FS 30/5/1/2/2/10052 MR

Boscia
ECOLOGICAL CONSULTING

ECOLOGICAL & WETLAND ASSESSMENT REPORT

Kophia Diamonds (Pty) Ltd

Blaauwboschfontein

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Kophia Diamonds (Pty) Ltd

The Farm Catherines Fancy 831 and Portion 4 of the Farm Blaauwboschfontein 229

District of Boshof

Free State Province

Ecological & Wetland Assessment Report in application for Environmental Authorisation related to a Mining Right Application (Ref: FS 30/5/1/2/2/10052 MR) that was lodged with the Department of Mineral Resources

April 2019

EXECUTIVE SUMMARY

Kophia Diamonds (Pty) Ltd is proposing the mining of diamonds on the Farm Catherines Fancy 831 and Portion 4 of the Farm Blaauwboschfontein 229. The mining right area is located within the Boshof District Municipality of the Free State Province. This ecological and wetland assessment report describes the characteristics of terrestrial, aquatic and wetland habitats in the proposed mining area, identifies the source of impacts from the mining operation and assesses these impacts, as well as the residual impacts after closure.

A desktop study and field investigation was performed to obtain ecological information for the proposed study area and identify the ecological characteristics and sensitivity of the site. Three plant communities were identified on site of which the open shrubland on transformed land is primarily earmarked for mining activities. Due to the long history of mining on site, this area is considered to be of low sensitivity. It is however possible that mining activities could creep into the pristine grassland, which is considered to be of medium sensitivity. An artificial ephemeral wetland also occurs within the mining right application boundary, but it falls outside the earmarked mining area. Even though it is artificial, regarded to be largely modified, with low Ecological Importance and Sensitivity it is still considered to be of Very High Sensitivity to mining activities due to its unique ecological functionality. In general impacts associated with the proposed mining activity are expected to be moderately low.

Species of conservation concern that are found on site primarily occurs within the pristine grassland habitat and includes Helichrysum lucilioides. A permit application regarding protected flora need to be lodged with the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs prior to any clearance of protected vegetation.

To conclude, the destruction of the natural habitats within the study area is not likely to be significant due to the land use history on site. However, minimal increased transformation is possible if activities creep into the pristine grassland. The significance of the impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the mining area. The majority of the site has already been modified and is not expected to be further affected significantly. In my opinion, authorisation can be granted as long as the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

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1. INTRODUCTION

1.1. Background information

Kophia Diamonds (Pty) Ltd is proposing the mining of diamonds on the Farm Catherines Fancy 831 and Portion 4 of the Farm Blaauwboschfontein 229 (from heron referred to as Blaauwboschfontein diamond mine). The mining right area is located within the Boshof District Municipality of the Free State Province and lies 30 km east of the town Boshof on a gravel road that turns from the R64 and connects with the R59, towards Hertzogville (Figure 1). The total extent of the mining right area is 126.6651 ha.

An ecological and wetland assessment is required in order to consider the impacts that the proposed activities might have on the ecosystems of Blaauwboschfontein and therefore Boscia Ecological Consulting has been appointed by the applicant to conduct an assessment and provide an ecological and wetland assessment report.

This assessment report describes the characteristics of terrestrial, aquatic and wetland habitats in the proposed mining area, identifies 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 in order to identify and describe different ecological habitats (terrestrial, aquatic and wetland) and provide an inventory of communities/species/taxa and associated species of conservation concern within the environment that may be affected by the proposed activity;

- identify the relative ecological sensitivity of the project area;

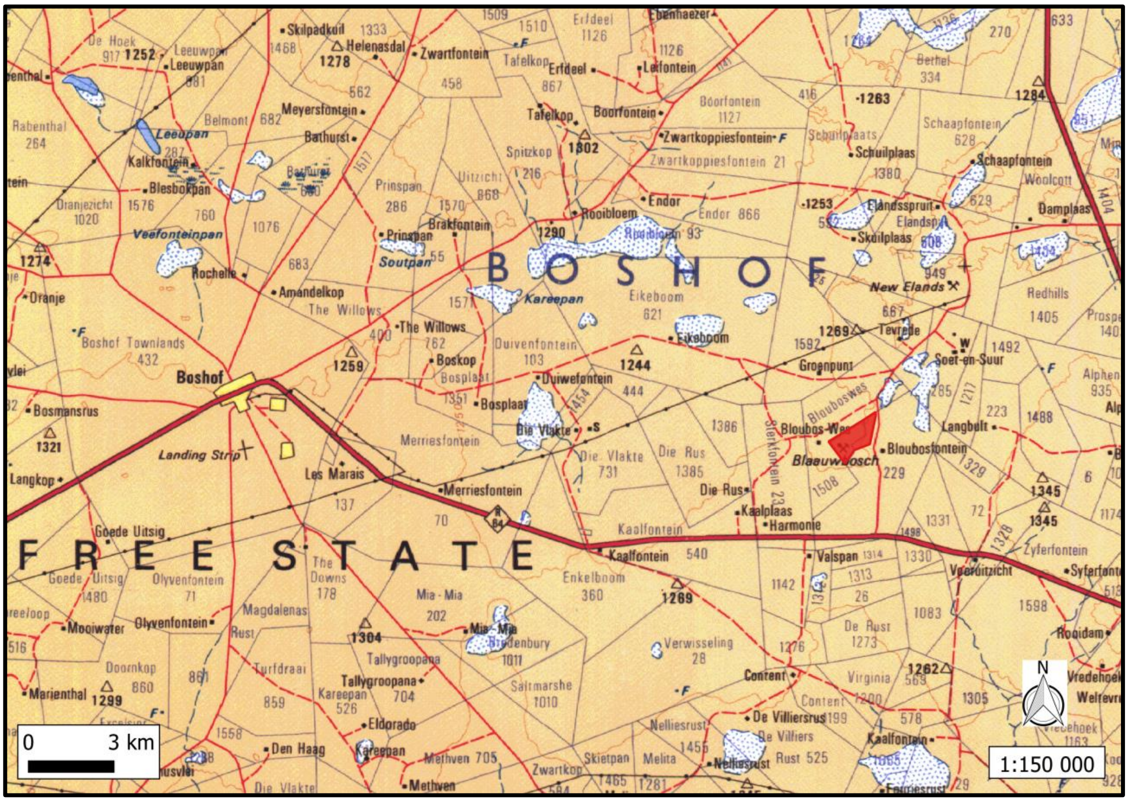
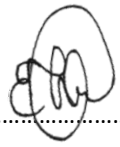


Figure 1. The location of the Blaauwboschfontein mining area is indicated in red.

- produce an ecological assessment report that:
  - indicates identified habitats and fauna and flora species,
  - delineates and classifies wetlands,
  - indicates the ecological sensitivity of habitats and conservation values of species, including Wetland Health Assessment (PES), Wetland Ecological Importance and Sensitivity (EIS) and Wetland Functional Assessment (Eco-Services)
  - determines the potential impacts of the project on the ecological integrity,
  - provides mitigation measures and recommendations to limit project impacts,
  - indicates ecological responsibilities pertaining to relevant conservation legislation.

1.3. Details of the specialist consultant

Company Name	Boscia Ecological Consulting cc	**Registration no:**	2011/048041/23
Address	PostNet Suite #194 Private Bag X2 Diamond 8305		
Contact Person	Dr Elizabeth (Betsie) Milne		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	PhD Botany (Nelson Mandela Metropolitan University) Masters Environmental Management (University of the Free State) BTech Nature Conservation (Tshwane University of Technology)		
Declaration of independence	I, Elizabeth (Betsie) Milne 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 based on diamonds resources that are confined to the Blaauwbosch Kimberlite Pipe. Diamonds will be extracted in three different ways; i.e. reclamation of old mine dumps, opencast mining as well as shaft mining. Kimberlite material from the old mined out dumps will be loaded with an excavator on a truck and then transported to the treatment facility. The Kimberlite blow and fissure will be mined by conventional opencast mining methods. Topsoil will be stripped where after overburden will be removed from the pit with an excavator to a level where diamond bearing material is exposed. The ore will then be removed with an excavator and loaded onto a tipper truck and transported to the treatment facility. The Kimberlite will be mined underground by means of inclined chambering, after the maximum depth for opencast mining has been reached. Groundwater extraction will be needed to keep the mining areas dry.

An estimated total volume of 647 955 tons of ore will be processed over 10 years. Mining activities will primarily make use of existing roads and infrastructure that have already been established during past mining activities (Figure 2). Main infrastructure related to the proposed activity include a processing plant, ablution facilities, a clean and dirty water system, fuel storage facilities, salvage yard, access control point, product stockpile area, waste disposal site, temporary workshop facilities and wash bay, water distribution pipeline and water tank.

2. METHODOLOGY

2.1. Data collection

The study comprised a combination of field and desktop surveys for data collection on fauna, flora and wetland habitats in order to obtain the most comprehensive data set for the assessment. The fieldwork component was conducted on 21 March 2019 and most data for the desktop component was obtained from the quarter degree square that includes the study area (2825 CB).

Figure 2. The locality of the core footprint for the mining operation is indicated in white, while the border of the proposed mining right area is indicated in red.

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 in order to characterise the species composition. The following quantitative data was collected:

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

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

2.2.2. Desktop survey

For the desktop component, the South African National Vegetation Map (Mucina and Rutherford 2006) was used to obtain data on broad scale vegetation types and their conservation status. The South African National Biodiversity Institute's (SANBI) BGIS database was also consulted to obtain information on biodiversity information for the Tokologo Local Municipality (FS182), in which the study area falls.

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

2.3. Fauna

2.3.1. Desktop survey

A desktop survey was undertaken to obtain lists of mammals, reptiles, amphibians, birds and invertebrates which are likely to occur in the study area. These were derived based on distribution records from the literature, including Friedmann and Daly (2004) and Stuart and Stuart (2015) for mammals, Alexander and Marais (2007) and Bates et al. (2014) for reptiles, Du Preez and Carruthers (2009) for amphibians, Gibbon (2006) for birds and Picker et al. (2004) and Griffiths et al. (2015) for invertebrates. Additional information on faunal distribution was extracted from the various databases hosted by the ADU web portal, http://adu.org.za. A map of important bird areas (BirdLifeSA 2015) was also consulted. The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.

The likelihood of Red Data species occurring on site has been determined using the distribution maps in the Red Data reference books (Friedmann and Daly 2004; Bates et al. 2014; Taylor et al. 2015; ADU 2016) and comparing their habitat preferences with the habitat described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria (IUCN 2019) and/or the various red data books for the respective taxa.

2.3.2. Field survey

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

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

2.4. Wetlands

2.4.1. Information collection

a) Desktop survey

A desktop survey was undertaken to obtain general information regarding the significance and ecological functioning of wetlands. Maps delineating wetland boundaries were generated using 1:50 000 topographic maps, satellite images and other geographic information systems. The National Freshwater Ecosystem Priority Areas (Nel et al. 2011) was inspected and the geological wetland descriptors were also determined using desktop information. Guidelines, including (Ollis et al. 2013), (DWAF 2007), (Macfarlane et al. 2007) and (Kotze et al. 2007a) were consulted in order to classify and assess wetlands on Blaauwboschfontein.

b) Field survey

The wetland survey was conducted concurrent with the vegetation and fauna survey to assess and delineate the wetlands on Blaauwboschfontein. The following elements were assessed:

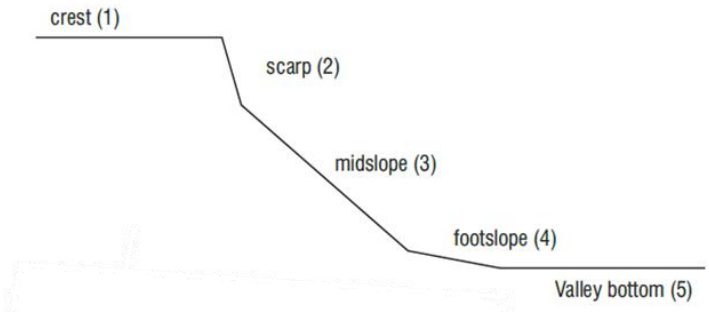
- Wetland descriptors
- Present ecological state
- Features of ecological importance and functionality
- Current impacts

2.4.2. Wetland assessment procedures

a) Wetland Delineation

Wetlands were delineated according to the delineation procedure as set out by DWAF (2005). The delineation procedure considered the following four attributes to determine the limitations of the wetland:

- **Terrain Unit Indicator** helps identifying those parts of the landscape where wetlands are most likely to occur. Typical terrain units are depicted below:



- **Soil Form Indicator** identifies the soil forms, as defined by SCWG (1991). A hydromorphic soil displays unique characteristics resulting from its prolonged and repeated saturation.

