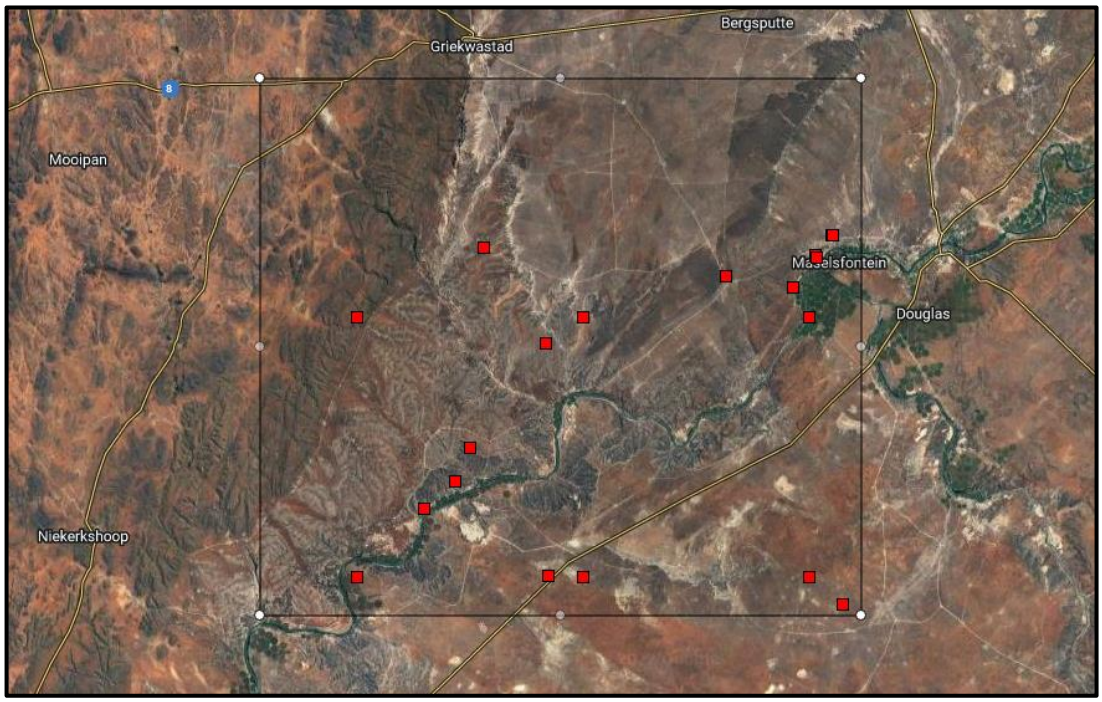


Figure 3. The extent of the map filter applied on the POSA website to extract species information is shown by the large black square. The small red squares indicate historical data points.

2.3. Fauna

2.3.1. Desktop Survey

A desktop survey was undertaken to obtain lists of mammals, reptiles, amphibians, birds, fish and invertebrates which are likely to occur in the study area 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 Thirion (2007), Picker et al. (2004) and Griffiths et al. (2015) for invertebrates. A map of important bird areas (BirdLifeSA 2015) was also consulted.

Additional information on faunal distribution was extracted from the various databases hosted by the ADU web portal, http://adu.org.za, as well as from the Baboon Spider Atlas https://www.baboonspideratlas.co.za/, the Freshwater Biodiversity Information System (FBIS) https://freshwaterbiodiversity.org/, and iNaturalist https://www.inaturalist.org/. The faunal species lists provided are based on species known to occur in the broad geographical area, as well as an 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, Minter et al. 2004, Bates et al. 2014, Taylor et al. 2015, ADU 2016) and comparing their habitat preferences with the habitats described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria (IUCN 2019) and/or the various red data books/red lists 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

The study took place during late winter, which is not an optimal time of the year. The area received good summer rainfall, but most grasses and annuals were dormant during the time of the field survey and therefore the vegetation was not in a favourable state for the assessment. Furthermore, due to the brief duration of the survey and lack of seasonal coverage, the species lists reflected in this report cannot be regarded as fully representative. Ideally, a site should be visited during different seasons to ensure the variation in species presence and habitat conditions are captured. However, this is rarely possible due to time and cost constraints related to mining right application processes. The survey was nevertheless conducted in a manner to ensure all representative communities were traversed, to include most of the common and important species present.

2.5. Sensitivity mapping and assessment

An ecological sensitivity map of the site was produced by integrating 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 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

The major land uses in the area are mining and agriculture. According to AGIS, the land capability of the study site is moderate along the river, low on the plateau, and very low along the ridge slopes. Irrigation suitability is excellent along the river, but low on the remainder of the site. The region is demarcated for sheep farming, with the grazing capacity on site being 24 ha/LSU. Apart from the proposed mining activities, the mining right application area is mainly used for agriculture. Crop irrigation is practised along the river, while the remaining areas are utilised as natural pastures for livestock grazing. Several surface disturbances and old diggings are evident and numerous earth berms have been constructed across the drainage network (Figure 4). Existing infrastructure include a homestead, farm building and roads (Figure 4).

3.2. Geology, soils, and topography

According to 1:250 000 Geological Map of 2922 Prieska, published by the Council for Geoscience in 1995, the geological features on Lanyon Vale comprise Quaternary, Tertiary and Carboniferous deposits. The northern plateau comprise calcrete, while the ridge slopes comprise Dwyka tillites of the Karoo Supergroup (Figure 5). Alluvium is found along the river (Figure 5). Higher terrace diamond deposits are associated with the calcrete, while intermediate terraces are located among the tillites. Lower terrace gravel is associated with the alluvium.

The calcrete plateau and alluvium along the river are characterised by level plains with some relief, while the tillite slopes are characterised by open ridges. Altitude ranges between 940 - 960 m along the alluvium, 980 – 1 000 m on the slopes, and 1 020 – 1 060 m along the calcrete plateau. The terrain is indicated by a level to gentle slope of 1 % on the plateau and 3% on the alluvium but increases to 5 - 8 % on the tillite slopes.

Land types found on the property include Ag115, Fc565 and Ia124 (Figure 6). The calcrete terraces, represented by the Ag115 land type, are characterised by red-yellow apedal, freely drained soils, red, with high base status, and are shallow (< 300 mm deep). The slopes, depicted by the Fc565 landtype, comprise Glenrosa and/or Mispah forms, usually shallow, on hard or weathering rock, with lime generally present. The areas along the river (Ia124 landtype) comprise undifferentiated, deep, alluvial deposits.

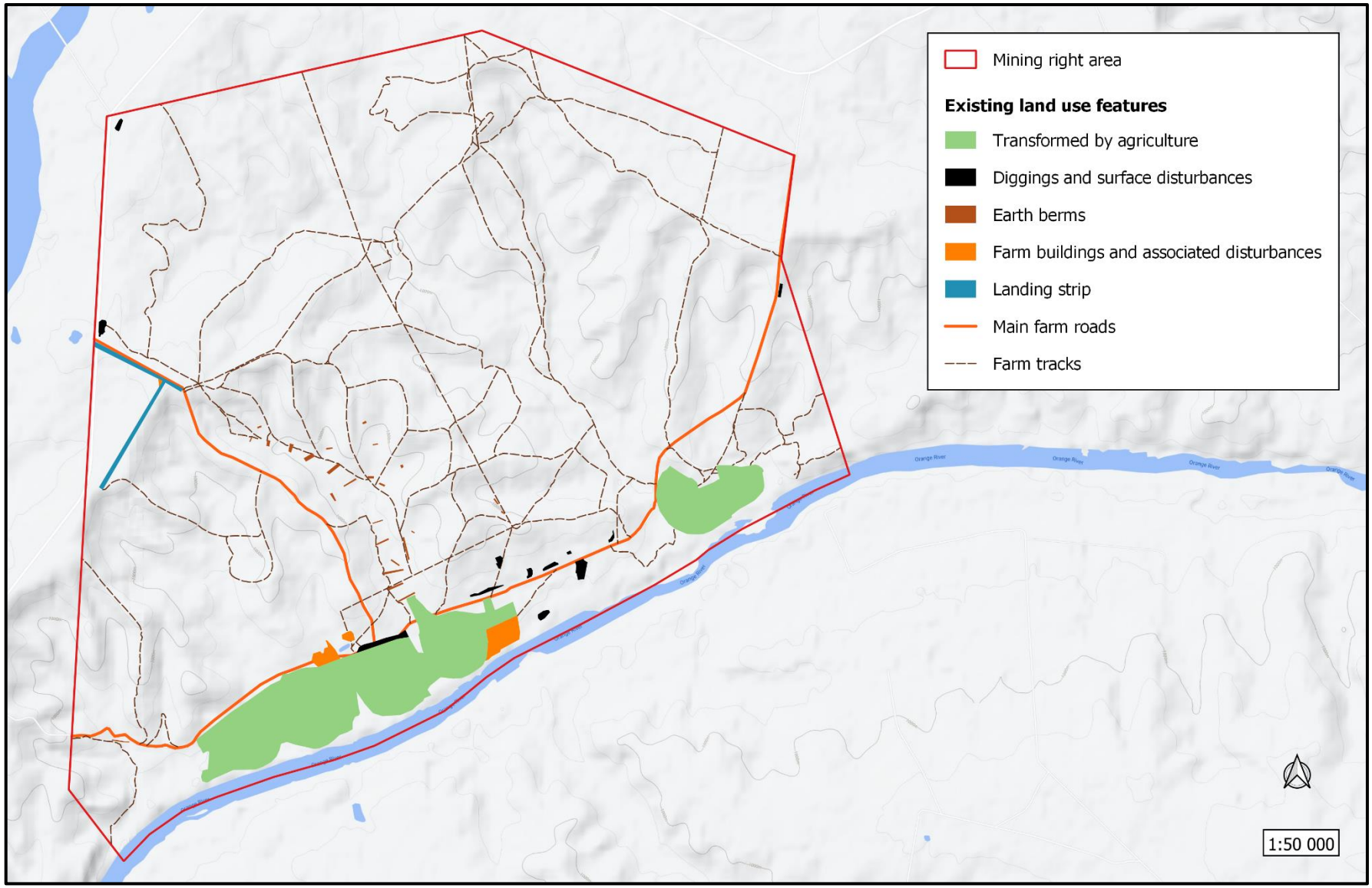


Figure 4. Evidence of existing infrastructure and past disturbances in the study area.

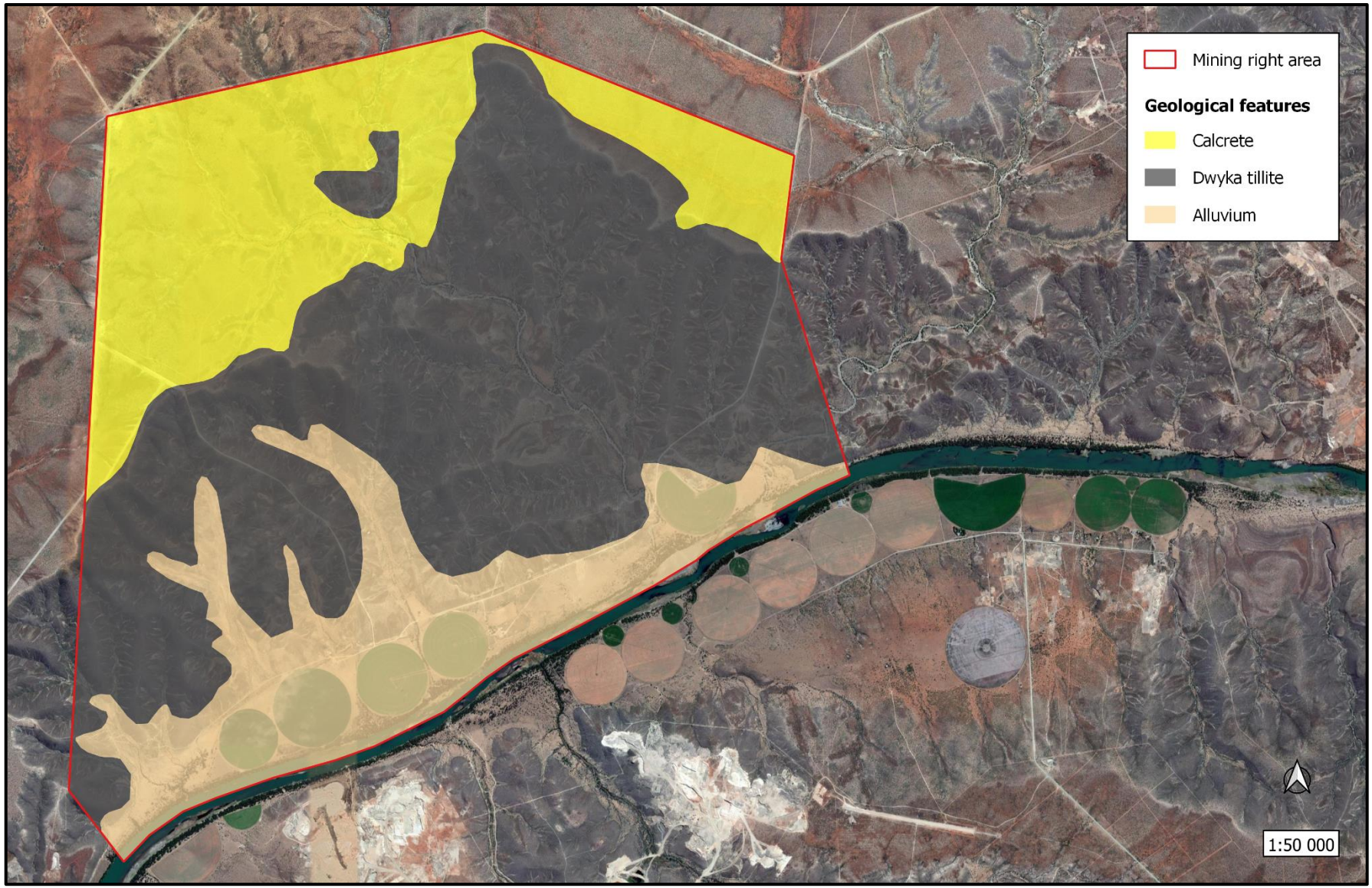


Figure 5. The distribution of geological features in the study area.

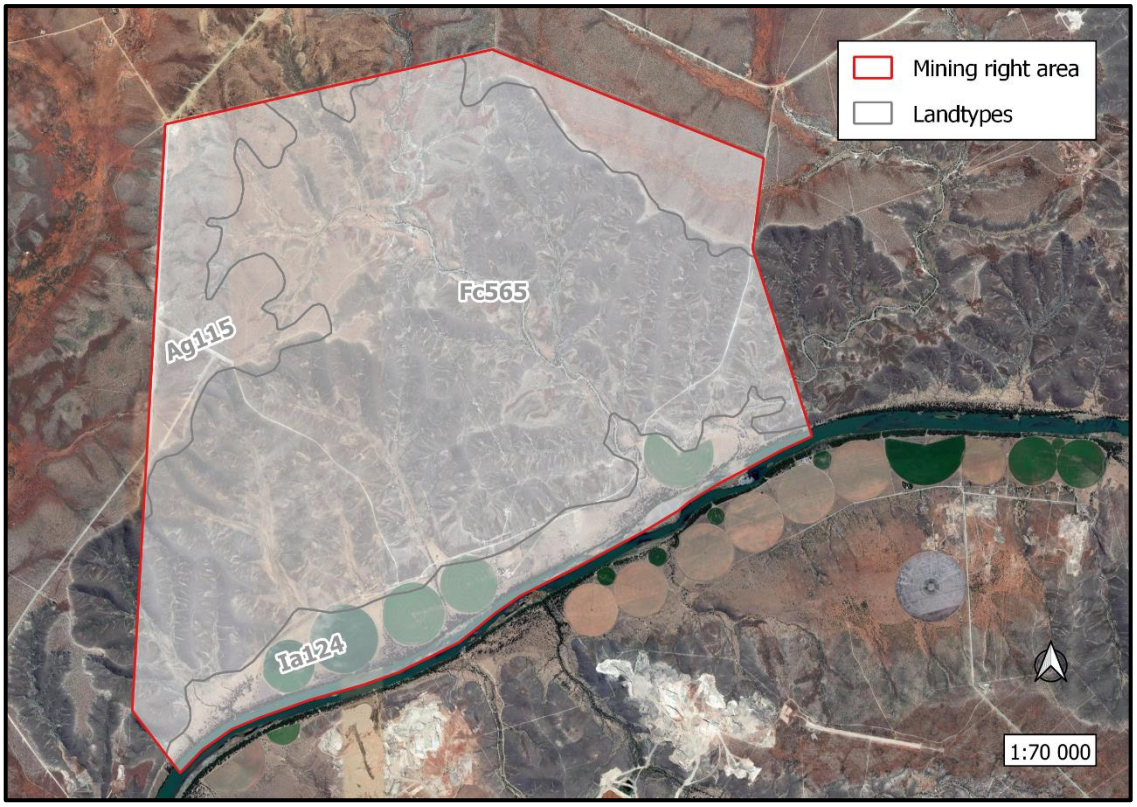


Figure 6. The distribution of land types in the study area.

Soils of the study area have moderately high wind- and water erosion susceptibility. Rainfall erosivity is low due to the arid climate, but the steep terrain of the slopes and drainage networks are most susceptible to water erosion during flooding events. Deep erosional features were observed along drainage network on the alluvium, during the field survey (Figure 7).

Figure 7. Very deep erosional features occur along the drainage network on the alluvium.

3.3. Water resources

The National Water Act (36 of 1998) (NWA) provides a framework to protect water resources. According to this Act, a water resource includes a watercourse, surface water, estuary, or aquifer; whereas a water course includes:

a) a river or spring,
b) a natural channel in which water flows regularly or intermittently,
c) a wetland, lake or dam into which, or from which, water flows, and
d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.

Any reference to a watercourse includes its bed and banks and a water resource does not only include the water within the system, but also the entire water cycle; i.e. evaporation, precipitation, the habitats and processes.

The purpose of this Act (Section 2) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors - (g) protecting aquatic and associated ecosystems and their biological diversity and (h) reducing and preventing pollution and degradation of water resources.

No activity may take place within a watercourse unless authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

The Lanyon Vale study area falls within the Boegoeberg quaternary catchment D71C of the Lower Orange Water Management Area (Figure 8). This quaternary catchment has been allocated a Present Ecological State (PES) of 'Moderately Modified' (C) by Smook et al. (2002) and information regarding its mean annual rainfall, evaporation potential and runoff is provided in Table 2.

Table 2. Catchment characteristics for the Boegoeberg quaternary catchment in which the study area falls, as presented by Smook et al. (2002).