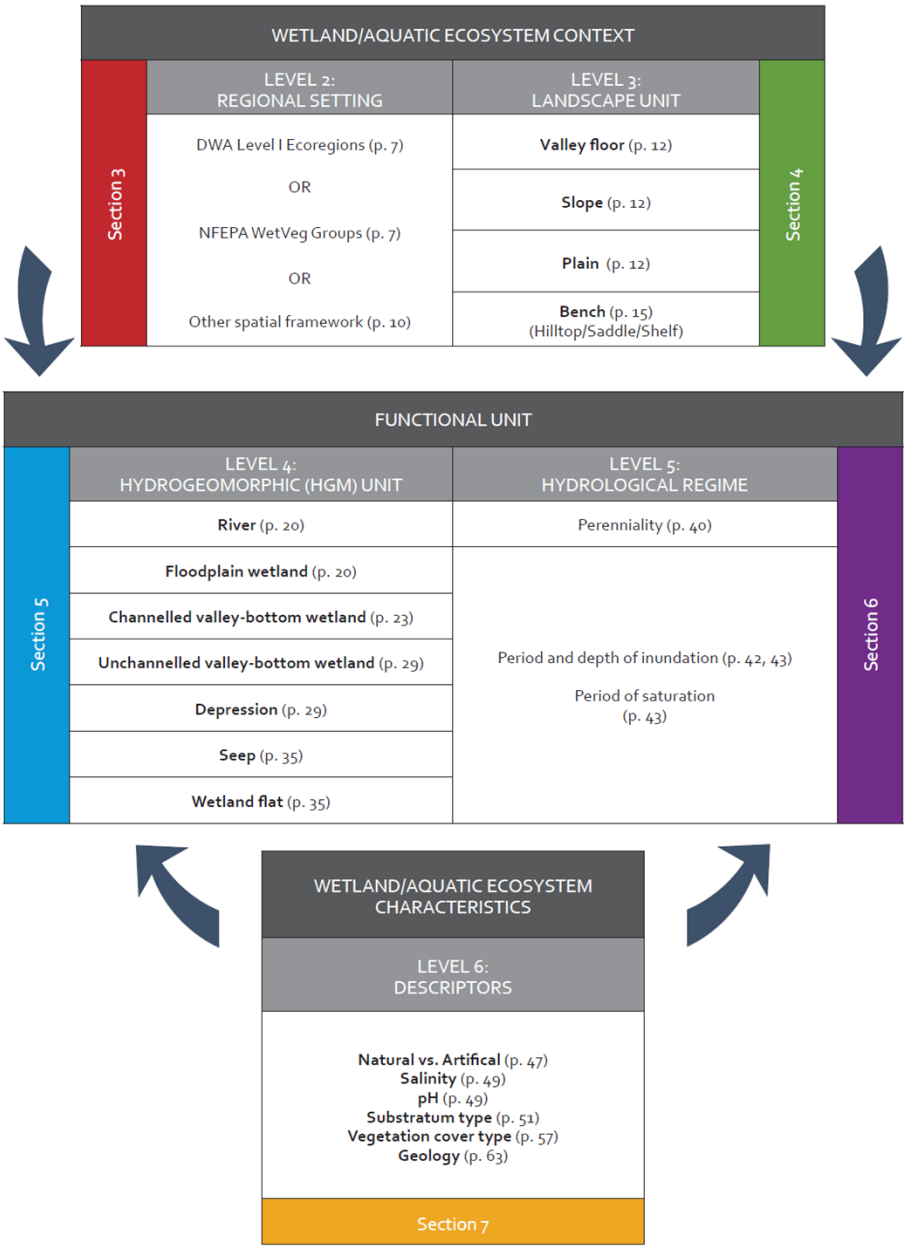
- **Soil Wetness Indicator** identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation. In practice, this indicator is used as the primary indicator.

- **Vegetation Indicator** identifies hydrophilic vegetation associated with frequently saturated soils. Plant communities undergo distinct changes in species composition along the wetness gradient.

The presence of all indicators provides a logical, defensible, and technical basis for identifying an area as wetland, but an area should display a minimum of either soil wetness or vegetation indicators in order to be classified as a wetland. Verification of the terrain unit and soil form indicators increases the level of confidence in deciding the boundary. In other words, the more indicators present, the higher the confidence in the delineation.

b) Wetland Classification

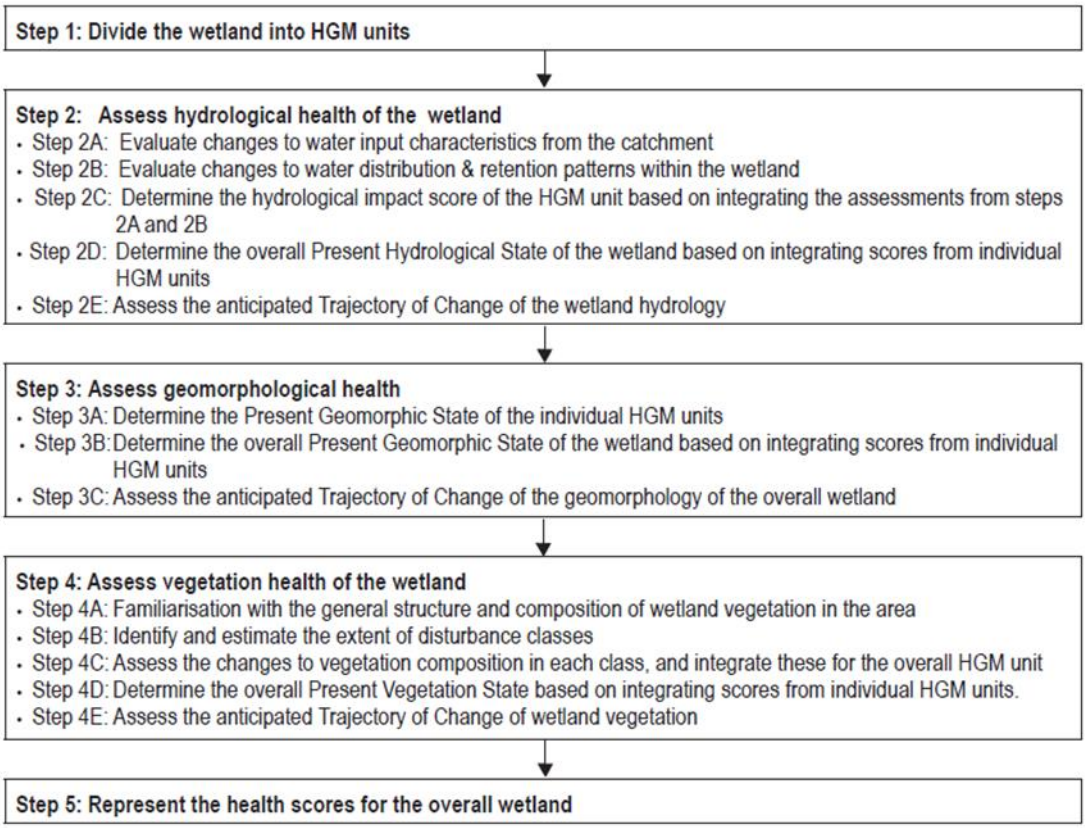
The wetlands were subsequently classified according to the classification procedure for inland systems (Level 2) developed by Ollis et al. (2013). The inland component of the Classification System has a tiered structure (see below diagram), which progresses from Regional Setting (Level 2) and Landscape Units (Level 3), to Hydrogeomorphic (HGM) Units at the finest spatial scale (Level 4). At Level 5, Inland Systems are distinguished from each other based on the hydrological regime and, in the case of open waterbodies, the inundation depth class. At Level 6, six 'descriptors' have been incorporated into the Classification System. These descriptors allow you to distinguish between aquatic ecosystems with different structural, chemical, and/or biological characteristics.



c) Wetland Health Assessment

A Present Ecological State (PES) assessment was conducted to establish baseline health for the wetlands, based on WET-Health (Macfarlane et al. 2007). WET-Health requires the identification of hydrogeomorphic (HGM) units and then assists in assessing the health of the identified HGM units using indicators based on geomorphology, hydrology and vegetation. A Wet-Health level 1 assessment was conducted to determine the PES of the wetlands on Blaauwboschfontein.

The PES assessment is conducted by following a 5 step process:



The overall PES is then calculated using the following formula, to give a score ranging from 0 (pristine) to 10 (critically impacted in all respects):

$$\frac{((\text{Hydrology score}) \times 3) + ((\text{Geomorphology score}) \times 2) + ((\text{Vegetation score}) \times 2)}{7}$$

The PES categories used by WET-Health to describe the integrity of the wetlands are:

Description	Combined impact score	PES Category
Unmodified, natural.	0 – 0.9	**A**
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9	**B**
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2 – 3.9	**C**
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9	**D**
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	**E**
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	**F**

Trajectory of Change classes, scores and symbols used to describe the predicted nature of change in the state of a wetland from its present state given threats and vulnerability, are:

Trajectory class	Description	Change score	Class Range	Symbol
Improve markedly	Condition is likely to improve substantially over the next five years	2	1.1 to 2.0	↑↑
Improve	Condition is likely to improve over the next 5 years	1	0.3 to 1.0	↑
Remain stable	Condition is likely to remain stable over the next 5 years	0	-0.2 to 0.2	→
Deterioration slight	Condition is likely to deteriorate slightly over the next 5 years	-1	-0.3 to -1.0	↓
Deterioration substantial	Condition is likely to deteriorate substantially over the next 5 years	-2	-1.1 to -2.0	↓↓

d) Wetland Ecological Importance and Sensitivity

An Ecological Importance and Sensitivity (EIS) assessment was conducted by using methodology adapted from Duthie (1999). For this assessment procedure, a series of determinants are considered using a ranking scale of 0 to 4, i.e. Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0:

Determinant
PRIMARY DETERMINANTS
1. Rare & Endangered Species
2. Populations of Unique Species
3. Species/taxon Richness
4. Diversity of Habitat Types or Features
5 Migration route/breeding and feeding site for wetland species
6. Sensitivity to Changes in the Natural Hydrological Regime
7. Sensitivity to Water Quality Changes
8. Flood Storage, Energy Dissipation & Particulate/Element Removal
MODIFYING DETERMINANTS
9. Protected Status
10. Ecological Integrity

The median of the determinants is used to allocate an Ecological Management Class (EMC):

EIS Category	Mean range	EMC
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	> 3 and <= 4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	> 2 and <= 3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	> 1 and <= 2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	> 0 and <= 1	D

a) Wetland Functional Assessment

To assessment of the ecosystem services supplied by the wetlands on Blaauwboschfontein was conducted according to guidelines provided for a Level 2 assessment in WET-EcoServices (Kotze et al. 2007b). This assessment examines and rates the following services according to their degree of importance and the degree to which the service is provided:

Ecosystem services supplied by wetlands	**Indirect benefits**	**Regulating and supporting benefits**	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
			Streamflow regulation		Sustaining streamflow during low flow periods
			Water quality enhancement benefits	Sediment trapping	The trapping and retention in the wetland of sediment carried by runoff waters
				Phosphate assimilation	Removal by the wetland of phosphates carried by runoff waters
				Nitrate assimilation	Removal by the wetland of nitrates carried by runoff waters
				Toxicant assimilation	Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters
				Erosion control	Controlling of erosion at the wetland site, principally through the protection provided by vegetation
			Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter
	Direct benefits	**Biodiversity maintenance**			Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity
		Provisioning benefits	Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agriculture or other purposes
			Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish etc.
			Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural benefits	Cultural heritage		Places of special cultural significance in the wetland, e.g. for baptisms or gathering of culturally significant plants
			Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
			Education and research		Sites of value in the wetland for education or research

Score	**< 0.5**	**0.5 – 1.2**	**1.3 – 2.0**	**2.1 – 2.8**	**> 2.8**
Rating of the likely extent to which a benefit is being supplied	Low	Moderately low	Intermediate	Moderately high	High

2.5. Sensitivity mapping and assessment

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

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

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

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

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

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

2.6. Impact assessment and mitigation

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

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

Consequence of impacts is defined as follows:

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

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

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

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

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

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

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

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

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

CONSEQUENCE
(Severity + Spatial Scope + Duration)

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

2.7. Assumptions and limitations

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

The site visit for the study took place during late summer, which is a favourable time of the year for vegetation surveys. Most grasses, annuals and other flowering plants were in a suitable condition for the survey. Most of the common and significant species encountered were identifiable and it is expected that any species of conservation concern would have been visible. However, the bulbs that were encountered were not identifiable and could possibly be among those listed as species of conservation concern.

The aquatic element of the dam on the other hand is best represented when inundated after good rainfall events. The dam was however dry during the survey and consequently, the timing of the site visit is considered to be a limiting factor in terms of portraying the aquatic ecology of this artificial wetland. Furthermore, the dam falls outside the boundary fence of the mine and was not accessible during the survey. This, along with the ephemerality of the dam did not provide ideal circumstances for these urgent types of surveys and therefore the field investigation was supplemented by desktop surveys to obtain comprehensive understanding of the overall ecology of the artificial wetland.

The methodology used to assess the wetlands on site were mainly developed for- and best applied to the more temperate wetlands of South Africa. The suite of methodologies available to date do not provide for a comprehensive assessment of the ephemeral wetlands in South Africa. This is mainly due to the fact that they are rarely wet and do not display those indicators typically used for wetland assessments in other parts of South Africa.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

The major land use in the region is agriculture; with the main agricultural enterprise in the region designated for grains. The site is classified as non-arable land with potential for grazing, woodland or wildlife. The proposed stocking rate for the region is 10 Ha per large stock unit. The site itself is classified to be most suitable for wheat, with an estimated yield of 0.5 – 1.5 ton/Ha.

The site has however been subject to mining activities since 1908, which in time created a large transformation footprint with very little pristine areas remaining today (Figure 3). Apart from the current mining application by Kophia Diamonds, no other activities are taking place on site.

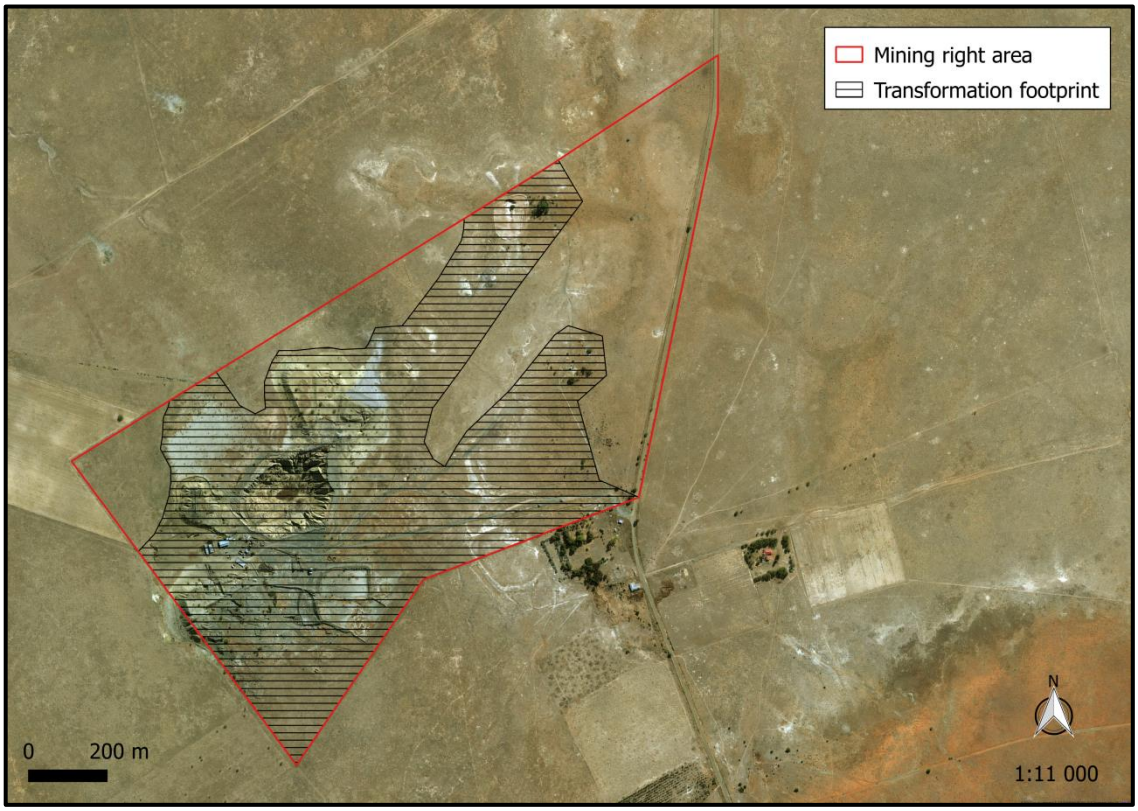


Figure 3. Evidence of the land use history on Blaauwboschfontein.

3.2. Geology, soils and topography

According to Bosch and Visser (1993) the geological features on Blaauwboschfontein comprise quaternary and Permian deposits. The western half is associated with shale, siltstone and sandstone from the Tierberg Formation of the Ecca Group, Karoo Supergroup, while the eastern half is associated with calcrete (Figure 4). The Blaauwbosch kimberlite pipe runs through the centre of the property (Figure 4) and forms the basis of this mining operation.

The region is characterised by level plains with some relief, with altitudes around 1 245 m above sea level. The terrain is flat indicated by a very gentle slope of < 2 % running north.

The site is closely associated with the Db3a landtype. Here, soils with a marked clay accumulation, strongly structured and a non-reddish colour are found. They may occur associated with one or more of vertic, melanic and plinthic soils. Rainfall erosivity is low with very low predicted soil loss, but the soils are moderately susceptible to wind erosion.

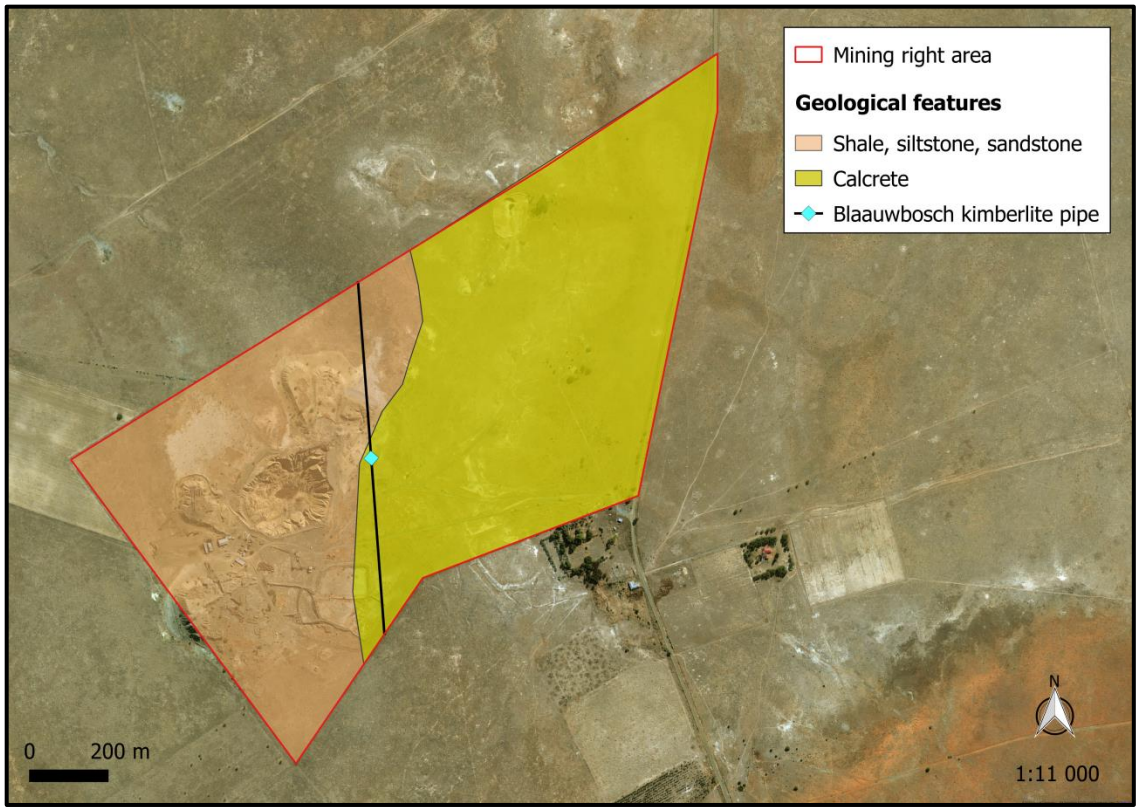


Figure 4. The distribution of geological features in the study area according to Bosch and Visser (1993).

3.3. Vegetation

3.3.1. Broad-scale vegetation patterns

The study area falls within the Grassland biome (Mucina and Rutherford 2006). According to the vegetation map of Mucina and Rutherford (2012), one broad-scale vegetation unit is present on site (Figure 5), i.e. Western Free State Clay Grassland.

Western Free State Clay Grassland is found in the Free State at altitudes between 1 200 and 1 420 m. It covers parts of the western district (south), Boshof (southwest), Hertzogville (west), Wesselsbron (north) and Brandfort (east) and consists of three main areas, of which the southern and middle sections are separated by a slightly elevated area (dolerite hills) between Hertzogville, Boshof and Soutpan. The Vet River separates the middle and northern sections and all three sections are separated from one another by belts of Vaal-Vet Sandy Grassland. It is restricted to flat bottomlands which support dry, species-poor grassland with a high number of salt pans embedded. Dwarf karoo shrublands surround the pans in disturbed habitats.

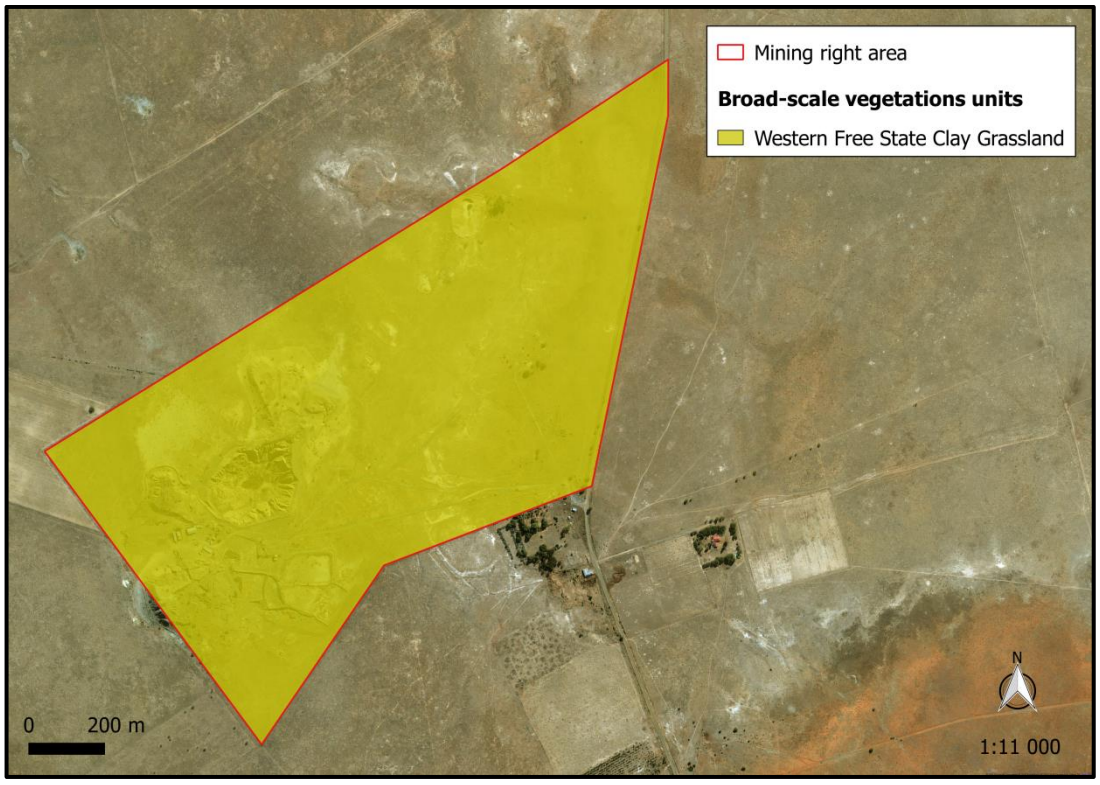


Figure 5. The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.

The geology and soil comprise deposits of sandstone, mudstone and shale, which underlie extensive areas of flat to undulating plains, interrupted by dolerite sills in places. No rivers or streams drain away from these plains and all the water drains into the numerous pans, a unique feature of this landscape. Dry, clayey, duplex soils typical of land types Da, Db and Dc are associated with this unit. The unit is classified as least threatened, with none being conserved in statutory conservation areas. Almost 20 % of this unit has already been transformed for maize and wheat cultivation and *Prosopis* is an occasional invasive. Erosion is very low (38 %) to moderate (28 %).

3.3.2. Fine-scale vegetation patterns

The plant communities within the study area are delineated according to plant species correspondences, change in soil structure, topographical changes and disturbance regimes. The vegetation on site can be divided into three distinct units (Figure 6) and are described below. A complete plant species list, including those species likely to occur in the area is presented in Appendix 1.

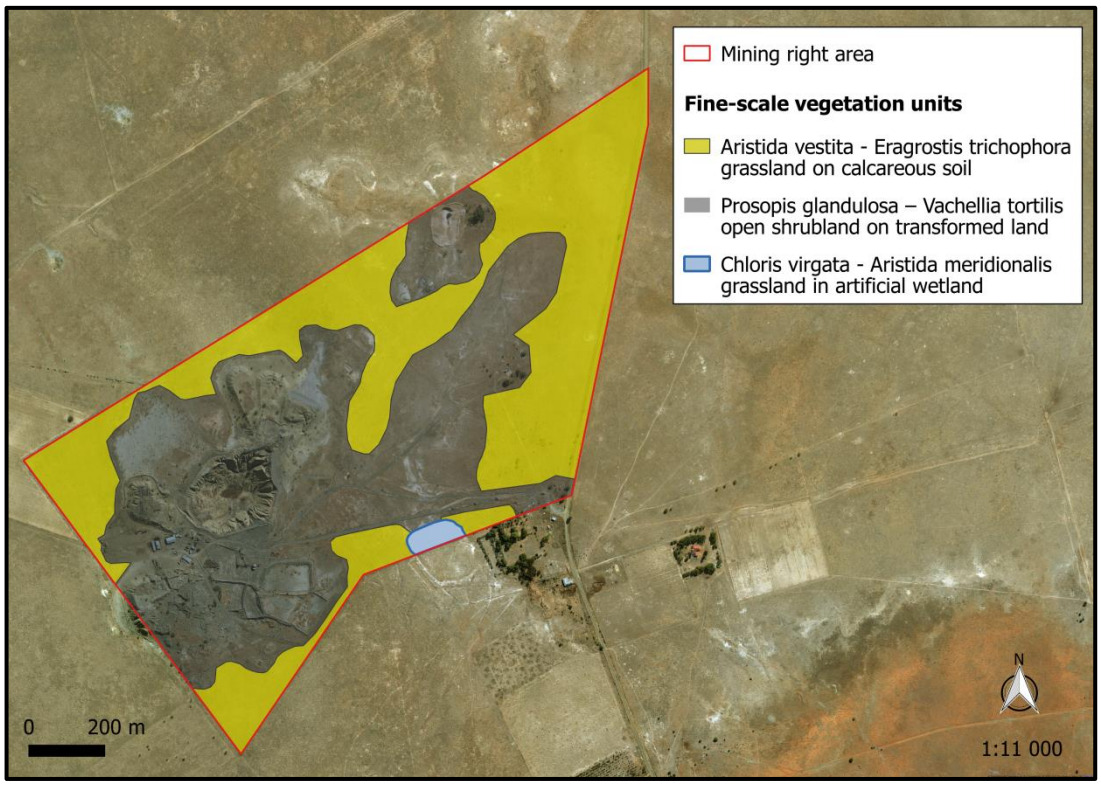


Figure 6. The distribution of fine-scale plant communities in the study area.

i) *Aristida vestita - Eragrostis trichophora* grassland on calcareous soil

This community comprises the pristine areas surrounding the mine footprint (Figure 6) and is found on calcareous soil, which constitutes about 5 % of the ground cover. It is typically represented as a well-developed grassland (Figure 7). *Aristida vestita* and *Eragrostis trichophora* equally dominates the vegetation cover, but *Eragrostis lehmanniana* is also very common. Other common grasses include *Fingerhuthia africana*, *Enneapogon cenchroides, Digitaria eriantha, Themeda triandra, Stipagrostis uniplumis, Schmidtia pappophoroides, Aristida meridionalis, Eragrostis obtusa* and *E. chloromelas. Sporobolus fimbriatus, Cymbopogon pospischilii, Panicum coloratum* and Cyperaceae sp. are also present.