Quaternary catchment	Catchment Area (km^2)	Mean Annual Rainfall (mm)	Mean Annual Evaporation (mm)	Mean Annual Runoff (10^6 m^3)
D71C	1 592	250	2 350	4.75

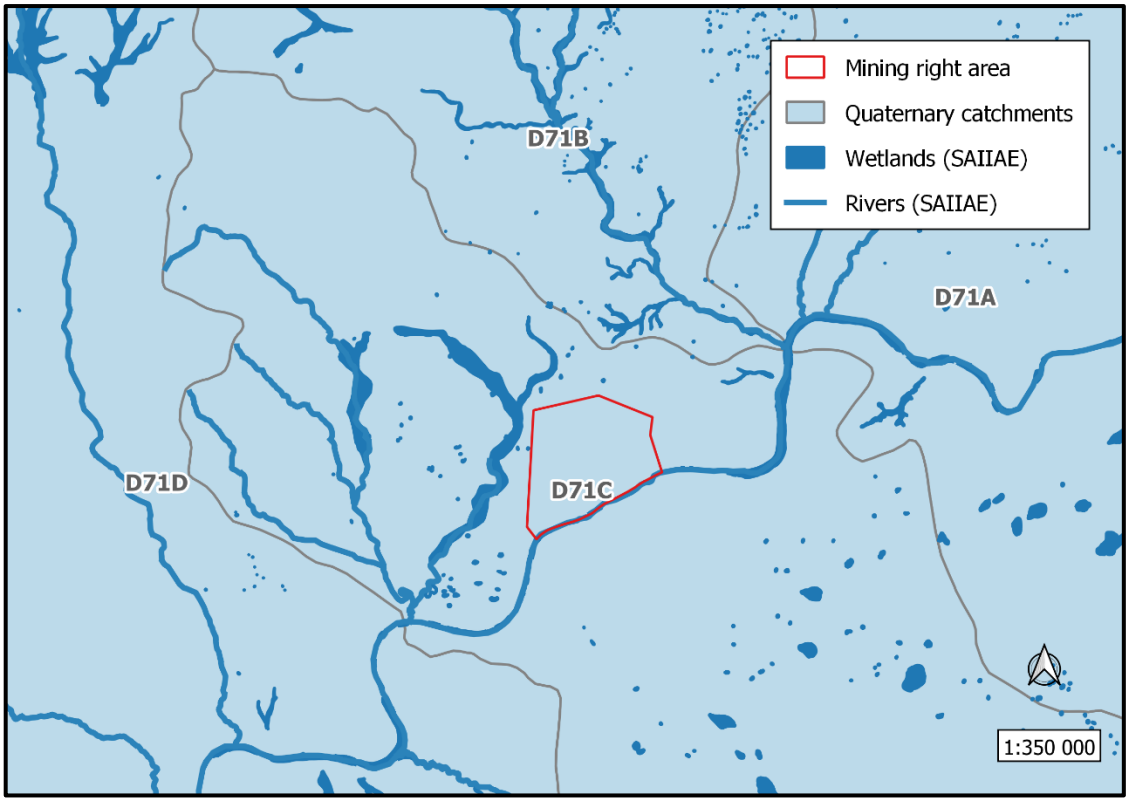


Figure 8. The locality of the proposed mining area in relation to the Boegoeberg quaternary catchment of the Lower Orange Water Management Area.

According to the South African Inventory of Inland Aquatic Ecosystems (SAIIAE), the study area falls within the Upper Karoo Bioregion, where 1.9 % (236 551 ha) of the land area is covered by inland wetlands, including depressions, floodplains, seeps and valley-bottom wetland types (Van Deventer et al. 2019). Their spatial extent according to their present ecological status is depicted in Table 3. Most of these wetlands have been moderately to severely modified.

The Orange River, with its associated wetlands and riparian zone, lines the mining right border in the south and an extensive network of drainage lines occur on site (Figure 9).

Table 3. Percentage of inland wetland spatial extent according to the present ecological status per wetland type of the Southern Namib Desert Bioregion.

Wetland type	Total Extent (%)	% Natural or near-natural (A/B)	% Moderately modified (C)	% Heavily to severely/critically modified (D/E/F)
Depression	27.9	49	10.6	40.4
Floodplains	27.5	0.4	1.7	98
Seeps	2.8	11.9	76.2	11.9
Valley-bottom	41.8	5.5	35.1	59.4

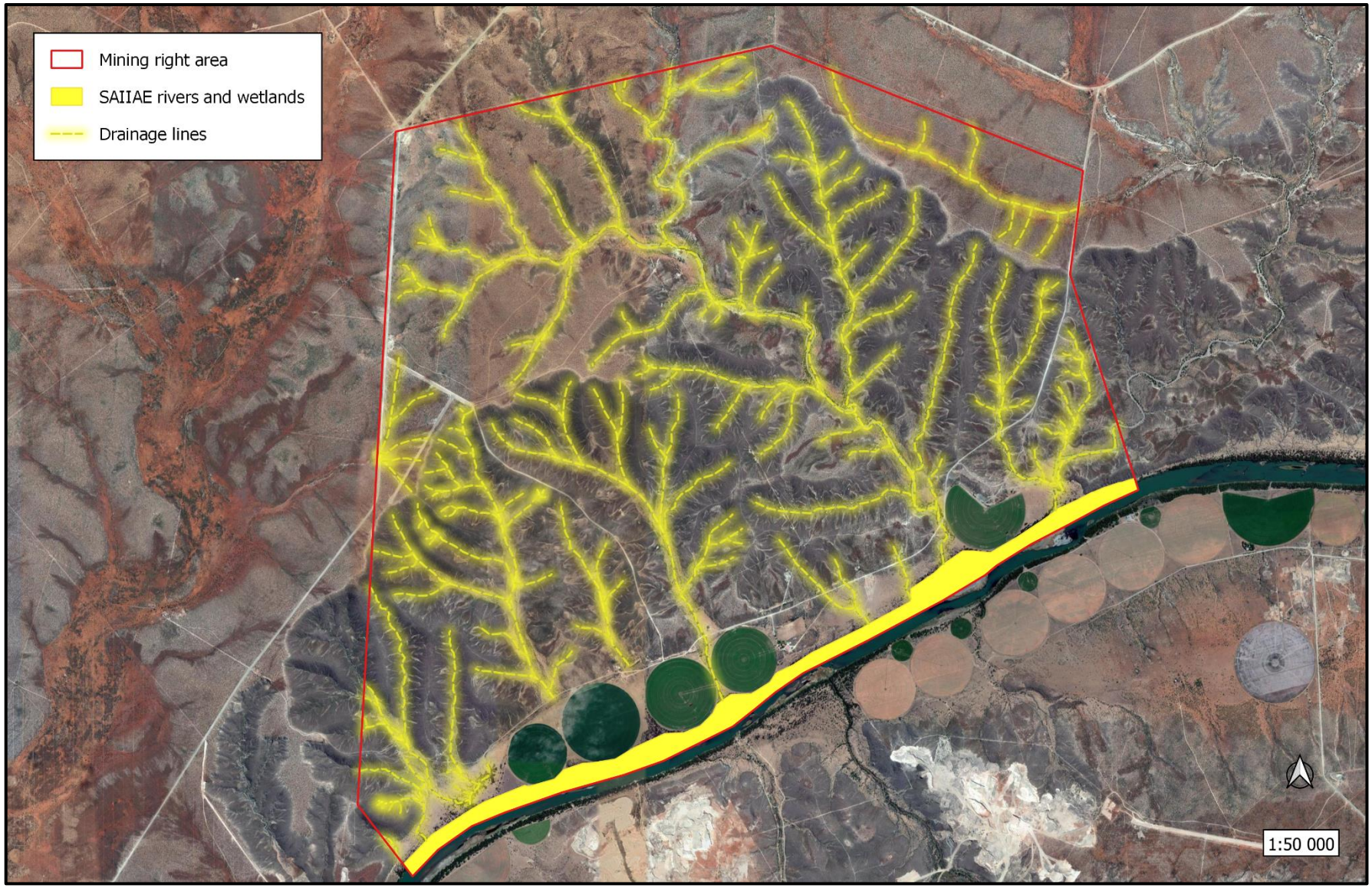


Figure 9. The location of SAIIAE wetlands and drainage lines on the proposed mining right area.

3.4. Vegetation

3.4.1. Broad-scale vegetation patterns

The study area falls within the Nama Karoo and Azonal Vegetation Biomes (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. Northern Upper Karoo and Upper Gariep Alluvial Vegetation (Figure 10).

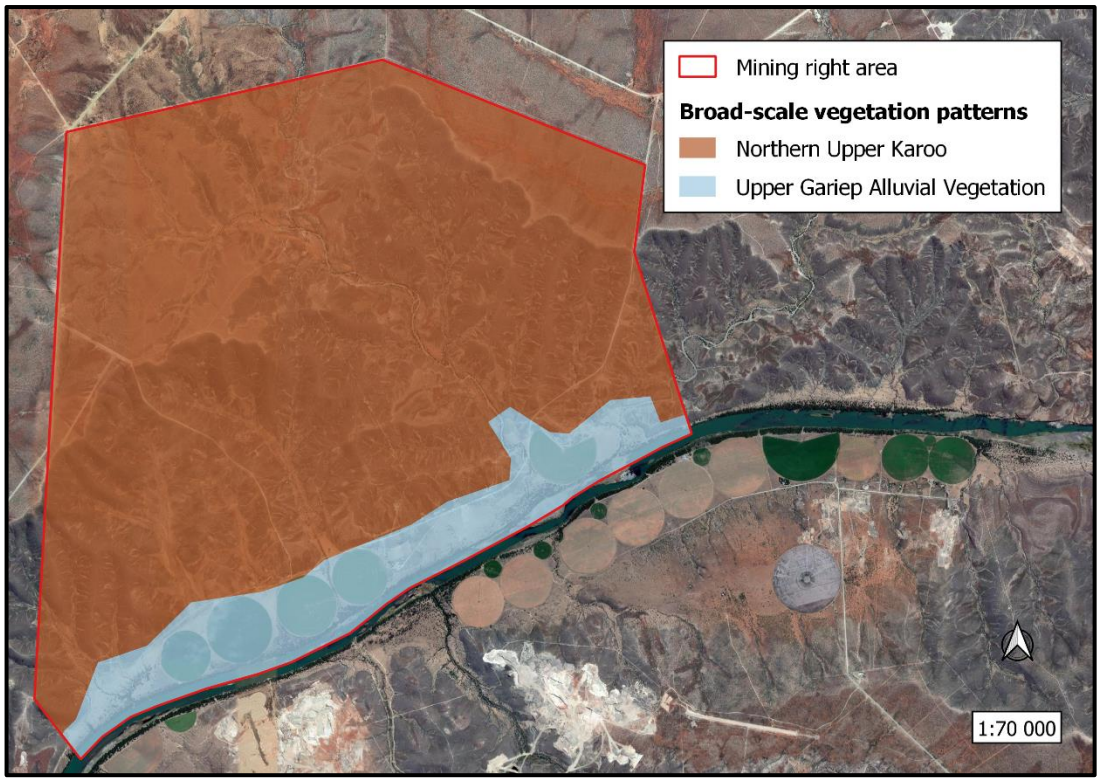


Figure 10. The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.

Northern Upper Karoo is found in the Northern Cape and Free State at altitudes between 1 000 and 1 500 m. It is mainly restricted to the Northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Phillipstown, Petrusville and Petrusburg in the east. The topography is typically flat to gently sloping, with isolated hills in the Upper Karoo Hardeveld (in the south) and Vaalbos Rocky Shrubland (in the northeast). Numerous pans are interspersed in this unit. The vegetation occurs mainly as shrubland dominated by dwarf karoo shrubs, grasses and *Senegalia mellifera*. The geology and soil of this unit varies greatly.

Geology includes shales of the Volksrust Formation, Dwyka Group Diamictite, Jurassic Karoo Dolerite sills and sheets, and calcretes of the Kalahari Group. Soils range from shallow to deep, red-yellow, apedal, freely drained to very shallow Glenrosa and Mispah forms. The most dominant landtypes are Ae, Ag and Fc. It is estimated that about 4 % of the Northern Upper Karoo has been cleared for cultivation or transformed by building of dams; and human settlements are increasing in the north-eastern parts. Erosion is moderate, very low and low, while *Prosopis glandulosa*, considered among the top 12 agriculturally significant invasive alien plants in South Africa, are widely distributed in this unit. The unit is classified as being least threatened and it is not currently conserved within any formal conservation areas. Endemic plant species known from this unit include *Lithops hookeri, Stomatium pluridens, Atriplex spongiosa, Galenia exigua* and *Manulea deserticola*.

Upper Gariep Alluvial Vegetation is found in the Northern Cape and Free State and includes the broad alluvia of the Orange River, lower Caledon and the lower stretches of the Vaal, Riet and Modder Rivers as far as Groblershoop. The topography is typically flat alluvial terraces that host riparian thicket vegetation (dominated by *Vachellia karroo* and *Diospyros lycioides*), flooded grasslands, reed beds and ephemeral herblands found mainly on sand banks within the river and on the riverbanks. The geology is presented as recent alluvial deposits underlain by Karoo Supergroup sediments and tillites. The soils are typically of the Ia group land types. This unit is subject to flooding during summer. It is estimated that more than 20 % has been transformed for cultivation and the building of dams. Exotic woody species like *Salix babylonica, Eucalyptus camaldulensis, E. sideroxylon, Prosopis* and *Populus* spp. dominate heavily disturbed alluvial vegetation. The unit is classified as being vulnerable and only 3 % is conserved within formal conservation areas, i.e. Tussen Die Riviere, Gariep Dam and Oviston Nature Reserves. No endemic plant species are known from this unit.

3.4.2. 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 four distinct units (Figure 11), which are described below. These descriptions include unique characteristics and the dominant species found in each unit. Those areas transformed by agriculture were excluded from the assessment. A complete plant species list, including those species likely to occur here is presented in Appendix 1.

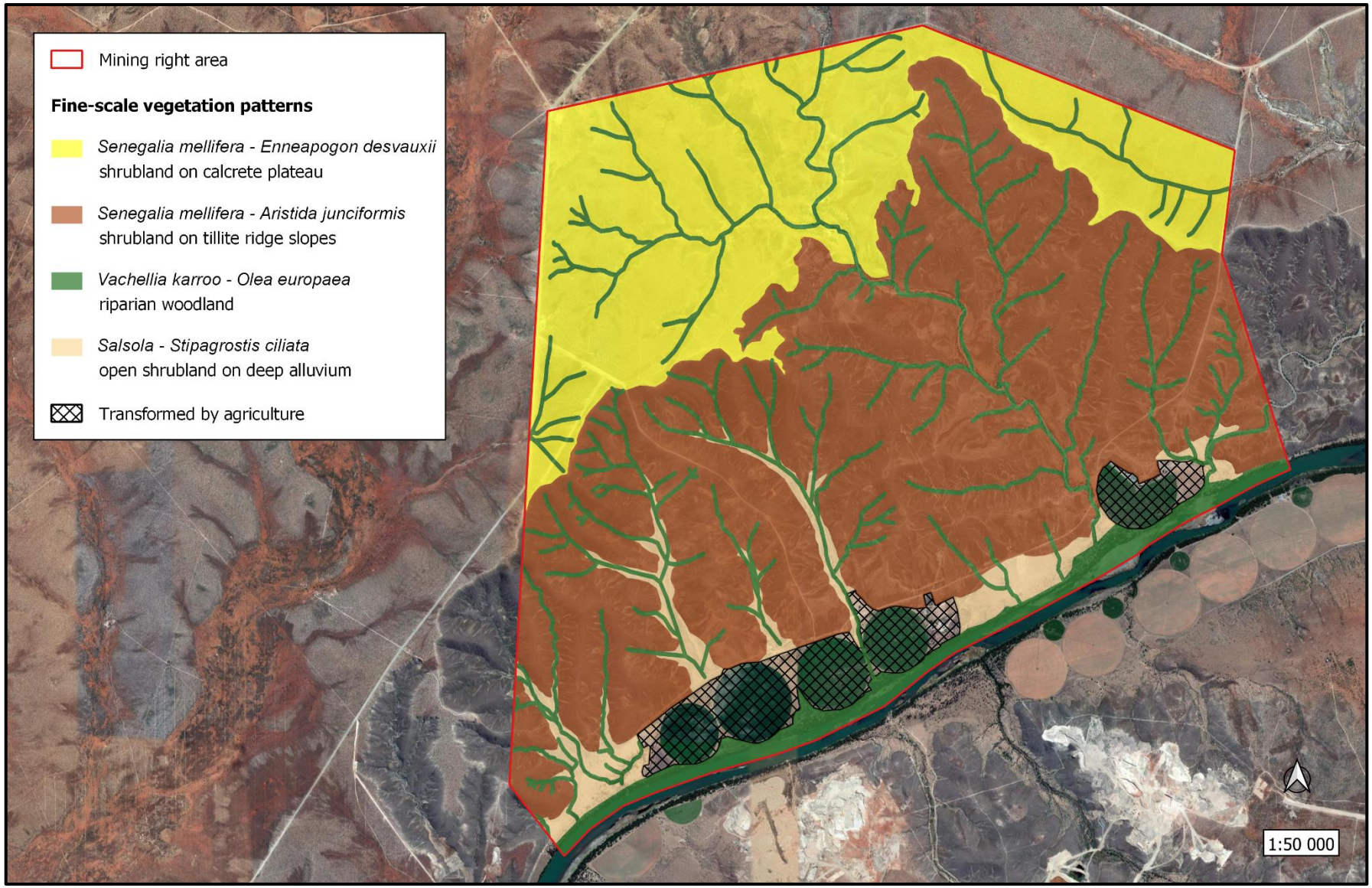


Figure 11. The distribution of fine-scale plant communities in the study area.

i) *Senegalia mellifera - Enneapogon desvauxii* shrubland on calcrete plateau

This community occurs on the calcrete plateau in the north of the study area (Figure 11). The vegetation is presented as shrubland with tall shrubs scattered in a short grassy matrix, intermixed with dwarf shrubs (Figure 12). Rocky, calcareous soil covers ± 20 - 30 % of the ground surface and biological soil crusts are prominent (Figure 12).

Senegalia mellifera dominates the tall shrub layer, but *Boscia albitrunca* is also common. Other tall and medium-sized shrubs include *Rhigozum obovatum, R. trichotomum, Cadaba aphylla, Searsia tridactyla, S. burchellii, Ehretia rigida* and *Nymania capensis*. The dwarf shrub layer, dominated by *Pentzia incana* and *Roepera lichtensteiniana*, is more diverse and also includes *Oedera humilis, Felicia fascicularis, Peliostomum origanoides, Aptosimum spinescens, Barleria rigida, Asparagus suaveolens, Lycium cinereum, Pteronia mucronata, Lasiosiphon polycephalus, Sericocoma avolans, Blepharis mitrata, Pegolettia retrofracta, Thesium lineatum, Plinthus karooicus, Aizoon secundum, A. schellenbergii* and *Salsola* sp.

The grass layer is predominantly short and dominated by *Enneapogon desvauxii*, but other grasses include *Cenchrus ciliaris, Aristida adscensionis, Eragrostis echinochloidea, Stipagrostis obtusa, S. uniplumis, S. ciliata* and *Fingerhuthia africana*.

Herbs include *Geigeria ornativa, Lasiopogon muscoides* and the succulent *Aloe hereroensis* var. *hereroensis*.

Figure 12. The calcrete plateau is presented by a shubland community with a tall shrub layer growing among a short grassy matrix intermixed with low shrubs (top). The shallow calcareous soil is covered with biological soil crusts (bottom).

ii) *Senegalia mellifera - Aristida junciformis* shrubland on tillite ridge slopes

This community covers the central parts of the study area (Figure 11), where it occurs on the rocky slopes of the tillite ridges, with many calcrete intrusions. Rocks constitute 20 – 30% of the ground cover. The vegetation presents continuous transitions between calcrete and tillite affinities and share many of the species found on the calcrete plateau. Here however, the grassy matrix is dominated by taller species (Figure 13).

Senegalia mellifera dominates the tall shrub layer, but other species include *Searsia tridactyla, Boscia albitrunca, Nymania capensis, Rhigozum obovatum* and *Ehretia rigida.* The diverse dwarf shrub layer includes *Eriocephalus decussatus, Euryops dregeanus, Justicia incana, Fagonia isotricha* var. *isotricha, Tetraena microcarpa, Roepera lichtensteiniana, Aizoon asbestinum, A. secundum, Pteronia glauca, P. mucronata, Felicia fascicularis, Barleria rigida, Aptosimum spinescens, Peliostomum origanoides, Pentzia incana, Lasiosiphon polycephalus, Lycium cinereum, Asparagus suaveolens* and *Oedera humilis.*

The grass layer is dominated by *Aristida junciformis,* but the low growing *Enneapogon desvauxii* is also common. Other common tall grass species include *Stipagrostis ciliata, Fingerhuthia africana, Eragrostis annulata, Aristida adscensionis* and *Cenchrus ciliaris.*

Herbs include *Senecio consanguineus, Barleria lichtensteiniana, Aptosimum indivisum, Dicoma capensis, Oxalis lawsonii, Limeum aethiopicum, Geigeria ornativa*, the bulb *Ornithoglossum dinteri* and the succulent *Aloe claviflora.*

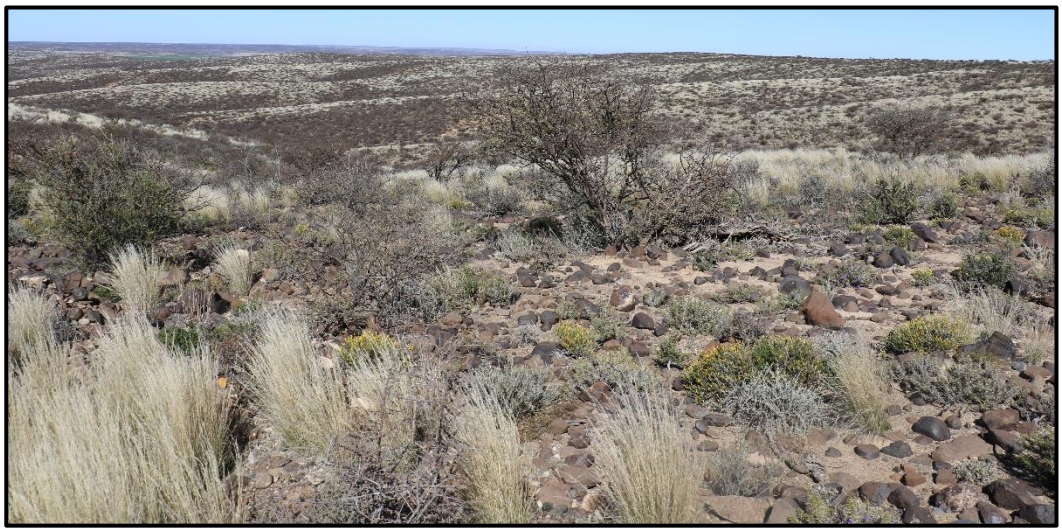


Figure 13. The matrix of the shrubland on ridge slopes is dominated by taller grass species.

iii) Riparian woodlands

This community lines the banks of the Orange River as well as the numerous drainage channels across the study area (Figure 11). The tree community transition from *Vachellia karroo* dominated woodland in the south to *Olea europaea* dominated woodland along the upper reaches of the drainage lines (Figure 14). In some areas, the woodland along the Orange River has been severely degraded and replaced by reed beds, dominated by *Phragmites australis* with shrubs and alien forbs along the fringes (Figure 14).

Apart from the dominant *V. karroo, Searsia pendulina, Eucalyptus camaldulensis* and *Salix mucronata* are also common in the canopy along the river. *Lycium hirsutum* and *Asparagus retrofractus* form almost impenetrable layers in the understory, while the floor is dominated by weeds, especially *Bidens bipinnata,* but also *Argemone ochroleuca, Sisymbrium capense, Senecio consanguineus, Urtica urens* and *Datura ferox.* Along the drainage lines, *O. europaea* co-occurs with *Tarchonanthus camphoratus, Searsia burchellii, Senegalia mellifera, Boscia albitrunca* and *Ziziphus mucronata* subsp. *mucronata*. The grasses *Fingerhuthia africana* and *Cenchrus ciliaris* are common here.

iv) *Salsola - Stipagrostis ciliata* open shrubland on deep alluvium

This community occurs in the south of the study area (Figure 11) on deep, consolidated alluvium. It represents remnant patches in between those areas already transformed by agriculture but is also associated with the broader channels in the lower reaches of the drainage network. It has been subject to severe degradation, with sparse vegetation cover and numerous erosional features (Figure 15).

The vegetation is presented as open shrubland, dominated by low shrubs, but with *Senegalia mellifera* scattered across the community. *Salsola* sp. dominates the low shrub layer, but other common species include *Lycium cinereum, Peliostomum origanoides, P. leucorrhizum, Aptosimum spinescens, Aizoon schellenbergii, A. secundum, Melolobium candicans, Lasiosiphon polycephalus* and *Plinthus karooicus*. The grassy matrix is dominated by *Stipagrostis ciliata*, but *Stipagrostis obtusa, Aristida congesta* subsp. *congesta* and *Enneapogon cenchroides* are also common. Herbs include *Lotononis laxa, Dicoma capensis, Sesamum triphyllum, Laggera decurrens* and the invasive Xanthium spinosum.

Figure 14. The riparian woodland along the banks of the Orange River is dominated by *Vachellia karroo* (top) and has been replaced by reedbeds in some places (centre). The woodland along the drainage lines in the upper reaches is dominated by *Olea europaea* (bottom).

Figure 15. The open shrubland on the deep alluvium has been degraded, with vegetation growing sparsely among erosional features.

3.4.3. 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, which are protected under the National Environmental: Biodiversity Act (Act No. 10 of 2004) (NEMBA), 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 from the region are classified as least concern; a category which includes widespread and abundant taxa. However, two species are red listed (Table 4). *Acanthopsis hoffmannseggiana* (Data Deficient – Taxonomically Problematic (DDT)) was not recorded during the survey, but they typically occur on the rocky shrublands in the region. It is a widespread and variable species that possibly contains several taxa, some of which may be of conservation concern and more study is needed to find reliable distinguishing characters to separate individual taxa. *Salsola smithii* is also listed as DDT. The entire *Salsola* genus needs taxonomic revision because its species are poorly defined and difficult to separate. Therefore, based on currently available data, the risk of extinction of this species cannot be assessed. *Salsola* sp. was common in the open shrubland on alluvium, but its identity could not be determined.

Species protected in terms of the National Forest Act include *Boscia albitrunca* (Table 4). It was recorded in the woodland lining the drainage channels in the upper reaches of the site as well as in the shrublands on calcrete and tillite (Figure 16). On the calcrete plateau it occurred at moderate densities of ± 2 - 3 individuals per hectare, represented by the entire population size range, i.e. saplings (70 cm (d) x 50 cm (h)), young shrubs (1.5 (d) x 1 m (h)), stunted shrubs (1 m (d) x 30 cm (h)) and adult trees (3 m (d) x 2 – 2.5 m (h)). The same is true for the population on the ridge slopes, but here they occurred at lower densities of ± 1 individual per hectare. Larger trees of 2 - 3 m in height x 3 - 5 m in diameter were recorded along the banks of the drainage lines.

Table 4. Plant species found in the region that are of conservation concern. Those recorded during the field survey is highlighted in red.

FAMILY	Scientific name	Status	NFA	NCNCA
ACANTHACEAE	*Acanthopsis hoffmannseggiana*	DDT		
AIZOACEAE	*Lithops hookeri*			S2
AIZOACEAE	*Mestoklema arboriforme*			S2
AIZOACEAE	*Mestoklema copiosum*			S2
AIZOACEAE	*Psilocaulon articulatum*			S2
AIZOACEAE	*Psilocaulon coriarium*			S2
AIZOACEAE	*Titanopsis calcarea*			S2
AMARANTHACEAE	*Salsola smithii*	DDT		
AMARYLLIDACEAE	*Ammocharis coranica*			S2
AMARYLLIDACEAE	*Crinum bulbispermum*			S2
AMARYLLIDACEAE	*Nerine laticoma*			S2
APIACEAE	*Deverra burchellii*			S2
APOCYNACEAE	*Fockea angustifolia*			S2
APOCYNACEAE	*Microloma armatum* var. *armatum*			S2
APOCYNACEAE	*Piaranthus decipiens*			S2
ASPHODELACEAE	*Aloe claviflora*			S2
ASPHODELACEAE	*Aloe hereroensis* var. *hereroensis*			S2
BRASSICACEAE	*Boscia albitrunca*			S2
CELASTRACEAE	*Gymnosporia buxifolia*			S2
COMBRETACEAE	*Combretum erythrophyllum*			S2
EUPHORBIACEAE	*Euphorbia davyi*			S2
EUPHORBIACEAE	*Euphorbia patula*			S2
FABACEAE	*Lessertia frutescens* subsp. *frutescens*			**S1**
HYACINTHACEAE	*Ornithogalum flexuosum*			S2
IRIDACEAE	*Babiana bainesii*			S2
IRIDACEAE	*Freesia andersoniae*			S2
IRIDACEAE	*Moraea pallida*			S2
IRIDACEAE	*Moraea polystachya*			S2
MELIACEAE	*Nymania capensis*			S2
OLEACEAE	*Olea europaea* subsp. *africana*			S2
OXALIDACEAE	*Oxalis haedulipes*			S2
OXALIDACEAE	*Oxalis lawsonii*			S2
SCROPHULARIACEAE	*Jamesbrittenia integerrima*			S2
SCROPHULARIACEAE	*Jamesbrittenia tysonii*			S2
SCROPHULARIACEAE	*Nemesia pubescens* var. *pubescens*			S2

To damage or remove any protected trees (seedlings to adults) an application must be submitted to the Northern Cape Department of Agriculture, Forestry and Fisheries (DAFF) and a licence obtained from DAFF at least three months prior to such activities.

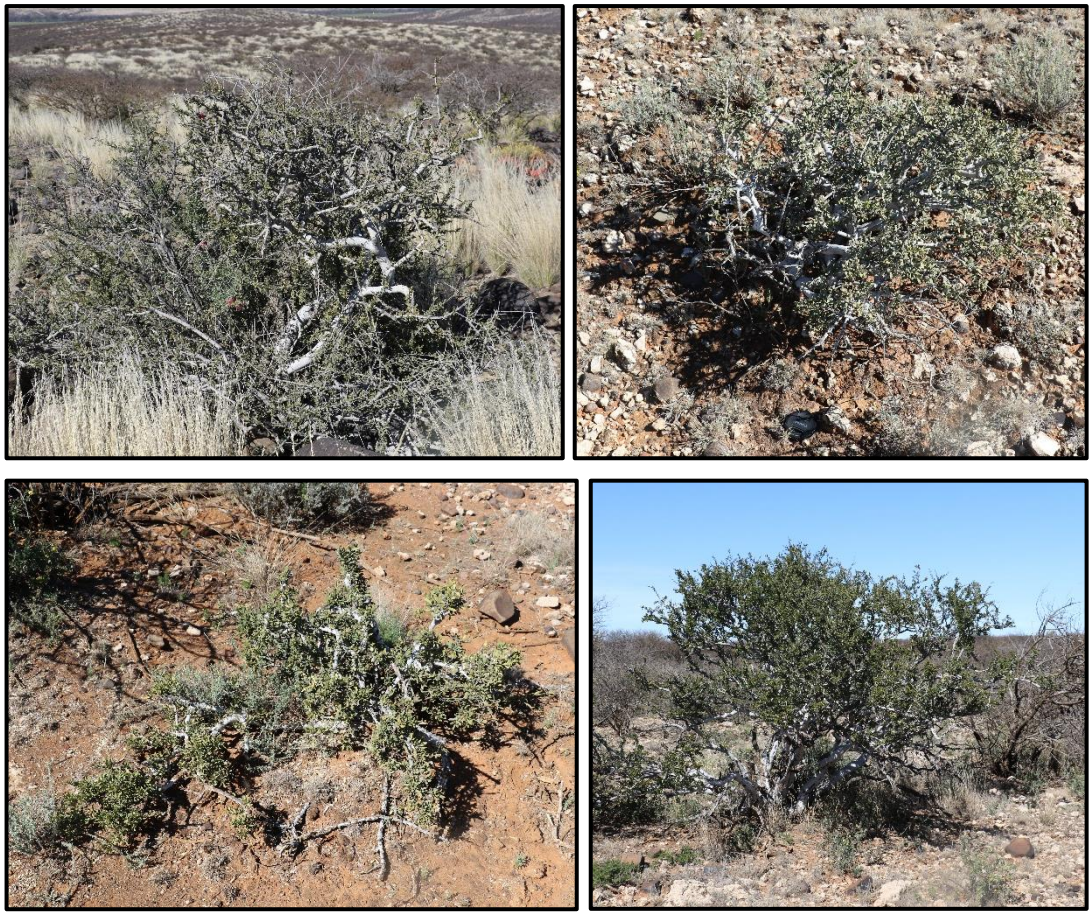


Figure 16. A collage of *Boscia albitrunca* individuals recorded on site.

In addition to these, specially protected species (Schedule 1) and protected species (Schedule 2) of the NCNCA known from the study region are also listed in Table 4. Of these, the two *Aloe* species and *Nymania capensis* were recorded in the shrublands on calcrete plateau and tillite ridge slopes, while *Oxalis lawsonii* was recorded on the ridge slopes. Large *Olea europaea* subsp. *africana* trees were found along the banks of the drainage channels at high densities.

A photo guide to all species of conservation concern recorded in the study area is provided in Appendix 3.

Furthermore, 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.

3.4.4. 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 5). All declared weeds and invasive species recorded on site are listed in Table 6, along with their categories according to CARA, NEMBA and NCNCA.

Table 5. 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 6. A list of declared weeds and invasive species recorded in the study area.

Scientific name	Common name	CARA	NEMBA	NCNCA
Argemone ochroleuca	White - flowered Mexican poppy	1	1b	S6
Datura ferox	Large thorn apple	1	1b	S6
Eucalyptus camaldulensis	River red gum	2	1b	S6
Prosopis velutina	Velvet mesquite	2	3	S6
Xanthium spinosum	Spiny cocklebur	1	1b	S6

3.4.5. 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, recorded on site, are listed in Table 7.

Table 7. Declared indicators of bush encroachment in the Northern Cape recorded in the study area.

Scientific name	Common name
Grewia flava	Velvet Raisin
Rhigozum trichotomum	Three – thorn Rhigozum
Senegalia mellifera	Black Thorn
Tarchonanthus camphoratus	Camphor Bush
Vachellia karroo	Sweet Thorn

3.5. 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 (Schedule 2) or specially protected (Schedule 1) wild 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. According to the act "wild animal" means a live vertebrate or invertebrate animal, and the egg or spawn of such animal. The landscape features on Lanyon Vale provides a few habitat opportunities to faunal communities. Animals likely to be found in the study area are discussed in their respective faunal groups below.

3.5.1. Mammals

As many as 54 terrestrial mammals and nine bat species have been recorded in the region (see Appendix 2), of which nine are listed either in the IUCN or the Mammal Red List of South Africa, Lesotho and Swaziland (Table 8). 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 are also indicated in Table 8.

Table 8. Mammals of conservation concern known from the region. Conservation values are indicated in terms of the international (IUCN) Red List, the Mammal Red List of South Africa, Lesotho and Swaziland (SAMRL) and Schedule 1 of the Northern Cape Nature Conservation Act (NCNCA).

Scientific name	Common name	IUCN	SAMRL	NCNCA
Eidolon helvum	African Straw-coloured Fruit-bat	NT		
Rhinolophus denti	Dent's Horseshoe Bat		NT	
Orycteropus afer	Aardvark			X
Parotomys littledalei	Littledale's Whistling Rat		NT	
Manis temminckii	Ground Pangolin	VU	VU	X
Atelerix frontalis	South African Hedgehog		NT	
Proteles cristata	Aardwolf			X
Felis silvestris	African Wild Cat			X
Felis nigripes	Black-footed Cat	VU	VU	X
Vulpes chama	Cape Fox			X
Hyaena brunnea	Brown Hyena	NT	NT	X
Otocyon megalotis	Bat-eared Fox			X
Aonyx capensis	Cape Clawless Otter	NT	NT	
Poecilogale albinucha	African Striped Weasel		NT	X
Ictonyx striatus	Striped Polecat			X
Mellivora capensis	Honey Badger			X

Aardvark has a high probability to occur on site, especially in the deep sandy alluvium. Honey Badger, Ground Pangolin, Aardwolf, African Wild Cat, Cape Fox, Bat-eared Fox and Striped Polecat also have a high chance of occurring across the site, given their wide habitat tolerances. Pangolins, however, are seldomly encountered due to their inconspicuous nature. Similarly, the South African Hedgehog also has a high chance of occurring on site based on their association with open, arid habitat. The Cape Clawless Otter is expected to be restricted to the Orange River.

Black-footed Cat prefers arid habitat, but their conspicuous nature and mining activities might cause them to avoid the site. African striped Weasel prefers grassland habitat, and the African Straw-coloured Fruit-bat requires fruit trees. Therefore, these species have a moderate chance to be found on site.

The Brown Hyaena has a low potential to be found on site mainly since farm fences are restricting their occurrences across their natural distribution range. The Dent's Horseshoe Bat also has a low chance to be found on site due to their preference for savanna habitat. The Littledale's whistling rat is also not expected to occur on site based on their restricted distribution.

Apart from these special species of conservation concern, Yellow Mongoose, Ground squirrel, Kudu and Steenbok were recorded on site. Vervet Monkey is a problem animal (Schedule 4) also recorded on site, and other problem animals with a high likelihood to occur on site include Black-backed Jackal and Caracal.

3.5.2. Reptiles

The Lanyon Vale mining area lies within the distribution range of at least 36 reptile species (see Appendix 2). No listed species are known to occur in the area, but most reptiles of the study area are protected either according to Schedule 1 or 2 of NCNCA (see Appendix 2). Specially protected species include *Karusasaurus polyzonus* (Southern Karusa Lizard) and *Chamaeleo dilepis dilepis* (Namaqua Chamaeleon). The Karusa Lizard is a rock-dwelling species inhabiting rocky outcrops and could potentially occur along the rocky ridge slopes. The Common Flap-neck Chameleon is typically found high up in bushes or trees and could therefore potentially occur across the site.

South African endemics include *Pachydactylus mariquensis* (Common Banded Gecko), *Lamprophis aurora* (Aurora Snake) and *Homopus femoralis* (Greater Dwarf Tortoise). The Common Banded Gecko prefers sandy soil and sparse vegetation in a variety of habitats such as sandy plains and dry riverbeds. The Aurora Snake is often found near streams and under rocks and old termitaria, while the Greater Dwarf Tortoise occurs in rocky areas with dense vegetation where they take shelter among rocks or under plants. The drainage lines could potentially provide a special habitat for the Marsh Terrapin. Images of these reptile species of special importance are shown in Figure 17.