Low shrubs occur abundantly in the grassland. The most conspicuous low shrubs include *Helichrysum lucilioides, Amphiglossa triflora, Nenax microphylla, Pentzia globosa* and *Chrysocoma obtusata*. However, *Pentzia incana, P. calcarea, Selago saxatili*s and *Lycium cinereum* are also common. *Leonotis pentadentata, Felicia muricata, Lasiosiphon polycephalus, Hertia pallens, Asparagus* sp. and *Thesium* sp. are also present, but at low abundances. Taller shrubs like *Vachellia tortilis, Ziziphus mucronata* and *Lycium hirsutum* are very sparsely scattered.

Herbs mainly include creepers such as *Kedrostis capensis, Gisekia pharnacioides* and *Tribulus* sp. Bulbs were also encountered but were not identifiable.

Figure 7. The pristine grassland on calcareous soil consists of a well-developed grass layer.

ii) *Prosopis glandulosa – Vachellia tortilis* open shrubland on transformed land

The open shrubland on transformed land comprises the majority of the study area and is found in the centre of the property (Figure 6). It is presented as shrubs scattered in a grassy matrix (Figure 8). The ground surface comprises disturbed soils affected by past mining activities, along with old dumps scattered across the landscape.

Dominant shrubs include *Prosopis glandulosa* and *Vachellia tortilis,* but *Tamarix ramosissima* is also common. Low shrubs typically include weeds like *Salsola kali, Datura ferox* and *Atriplex semibaccata*. The graminoid layer includes many of the same species found in the pristine grassland community, but species such as *Chloris virgata, Tragus berteronianus, T. racemosus, T. koelerioides*, *Brachiaria marlothii* and *Phragmites australis* are more conspicuous. Common herbs recorded here include *Arctotis venusta* and *Oxalis depressa.*

Figure 8. The open shrubland on transformed land is presented as shrubs scattered in a grassy matrix.

iii) *Chloris virgata - Aristida meridionalis* grassland in artificial wetland

The artificial wetland is found on the south-eastern boundary of the mining right area (Figure 6). The ground surface comprises light-grey sandy clay soil underlain by calcrete. The vegetation is presented as a grassland (Figure 9) with *Chloris virgata* and *Aristida meridionalis* dominating the majority of the vegetation cover. Other common grasses include *Eragrostis truncata* and *Tragus racemosus*.

Figure 9. The artificial wetland is presented as a grassland found on light-grey sandy clay soil, underlain by calcrete.

3.3.3. Population of sensitive, threatened and protected plant species

The SANBI Red List provides information on the national conservation status of South Africa's indigenous plants, while the National Forests Act (No. 84 of 1998) (NFA) and Chapter IV of the Free State Nature Conservation Ordinance (Act No. 8 of 1969) (FSNCO) restricts activities regarding sensitive plant species.

All red listed plant species are protected in terms of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004 (Notice 256 of 2015) and therefore a permit is required from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs for any restricted activity listed in the act. 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 30 of the FSNCO prohibits anyone to pick any protected (Schedule 6) plants, except under the authority of a permit, while Section 31 prevents a person to pick any indigenous plant on land of which he/she is not the owner, without written permission of the owner.

Most species recorded in the area are classified as least concern; a category which includes widespread and abundant taxa. However, one species, i.e. *Pentzia oppositifolia* is classified as Rare (Table 2). It is a widespread, but localized habitat specialist and is not suspected to be in danger of extinction. It is primarily found on alluvial soils in and around dolomitic limestone pans and was historically recorded in the region. It was not encountered on site and due to its habitat requirements it is not expected to occur on site.

None of the species from the study area are protected in terms of the National Forests Act (NFA) No 84 of 1998.

Protected species in terms of Schedule 6 of Free State Nature Conservation Ordinance (Act No. 8 of 1969) (Table 2) that are known from the study area include *Euphorbia spartaria* and *Helichrysum lucilioides.* Of these, *Helichrysum lucilioides* is abundant in the pristine grassland, but *E. spartaria* was not encountered on site. A photographic guide to these species is attached as Appendix 3.

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

FAMILY	Scientific name	Status	NFA	NCNCA
ASTERACEAE	*Helichrysum lucilioides*	LC		X
	Pentzia oppositifolia	Rare		
EUPHORBIACEAE	*Euphorbia spartaria*	LC		X

3.3.4. Weeds and invader plant species

Weeds and invasive species are controlled in terms of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004 and the Conservation of Agricultural Resources (CARA) Act 43 of 1993. 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 3). Those declared weeds or invasive species that were recorded in and around the study area are listed in Table 4.

Table 3. 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 4. A list of declared weeds and invasive species recorded in the study area.

Scientific name	Common name	CARA	NEMBA
Datura ferox	Large thorn apple	1	1b
Eucalyptus camaldulensis	Red river gum	2	1b
Opuntia ficus-indica	Sweet prickly pear	1	1b
Prosopis glandulosa var. *glandulosa*	Honey mesquite	2	1b
Salsola kali	Tumbleweed	-	1b
Tamarix ramosissima	Pink tamarisk	3	1b

3.3.5. Indicators of bush encroachment

Bush encroacher species are controlled in terms of Regulation 16 of CARA; where land users of an area in which natural vegetation occurs and that contains communities of encroacher indicator plants are required to follow sound practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs. Declared indicators of bush encroachment in the Free State, which were recorded in the study area, are listed in Table 5.

Table 5. A list of declared indicators of bush encroachment in the Free State found in the study area.

Scientific name	Common name
Vachellia tortilis	Umbrella thorn
Asparagus spp.	Wild asparagus

3.4. Faunal communities

All red listed fauna species are protected in terms of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004 (Notice 256 of 2015). No person may carry out any restricted activity involving listed, threatened or protected species without a permit from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs. Section 2 of the FSNCO prohibits anyone to hunt any protected (Schedule 1) wildlife, except under the authority of a permit, while Section 5 prevents a person to hunt any ordinary game without a licence and without written permission of the owner. Section 14 further prevents any person to hold any live wild animal in captivity, except under authority of a permit.

The landscape features on Blaauwboschfontein does not provide a particularly diverse habitat opportunity to faunal communities, but those likely to be found in the study area are discussed in their respective faunal groups below.

3.4.1. Mammals

As many as 59 terrestrial mammals and seven bat species have been recorded in the region (see Appendix 2); of which 15 species are of conservation concern (Table 6). No mammal species were however encountered on site.

Table 6. Mammal species of conservation concern that are likely to occur in the region. Conservation values are indicated in terms of the international (IUCN) Red List, the South African Red Data Book (SA RDB) and Schedule 1 of the Free State Nature Conservation Ordinance (FSNCO).

Scientific name	Common name	IUCN	SA RDB	FSNCO
Eidolon helvum	African Straw-coloured Fruit-bat	NT		
Rhinolophus clivosus	Geoffroy's Horseshoe Bat		NT	
Chlorotalpa sclateri	Sclater's Golden Mole		DD	
Orycteropus afer	Aardvark			X
Gerbilliscus leucogaster	Bushveld Gerbil		DD	
Smutsia temminckii	Ground Pangolin	VU	VU	X
Suncus varilla	Lesser Dwarf Shrew		DD	
Atelerix frontalis	South African Hedgehog		NT	X
Felis nigripes	Black-footed cat	VU		
Aonyx capensis	Cape Clawless Otter	NT		
Hydrictis maculicollis	Spotted-necked Otter	NT	NT	
Hyaena brunnea	Brown Hyena	NT	NT	
Otocyon megalotis	Bat-eared Fox			X
Poecilogale albinucha	African Striped Weasel		DD	
Mellivora capensis	Honey Badger		NT	

The listed bat species have a high chance to occur on site and could potentially also be found roosting in the mine shafts. Smaller species like the Bushveld Gerbil and African Striped Weasel could potentially occur in the pristine grassland, due to their preference for grassy habitats. However, even though the larger species such as Aardvark, Bat-eared Fox and Honey Badger have a wide habitat tolerance, their likelihood to be found on site is minimised by the land use history and limited pristine habitat available. Ground Pangolin, South African Hedgehog, Black-footed cat and Brown Hyaena are not likely to occur on site, because they are rather skittish and land use history on site has probably excluded them many year ago already. The Cape Clawless Otter and Spotted-necked Otter are also not likely to occur on site due to their preference for perennial aquatic habitats.

In general, impacts on mammals arising from the diamond mining activities will primarily be very low.

3.4.2. Reptiles

The Blaauwboschfontein mining area lies within the distribution range of at least 36 reptile species (see Appendix 2) of which the puff adder was encountered during the field survey. None of these species are red listed, but four species; i.e. Southern Karusa Lizard, Greater Dwarf Tortoise, Serrated Tent Tortoise and Leopard Tortoise are protected according to Schedule 1 of the FSNCO. Furthermore, the Eastern Ground Agama, Aurora Snake and Peters' Thread Snake are endemic to South Africa.

All of the reptiles of conservation concern are most likely to be associated with the grassy habitat typically found in the pristine and transformed areas on site. Impacts on reptiles from the diamonds mining activities will primarily be restricted to those occurring in the transformed habitat.

3.4.3. Amphibians

Fourteen amphibian species are known from the region (Appendix 2), indicating that the site potentially have a rather diverse frog community. No natural permanent water occurs on site that would represent suitable breeding habitats for most of these species, but the artificial wetland will be important during periods of inundation. As a result, only those species which are relatively independent of water are likely to occur regularly in the area.

The Giant Bull Frog (*Pyxicephalus adspersus*) 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 the known distribution of this species and the artificial wetland could therefore potentially provide the ideal habitat for it. Its presence will however only be confirmed after a good rainfall event causes inundation of the dam.

In general, impacts on amphibians arising from the proposed diamond mining activities will be minimal if the mine footprint does not creep towards the dam.

3.4.5. Avifauna

The study site does not fall within any of the Important Bird Areas (IBA) defined by Birdlife South Africa, but it is located near (< 100 km) of four IBAs, i.e. Dronfield, Soetdoring Nature Reserve, Kamfersdam and Benfontein (Figure 10).

Figure 10. Blaauwboschfontein (indicated in red) lies in the vicinity of four Important Bird Areas (BirdLifeSA 2015) as indicated in yellow.

Dronfield lies 60 km west of Blaauwboschfontein and supports large numbers of breeding White-backed Vulture, which comprises 41 % of the breeding pairs in the Kimberley region. These birds forage over wide areas and a pair was encountered soaring over the study area during the site visit. The use of poisons in farming areas to combat mammalian predators still poses a threat to scavenging raptors, and hundreds of vultures can be killed in a single poisoning incident. Collisions with transmission power lines and electrocutions on reticulation and distribution power lines also pose an ongoing threat to vultures and other trigger species.

Soetdoring Nature Reserve is situated 65 km south east of Blaauwboschfontein. It is essentially an island in a sea of agricultural land and comprises Krugerdrift Dam as well as a large stretch of the Modder River. Globally threatened species found here include Ludwig's Bustard, Blue Korhaan, Melodious Lark, Chestnut-banded Plover, Grey Crowned Crane, Secretarybird, Martial Eagle, Black-winged Pratincole and Kori Bustard. The regionally

threatened species include Caspian Tern and Greater Flamingo. Historically, the area was grazed by livestock and has recovered well since it was proclaimed a reserve in 1978. Poison sprays (Queleatox) used to control Red-billed Quelea in the past killed non-target bird species as well and these toxins still linger in the ecosystem. The blasting of roost and breeding sites as a means of control was later used and is still the preferred method. Currently the most significant threats are algal blooms in the dam due to water quality deterioration resulting from the inflow of urban waste water and sewage effluent, and occasional outbreaks of botulism. Fishing equipment, such as lines, discarded by anglers is also of concern. Solar and possibly wind energy facilities may be a potential threat on neighbouring land.

Kamfersdam lies 75 km south west of Blaauwboschfontein and is an endorheic pan that has been transformed into a permanent wetland over the past decade due to an increase in sewage effluent inflow. Hence, it has become an important habitat for birds, especially the Greater- and Lesser Flamingos. The dam supports the largest permanent population of Lesser Flamingos in southern Africa. The most significant threats to Kamfersdam are poor water quality, flooding and expansion of urban development, while threats to the bird population include illegal hunting of water birds and the collisions and mortality of flamingos and other water birds caused by power lines and the electrical transmission lines along the railway.