3.5.3. Amphibians

Fourteen amphibian species are known from the region (Appendix 2). The Orange River and associated pools represents suitable habitat for water-dependent species, and the ephemeral drainage lines is expected to also be important during wet periods for breeding. Those frog species that are fairly independent of water (i.e. Bushveld Rain Frog, Boettger's Caco) are expected to take refuge under rocks and logs, soil cracks, sandy substrates, leaf litter and abandoned mounds of termites.

Southern Karusa Lizard

Common Banded Gecko

Aurora Snake

Greater Dwarf Tortoise

Common Flap-neck Chameleon

Marsh Terrapin

Figure 17. Reptile species of special importance that are expected to occur in the study area, and common species observed during the field survey.

The Giant Bull Frog (*Pyxicephalus adspersus*) (Figure 18) is listed as Near Threatened and is protected according to Schedule 1 of the NCNCA. They prefer seasonal shallow grassy pans, vleis and other rain-filled depressions in open flat areas of grassland or savanna, but mainly remain buried up to 1 m underground until conditions become favourable. The site lies within their known distribution, but no ideal habitat for them occurs on site.

Figure 18. The Giant Bull Frog's distribution range overlaps with that of the study area, but no ideal habitat occurs on site.

All other amphibians of the study area are protected according to Schedule 2 of NCNCA (Appendix 2). Raucous Toad and Southern Pygmy Toad are endemic to South Africa and occur in a variety of terrestrial habitats for most of the time. However, they use temporary waterbodies containing rainwater to breed, including pans, pools, roadsides, farm dams and even quarries, and could therefore also potentially occur on site during the rainy season.

3.5.4. 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 261 bird species have been recorded from the region. As many as 25 listed bird species are known from the region, all of which are classified as Vulnerable, Near Threatened, Endangered or Critically Endangered (Table 9). Furthermore, all birds are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected (Schedule 1) are also listed in Table 9.

Plants, from grass tufts to shrubs and trees provide important micro-habitats to birds and therefore the entire study area is expected to host a diverse avifauna community. The most common bird species of conservation concern expected to occur on site include Kori Bustard (Near Threatened) and Ludwig's Bustard (Endangered) (Figure 19). They are expected to be most active in the shrubland on calcrete terraces and tillite slopes.

Table 9. Birds of conservation concern that are likely to occur on site. Species are indicated in terms of the IUCN, SA Red Data Book and Schedule 1 of the NCNCA.

Scientific name	Common name	IUCN	SA RDB	NCNCA
Accipiter badius	Shikra			X
Anthropoides paradisea	Blue Crane	VU	NT	
Aquila rapax	Tawny Eagle	VU	EN	X
Aquila verreauxii	Verreaux's Eagle		VU	X
Ardeotis kori	Kori Bustard	NT	NT	
Bubo africanus	Spotted Eagle-Owl			X
Bubo lacteus	Verreaux's Eagle-Owl			X
Buteo rufofuscus	Jackal Buzzard			X
Buteo vulpinus	Steppe Buzzard			X
Calidris ferruginea	Curlew Sandpiper	NT		X
Caprimulgus europaeus	European Nightjar			X
Caprimulgus rufigena	Rufous-cheeked Nightjar			X
Caprimulgus tristigma	Freckled Nightjar			X
Charadrius pallidus	Chestnut-banded Plover	NT	NT	X
Ciconia abdimii	Abdim's Stork		NT	
Ciconia nigra	Black Stork		VU	X
Circaetus pectoralis	Black-chested Snake-Eagle			X
Circus maurus	Black Harrier	EN		X
Circus pygargus	Montagu's Harrier			X
Circus ranivorus	African Marsh-Harrier		EN	X
Coracias garrulus	European Roller		NT	
Cursorius rufus	Burchell's Courser		VU	
Elanus caeruleus	Black-shouldered Kite			X
Falco biarmicus	Lanner Falcon		VU	X
Falco naumanni	Lesser Kestrel			X
Falco peregrinus	Peregrine Falcon			X
Falco rupicolis	Rock Kestrel			X
Falco rupicoloides	Greater Kestrel			X
Glareola nordmanni	Black-winged Pratincole	NT	NT	X
Glaucidium perlatum	Pearl-spotted Owlet			X
Gyps africanus	White-backed Vulture	CR	CR	X
Gyps coprotheres	Cape Vulture	VU	EN	X
Haliaeetus vocifer	African Fish-Eagle			X
Hieraaetus pennatus	Booted Eagle			X
Leptoptilos crumeniferus	Marabou Stork		NT	X
Melierax canorus	Southern Pale Chanting Goshawk			X
Melierax gabar	Gabar Goshawk			X
Milvus migrans	Black Kite			X
Neotis ludwigii	Ludwig's Bustard	EN	EN	X
Oxyura maccoa	Maccoa Duck	VU	NT	
Phoenicopterus minor	Lesser Flamingo	NT	NT	X
Phoenicopterus ruber	Greater Flamingo		NT	X
Polemaetus bellicosus	Martial Eagle	EN	EN	X
Polihierax semitorquatus	Pygmy Falcon			X
Polyboroides typus	African Harrier-Hawk			X
Ptilopsus granti	Southern White-faced Scops-Owl			X
Rostratula benghalensis	Greater Painted-snipe		NT	X
Sagittarius serpentarius	Secretarybird	EN	VU	X
Torgos tracheliotus	Lappet-faced Vulture	EN	EN	X
Tyto alba	Barn Owl			X

Kori Bustard **Ludwig's Bustard** **African Fish-Eagle**

Figure 19. Bird species of conservation concern from the study area.

African Fish-Eagle (Schedule 1 of the NCNCA) was heard calling from the riparian woodland during the field survey and could potentially use the trees along the river for breeding sites (Figure 19). Many of the remaining species of conservation concern are also expected to occur on site either by occasionally passing over, foraging, or nesting.

3.5.5. Fish

In addition to those regulations in the NCNCA pertaining to wild animals, Section 32 and 33 of the NCNCA states that no person may, without a permit angle and not immediately release, catch, import, export, transport, keep, possess, breed, or trade in a specimen of a specially protected (Schedule 1) or protected (Schedule 2) fish.

Seven fish species are expected to be found in the Orange River and are listed in Table 10, along with their conservation status and sensitivity to physico-chemical and no-flow conditions. They are all listed as least concern. However, they are all protected either according to Schedule 1 or 2 of the NCNCA. Specially protected species include the Vaal-orange Smallmouth Yellowfish. Their population is highly fragmented and continuing to experience decline of mature individuals due to the continuing decline in area, extent, and quality of their habitat. They typically occur in pools, riffles and rapids and fast flowing rivers, preferring sand and gravel substrates. They migrate to suitable gravel beds and breed in spring to midsummer after major summer rains.

Table 10. Fish species expected to occur in the active channel of the Orange River on Lanyon Vale, along with their IUCN status and sensitivity to physico-chemical and no-flow conditions. Their respective NCNCA schedule numbers are indicated in superscript.

Scientific Name	Common name	IUCN	Phys-Chem sensitivity	No-Flow sensitivity
[2]*Barbus anoplus*	Chubbyhead Barb	LC	Moderate	Moderate
[2]*Barbus paludinosus*	Straightfin Barb	LC	High	Moderate
[2]*Barbus trimaculatus*	Threespot Barb	LC	High	Moderate
[2]*Labeo capensis*	Orange River Mudfish	LC	Moderate	High
[1]*Labeobarbus aeneus*	Vaal-orange Smallmouth Yellowfish	LC	Moderate	High
[2]*Pseudocrenilabrus philander*	Southern Mouthbrooder	LC	Low	Low
[2]*Tilapia sparrmanii*	Banded Tilapia	LC	Low	Low

3.5.6. 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). In general, they are widely distributed and extremely diverse, which makes it almost impossible to list all species that may possibly occur on site without a dedicated study. Invertebrates have also not been surveyed as comprehensively as plants, mammals and birds and therefore current available data on their distribution is much scarcer. Nevertheless, key morphospecies and species of conservation concern are discussed here, as well as the major habitats which delimit possible invertebrate communities on site.

Eight invertebrate species of the Northern Cape appear on the IUCN Red Data list of threatened species and are listed in Table 11. However, none of these species' distribution ranges overlap with that of the study area. In addition, those species that are specially protected according to Schedule 1 of the NCNCA include all Velvet worms as well as some baboon spider species, Stag Beetles and the Flightless Dung Beetle (Table 11). None of these taxa are known to occur in the study region either.

All Rock- Creeping- and Burrowing Scorpions are protected according to Schedule 2 of the NCNCA, along with several beetles, butterflies, and moths (Table 11). Of these, Burrowing and Rock Scorpions as well as some Gossamer-winged Butterflies, Skippers, Brush-footed Butterflies and Satyrs have the highest likelihood to be found on site (Figure 20).

Table 11. 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
	SCORPIONES	*Hadogenes* spp.	All Rock Scorpions	S2
		Opisthacanthus spp.	All Creeping Scorpions	S2
		Opistophthalmus spp.	All Burrowing Scorpions	S2
INSECTA	COLEOPTERA	*Circellium bacchus*	Flightless Dung Beetle	S1
		Colophon spp.	All Stag Beetles	S1
		Dromica spp.	Tiger Beetles (all species)	S2
		Graphipterus assimilis	Velvet Ground Beetle	S2
		Ichnestoma spp.	All Fruit Chafer Beetles	S2
		Manticora spp.	All Monster Tiger Beetles	S2
		Megacephala asperata	Tiger Beetle	S2
		Megacephala regalis	Tiger Beetle	S2
		Nigidius auriculatus	Stag Beetle	S2
		Oonotus adspersus	Stag Beetle	S2
		Oonotus interioris	Stag Beetle	S2
		Oonotus rex	Stag Beetle	S2
		Oonotus sericeus	Stag Beetle	S2
		Platychile pallida	Tiger Beetle	S2
		Prosopocoilus petitclerci	Stag Beetle	S2
		Prothyma guttipennis	Tiger Beetle	S2
	LEPIDOPTERA	*Lepidochrysops penningtoni*	Pennington's Blue	**DD**
		Lycaenidae	All Gossamer-winged Butterflies	S2
		Hepialidae	All Swift Moths	S2
		Hesperiidae	All Skippers	S2
		Nymphalidae	All Brush-footed Butterflies	S2
		Satyridae	All Satyrs	S2
	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			All Velvet worms	S1

Two major habitats delimit possible invertebrate communities in the study area:

i. Terrestrial vegetation classified as Karoo (Picker et al. 2004)

All the terrestrial vegetation communities on site fall within this habitat and represent unique species assemblages, with an above-average representation of beetles, grasshoppers, flies, wasps, and lacewings. The protected butterflies and scorpions discussed above would also be associated with this habitat. Figure 20 presents common species recorded on site.

ii. Orange River

Invertebrates expected to be associated with the Orange River include Flatworms, earthworms, leeches, freshwater crabs, mussels and prawn, basket clams, freshwater bivalve- and pulmonate snails, bladder snails, pond snails, prong-gilled mayflies, small squaregill mayflies and numerous other species of mayflies, jewel damselflies, narrowwinged damselflies, clubtail dragonflies, emerald dragonflies, skimmers dragonflies, grass moths, giant water bugs, water boatmen, water striders, water treaders, marsh treaders, creeping water bugs, water mites, sponges, water scorpions, backswimmers, pygmy backswimmers, riffle bugs, long-horned caddisflies, microcaddisflies, net-spinning caddisflies, diving beetles, riffle beetles, whirligig beetles, water scavenger beetles, long-toed water beetles, minute moss beetles, biting midges, meniscus midges, mosquitoes, house flies, black flies, horse flies, crane flies and nematoceran flies. generalist species like water boatmen, predaceous diving beetles, whirligig beetles, biting midges, non-biting midges and mosquitos.

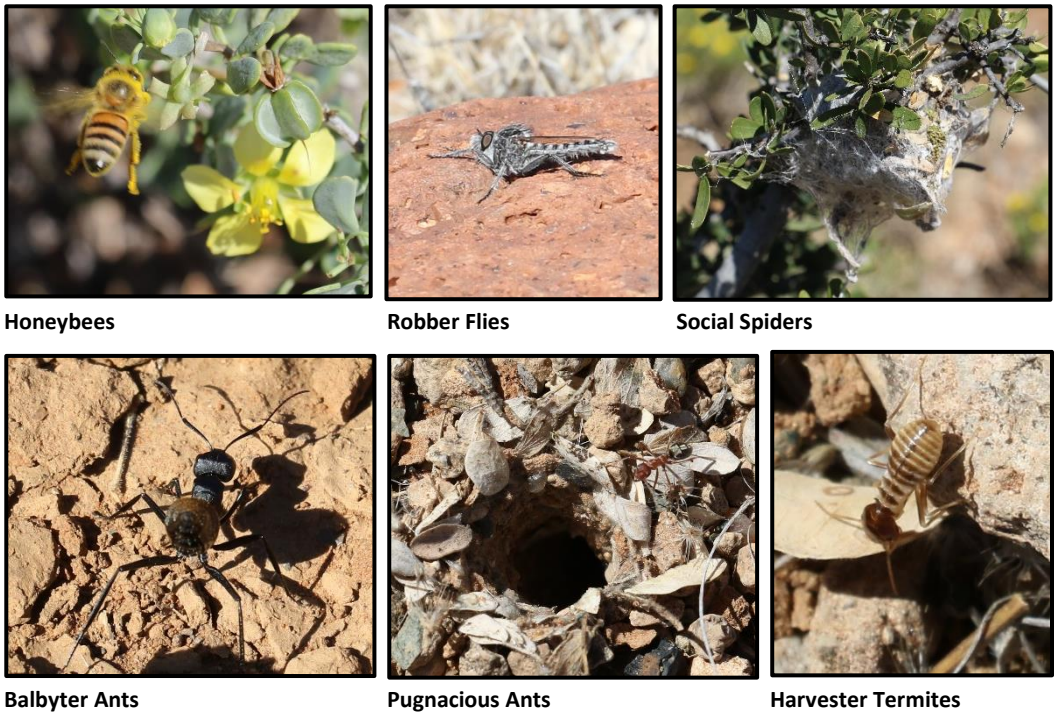


Figure 20. Common invertebrate species recorded in the study area.

3.6. Critical biodiversity areas and broad-scale processes

The proposed mining site falls within critical biodiversity areas (Figure 21), 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. The Orange River and its riparian- and buffer zones are classified as *Critical Biodiversity Area One,* while the remainder of the pristine sections on site, which encompass the drainage catchment, are classified as *Critical Biodiversity Area Two* (Figure 21). No *Protected Areas* occur in or near the study area.

Similarly, the Mining and Biodiversity Guidelines (DENC et al. 2013) recognises the buffer along the Orange River to have *Highest Biodiversity Importance* (Figure 22), which constitute a high risk for mining. However, the remainder of the site is not considered to have any biodiversity importance. These guidelines were developed to identify and categorize biodiversity priority areas sensitive to the impacts of mining to support mainstreaming of biodiversity issues in decision making in the mining sector.

Furthermore, according to the National Web based Environmental Screening Tool the study area is considered to have sensitive environmental features (Figure 23). This tool is a geographically based web-enabled application which allows a proponent intending to apply for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014 (as amended), to screen their proposed site for any environmental sensitivity. According to the screening tool, the Lanyon Vale study area is of very high sensitivity based on the Terrestrial Biodiversity Theme. This sensitivity is a direct function of the Critical Biodiversity Areas according to the Northern Cape Critical Biodiversity Areas Map. The study area is of medium sensitivity based on the Animal Species Theme, due to the suitable habitat opportunity for the bird species *Neotis ludwigii* (Ludwig's Bustard). The site is however of low sensitivity based on the Plant Species- and Aquatic Biodiversity Themes.

According to the Pixley ka Seme Spatial Development Framework, all rivers and wetlands, including a generic buffer of 100m, are regarded as ecological corridors and sensitive. Their mandate is to conserve existing ecological corridors and rehabilitate any remnants of corridors.

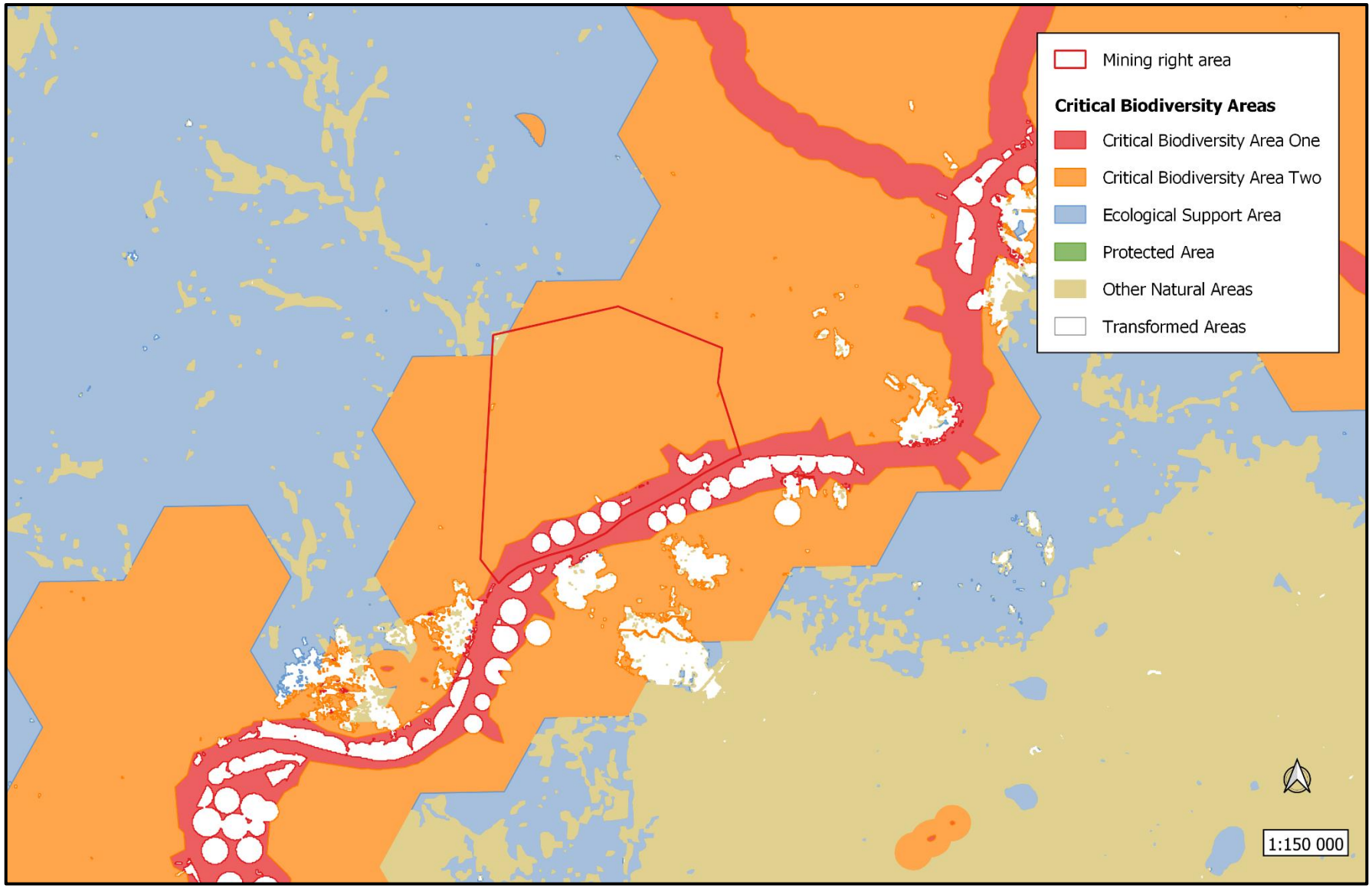


Figure 21. The study area in relation to the Northern Cape Critical Biodiversity Areas.

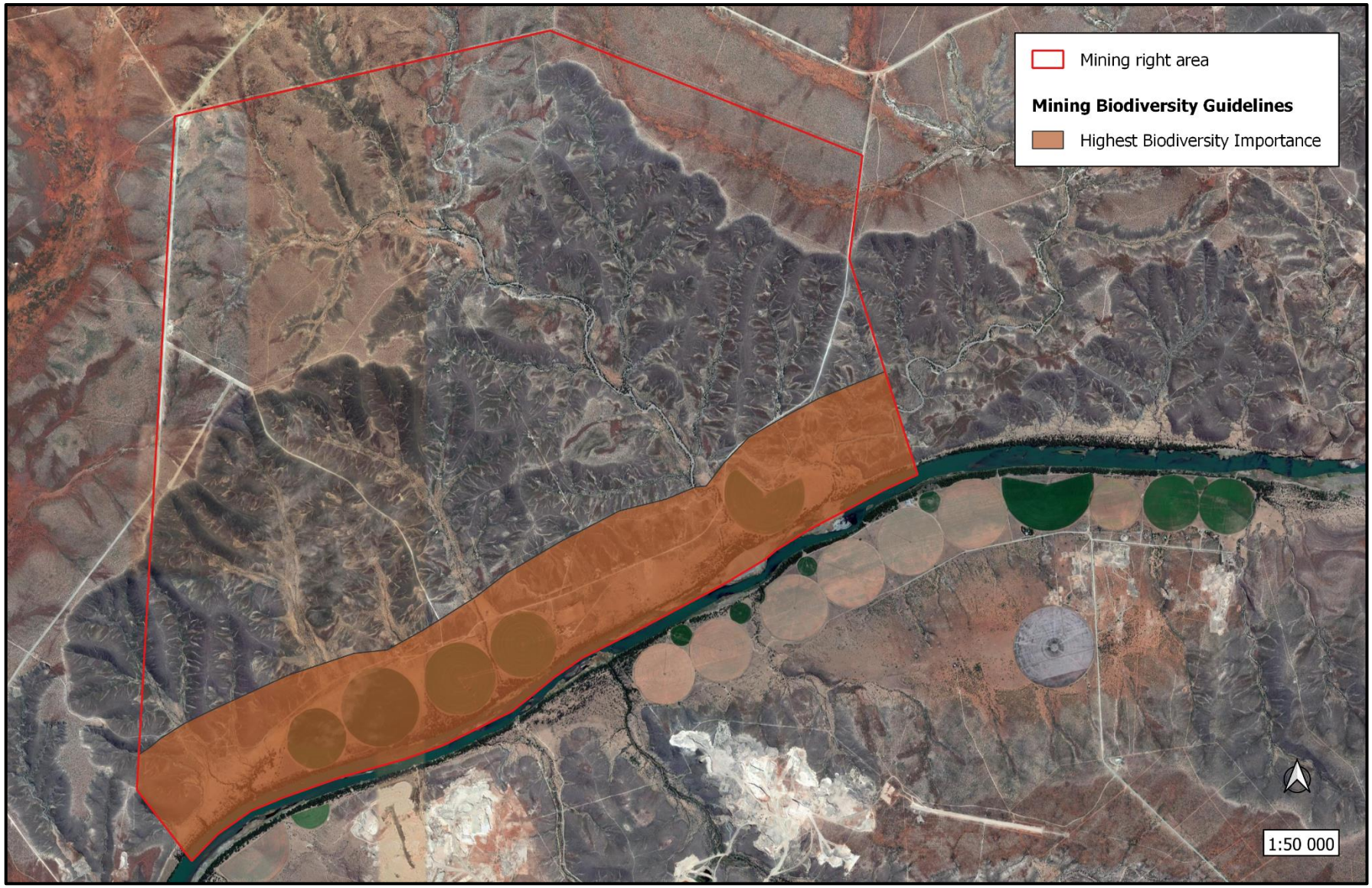


Figure 22. The study area in relation to the Mining and Biodiversity Guidelines.

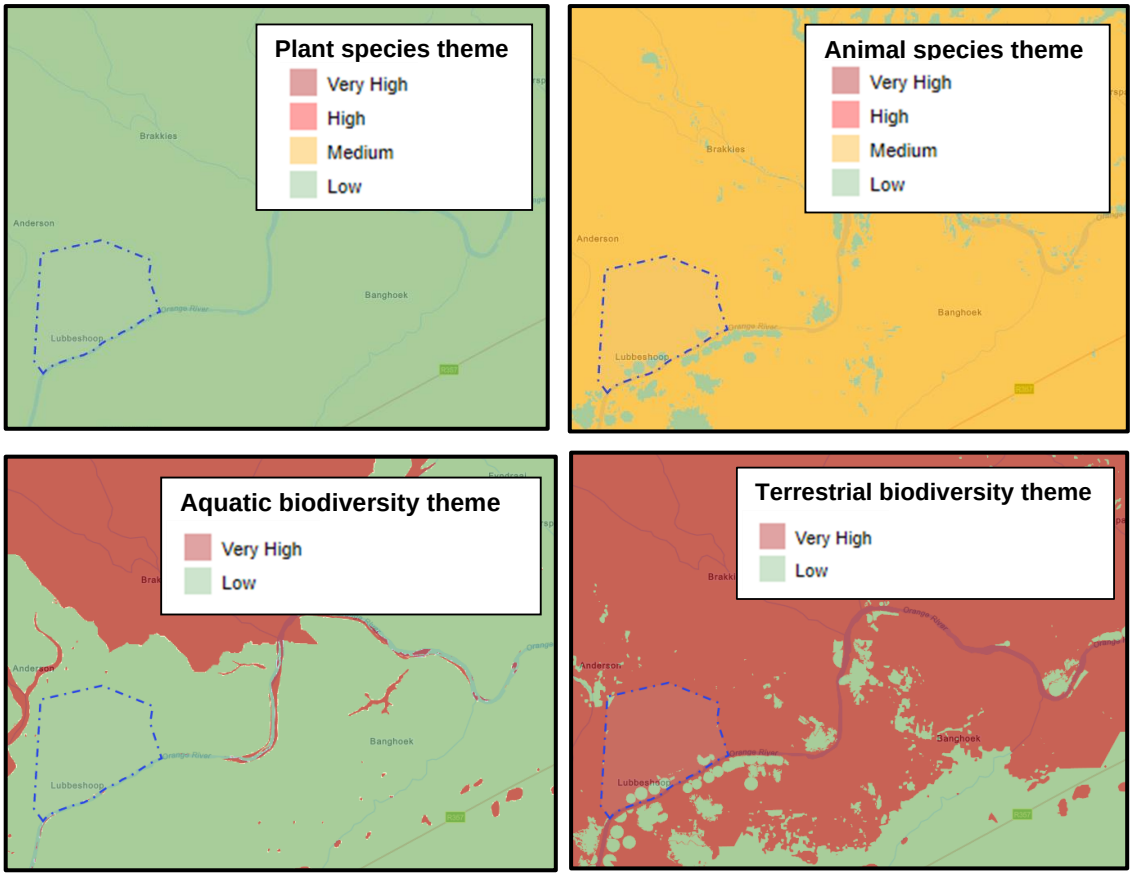


Figure 23. Environmental sensitivities in the study area, according to the National Web based Environmental Screening Tool.

The study area also borders the southern boundary of the Griqualand West Centre (GWC) of Endemism core (Frisby et al. 2019) (Figure 24). A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics (Van Wyk and Smith 2001). Relatively small disturbances in a centre of endemism may easily pose a serious threat to its many range-restricted species. Endemics are specifically vulnerable due to their restricted distribution ranges.

Finally, the study area falls within a region where one of South Africa's largest economically most important alluvial diamond deposits are found (Figure 25), i.e. along the Orange and Vaal Rivers (Gresse 2003). The most significant crop irrigation in the Northern Cape also stretches along these rivers (Durand 2006). These factors increase the operation's cumulative impacts.

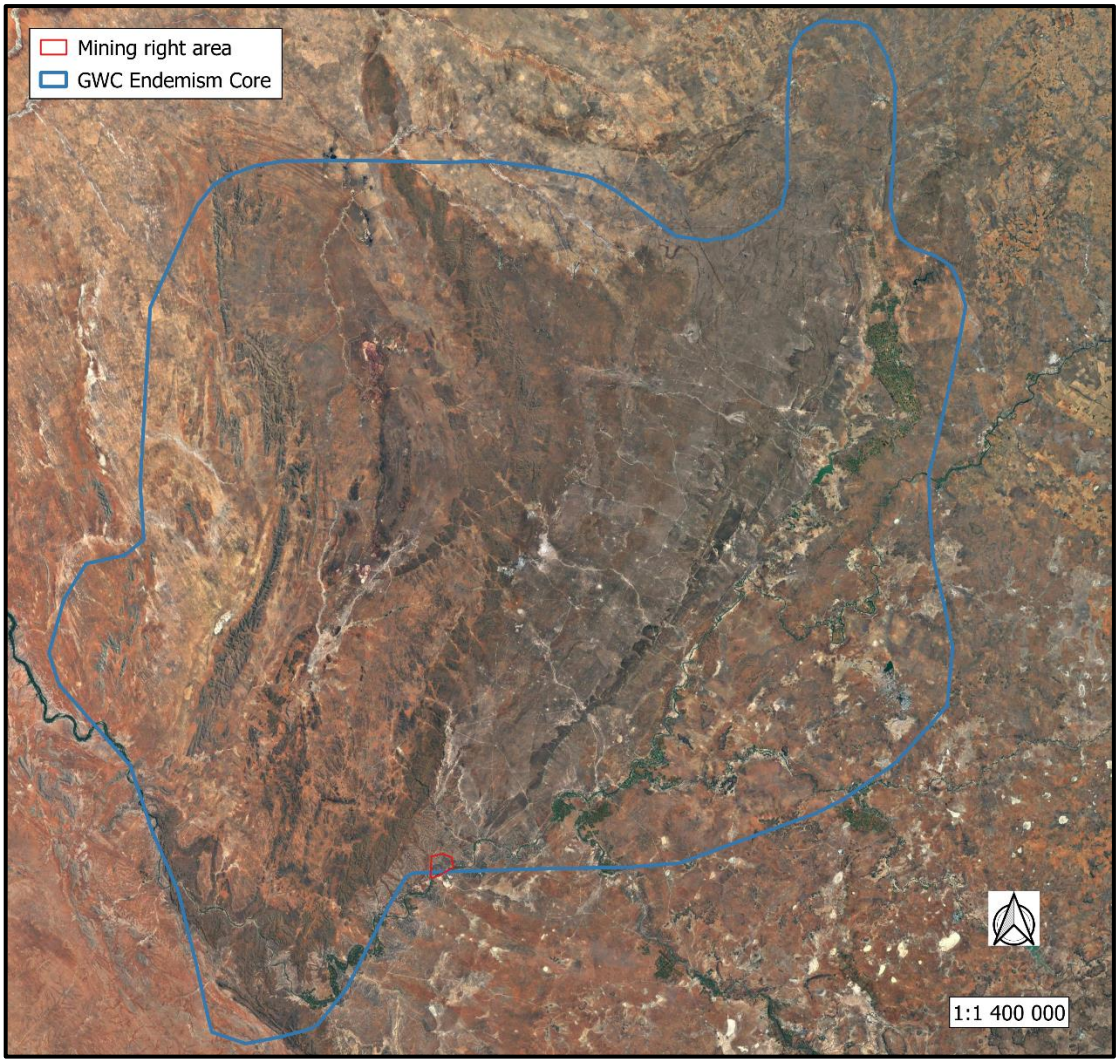


Figure 24. Lanyon Vale in relation to the Griqualand West Centre of Endemism (Frisby et al. 2019).

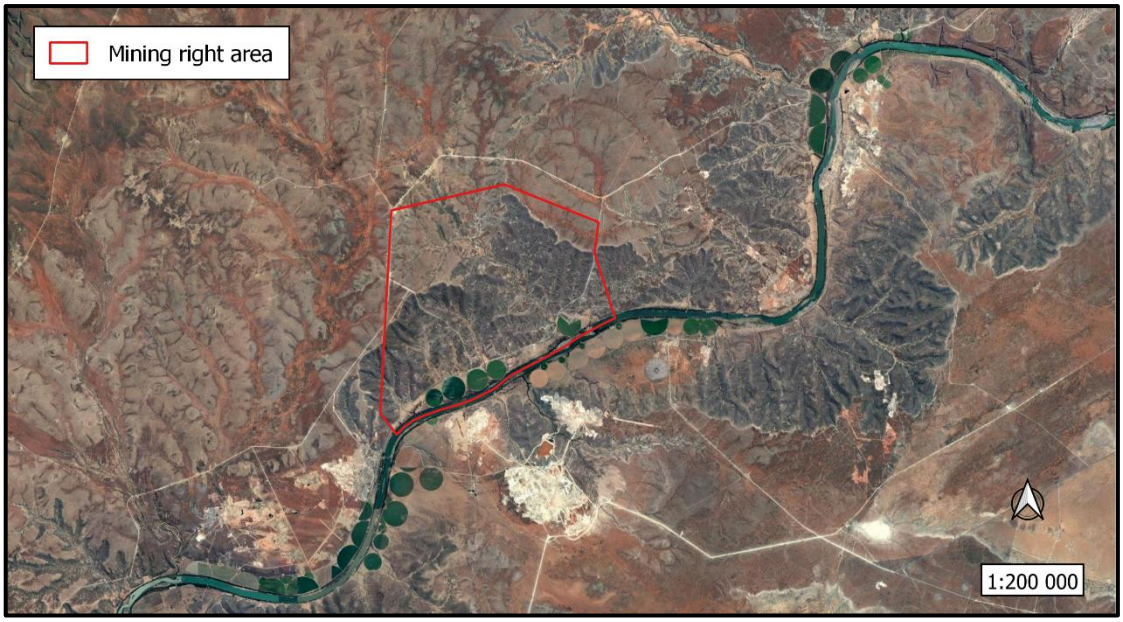


Figure 25. The extent of transformation through mining and agriculture along the Orange River.

3.7. Site sensitivity

The ecological sensitivity map for Lanyon Vale is illustrated in Figure 26. The Orange River and drainage lines, along with their riparian buffers, are of **very high** sensitivity due to their vital ecological and hydrological functionality and significance. All watercourses are unique habitats protected in terms of the National Water Act (Act No 36 of 1998). These highly sensitive areas should be considered as **no-go areas**.

The shrublands on the plateau, ridge slopes and alluvium are all of **high** sensitivity. Healthy populations of the nationally protected tree, *Boscia albitrunca,* occur widespread across the plateau and ridge slopes and these units also provide ideal habitat for the listed Ludwig's Bustard. The open shrubland on alluvium, although degraded through anthropogenic activities, fall within the local catchments of the drainage lines and the Orange River. The substrate is highly prone to erosion and runoff losses, which poses secondary risks to the watercourses through sedimentation. These areas are not regarded as no-go areas, but activities should proceed with caution as it may not be possible to mitigate all impacts.

Areas transformed by agriculture are of **low** sensitivity. These are transformed habitats 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.

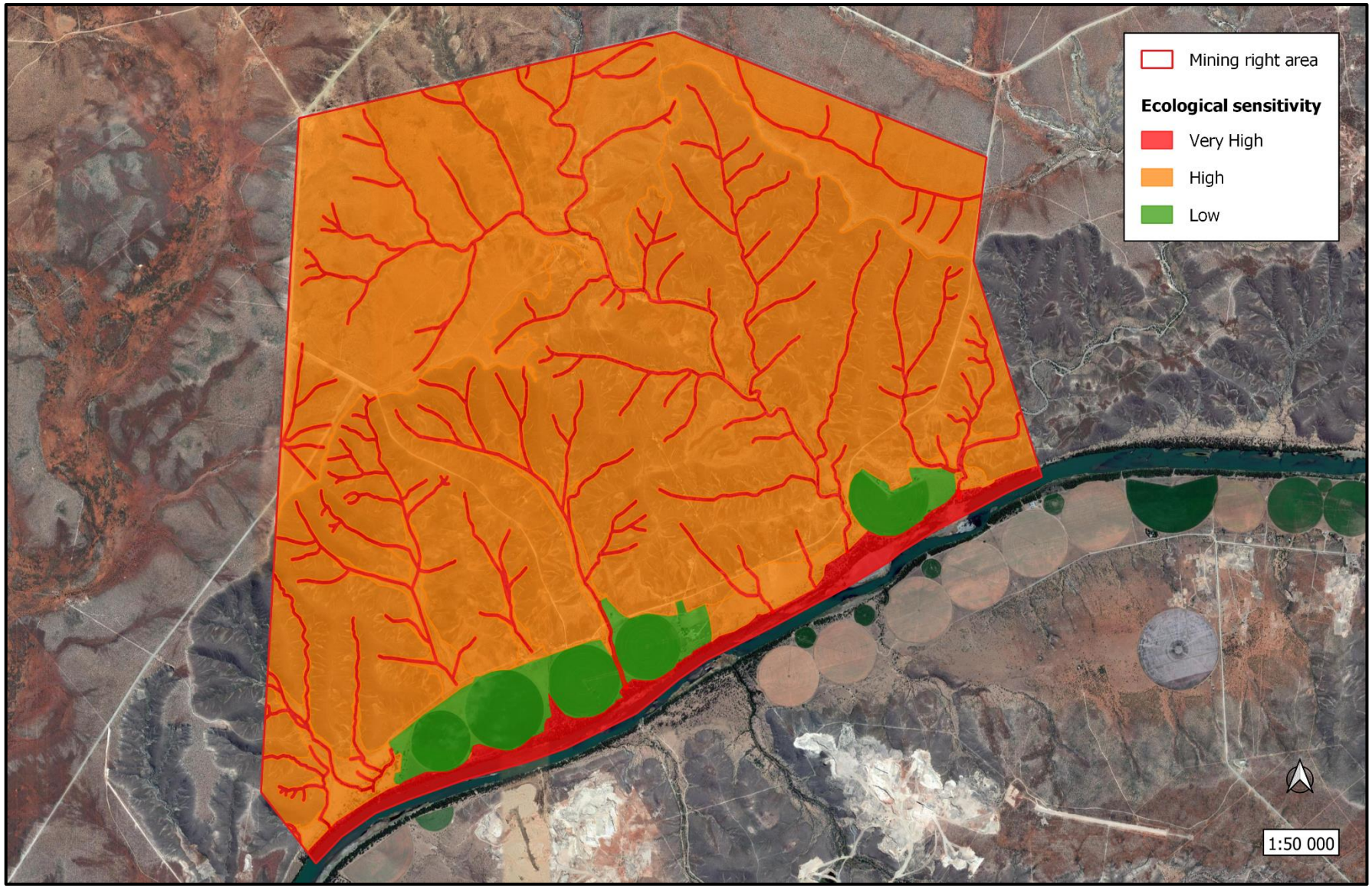


Figure 26. A sensitivity map relating to the ecological features on the Lanyon Vale mining right area.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, the potential impacts and associated risk factors that may be generated by the Lanyon Vale mining operation are identified and described. A detailed analysis of each impact is provided in Table 12. 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.