Benfontein is a Nature Reserve owned by De Beers Consolidated Mines since 1891 and there has been significant investment by research groups over the years. The farm lies 75 km south west of Blaauwboschfontein and supports small numbers of breeding White-backed Vulture, Blue Crane and Blue Korhaan. The farm also holds several biome-restricted assemblage species and congregatory species, including Lesser Flamingo. More than 1 700 water birds are present during years of high rainfall on the ephemeral Benfontein Pan, and 65 water bird species have been recorded on the pan. There are presently few threats to this IBA as it is being well conserved. The invasive mesquite Prosopis glandulosa, currently present in the north-eastern section and spreading along the N8 on the eastern boundary, could become a significant threat if not controlled. Collisions with the power line transecting the eastern side of Benfontein are a threat to the White-backed Vultures and large terrestrial birds such as Blue Crane and Ludwig's Bustard. Anglo American has recently bought De Beers and this change of ownership may lead to a change in land use or the sale of the property.

A total number of 301 bird species have been recorded from the region. Virtually all of these species are protected according to Schedule 1 of the FSNCO (see Appendix 2) and as many as 30 listed bird species are known from the region, all of which are classified as Vulnerable, Near Threatened, Endangered or Critically Endangered (Table 7). None of these species of conservation concern are expected to reside or breed on site due to the land use history and associated footprint of transformation.

Table 7. Bird of conservation concern that are likely to occur on site. Species are indicated in terms of the IUCN Red List and SA Bird Atlas.

Scientific name	Common name	IUCN	SA Bird Atlas
Anthropoides paradisea	Blue Crane	NT	NT
Anthus crenatus	African Rock Pipit	NT	NT
Aquila rapax	Tawny Eagle	VU	EN
Ardeotis kori	Kori Bustard	NT	NT
Certhilauda chuana	Short-clawed Lark		NT
Charadrius pallidus	Chestnut-banded Plover	NT	NT
Ciconia abdimii	Abdim's Stork		NT
Ciconia nigra	Black Stork		VU
Circus macrourus	Pallid Harrier	NT	NT
Circus ranivorus	African Marsh-Harrier	EN	EN
Coracias garrulus	European Roller		NT
Cursorius rufus	Burchell's Courser		VU
Eupodotis caerulescens	Blue Korhaan	NT	
Falco biarmicus	Lanner Falcon	VU	VU
Glareola nordmanni	Black-winged Pratincole	NT	NT
Gyps africanus	White-backed Vulture	CR	CR
Gyps coprotheres	Cape Vulture	EN	EN
Leptoptilos crumeniferus	Marabou Stork		NT
Limosa limosa	Black-tailed Godwit	NT	
Mycteria ibis	Yellow-billed Stork		EN
Neotis ludwigii	Ludwig's Bustard	EN	EN
Numenius arquata	Eurasian Curlew	NT	NT
Oxyura maccoa	Maccoa Duck	NT	NT
Pelecanus rufescens	Pink-backed Pelican		VU
Phoenicopterus minor	Lesser Flamingo	NT	NT
Phoenicopterus ruber	Greater Flamingo	NT	NT
Polemaetus bellicosus	Martial Eagle	EN	EN
Rostratula benghalensis	Greater Painted-snipe		NT
Sagittarius serpentarius	Secretarybird	VU	VU
Torgos tracheliotus	Lappet-faced Vulture	EN	EN

In general, bird species of the study area are likely to experience some disturbances as a result of the proposed mining activities in the form of noise and movement. Birds are however highly mobile and are expected to move to adjacent pristine habitats, if necessary. It is not expected that any major additional habitat destruction will be produced by the proposed mining activities or that any of the bird species of conservation concern will be affected.

3.5. 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 study area falls within the Vaal D/S of Bloemhof quaternary catchment C91C of the Lower Vaal Water Management Area (Figure 11). The quaternary catchment has been allocated a Present Ecological State (PES) of 'Largely Modified' (D) by Delport and Mallory (2002) and information regarding mean annual rainfall, evaporation potential and runoff for the quaternary catchment is provided in Table 8. Watercourses on the study site that have been formally mapped include an artificial wetland (Figure 12).

Table 8. Catchment characteristics for the Vaal D/S Bloemhof quaternary catchment, as presented by Delport and Mallory (2002).

Quaternary catchment	Catchment Area (km^2)	Mean Annual Rainfall (mm)	Mean Annual Evaporation (mm)	Mean Annual Runoff (10^6 m^3)
C91C	3 135	430	1 880	6.90

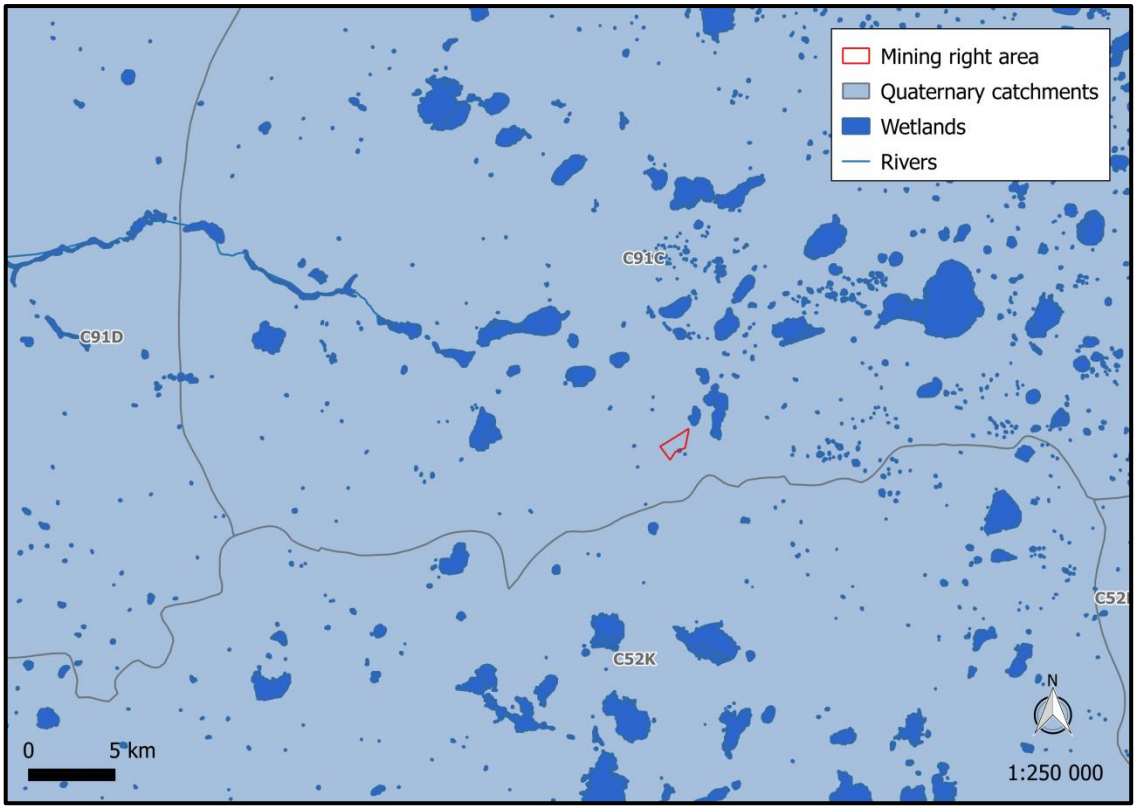


Figure 11. The locality of the proposed mining area in relation to the quaternary catchments of the Lower Vaal Water Management Area.

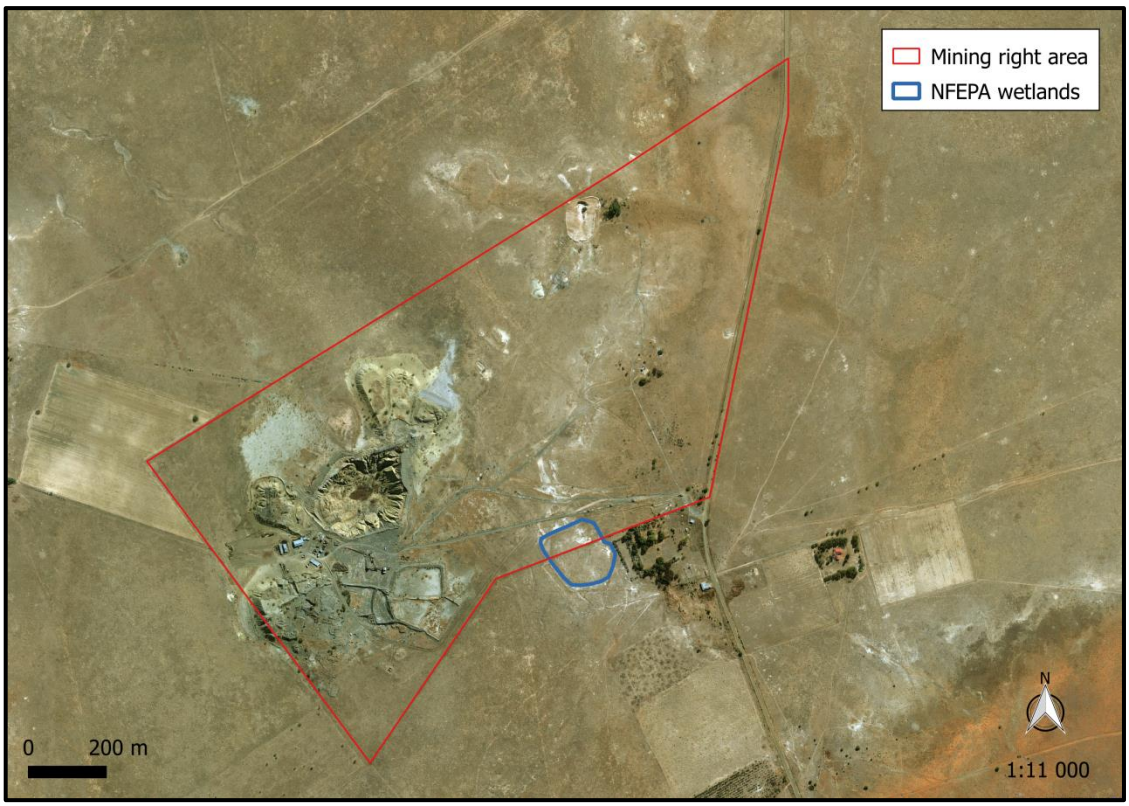


Figure 12. The location of formally mapped watercourses on the proposed mining right area.

3.5.1. Wetland delineation and classification

One wetland was identified on site. The wetland has a total area of ± 2.6 ha of which ± 1 ha falls within the boundaries of the mining right application area. The wetland is indicated in Figure 13, along with its buffer zone. This 100 m buffer is required by the NWA to be assigned to all watercourses that fall within an area earmarked for development, to minimise anthropogenic impacts.

The wetland has a flat terrain on soils underlain by Calcrete and is classified as an artificial dammed depression, i.e. off-channel dam (Figure 14 and Table 9). Water enters the depression primarily through direct precipitation and overland inflow, but it is intermittently inundated. This hydrological regime limits practitioners to produce quantitative baseline information on the water quality associated with the wetland. The depression floor is vegetated with indigenous grassland (see section 3.4.2) and the substratum consists of light-grey sandy clay soil (Figure 15 and Table 9).

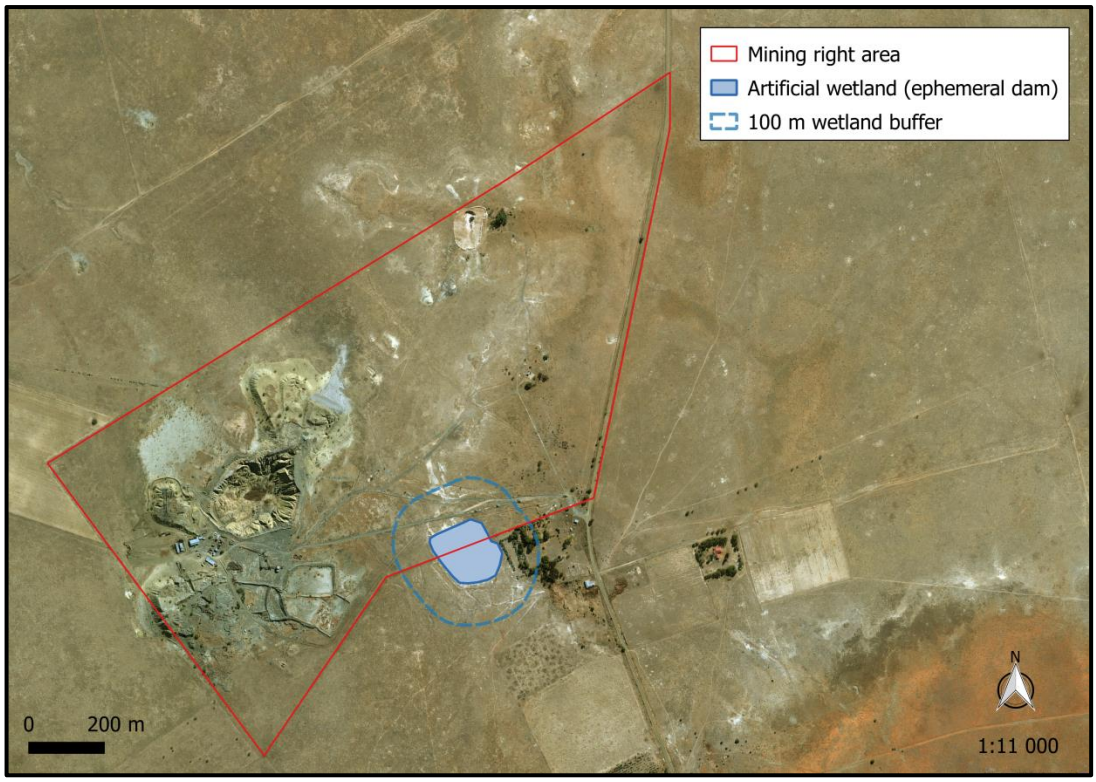


Figure 13. The delineation of the artificial wetland on Blaauwboschfontein, along with its buffer zone.