4.1. Topography, soil erosion and associated degradation of landscapes

4.1.1. Alteration of soil character and quality

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, oil and petrochemical spills.

Description of the impact

Topsoil contains living organisms and seed banks that provide ecological resilience against disturbances, and any disturbances to the intact soil profile will change its ability to sustain natural ecological functioning. Vehicles and mining equipment may potentially leak hazardous fluids on the soil surface, which will cause soil pollution. Apart from the direct disturbances caused by the mining activities, soil compaction by dump loads as well as heavy machinery and vehicles will causes a decrease in large pores, and subsequently the water infiltration rate into soil.

Mitigation and monitoring

- Topsoil needs to be removed and stored separately during mining and the construction of roads, infrastructure and stockpile areas.
- These 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 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 by no means be mixed with sub-soils.

Table 12. A detailed analysis of ecological impacts identified for the Lanyon Vale mining operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Soil	Alteration of soil character and quality	✓	✓	✓	On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Loss of topsoil and soil fertility	✓	✓	✓	On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Increase in soil erosion	✓	✓		Local (2)	Decommissioning (3)	Medium (2)	Possible, frequently (8)	Low - Medium (56)	Low
Flora	Loss of indigenous vegetation	✓	✓		On-site (1)	Residual (4)	Medium (2)	Certain for life of operation (10)	Low - Medium (70)	Low-Medium
	Loss of Red data and/or protected floral species	✓	✓		On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Introduction or spread of alien species	✓	✓	✓	Local (2)	Residual (4)	Medium (2)	Possible, frequently (8)	Low-Medium (64)	Very low
	Bush encroachment	✓	✓	✓	On-site (1)	Residual (4)	Medium (2)	Possible, infrequently (7)	Low (49)	Very low
Fauna	Habitat fragmentation	✓	✓		Regional (3)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (100)	Low-Medium
	Disturbance, displacement and killing of fauna	✓	✓	✓	Local (2)	Decommissioning (2)	Medium (2)	Certain, for life of operation (10)	Low-Medium (60)	Low

Table 12 (cont.). A detailed analysis of ecological impacts identified for the Lanyon Vale mining operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Water resources	Alteration/destruction of watercourses	✓	✓		Regional (3)	Permanent (5)	High (3)	Possible, infrequent (7)	Medium - High (77)	Low-Medium
	Siltation of surface water	✓	✓	✓	Regional (3)	Residual (4)	High (3)	Possible, infrequent (7)	Low-Medium (70)	Low
Cumulative	Compromise of broadscale ecological processes	✓	✓		Regional (3)	Residual (4)	High (2)	Certain for life of operation (10)	Medium - High (90)	Low-Medium

- The topsoil should be replaced as soon as possible on to the disturbed areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.
- For restoration of the affected areas without topsoil, soils can be sourced from other sustainable areas and chemically changed to match with the surrounding environment.
- To restore areas where compacted soil occurs, a ripper blade or deep plow can be pulled across the affected area to alleviate compaction.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.
- Vehicles and machinery should be regularly serviced and maintained.
- Refuelling and vehicle maintenance must take place in well demarcated areas and over suitable drip trays to prevent soil pollution.
- Drip trays must be available on site and installed under all stationary vehicles.
- Spill kits to clean up accidental spills from any accidental spillages must be well-marked and available on site.
- Workers must undergo induction to ensure that they are prepared for rapid clean-up procedures.
- Any soil or area that is contaminated must be cleaned immediately by removing the soil and disposing it as hazardous waste in the correct manner.

4.1.2. Loss of soil fertility

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

Topsoil contains living organisms that naturally regulate the ecological functioning of a habitat. Therefore, any disturbances to the intact soil profile can result in soil sterilisation which will directly affect vegetation communities. Apart from the direct disturbances caused by the mining activities, loss of soil fertility can also occur through soil compaction by dump loads as well as heavy machinery and vehicles.

Mitigation and monitoring

- Topsoil needs to be removed and stored separately during mining and the construction of roads, infrastructure and stockpile areas.

- These 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 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 by no means be mixed with sub-soils.
- The topsoil should be replaced as soon as possible on to the disturbed areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.
- For restoration of the affected areas without topsoil, soils can be sourced from other sustainable areas and chemically changed to match with the surrounding environment.
- To restore areas where compacted soil occurs, a ripper blade or deep plow can be pulled across the affected area to alleviate compaction.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.

4.1.3. Soil erosion

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, natural events.

Description of the impact

Vegetation will be stripped for construction of new roads and mining areas and these areas will be bare and highly susceptible to erosion. Any topsoil-, overburden- and ore stockpiles can be eroded by wind, rain and flooding. Exposed sediments in the watercourses can be carried away during runoff causing downstream sediment deposition. Any leaking pipes can also cause additional water erosion.

Mitigation and monitoring

- Bare ground exposure should be minimised at all times in terms of the surface area and duration.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible, once activities in the area have ceased.
- No new roads, infrastructure or mining areas should be developed over watercourses, including drainage lines.

- Disturbances during the rainy season should be monitored and controlled.
- Any potential run-off from exposed ground should be controlled with flow retarding barriers.
- Regular monitoring during the mining operation should be carried out to identify areas where erosion is occurring; followed by appropriate remedial actions.

4.2. Vegetation and floristics

4.2.1. Loss of indigenous vegetation

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

The Lanyon Vale mining activities is expected to destroy a large area of natural vegetation. It is expected that the ecological functioning and biodiversity will take many years to fully recover. Vehicle traffic and mining activities generate lots of dust which can reduce the growth success and seed dispersal of many small plant species in the adjacent pristine areas.

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation, by keeping to existing roads and earmarked areas where possible.
- Implement effective avoidance measures to limit any activities in the highly sensitive areas, by applying the no-go principles.
- Ensure measures for the adherence to a maximum speed limit of 40 km/h to minimise dust fallout and associated effects on plants in the adjacent pristine areas.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.
- The setup of a small nursery is advisable to maximise translocation and re-establishment efforts of affected areas.
- Apply for permits to authorise the clearance of indigenous plants from DENC at least three months before such activities will commence.

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

Source of the impact

Removal of plant species of conservation concern during clearing of an area for excavations, construction of infrastructure and roads, stockpiling. Intentional removal of these plant species for non-mine related purposes, e.g. illegal plant trade, fire-wood, medicinal, ornamental purposes.

Description of the impact

There are a few plant species of conservation concern present on the Lanyon Vale Mining Right area as discussed in this report. Many of the species are found in the core mining area and therefore it is likely that the mining operation will impact on their population dynamics. The most significant concern is the loss of *Boscia albitrunca* recruits. Saplings are rarely visible during clearance operations and therefore the younger populations often get wiped out. Furthermore, any illegal harvesting of these and other plants for whatever reason by staff, contractors or secondary land users could have devastating effects on the population of these species.

Mitigation and monitoring

- The footprint areas of the mining activities must be scanned for Red Listed and protected plant species prior to any destructive activities by means of a search-and-rescue operation.
- 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, due to the nature of the proposed mining activities they will most likely all be removed or relocated if possible. The relevant permits from DAFF and/or DENC should be applied for at least three months before such activities will commence.
- The setup of a small nursery is advisable to maximise translocation and re-establishment efforts of all the rescued plants.
- 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 designation of an environmental officer is recommended to 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 as well as the legislation relating to protected species.
- Employ regulatory measures to ensure that no illegal harvesting takes place.

4.2.3. Introduction or spread of alien species

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, improper rehabilitation practises.

Description of the impact

Several weeds and invasive species occur on site, especially in and around the transformed habitats, which clearly indicates the effect of anthropogenic disturbances. Any anthropogenic disturbances to natural vegetation, especially the clearance of large areas of land, provide the opportunity for invasive plants to increase. This is due to their opportunistic nature of dispersal and establishing in disturbed areas. If invasive plants establish in disturbed areas, it may cause an impact beyond the boundaries of the mining site, because they spread easily to neighbouring habitats where they outcompete indigenous species. These alien invasive species are thus a threat to surrounding natural vegetation and can result in the decrease of biodiversity as well as reduction in the ecological value and land use potential 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

- Implement best practise principles to minimise the footprint of transformation, by keeping to existing roads and earmarked areas where possible.
- Mechanical methods of control should be implemented pro-actively as soon as invasive species start to emerge.
- Regular follow-up monitoring of invasive control areas needs to be implemented to ensure effective eradication.
- Encourage proper rehabilitation of disturbed areas through soil restoration and reseeding of indigenous plant species.

4.2.4. Encouraging bush encroachment

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, improper rehabilitation practises.

Description of the impact

The extent of bush encroaching species on site is high, especially regarding the densities of *Senegalia mellifera*. Bush encroachment is a natural phenomenon characterised by the excessive expansion of certain indigenous shrub species at the expense of other indigenous plant species. Overgrazing is generally one of the main causes of bush encroachment, but any surface disturbances where the grassland matrix is removed can lead to the expansion of encroaching shrubs and trees. When the areas surrounding the shrubs area cleared, it causes an open niche for these competitive species to establish and outcompete the surrounding plants, eventually forming dense and impenetrable stands. This lowers the potential for future land use and decreases biodiversity. With proper mitigation, the impacts can be substantially reduced. In fact, the proposed mining activities could reduce the extent of these shrubs significantly. By clearing large stands of shrubs and subsequently effectively rehabilitating the cleared areas, it can benefit biodiversity.

Mitigation and monitoring

- Mechanical methods of control should be implemented pro-actively when encroaching species form dense stands.
- Regular follow-up monitoring of encroached control areas needs to be implemented to ensure effective eradication.
- Encourage proper rehabilitation of disturbed areas through soil restoration and reseeding of indigenous plant species.

4.3. Fauna

4.3.1. Habitat fragmentation

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

Fragmentation of habitats typically leads to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This can be in the form of small-scale fragmentation for reptiles, amphibians, and invertebrates, to more large-scale fragmentation that hinder dispersal of birds and plants. It also includes the degradation of aquatic habitats, like the ephemeral drainage channels and Orange River, which has landscape-level connectivity. Fragmentation of habitats usually results in a subsequent loss of genetic variability between meta-populations occurring within the region. Pockets of fragmented natural habitats hinder the growth and development of populations. The mining activities is expected to result in the loss of connectivity and fragmentation of natural terrestrial habitats on a local scale but could have regional scale effects if any of the watercourses are severely impacted.

Mitigation and monitoring

- All activities associated with the mining operation must be planned, where possible 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.
- No new roads should be created across a watercourse.
- No mining should take place in the ephemeral drainage channels or river.
- If watercourse disturbances are unavoidable, a water use license to alter the beds and banks of these watercourses should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected terrestrial and aquatic habitats.

4.3.2. Disturbance, displacement and killing of fauna

Source of the impact

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

Description of the impact

The transformation of natural habitats will result in the loss of micro habitats, affecting individual species and ecological processes. This will result in the displacement of faunal species that depend on such habitats, e.g. birds that nest in trees or animals residing in holes in the ground or among rocks. Increased noise and vibration will disturb and possibly displace 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 their local populations.

Mitigation and monitoring

- Careful planning of the operation is needed to avoid the destruction of pristine habitats and minimise the overall disturbance footprint.
- The extent of the mining activities should be demarcated on site layout plans, and no personnel or vehicles may leave the demarcated area except if authorised. Areas surrounding the earmarked site that are not part of the demarcated area should be considered as a no-go zone.
- No mining should take place in the drainage lines or river and no new roads should be created across these watercourses. If this is unavoidable, a water use license to alter the beds and banks of each earmarked watercourse should be obtained from DWS prior to such activities.
- If any of the protected wildlife species are directly threatened by habitat destruction or displacement during the mining operation, then the relevant permits from DENC should be obtained followed by the relevant mitigation procedures stipulated in the permits.
- Everyone on site must undergo environmental induction for awareness on not capturing or harming species that are often persecuted out of superstition and to be educated about the conservation importance of the fauna occurring on site.
- Reptiles, amphibians, mammals, special invertebrates or active bird nests exposed during the clearing operations should be captured for later release or translocation by a qualified expert.
- Employ measures that ensure adherence to a speed limit of 40 km/h as well as driving mindfully to lower the risk of animals being killed on the roads or elsewhere in the mining area.

4.4. Water resources

4.4.1. Alteration/destruction of watercourses

Source of the impact

During excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

During mining activities there is a possibility that the watercourses on site (Orange River and drainage lines) might be altered or indirectly affected. This includes direct mining within the watercourses as well as development of roads, infrastructure or stockpiles within their active zones, catchment areas, or buffer zones. Such activities can completely change the hydrologic regime or habitat conditions of the watercourses, which will not only compromise their ecological functioning, but also have downstream effects.

Mitigation and monitoring

- All activities associated with the mining operation must be planned to avoid any disturbances to the watercourses and their buffer zones.
- No new roads should be created across a watercourse and no mining should take place in them. If this is unavoidable, a water use license to alter the beds and banks of each earmarked watercourse should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected watercourses.

4.4.2. Siltation of surface water

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, natural events.

Description of the impact

Vegetation will be stripped in preparation for the mining areas and associated infrastructure. These bare areas will be very susceptible to water erosion without plants to stabilise the soil, creating potential sediment source zones. High runoff events could potentially cause the drainage lines and river to be filled with silt from mining areas if the sediment source zones lie along the drainage paths towards these watercourses. This may lead to a change in hydrologic regime or character of the watercourses.

Mitigation and monitoring

- Bare ground exposure should always be minimised in terms of the surface area and duration.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible once activities in the area have ceased.
- No new roads, infrastructure or mining areas should be developed over watercourses.
- Disturbances during the rainy season should be monitored and controlled.

- Any potential run-off from exposed ground should be controlled with flow retarding barriers.
- Regular monitoring during the mining operation should be carried out to identify areas where erosion is occurring; followed by appropriate remedial actions.

4.5. Broad-scale ecological processes

Source of the impact

Clearing of vegetation and disturbance during the construction of roads and mining activities; alterations to watercourse habitat characteristics.

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 habitats on site are vulnerable to cumulative disturbances, due to the vast extent of transformation through mining and agriculture in the region. Fragmentation of these habitats through loss of keystone species will destroy connectivity of vital ecological corridors and it will disrupt the food web, which might have cascading effects on a landscape level over the long-term.

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation, by keeping to existing roads and earmarked areas where possible.
- Apply for the relevant permits from DENC and DAFF.
- No new roads should be created across a watercourse and no mining should take place in them. If this is unavoidable, a water use license to alter the beds and banks of each earmarked watercourse should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected habitats.
- For restoration of the affected areas without topsoil, soils can be sourced from other sustainable areas and chemically changed to match with the surrounding environment.
- To restore areas where compacted soil occurs, a ripper blade or deep plow can be pulled across the affected area to alleviate compaction.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.
- The setup of a small nursery is advisable to maximise translocation and re-establishment efforts of affected areas.

5. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Four habitats were identified on site, of which the Orange River, drainage lines and their riparian buffer zones are the most sensitive to mining. The shrublands on the calcrete plateau and tillite ridge slopes host a widespread occurrence of *Boscia albitrunca* and is considered to be of high sensitivity. Furthermore, the substrate of the open shrubland on alluvium poses high runoff and sedimentation risks to the adjacent watercourses and is therefore also considered to be of high sensitivity.

The most profound impacts expected to be related to the proposed mining operation include cumulative loss of intact habitat and biodiversity on a landscape level, as well as potential loss in soil fertility and loss of *Boscia albitrunca* recruits. Saplings are rarely visible during clearance operations and therefore the younger populations often get wiped out completely. Permit applications need to be lodged with the Northern Cape Department of Environment and Nature Conservation three months prior to any removal of protected species. Similarly, a licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries three months prior to any potential disturbances to the *Boscia albitrunca* trees. If any of the watercourses will be impacted, then a general authorisation or water use license should be obtained from Department of Water and Sanitation, prior to such activities.

The destruction of the natural plant species and habitats is inevitable during mining operations, but the significance of the impacts will ultimately be affected by the success of the mitigation measures implemented during the mining operation. In my opinion, authorisation for the proposed operation can be granted. However, the applicant should commit to the strict adherence of effective avoidance, management, mitigation, and rehabilitation measures.

6. REFERENCES

ADU. 2016. Summary Data of the Frogs of South Africa, Lesotho and Swaziland. Animal Demography Unit, Department of Zoology, University of Cape Town. .

ALEXANDER, G. and MARAIS, J. 2007. A guide to the reptiles of southern Africa. Struik Nature, Cape Town.

BATES, F., BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.J., and DE VILLIERS, M.S. 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. South African National Biodiversity Institute, Pretoria.

BIRDLIFESA. 2015. Important Bird Areas Map.

DENC, DMR, COM, SAMBF, and SANBI. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector, Pretoria.

DU PREEZ, L. and CARRUTHERS, V. 2009. A complete guide to the frogs of southern Africa. Struik Nature, Cape Town.

DURAND, W. 2006. Assessing the impact of climate change on crop water use in South Africa. ARC-Grain Crops Institute, Potchefstroom.

FRIEDMANN, Y. and DALY, B. 2004. Red data book of the mammals of South Africa: a conservation assessment. CBSG-EWT, Johannesburg.

FRISBY, A.W., SIEBERT, S.J., STRUWIG, M., and CILLIERS, D.P. 2019. Plant endemism in GriqualandWest, South Africa. *South African Journal of Botany* 124, 127-137.

GIBBON, G. 2006. Robert's Multimedia Birds of Southern Africa version 3. . Southern African Birding cc.

GRESSE, P.G. 2003. The preservation of alluvial diamond deposits in abandoned meanders of the middle-Orange River. SAIMM Colloquium: Diamonds - Source to use, Oct. 2003.

GRIFFITHS, C., DAY, J., and PICKER, M. 2015. Freshwater Life: A field guide to the plants and animals of Southern Africa. Struik Nature, Cape Town.

HOLNESS, S. and OOSTHUYSEN, E. 2016. Critical Biodiversity Areas of the Northern Cape. Northern Cape Department of Environment and Nature Conservation, http://bgis.sanbi.org.

HORNSVELD, H. 1977. 2822 Postmasburg, 1:250 000 scale published geological sheet. The Government Printer, Pretoria.

IUCN. 2019. IUCN Red List of Threatened Species. Version 2019.1

KLEYNHANS, C.J. 2007. Module D: Fish Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry, Pretoria.

KREMEN, C., COLWELL, R.K., ERWIN, T.L., MURPHY, D.D., NOSS, R.F., and SANJAYAN, M.A. 1993. Terrestrial arthropod assemblages: their use in conservation planning. *Conservation Biology* 7:4, 796-808.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J., and KLOEPFER, D. 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. Smithsonian Institution, Washington, DC.

MUCINA, L. and RUTHERFORD, M.C. 2006. The Vegetation Map of South Africa, Lesotho and Swaziland. SANBI, Pretoria, South Africa.

MUCINA, L. and RUTHERFORD, M.C. 2012. Vegetation Map of South Africa, Lesotho and Swaziland. SANBI, Claremont.

PICKER, M., GRIFFITHS, C., and WEAVING, A. 2004. Field Guide to the Insects of South Africa. Struik Nature, Cape Town.

SANBI. 2020. Red List of South African Plants. Version 2020.1

SMOOK, A.J., POURNARA, D.J., and CRAIG, A.R. 2002. Lower Orange Water Management Area: Water resource situation assessment. REPORT NO: 14000/00/0101. DEPARTMENT: WATER AFFAIRS AND FORESTRY.

TAYLOR, M.R., PEACOCK, F., and WANLESS, R.M. 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Dunkeld West.

THIRION, C. 2007. Module E: Macroinvertebrate Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). *WRC Report No. TT 332/08*, Joint Water Research Commission and Department of Water Affairs and Forestry, Pretoria.

VAN DEVENTER, H., SMITH-ADAO, L., COLLINS, N.B., GRENFELL, M., GRUNDLING, A., GRUNDLING, P.-L., IMPSON, D., JOB, N., LÖTTER, M., OLLIS, D., PETERSEN, C., SCHERMAN, P., SIEBEN, E., SNADDON, K., TERERAI, F., and VAN DER COLFF, D. 2019. South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. South African National Biodiversity Institute, Pretoria.

VAN WYK, A.E. and SMITH, G.F. 2001. Regions of floristic endemism in southern Africa. Umdaus press, Hatfield.

WEISSER, W.W. and SIEMANN, E. 2004. The various effects of insects on ecosystem functioning. Pages 3-24 *in* W. W. Weisser and E. Siemann, editors. Insects and Ecosystem Function, Ecological Studies Series, Volume 173. Springer-Verlag, Berlin.

Boscia
ECOLOGICAL CONSULTING

APPENDICES

APPENDIX 1

Plant species list

FAMILY	SPECIES	STATUS	NFA	NCNCA
ACANTHACEAE	*Acanthopsis hoffmannseggiana*	DDT		
	Barleria lichtensteiniana	LC		
	Barleria rigida var. *rigida*	LC		
	Blepharis mitrata	LC		
	Justicia distichotricha	LC		
	Justicia incana	LC		
AIZOACEAE	*Aizoon asbestinum*	LC		
	Aizoon schellenbergii	LC		
	Aizoon secundum	LC		
	Lithops hookeri	LC		S2
	Mestoklema arboriforme	LC		S2
	Mestoklema copiosum	LC		S2
	Plinthus cryptocarpus	LC		
	Plinthus karooicus	LC		
	Psilocaulon articulatum	LC		S2
	Psilocaulon coriarium	LC		S2
	Tetragonia arbuscula	LC		
	Titanopsis calcarea	LC		S2
AMARANTHACEAE	***Chenopodium album***	Nat. Exotic		
	Hermbstaedtia odorata	LC		
	Salsola glabrescens	LC		
	Salsola smithii	DDT		
	Sericocoma avolans	LC		
AMARYLLIDACEAE	***Ammocharis coranica***	LC		S2
	Crinum bulbispermum	LC		S2
	Nerine laticoma	LC		S2
ANACARDIACEAE	*Searsia burchellii*	LC		
	Searsia pendulina	LC		
	Searsia tridactyla	LC		
APIACEAE	***Deverra burchellii***	LC		S2
APOCYNACEAE	***Fockea angustifolia***	LC		S2
	Microloma armatum* var. *armatum	LC		S2
	Piaranthus decipiens	LC		S2
ASPARAGACEAE	*Asparagus retrofractus*	LC		
	Asparagus suaveolens	LC		
ASPHODELACEAE	***Aloe claviflora***	LC		S2
	Aloe hereroensis* var. *hereroensis	LC		S2
ASPLENIACEAE	*Asplenium cordatum*	LC		
ASTERACEAE	*Arctotis arctotoides*	LC		
	Bidens bipinnata	Nat. Exotic		
	Chrysocoma ciliata	LC		
	Dicoma capensis	LC		
	Eriocephalus ambiguus	LC		
	Eriocephalus decussatus	LC		
	Euryops dregeanus	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
ASTERACEAE	*Euryops subcarnosus* subsp. *vulgaris*	LC		
	Felicia burkei	LC		
	Felicia clavipilosa subsp. *clavipilosa*	LC		
	Felicia fascicularis	LC		
	Gazania krebsiana subsp. *arctotoides*	LC		
	Helichrysum argyrosphaerum	LC		
	Helichrysum lucilioides	LC		
	Hertia pallens	LC		
	Laggera decurrens	LC		
	Lasiopogon muscoides	LC		
	Nolletia ciliaris	LC		
	Nolletia gariepina	LC		
	Oedera humilis	LC		
	Pegolettia retrofracta	LC		
	Pentzia incana	LC		
	Phymaspermum parvifolium	LC		
	Psiadia punctulata	LC		
	Pteronia glauca	LC		
	Pteronia mucronata	LC		
	Senecio consanguineus	LC		
	Tarchonanthus camphoratus	**Encr.**		
	Xanthium spinosum	**Decl. Inv.**		
BIGNONIACEAE	*Rhigozum obovatum*	LC		
	Rhigozum trichotomum	**Encr.**		
BORAGINACEAE	*Ehretia rigida*	LC		
	Heliotropium lineare	LC		
	Heliotropium ovalifolium	LC		
BRASSICACEAE	***Boscia albitrunca***	LC	**X**	**S2**
	Cadaba aphylla	LC		
	Sisymbrium capense	LC		
CAMPANULACEAE	*Wahlenbergia nodosa*	LC		
CARYOPHYLLACEAE	*Herniaria erckertii* subsp. *erckertii*	LC		
	Spergularia media	**Nat. Exotic**		
CELASTRACEAE	***Gymnosporia buxifolia***	LC		**S2**
	Maytenus undata	LC		
CLEOMACEAE	*Cleome monophylla*	LC		
COLCHICACEAE	*Ornithoglossum dinteri*	LC		
COMBRETACEAE	***Combretum erythrophyllum***	LC		**S2**
COMMELINACEAE	*Commelina benghalensis*	LC		
CONVOLVULACEAE	*Convolvulus multifidus*	LC		
	Seddera suffruticosa	LC		
CUCURBITACEAE	*Coccinia rehmannii*	LC		
	Corallocarpus schinzii	LC		
	Cucumis myriocarpus subsp. *leptodermis*	LC		
	Trochomeria debilis	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
CYPERACEAE	*Bulbostylis humilis*	LC		
	Cyperus laevigatus	LC		
EBENACEAE	*Diospyros lycioides* subsp. *lycioides*	LC		
	Euclea undulata	**Encr.**		
ELATINACEAE	*Bergia anagalloides*	LC		
EUPHORBIACEAE	***Euphorbia davyi***	LC		**S2**
	Euphorbia patula	LC		**S2**
FABACEAE	*Calobota spinescens*	LC		
	Indigofera alternans var. *alternans*	LC		
	Lessertia frutescens* subsp. *frutescens	LC		**S1**
	Lotononis laxa	LC		
	Melolobium candicans	LC		
	Melolobium macrocalyx var. *longifolium*	LC		
	Prosopis velutina	**Decl. Inv.**		
	Ptycholobium biflorum subsp. *biflorum*	LC		
	Senegalia mellifera	**Encr.**		
	Senna italica subsp. *arachoides*	LC		
	Vachellia karroo	**Encr.**		
GISEKIACEAE	*Gisekia pharnacioides*	LC		
HYACINTHACEAE	*Albuca* sp.	-		
	Ornithogalum flexuosum	LC		**S2**
IRIDACEAE	***Babiana bainesii***	LC		**S2**
	Freesia andersoniae	LC		**S2**
	Moraea pallida	LC		**S2**
	Moraea polystachya	LC		**S2**
LAMIACEAE	*Acrotome inflata*	LC		
	Salvia namaensis	LC		
	Stachys cuneata	LC		
	Stachys spathulata	LC		
LIMEACEAE	*Limeum aethiopicum*	LC		
	Limeum myosotis var. *myosotis*	LC		
LORANTHACEAE	*Tapinanthus oleifolius*	LC		
MALVACEAE	*Abutilon austro-africanum*	LC		
	Grewia flava	**Encr.**		
	Hermannia comosa	LC		
	Hermannia desertorum	LC		
	Hermannia erodioides	LC		
	Hermannia pulverata	LC		
	Hermannia quartiniana	LC		
	Hermannia spinosa	LC		
	Hermannia stellulata	LC		
	Radyera urens	LC		
MELIACEAE	***Nymania capensis***	LC		**S2**
MOLLUGINACEAE	*Pharnaceum viride*	LC		
MORACEAE	*Ficus cordata* subsp. *cordata*	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
MYRTACEAE	***Eucalyptus camaldulensis***	**Decl. Inv.**		
NYCTAGINACEAE	*Phaeoptilum spinosum*	LC		
OLEACEAE	***Olea europaea* subsp. *africana***	LC		**S2**
OPHIOGLOSSACEAE	*Ophioglossum polyphyllum* var. *polyphyllum*	LC		
OROBANCHACEAE	*Alectra welwitschii*	LC		
OXALIDACEAE	***Oxalis haedulipes***	LC		**S2**
	Oxalis lawsonii	LC		**S2**
PAPAVERACEAE	***Argemone ochroleuca***	**Decl. Inv.**		
PEDALIACEAE	*Sesamum triphyllum*	LC		
PLANTAGINACEAE	*Veronica anagallis-aquatica*	LC		
PLUMBAGINACEAE	*Dyerophytum africanum*	LC		
POACEAE	*Aristida adscensionis*	LC		
	Aristida congesta subsp. *congesta*	LC		
	Aristida junciformis	LC		
	Aristida vestita	LC		
	Cenchrus ciliaris	LC		
	Centropodia glauca	LC		
	Cymbopogon pospischilii	**Nat. Exotic**		
	Enneapogon cenchroides	LC		
	Enneapogon desvauxii	LC		
	Enneapogon scaber	LC		
	Enneapogon scoparius	LC		
	Eragrostis annulata	LC		
	Eragrostis brizantha	LC		
	Eragrostis echinochloidea	LC		
	Eragrostis homomalla	LC		
	Eragrostis lehmanniana var. *lehmanniana*	LC		
	Eragrostis nindensis	LC		
	Eragrostis truncata	LC		
	Fingerhuthia africana	LC		
	Melinis repens subsp. *grandiflora*	LC		
	Panicum maximum	LC		
	Phragmites australis	LC		
	Setaria incrassata	LC		
	Sporobolus discosporus	LC		
	Stipagrostis anomala	LC		
	Stipagrostis ciliata var. *capensis*	LC		
	Stipagrostis namaquensis	LC		
	Stipagrostis obtusa	LC		
	Stipagrostis uniplumis var. *neesii*	LC		
	Stipagrostis uniplumis var. *uniplumis*	LC		
	Tragus racemosus	LC		
	Triraphis purpurea	LC		
	Vulpia bromoides	**Nat. Exotic**		
POLYGALACEAE	*Polygala asbestina*	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
POLYGALACEAE	*Polygala krumanina*	LC		
	Polygala pungens	LC		
	Oxygonum alatum var. *alatum*	LC		
POTAMOGETONACEAE	*Zannichellia palustris*	LC		
PTERIDACEAE	*Cheilanthes hirta* var. *hirta*	LC		
	Pteris vittata	LC		
RHAMNACEAE	*Ziziphus mucronata* subsp. *mucronata*	LC		
RUSCACEAE	*Eriospermum corymbosum*	LC		
SALICACEAE	*Salix mucronata*	LC		
SANTALACEAE	*Thesium hystrix*	LC		
	Thesium lineatum	LC		
SCROPHULARIACEAE	*Aptosimum indivisum*	LC		
	Aptosimum spinescens	LC		
	Buddleja saligna	LC		
	Chaenostoma halimifolium	LC		
	Diclis petiolaris	LC		
	Jamesbrittenia integerrima	LC		**S2**
	Jamesbrittenia tysonii	LC		**S2**
	Limosella maior	LC		
	Nemesia pubescens* var. *pubescens	LC		**S2**
	Peliostomum leucorrhizum	LC		
	Peliostomum origanoides	LC		
	Selago paniculata	LC		
SOLANACEAE	***Datura ferox***	**Decl. Inv.**		
	Lycium cinereum	LC		
	Lycium hirsutum	LC		
	Lycium pilifolium	LC		
	Lycium schizocalyx	LC		
	Withania somnifera	LC		
THYMELAEACEAE	*Lasiosiphon polycephalus*	LC		
URTICACEAE	*Forsskaolea candida*	LC		
	Urtica urens	**Nat. Exotic**		
VERBENACEAE	*Lippia javanica*	LC		
ZYGOPHYLLACEAE	*Fagonia isotricha* var. *isotricha*	-		
	Roepera lichtensteiniana	LC		
	Tetraena microcarpa	LC		
	Tetraena simplex	LC		
	Tribulus terrestris	LC		
	Tribulus zeyheri subsp. *zeyheri*	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	SAMRL	Habitat	Potential occurrence
CHIROPTERA	[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	**NT**	LC	Wide habitat tolerance.	Moderate
	[2]*Eptesicus hottentotus*	Long-tailed Serotine Bat	LC	LC	Mainly close to rivers and surrounding habitats.	High
	[2]*Neoromicia capensis*	Cape Bat	LC	LC	Wide habitat tolerance, but found in arid areas, grassland, bushveld and *Acacia* woodland. Roosts under the bark of trees and similar vegetation.	Moderate
	[3]*Miniopterus natalensis*	Natal Long-fingered Bat	LC	LC	Mainly roosts in caves or mine shafts, but also in crevices and holes in trees.	Low
	[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.	Moderate
	[2]*Rhinolophus denti*	Dent's Horseshoe Bat	LC	**NT**	Savanna habitats in broken country with rocky outcrops or suitable caves	Low
	[2]*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	LC	LC	Wide habitat tolerance.	High
	[2]*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC	LC	Savanna habitats.	Low
	[2]*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	LC	LC	Wide habitat tolerance.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
MACROSCELIDIDAE	[2]*Macroscelides proboscideus*	Round-eared Sengi	LC	LC	Restricted to gravel plains associated with alluvial plains and relatively flat areas between higher elevation areas such as outcrops, hills and mountains.	High
	[2]*Elephantulus rupestris*	Western Rock Sengi	LC	LC	Arid habitats, including deserts, dry savannas, and dry shrublands. Associated with rocky ridges, outcrops or koppies, 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.	Moderate

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
PRIMATES	[4]*Papio ursinus*	Chacma Baboon	LC	LC	Fynbos, montane grasslands, riverine courses in deserts. Only needs water and access to refuge.	Low
	[4]*Chlorocebus pygerythrus*	Vervet Monkey	LC	LC	Woodland savanna, riverine woodland, isolated stands of trees along rivers.	Confirmed
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 crop-growing areas or in fallow lands where there is some bush development.	High
	[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.	High
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.	Confirmed
	[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 (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
RODENTIA	[2]*Malacothrix typica*	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	High
	[2]*Saccostomus campestris*	Pouched Mouse	LC	LC	Wide habitat tolerance but prefers soft, particularly sandy soils; can be found in open and dense vegetation and in rocky areas; annual rainfall of 250 - 1 200 mm.	Moderate
	[2]*Malacothrix typica*	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	High
	[2]*Desmodillus auricularis*	Cape Short-tailed Gerbil	LC	LC	Occurs on hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	High
	[2]*Gerbillurus paeba*	Pygmy Hairy-footed Gerbil	LC	LC	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	LC	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
	[2]*Micaelamys namaquensis*	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
RODENTIA	[3]*Rhabdomys dilectus*	Mesic Four-striped Grass Mouse	LC	LC	Wide habitat tolerance, from desert fringe to high-rainfall montane areas with grass cover.	High
	[2]*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	LC	Occurs in wide variety of habitats where there is good grass cover.	High
	[2]*Mastomys coucha*	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	[3]*Mus musculus*	House Mouse	LC	*Not assessed*	Wide habitat tolerance.	High
	[2]*Thallomys nigricauda*	Black-tailed Tree Rat	LC	LC	Arboreal species generally associated with *Acacia* bushland habitats.	Low
	[2]*Parotomys littledalei*	Littledale's Whistling Rat	LC	**NT**	Occurs in shrublands, specifically in coastal hummocks, sand dunes, gravel plains and dry riverine systems. Avoids open habitats.	Low
	[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]*Cryptomys hottentotus*	African Mole Rat	LC	LC	Occurs in a wide range of substrates and habitats	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
PHOLIDOTA	[1]Smutsia temminckii	Ground Pangolin	**VU**	**VU**	Low to high rainfall areas, including open grassland, woodland and rocky hills, but excluding forest and true desert; nevertheless, present throughout the Kalahari sand country.	High
EULIPOTYPHLA	[2]*Crocidura cyanea*	Reddish-Grey Musk Shrew	LC	LC	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	LC	Generally associated with termite mounds, grassland habitat.	Low
	[1]*Atelerix frontalis*	South African Hedgehog	LC	**NT**	Generally found in semi-arid and sub-temperate environments with ample ground cover.	High
CARNIVORA	[1]*Vulpes chama*	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	High
	[1]*Otocyon megalotis*	Bat-eared Fox	LC	LC	Prefers short-grass plains, shrub lands and open arid savanna. Absent from true desert or afforested areas.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CARNIVORA	[4]*Canis mesomelas*	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High
	[2]*Aonyx capensis*	Cape Clawless Otter	**NT**	**NT**	Rivers, marshes, dams and lakes; dry stream beds if pools of water exist.	High
	[1]*Mellivora capensis*	Honey Badger	LC	LC	Wide habitat tolerance.	High
	[1]*Poecilogale albinucha*	African Striped Weasel	LC	**NT**	Wide habitat tolerance, but most common in grassland areas.	Moderate
	[1]*Ictonyx striatus*	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	[2]*Cynictis penicillata*	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	Confirmed
	[2]*Herpestes sanguineus*	Slender Mongoose	LC	LC	Wide habitat tolerance, but areas with adequate cover.	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]*Genetta genetta*	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential 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]*Proteles cristata*	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes. Absent from true desert and forests.	High
	[1]*Felis silvestris*	African Wild Cat	LC	LC	Wide habitat tolerance.	High
	[1]*Felis nigripes*	Black-footed cat	**VU**	**VU**	Associated with arid country, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	Moderate
	[4]*Caracal caracal*	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CETARTIODACTYLA	[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]*Tragelaphus strepsiceros*	Greater Kudu	LC	LC	Wooded savanna	Confirmed
	[2]*Antidorcas marsupialis*	Springbok	LC	LC	Open arid plains with short vegetation	Low
	[2]*Raphicerus campestris*	Steenbok	LC	LC	Inhabits open country.	Confirmed
	[2]*Sylvicapra grimmia*	Common Duiker	LC	LC	Presence of bushes are important.	High

LIST OF REPTILES

Reptiles protected according to NCNCA are indicated with their respective Schedule no. in superscript. South African endemics are indicated with [E].