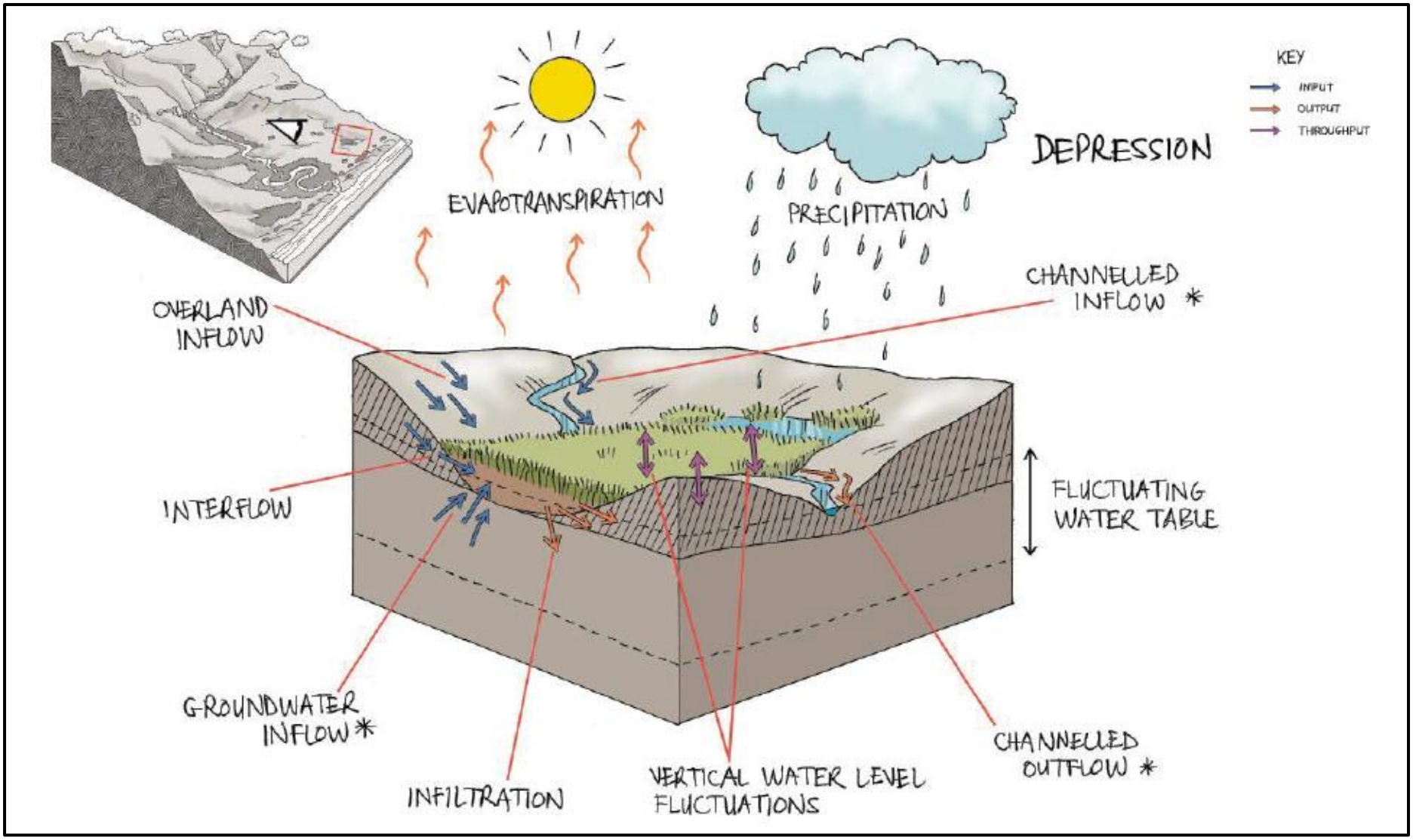


Figure 14. Conceptual illustration of a depression, showing the typical landscape setting and the dominant inputs, throughputs and outputs of water (Ollis et al. 2013).

Table 9. Summary of the results for the application of Levels 1 to 6 of the Classification System (Ollis et al. 2013), to the wetland on Blaauwboschfontein. The confidence rating of classification at each level is given in brackets.

Level 1	Level 2		Level 3	Level 4: HGM Unit		
System type	**DWA Ecoregion**	**NFEPA WetVeg Group**	**Landscape Unit**	**4A**	**4B**	**4C**
INLAND (high)	Highveld (high)	Dry Highveld Grassland Group 3 (high)	Valley floor (medium)	Depression (high)	Dammed (high)	Without channelled inflow (high)

Level 5: Dominant hydroperiod (and inundation depth-class)		
5A: Inundation period	**5B: Saturation period**	**5C: Inundation depth-class**
Intermittently inundated (high)	Intermittently saturated (high)	n/a

Level 6: Dominant descriptor categories										
Natural vs. Artificial		**Geology**	**Vegetation cover, form and status**				**Substratum type**		**Salinity**	**pH**
6A	**6B: Artificial subcategories**		**6A: Vegetation cover**	**6B: Primary vegetation form**	**6C & 6D: Detailed vegetation form**	**6E: Vegetation status**	**6A: Primary categories**	**6B: Secondary categories**		
Natural	Dam (off-channel)	Calcrete	Vegetated	Herbaceous	Grasses	Indigenous	Clayey soil	Sandy clay	No info	No info

Figure 15. The substratum of the wetland on Blaauwboschfontein consists of light-grey sandy clay soil.

3.5.2. Wetland Health Assessment (PES)

The dam on Blaauwboschfontein is an artificial wetland. It has been created through construction of a wall that could retain water during rainfall events. As such, clay accumulated over time on the surface and the pristine grassland habitat evolved into species poor grassland. A large stand of invasive alien trees are also found on its eastern banks, which further degrades its habitat integrity. A large change in ecosystem processes and loss of natural habitat and biota has therefore occurred. It is therefore regarded to be largely modified (PES D, Table 10).

Table 10. Summarised results of Wet-Health level 1 assessment (Macfarlane et al. 2007) to the dam on Blaauwboschfontein.

Ha	HGM Extent (%)	Hydrology		Geomorphology		Vegetation	
		Impact score	Change score	Impact score	Change score	Impact score	Change score
2.6	100	3.5	0	4.2	-1	4.2	0
Present State Categories		D	→	D	↓	D	→
						Overall PES	**4 (D)**

3.5.3. Wetland Ecological Importance and Sensitivity

The EIS of the dam on Blaauwboschfontein was rated to have a Low EIS (Table 11) and is not considered to be ecologically important and sensitive at any scale. The biodiversity of this system is ubiquitous and not sensitive to flow and habitat modifications. The assessment was mainly based on a "wet scenario", because its ecological importance will primarily only manifest during times of inundation. A number of red listed water birds could potentially occur in the dam when it is inundated. These include the Chestnut-banded Plover, Abdim's Stork, Black Stork, Marabou Stork, Yellow-billed Stork, Maccoa Duck, Pink-backed Pelican, Greater Painted-snipe, Lesser Flamingo and Greater Flamingo; which are either classified as Near-Threatened or Vulnerable.

The dam hosts fairly low species richness and habitat diversity compared to perennial wetlands, but it is considered to be moderately important breeding and feeding links in terms of connectivity, especially for the survival of wetland birds in South Africa during wet periods by providing stepping-stone corridors in an arid landscape.

The dam is also considered to have a low sensitivity to changes in hydrology and water quality, because it floods infrequently (< annually). The dam does not fall within any category of protected status that reflects its importance for conservation of ecological diversity at any scale and therefore it has been considered to have a low protected status.

Table 11. Summary of the results for the application of an EIS assessment (Duthie 1999) to the dam on Blaauwboschfontein.

DETERMINANT	SCORE	CONFIDENCE
PRIMARY DETERMINANTS		
1. Rare & Endangered Species	4	4
2. Populations of Unique Species	1	3
3. Species/taxon Richness	1	4
4. Diversity of Habitat Types or Features	1	4
5 Migration route/breeding and feeding site for wetland species	2	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	4
7. Sensitivity to Water Quality Changes	1	4
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	2	3
MODIFYING DETERMINANTS		
9. Protected Status	0	3
10. Ecological Integrity	2	3
TOTAL	**15**	
MEDIAN	**1**	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**Low**	

3.5.4. Wetland Functional Assessment

The functionality of the dam on Blaauwboschfontein scored moderate in flood attenuation, sediment trapping, phosphate removal, toxicant removal, erosion control, maintenance of biodiversity, provision of harvestable natural resources and provision of cultivated foods. It however scored low and moderately low in the remaining functionalities (Figure 16).

The moderate provision of these functions is primarily based on the dense grassland found in the dam as well as wetland birds that could potentially occur here during periods of inundation. The significance of some of these benefits increases due to the fact that the study site is located in a rural area, where the poverty level is moderately high.

The current state and functionality of the dam is not likely to change significantly as a result of the planned mining activities. Nevertheless, the most profound threats are in the form of additional geomorphological and hydrological alterations if the planned activities extend beyond the footprint of the reported disturbances. Related impacts also include erosion, as well as changes in the sediment input and hydrologic regime. These secondary threats are however inconsequential due to the low frequency of rainfall and subsequent flooding in the area.

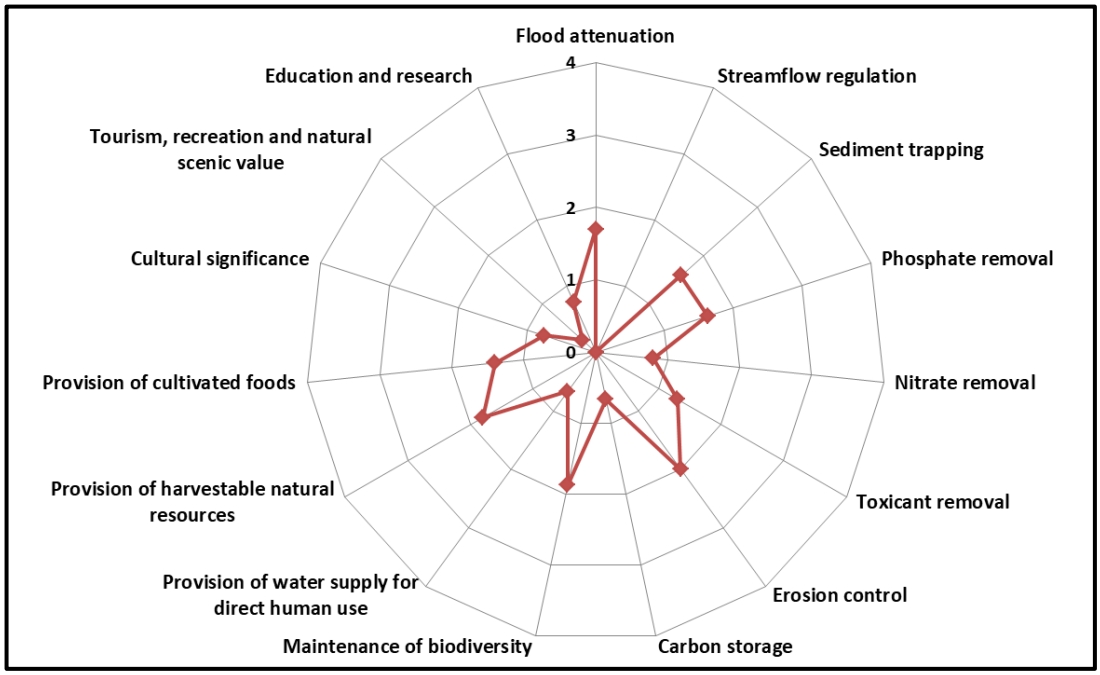


Figure 16. A spider diagram representing different ecosystem services provided by the dam on Blaauwboschfontein. Ecosystem services are scored form 0 (no importance) to 4 (very important).

3.5.5. Wetland cumulative impact evaluation

According to the Wetland Freshwater Priority Areas project the largest proportion of wetlands (46 %) which occur in the Dry Highveld Vegetation Group 3 have been classified to have a Present Ecological State (PES) of being heavily to critically modified, while 39 % is in natural or good condition and 16 % have been moderately transformed. Within the direct vicinity of the proposed mining operation most wetlands have been rated to be in good condition, but those that have been moderately and critically modified are also common (Figure 17). None of them have been identified as significant wetlands in terms of Ramsar sites, IUCN Frog localities, threatened water bird localities or Crane breeding grounds.