Family	Scientific name	Common name	IUCN status
AGAMIDAE	[3]*Agama aculeata aculeata*	Western Ground Agama	LC
	[3]*Agama atra*	Southern Rock Agama	LC
AMPHISBAENIDAE	[3]*Monopeltis capensis*	Cape Worm Lizard	LC
	[3]*Monopeltis infuscata*	Dusky Worm Lizard	LC
	[3]*Zygaspis quadrifrons*	Kalahari Dwarf Worm Lizard	LC
CHAMAELEONIDAE	[1]*Chamaeleo dilepis dilepis*	Common Flap-neck Chameleon	LC
COLUBRIDAE	[2]*Dispholidus typus*	Boomslang	LC
	[2]*Philothamnus semivariegatus*	Spotted Bush Snake	LC
CORDYLIDAE	[1]*Karusasaurus polyzonus*	Southern Karusa Lizard	LC
ELAPIDAE	[3]*Naja nivea*	Cape Cobra	LC
GEKKONIDAE	[3]*Chondrodactylus bibronii*	Bibron's Gecko	LC
	[3]*Pachydactylus capensis*	Cape Gecko	LC
	[3]*Pachydactylus mariquensis*[E]	Common Banded Gecko	LC
	[3]*Ptenopus garrulus garrulus*	Common Barking Gecko	LC
GERRHOSAURIDAE	[3]*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	LC
LACERTIDAE	[2]*Heliobolus lugubris*	Bushveld Lizard	LC
	[2]*Nucras intertexta*	Spotted Sandveld Lizard	LC
	[2]*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	LC
	[2]*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC
LAMPROPHIIDAE	[2]*Boaedon capensis*	Common House Snake	LC
	[2]*Lamprophis aurora*[E]	Aurora Snake	LC
	[3]*Psammophis trinasalis*	Fork-marked Sand Snake	LC
	[3]*Psammophylax tritaeniatus*	Striped Grass Snake	LC
	[3]*Pseudaspis cana*	Mole Snake	LC
LEPTOTYPHLOPIDAE	[3]*Leptotyphlops scutifrons*	Peter's Thread Snake	LC
PELOMEDUSIDAE	[3]*Pelomedusa subrufa*	Marsh Terrapin	LC
SCINCIDAE	[3]*Trachylepis capensis*	Cape Skink	LC
	[3]*Trachylepis sulcata sulcata*	Western Rock Skink	LC
	[3]*Trachylepis variegata*	Variegated Skink	LC

LIST OF REPTILES (continued)

Reptiles protected according to NCNCA are indicated with their respective Schedule no. in superscript. South African endemics are indicated with [E].

Family	Scientific name	Common name	IUCN status
TESTUDINIDAE	[3]*Homopus femoralis*[E]	Greater Dwarf Tortoise	LC
	[3]*Psammobates oculifer*	Serrated Tent Tortoise	LC
	[3]*Psammobates tentorius*	Tent Tortoise	LC
	[3]*Stigmochelys pardalis*	Leopard Tortoise	LC
TYPHLOPIDAE	[3]*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	LC
VARANIDAE	[2]*Varanus albigularis albigularis*	Southern Rock Monitor	LC
VIPERIDAE	[3]*Bitis arietans arietans*	Puff Adder	LC

LIST OF AMPHIBIANS

Amphibians protected according to NCNCA are indicated with their respective Schedule no. in superscript. South African endemics are indicated with [E].

Family	Scientific name	Common name	IUCN status
BUFONIDAE	[2]*Amietophrynus gutturalis*	Guttural Toad	LC
	[2]*Amietophrynus poweri*	Western Olive Toad	LC
	[2]*Amietophrynus rangeri*[E]	Raucous Toad	LC
	[2]*Poyntonophrynus vertebralis*[E]	Southern Pygmy Toad	LC
	[2]*Bufo gariepensis*	Karoo Toad	LC
HYPEROLIIDAE	[2]*Kassina senegalensis*	Bubbling Kassina	LC
MICROHYLIDAE	[2]*Breviceps adspersus*	Bushveld Rain Frog	LC
PIPIDAE	[2]*Xenopus laevis*	Common Platanna	LC
PYXICEPHALIDAE	[2]*Amietia fuscigula*	Cape River Frog	LC
	[2]*Amietia quecketti*	Common River Frog	LC
	[2]*Cacosternum boettgeri*	Boettger's Caco	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 the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[1] *Accipiter badius*	Shikra	LC	LC
[2] *Acrocephalus baeticatus*	African Reed-Warbler	LC	LC
[2] *Acrocephalus gracilirostris*	Lesser Swamp-Warbler	LC	LC
[2] *Actitis hypoleucos*	Common Sandpiper	LC	LC
[2] *Alcedo cristata*	Malachite Kingfisher	LC	LC
[2] *Alopochen aegyptiacus*	Egyptian Goose	LC	LC
[2] *Amadina erythrocephala*	Red-headed Finch	LC	LC
[2] *Amaurornis flavirostris*	Black Crake	LC	LC
[2] *Anas capensis*	Cape Teal	LC	LC
[2] *Anas erythrorhyncha*	Red-billed Teal	LC	LC
[2] *Anas hottentota*	Hottentot Teal	LC	LC
[2] *Anas smithii*	Cape Shoveler	LC	LC
[2] *Anas sparsa*	African Black Duck	LC	LC
[2] *Anas undulata*	Yellow-billed Duck	LC	LC
[2] *Anhinga rufa*	African Darter	LC	LC
[2] *Anthoscopus minutus*	Cape Penduline-Tit	LC	LC
[2] *Anthropoides paradisea*	Blue Crane	**VU**	**NT**
[2] *Anthus cinnamomeus*	African Pipit	LC	LC
[2] *Anthus vaalensis*	Buffy Pipit	LC	LC
[2] *Apus affinis*	Little Swift	LC	LC
[2] *Apus apus*	Common Swift	LC	LC
[2] *Apus bradfieldi*	Bradfield's Swift	LC	LC
[2] *Apus caffer*	White-rumped Swift	LC	LC
[2] *Apus horus*	Horus Swift	LC	LC
[1] *Aquila rapax*	Tawny Eagle	**VU**	**EN**
[1] *Aquila verreauxii*	Verreaux's Eagle	LC	**VU**
[2] *Ardea cinerea*	Grey Heron	LC	LC
[2] *Ardea goliath*	Goliath Heron	LC	LC
[2] *Ardea melanocephala*	Black-headed Heron	LC	LC
[2] *Ardea purpurea*	Purple Heron	LC	LC
[2] *Ardeola ralloides*	Squacco Heron	LC	LC
[1] *Ardeotis kori*	Kori Bustard	**NT**	**NT**
[2] *Batis pririt*	Pririt Batis	LC	LC
[2] *Bostrychia hagedash*	Hadeda Ibis	LC	LC
[2] *Bradornis infuscatus*	Chat Flycatcher	LC	LC
[2] *Bradornis mariquensis*	Marico Flycatcher	LC	LC
[1] *Bubo africanus*	Spotted Eagle-Owl	LC	LC
[1] *Bubo lacteus*	Verreaux's Eagle-Owl	LC	LC
[2] *Bubulcus ibis*	Cattle Egret	LC	LC
[2] *Burhinus capensis*	Spotted Thick-knee	LC	LC
[1] *Buteo rufofuscus*	Jackal Buzzard	LC	LC

LIST OF BIRDS (Cont.)

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

Scientific name	Common name	IUCN status	SA RDB
[1] *Buteo vulpinus*	Steppe Buzzard	LC	LC
[2] *Calandrella cinerea*	Red-capped Lark	LC	LC
[2] *Calendulauda africanoides*	Fawn-coloured Lark	LC	LC
[2] *Calendulauda bradfieldi*	Bradfield's Lark	-	LC
[2] *Calidris alba*	Sanderling	LC	LC
[2] *Calidris ferruginea*	Curlew Sandpiper	**NT**	LC
[2] *Calidris minuta*	Little Stint	LC	LC
[2] *Campethera abingoni*	Golden-tailed Woodpecker	LC	LC
[1] *Caprimulgus europaeus*	European Nightjar	LC	LC
[1] *Caprimulgus rufigena*	Rufous-cheeked Nightjar	LC	LC
[1] *Caprimulgus tristigma*	Freckled Nightjar	LC	LC
[2] *Cercomela familiaris*	Familiar Chat	LC	LC
[2] *Cercomela sinuata*	Sickle-winged Chat	LC	LC
[2] *Cercotrichas coryphoeus*	Karoo Scrub-Robin	LC	LC
[2] *Cercotrichas paena*	Kalahari Scrub-Robin	LC	LC
[2] *Ceryle rudis*	Pied Kingfisher	LC	LC
[2] *Charadrius asiaticus*	Caspian Plover	LC	LC
[2] *Charadrius hiaticula*	Common Ringed Plover	LC	LC
[1] *Charadrius pallidus*	Chestnut-banded Plover	**NT**	**NT**
[2] *Charadrius pecuarius*	Kittlitz's Plover	LC	LC
[2] *Charadrius tricollaris*	Three-banded Plover	LC	LC
[2] *Chersomanes albofasciata*	Spike-heeled Lark	LC	LC
[2] *Chlidonias hybridus*	Whiskered Tern	LC	LC
[2] *Chlidonias leucopterus*	White-winged Tern	LC	LC
[2] *Chrysococcyx caprius*	Diderick Cuckoo	LC	LC
[2] *Ciconia abdimii*	Abdim's Stork	LC	**NT**
[2] *Ciconia ciconia*	White Stork	LC	LC
[1] *Ciconia nigra*	Black Stork	LC	**VU**
[2] *Cinnyris fusca*	Dusky Sunbird	LC	LC
[2] *Cinnyris mariquensis*	Marico Sunbird	LC	LC
[1] *Circaetus pectoralis*	Black-chested Snake-Eagle	LC	LC
[1] *Circus maurus*	Black Harrier	**EN**	LC
[1] *Circus pygargus*	Montagu's Harrier	LC	LC
[1] *Circus ranivorus*	African Marsh-Harrier	LC	**EN**
[2] *Cisticola aridulus*	Desert Cisticola	LC	LC
[2] *Cisticola fulvicapillus*	Neddicky	LC	LC
[2] *Cisticola juncidis*	Zitting Cisticola	LC	LC
[2] *Cisticola subruficapillus*	Grey-backed Cisticola	LC	LC
[2] *Cisticola tinniens*	Levaillant's Cisticola	LC	LC
[2] *Clamator glandarius*	Great Spotted Cuckoo	LC	LC
[2] *Clamator jacobinus*	Jacobin Cuckoo	LC	LC

LIST OF BIRDS (Cont.)

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

Scientific name	Common name	IUCN status	SA RDB
[3] *Colius colius*	White-backed Mousebird	LC	LC
[2] *Columba guinea*	Speckled Pigeon	LC	LC
[2] *Columba livia*	Rock Dove	LC	LC
[2] *Coracias caudata*	Lilac-breasted Roller	LC	LC
[2] *Coracias garrulus*	European Roller	LC	**NT**
[2] *Coracias naevia*	Purple Roller	LC	LC
[3] *Corvus albus*	Pied Crow	LC	LC
[3] *Corvus capensis*	Cape Crow	LC	LC
[2] *Cossypha caffra*	Cape Robin-Chat	LC	LC
[2] *Coturnix coturnix*	Common Quail	LC	LC
[2] *Creatophora cinerea*	Wattled Starling	LC	LC
[2] *Cuculus clamosus*	Black Cuckoo	LC	LC
[2] *Cursorius rufus*	Burchell's Courser	LC	**VU**
[2] *Cursorius temminckii*	Temminck's Courser	LC	LC
[2] *Cypsiurus parvus*	African Palm-Swift	LC	LC
[2] *Dendrocygna bicolor*	Fulvous Duck	LC	LC
[2] *Dendrocygna viduata*	White-faced Duck	LC	LC
[2] *Dendropicos fuscescens*	Cardinal Woodpecker	LC	LC
[2] *Dicrurus adsimilis*	Fork-tailed Drongo	LC	LC
[2] *Egretta alba*	Great Egret	LC	LC
[2] *Egretta garzetta*	Little Egret	LC	LC
[2] *Egretta intermedia*	Yellow-billed Egret	LC	LC
[1] *Elanus caeruleus*	Black-shouldered Kite	LC	LC
[2] *Emberiza capensis*	Cape Bunting	LC	LC
[2] *Emberiza flaviventris*	Golden-breasted Bunting	LC	LC
[2] *Emberiza impetuani*	Lark-like Bunting	LC	LC
[2] *Emberiza tahapisi*	Cinnamon-breasted Bunting	LC	LC
[2] *Eremomela icteropygialis*	Yellow-bellied Eremomela	LC	LC
[2] *Eremopterix verticalis*	Grey-backed Sparrowlark	LC	LC
[2] *Estrilda astrild*	Common Waxbill	LC	LC
[2] *Estrilda erythronotos*	Black-faced Waxbill	LC	LC
[2] *Euplectes afer*	Yellow-crowned Bishop	LC	LC
[3] *Euplectes orix*	Southern Red Bishop	LC	LC
[2] *Eupodotis afraoides*	Northern Black Korhaan	LC	LC
[2] *Eupodotis ruficrista*	Red-crested Korhaan	LC	LC
[1] *Falco biarmicus*	Lanner Falcon	LC	**VU**
[1] *Falco naumanni*	Lesser Kestrel	LC	LC
[1] *Falco peregrinus*	Peregrine Falcon	LC	LC
[1] *Falco rupicolis*	Rock Kestrel	LC	LC
[1] *Falco rupicoloides*	Greater Kestrel	LC	LC

LIST OF BIRDS (Cont.)

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

Scientific name	Common name	IUCN status	SA RDB
[2] *Fulica cristata*	Red-knobbed Coot	LC	LC
[2] *Gallinago nigripennis*	African Snipe	LC	LC
[2] *Gallinula chloropus*	Common Moorhen	LC	LC
[1] *Glareola nordmanni*	Black-winged Pratincole	**NT**	**NT**
[1] *Glaucidium perlatum*	Pearl-spotted Owlet	LC	LC
[2] *Granatina granatina*	Violet-eared Waxbill	LC	LC
[1] *Gyps africanus*	White-backed Vulture	**CR**	**CR**
[1] *Gyps coprotheres*	Cape Vulture	**VU**	**EN**
[2] *Halcyon chelicuti*	Striped Kingfisher	LC	LC
[1] *Haliaeetus vocifer*	African Fish-Eagle	LC	LC
[1] *Hieraaetus pennatus*	Booted Eagle	LC	LC
[2] *Himantopus himantopus*	Black-winged Stilt	LC	LC
[2] *Hippolais icterina*	Icterine Warbler	LC	LC
[2] *Hirundo albigularis*	White-throated Swallow	LC	LC
[2] *Hirundo cucullata*	Greater Striped Swallow	LC	LC
[2] *Hirundo dimidiata*	Pearl-breasted Swallow	LC	LC
[2] *Hirundo fuligula*	Rock Martin	LC	LC
[2] *Hirundo rustica*	Barn Swallow	LC	LC
[2] *Hirundo semirufa*	Red-breasted Swallow	LC	LC
[2] *Hirundo spilodera*	South African Cliff-Swallow	LC	LC
[2] *Indicator indicator*	Greater Honeyguide	LC	LC
[2] *Ixobrychus minutus*	Little Bittern	LC	LC
[2] *Lagonosticta senegala*	Red-billed Firefinch	LC	LC
[2] *Lamprotornis nitens*	Cape Glossy Starling	LC	LC
[2] *Laniarius atrococcineus*	Crimson-breasted Shrike	LC	LC
[2] *Lanius collaris*	Common Fiscal	LC	LC
[2] *Lanius collurio*	Red-backed Shrike	LC	LC
[2] *Lanius minor*	Lesser Grey Shrike	LC	LC
[2] *Larus cirrocephalus*	Grey-headed Gull	LC	LC
[1] *Leptoptilos crumeniferus*	Marabou Stork	LC	**NT**
[2] *Malcorus pectoralis*	Rufous-eared Warbler	LC	LC
[2] *Megaceryle maxima*	Giant Kingfisher	LC	LC
[1] *Melierax canorus*	Southern Pale Chanting Goshawk	LC	LC
[1] *Melierax gabar*	Gabar Goshawk	LC	LC
[2] *Merops apiaster*	European Bee-eater	LC	LC
[2] *Merops hirundineus*	Swallow-tailed Bee-eater	LC	LC
[2] *Milvus aegyptius*	Yellow-billed Kite	LC	LC
[1] *Milvus migrans*	Black Kite	LC	LC
[2] *Mirafra fasciolata*	Eastern Clapper Lark	LC	LC
[2] *Mirafra passerina*	Monotonous Lark	LC	LC

LIST OF BIRDS (Cont.)

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

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

LIST OF BIRDS (Cont.)

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

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

LIST OF BIRDS (Cont.)

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

Scientific name	Common name	IUCN status	SA RDB
[2] *Tockus nasutus*	African Grey Hornbill	LC	LC
[1] *Torgos tracheliotus*	Lappet-faced Vulture	**EN**	**EN**
[2] *Trachyphonus vaillantii*	Crested Barbet	LC	LC
[2] *Tricholaema leucomelas*	Acacia Pied Barbet	LC	LC
[2] *Tringa glareola*	Wood Sandpiper	LC	LC
[2] *Tringa nebularia*	Common Greenshank	LC	LC
[2] *Tringa stagnatilis*	Marsh Sandpiper	LC	LC
[2] *Turdus smithi*	Karoo Thrush	-	LC
[2] *Turnix sylvatica*	Small Buttonquail	LC	LC
[1] *Tyto alba*	Barn Owl	LC	LC
[2] *Upupa africana*	African Hoopoe	LC	LC
[3] *Urocolius indicus*	Red-faced Mousebird	LC	LC
[2] *Vanellus armatus*	Blacksmith Lapwing	LC	LC
[2] *Vanellus coronatus*	Crowned Lapwing	LC	LC
[2] *Vidua chalybeata*	Village Indigobird	LC	LC
[2] *Vidua macroura*	Pin-tailed Whydah	LC	LC
[2] *Vidua regia*	Shaft-tailed Whydah	LC	LC
[2] *Zosterops pallidus*	Orange River White-eye	LC	LC

APPENDIX 3

A photographic guide for species of conservation concern that occur on site

Boscia albitrunca

Protected under the NFA and Schedule 2 of the NCNCA

Oxalis lawsonii

All *Oxalis* spp. are protected under Schedule 2 of the NCNCA

Nymania capensis

Protected under Schedule 2 of the NCNCA

Olea europaea subsp. *africana*

Protected under Schedule 2 of the NCNCA

Aloe claviflora

All Asphodelaceae spp. are protected under Schedule 2 of the NCNCA

Aloe hereroensis var. *hereroensis*

All Asphodelaceae spp. are protected under Schedule 2 of the NCNCA