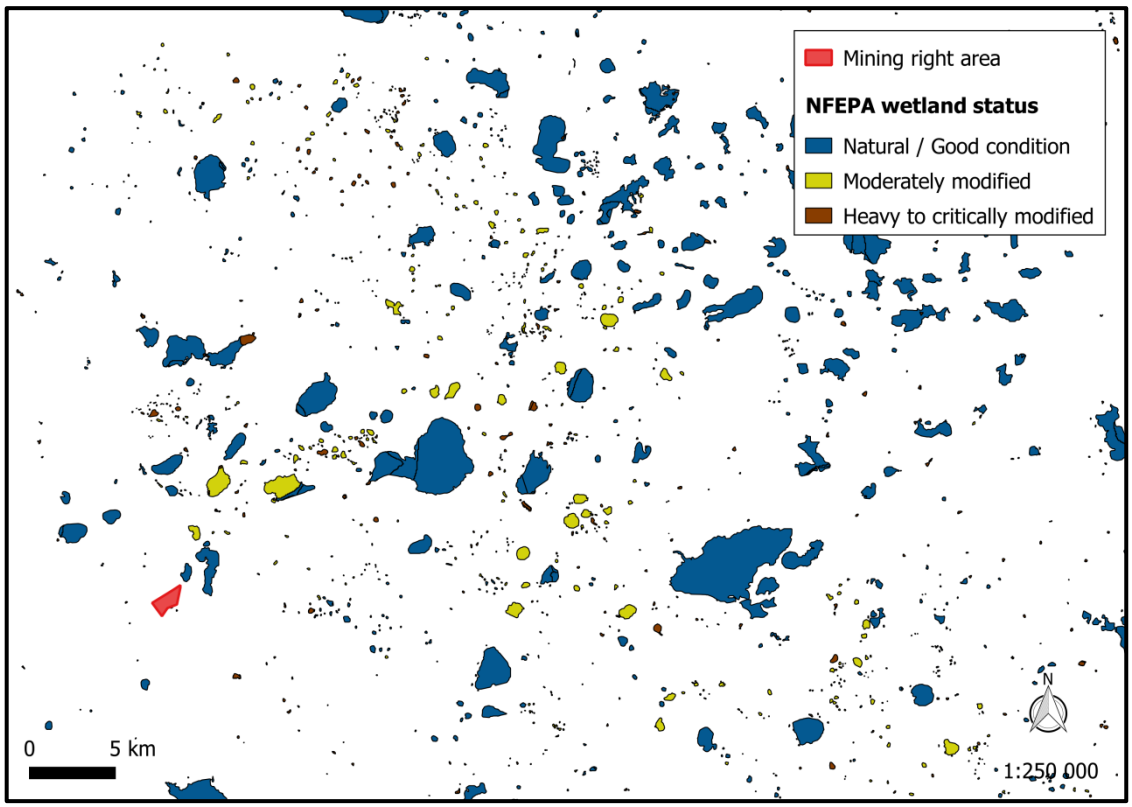


Figure 17. The status of wetlands occurring in the vicinity of the proposed mining right area.

3.6. Critical biodiversity areas and broad-scale processes

The broad-scale vegetation unit of the study area is classified as least threatened and therefore no formal fine-scale conservation planning has been conducted for it, but according to the Mining and Biodiversity Guidelines (DENC et al. 2013) a portion of the site is regarded for Biodiversity Importance. The eastern section is classified to have Highest Biodiversity Importance, which constitute the highest risk for mining (Figure 18). These guidelines were developed to identify and categorize biodiversity priority areas sensitive to the impacts of mining in order to support mainstreaming of biodiversity issues in decision making in the mining sector.

The proposed mining site does not fall within any formally protected area or within a National Protected Areas Expansion Strategy Focus Area (NPAES). It does however neighbour the Free State Highveld Grassland focus area (NPAES #12) (Figure 19). This focus area includes some of the last remaining opportunities for relatively large protected areas in the highly threatened Grassland Biome, as well as the opportunity to incorporate intact river reaches and a number of threatened river types. Options for meeting protected area targets are retreating rapidly in this area, making protected area expansion urgent.

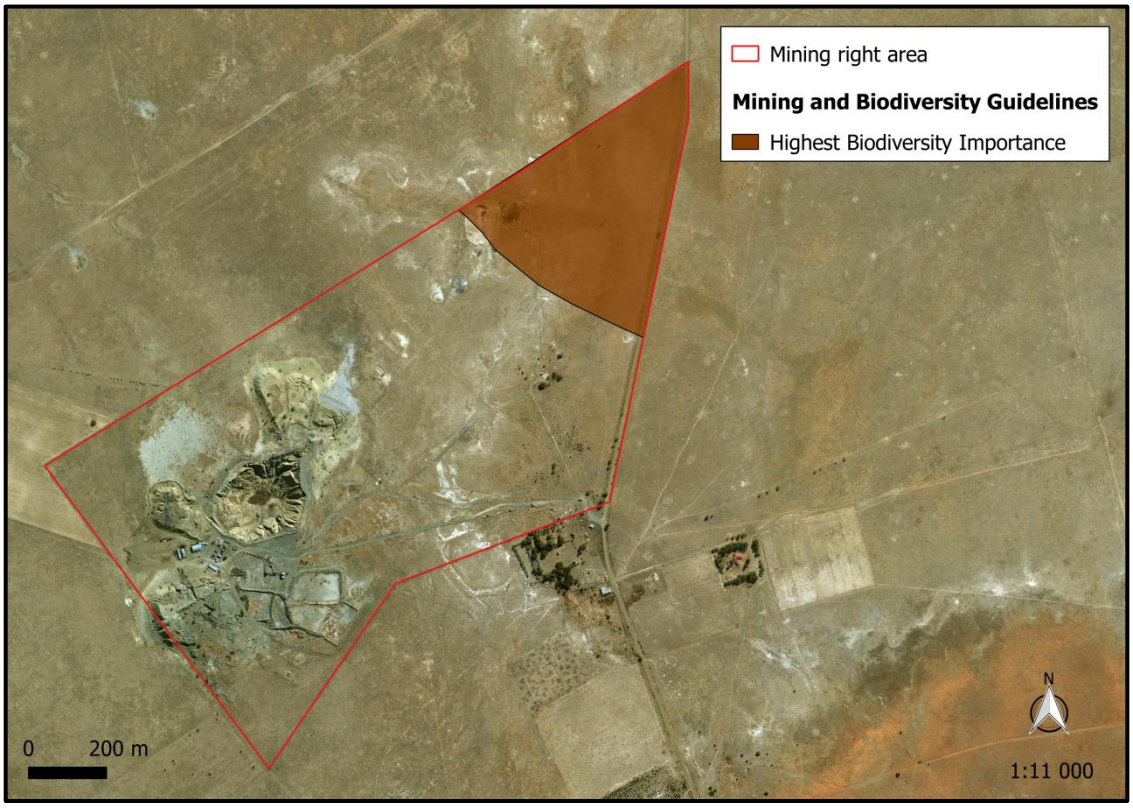


Figure 18. The study area in relation to the Mining and Biodiversity Guidelines.

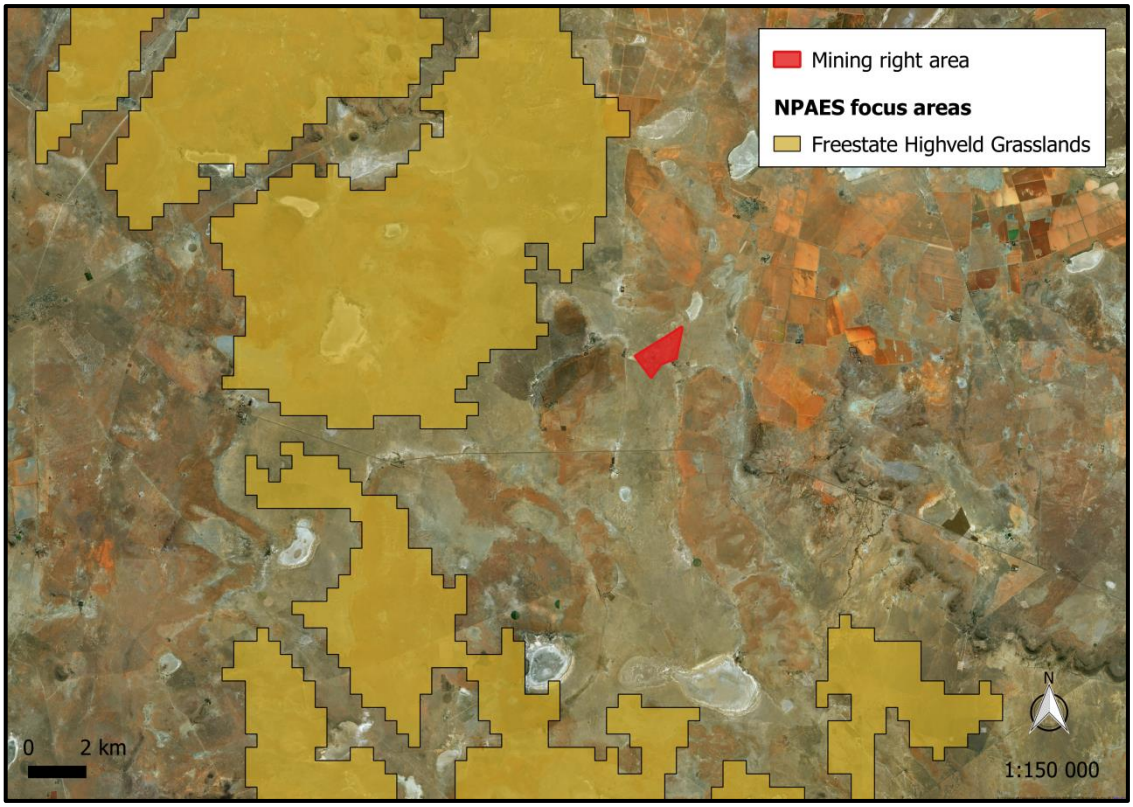


Figure 19. The study area in relation to adjacent National Protected Areas Expansion Strategy Focus areas.

According to the Free State Province Biodiversity Plan (Collins 2019) the site is classified as ecological support areas (Figure 20). These are areas that play an important role in supporting the ecological functioning of a protected area or critical biodiversity areas, or in delivering ecosystem services. In most cases ecological support areas (ESAs) are currently in at least fair ecological condition, and should remain in at least fair functioning condition. The ESA1 represent areas with minimal degradation, while ESA2 are those with degradation.

The Tokologo 4th generation Integrated Development Plan 2017/18, regards rivers and wetlands as core ecological corridors that need to be protected by a setback line of at least 32 m, from the banks of all rivers and water bodies. The artificial wetland on site is however not regarded as a sensitive or important system and it falls outside the boundaries of the mining operation. Although this artificial wetland on the site is in itself not sensitive, an ephemeral pan, which is a unique habitat protected in terms of the National Water Act (Act No 36 of 1998), is situated in very close proximity (400 m) to the site. However, the mining activities are not hydrologically connected to this pan and are not expected to have any effect on its functioning.

Much of the surrounding habitat in the vicinity of the site, i.e. Endangered vegetation type Vaal-Vet Sandy Grassland, have been transformed by agriculture (Figure 21). The proposed mining operation itself is however not expected to cause additional habitat transformation, as the site has already been transformed by mining activities in the past and is not expected to contribute significantly to cumulative habitat loss and the disruption of the broad-scale landscape connectivity in the region.

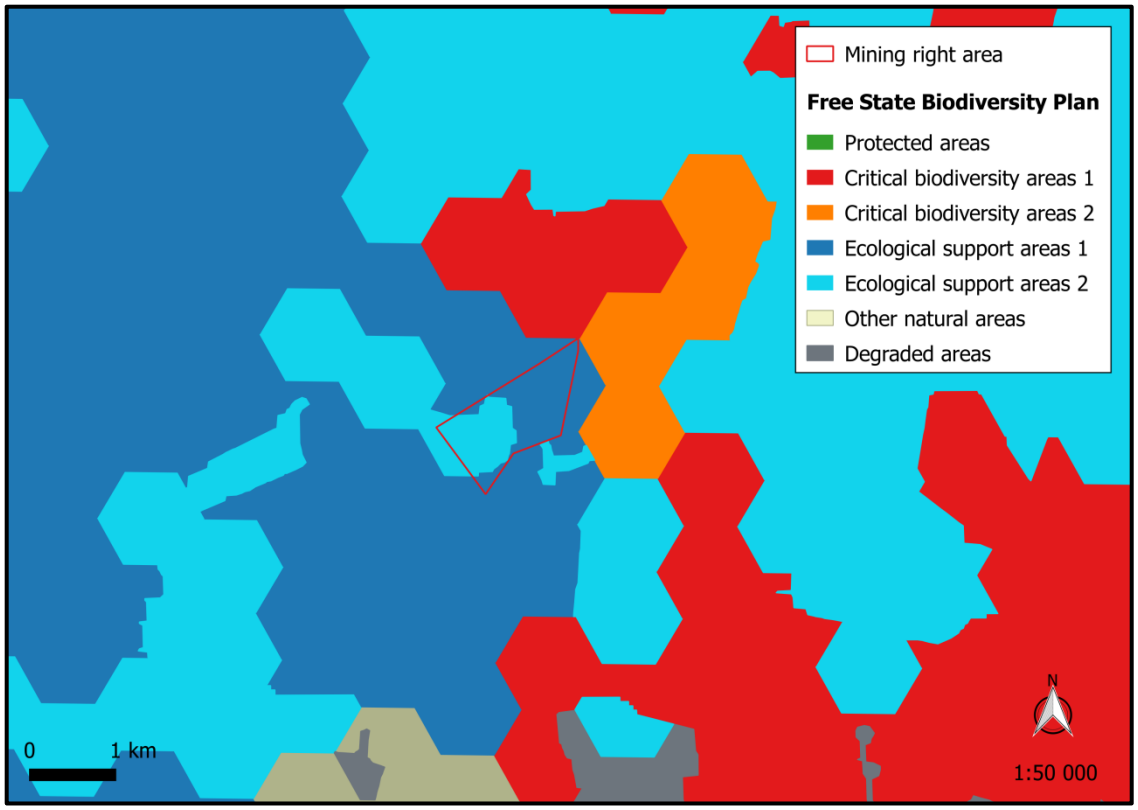


Figure 20. The study area in relation to the Free State Province Biodiversity Plan.

Figure 21. The study area (in red) falls within a region that is heavily transformed by agriculture.

3.7. Site sensitivity

The sensitivity map for the Blaauwboschfontein mining operation is illustrated in Figure 22. The artificial wetland is considered to be of **very high** sensitivity due to its vital ecological and hydrological functionality and significance as a wetland. Even though it is artificially created, it remains a unique habitats protected in terms of the National Water Act (Act No 36 of 1998).

The pristine grassland is considered to be of **medium** sensitivity. This section is not primarily earmarked for mining activities, but activities could creep into it. Only one significant plant species of conservation occurs here. Therefore, impacts are expected to be largely local.

The open shrubland on transformed land is considered to be of **low** sensitivity due to the large-scale transformation that has already occurred here. Activities can proceed here with little ecological impact.

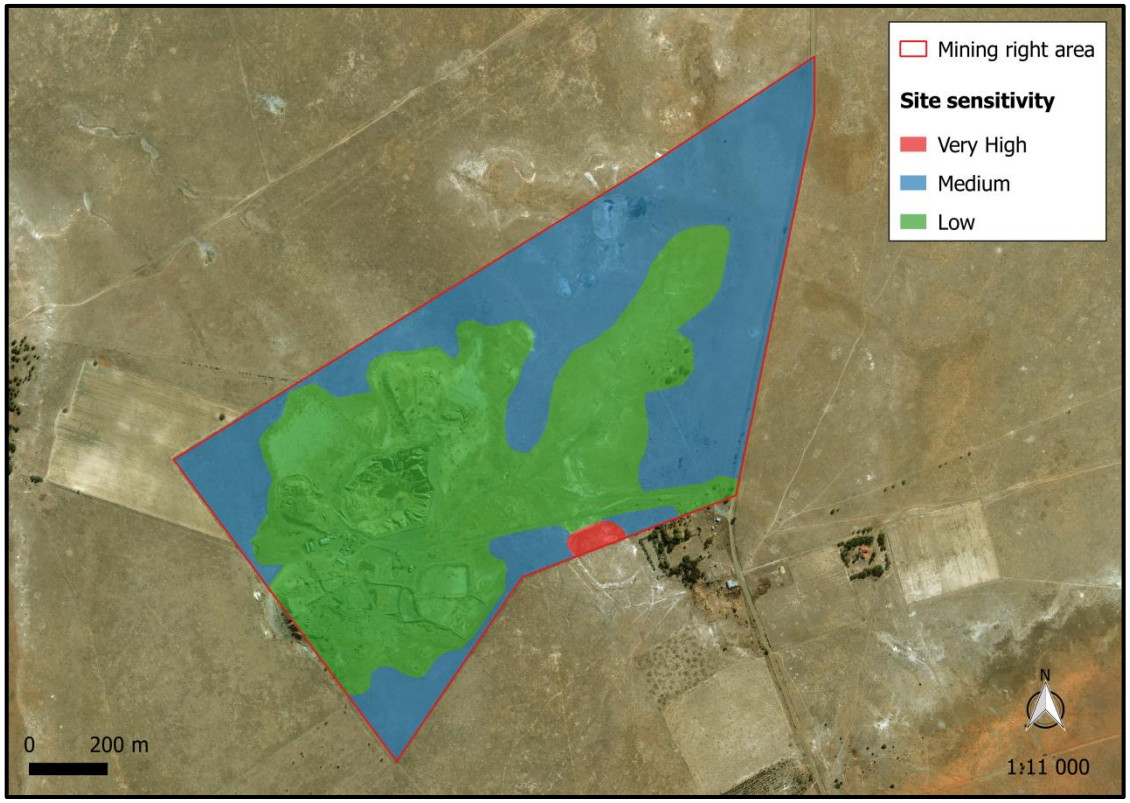


Figure 22. A sensitivity map for the Blaauwboschfontein mining area.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, the potential impacts and associated risk factors that may be generated by the Blaauwboschfontein 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. In order to ensure that the impacts identified are broadly applicable and inclusive, all the likely or potential impacts that may be associated with the mining activities are listed.

4.1. Topography, soil erosion and associated degradation of landscapes

4.1.1. Loss of soil fertility

Source of the impact

During the removal of topsoil. This impact is mainly associated with any new activities planned in the pristine grassland.

Description of the impact

Improper stockpiling and soil compaction can result in soil sterilisation. Leaching can also occur, resulting in the loss of nutrients.

Mitigation and monitoring

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

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

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Landscape	Loss of soil fertility	✓	✓	✓	Activity specific (0)	Short term (1)	Medium (2)	Possible, temporarily (6)	Very Low (18)	Very low
	Increase in soil erosion	✓	✓	✓	Local (2)	Decommissioning (3)	High (3)	Possible during life of operation (9)	Low-Medium (72)	Low
Flora	Loss of indigenous vegetation	✓	✓	✓	On-site (1)	Short term (1)	Minimal (1)	Certain, temporarily (7)	Very Low (21)	Very low
	Loss of Red data and/or protected floral species	✓	✓		On-site (1)	Life of operation (2)	Medium (2)	Possible, infrequently (7)	Low (35)	Very low
	Introduction or spread of alien species	✓	✓	✓	Local (2)	Decommissioning (3)	Medium (2)	Possible during life of operation (9)	Low-Medium (63)	Very low/Positive
	Bush encroachment			✓	On-site (1)	Decommissioning (3)	Medium (2)	Remotely possible, temporarily (5)	Low (30)	Very low/Positive

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Fauna	Habitat fragmentation	✓	✓	✓	Regional (3)	Decommissioning (3)	High (3)	Rare for life of operation (7)	Low-Medium (63)	Low
	Disturbance, displacement and killing of fauna	✓	✓	✓	Local (2)	Life of operation (2)	High (3)	Possible for life of operation (9)	Low-Medium (63)	Low
Ecological Processes	Compromise of ecological processes	✓	✓	✓	Regional (3)	Residual (4)	High (3)	Rare for life of operation (7)	Low-Medium (70)	Low

4.1.2. Soil erosion

Source of the impact

Any additional infrastructure development or activities in the pristine grassland.

Description of the impact

In the grassland, vegetation might be stripped in preparation for placement of infrastructure and therefore the areas will be bare and susceptible to erosion, particularly wind erosion. Topsoil and overburden that is stripped and piled on surrounding areas can also be eroded by wind, rain and flooding. The soil/sediments will be carried away during runoff. The affected areas will be rehabilitated, but full restoration might only occur over a number of years, subsequent to the re-establishment of vegetation.

Mitigation and monitoring

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

4.2. Vegetation and floristics

4.2.1. Loss of indigenous vegetation

Source of the impact

Construction of any additional infrastructure in the grassland; placement of stockpiles; the clearing of vegetation for materials storage and topsoil stockpiles; vehicular movement.

Description of the impact

The historic land use relating to construction and mining activities on site have already reduced the natural habitat for ecological functioning, but if the proposed mining activities creep into the pristine grassland areas, this impact will be amplified.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of disturbed areas.
- Encourage the growth of natural plant species by sowing indigenous seeds or by planting seedlings.

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

Source of the impact

Removal of listed or protected plant species; during the construction of additional supporting infrastructure; the placement of stockpiles; and the clearing of vegetation in the grassland.

Description of the impact

Only one protected species were encountered during the field visit, i.e. *Helichrysum lucilioides*. This species was common in the pristine grassland. It is however very unlikely that mining activities will have a significant impact on this species, because even if activities do spill over to the pristine grassland it is expected that this species is also abundant in the undisturbed farmlands adjacent to the mining site. However, any illegal harvesting of potentially protected bulbs for trade or medicinal use could potentially have a negative impact on the population of these species.

Mitigation and monitoring

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

4.2.3. Introduction or spread of alien species

Source of the impact

Clearing of vegetation; mining activities in the grassland; historic land use.

Description of the impact

A number of alien invasive species were encountered on site, which reflects the typical effect that the historical mining activities had on site. Invasive plants usually invade areas after disturbances of the pristine conditions.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of excavated areas.

- Encourage the growth of natural plant species.
- Mechanical methods of control to be implemented extensively.
- Annual follow-up operations to be implemented.

4.2.4. Encouraging bush encroachment

Source of the impact

Clearing of vegetation; mining activities in the grassland; historic land use.

Description of the impact

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

Mitigation and monitoring

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

4.3. Fauna

4.3.1. Habitat fragmentation

Source of the impact

Clearance of vegetation in the pristine grassland.

Description of the impact

Disturbances related to any additional construction of associated infrastructure in the grassland will result in the loss of connectivity and fragmentation of natural habitats. Fragmentation of habitats could lead to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This could result in a subsequent loss of genetic variability between meta-populations occurring within the study site. Pockets of fragmented natural habitats hinder the growth and development of populations. This impact will however not be profound on site due to the land use history and the small extent of likely additional transformation.

Mitigation and monitoring

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

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

Increased noise and vibration disturb and possibly displace birds and other wildlife. Fast moving vehicles cause road kills of small mammals, birds, reptiles, amphibians and a large number of invertebrates. Intentional killing of snakes, reptiles, vultures and owls will negatively affect the local populations.

Mitigation and monitoring

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

4.4. Broad-scale ecological processes

Source of the impact

The additional construction of roads, supporting infrastructure and the clearing of vegetation in the grassland.

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. However, due to the land use history and the extent of pristine adjacent farm lands of the same habitat, the cumulative impact of the proposed mining operation is moderately low.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of affected areas where possible.
- Encourage the growth of natural plant species in the grassland.
- Employ sound rehabilitation measures to restore the characteristics of grassland habitat.

5. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Three plant communities were identified on site of which the open shrubland on transformed land is primarily earmarked for mining activities. Due to the long history of mining on site, this area is considered to be of low sensitivity. It is however possible that mining activities could creep into the pristine grassland, which is considered to be of medium sensitivity. An artificial ephemeral wetland also occurs within the mining right application boundary, but it falls outside the earmarked mining area. Even though it is artificial, regarded to be largely modified, with low Ecological Importance and Sensitivity it is still considered to be of Very High Sensitivity to mining activities due to its unique ecological functionality. In general impacts associated with the proposed mining activity are expected to be moderately low.

Species of conservation concern that are found on site primarily occurs within the pristine grassland habitat and includes *Helichrysum lucilioides*. A permit application regarding protected flora need to be lodged with the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs prior to any clearance of protected vegetation.

To conclude, the destruction of the natural habitats within the study area is not likely to be significant due to the land use history on site. However, minimal increased transformation is possible if activities creep into the pristine grassland. The significance of the impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the mining area. The majority of the site has already been modified and is not expected to be further affected significantly. In my opinion, authorisation can be granted as long as the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

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APPENDICES

APPENDIX 1

Plant species list

Family	Scientific name	Status	NFA	NCNCA
AGAVACEAE	*Agave americana*	Nat. Ex.		
AMARANTHACEAE	*Atriplex semibaccata*	LC		
	Salsola exalata	LC		
	Salsola kali	**Alien Inv.**		
ANACARDIACEAE	*Searsia lancea*	LC		
APOCYNACEAE	*Aspidoglossum interruptum*	LC		
ASPARAGACEAE	*Asparagus sp.*	-		
ASPLENIACEAE	*Asplenium cordatum*	LC		
ASTERACEAE	*Amphiglossa triflora*	LC		
	Arctotis venusta	LC		
	Chrysocoma obtusata	LC		
	Felicia muricata	LC		
	Helichrysum lucilioides	LC		X
	Hertia pallens	LC		
	Pentzia globosa	LC		
	Pentzia incana	LC		
	Pentzia oppositifolia	**Rare**		
	Pentzia calcarea	LC		
	Tarchonanthus camphoratus	LC		
CACTACEAE	***Opuntia ficus-indica***	**Alien Inv.**		
CARYOPHYLLACEAE	*Silene burchellii subsp. pilosellifolia*	LC		
CUCURBITACEAE	*Kedrostis capensis*	LC		
CYPERACEAE	*Cyperaceae sp.*	-		
EUPHORBIACEAE	***Euphorbia spartaria***	LC		X
FABACEAE	***Prosopis glandulosa***	**Alien Inv.**		
	Vachellia tortilis	LC		
GISEKIACEAE	*Gisekia pharnacioides*	LC		
LAMIACEAE	*Leonotis pentadentata*	LC		
MALVACEAE	*Corchorus schimperi*	LC		
MYRTACEAE	***Eucalyptus camaldulensis***	**Alien Inv.**		
OXALIDACEAE	*Oxalis depressa*	LC		
POACEAE	*Aristida meridionalis*	LC		
	Aristita vestita	LC		
	Brachiaria marlothii	LC		
	Chloris virgata	LC		
	Cymbopogon pospischilii	Nat. Ex.		
	Cynodon incompletus	LC		
	Digitaria eriantha	LC		

Family	Scientific name	Status	NFA	NCNCA
POACEAE	*Enneapogon cenchroides*	LC		
	Eragrostis chloromelas	LC		
	Eragrostis lehmanniana	LC		
	Eragrostis obtusa	LC		
	Eragrostis trichophora	LC		
	Eragrostis truncata	LC		
	Fingerhuthia africana	LC		
	Panicum coloratum	LC		
	Phragmites australis	LC		
	Schmidtia pappophoroides	LC		
	Sporobolus coromandelianus	LC		
	Sporobolus fimbriatus	LC		
	Sporobolus tenellus	LC		
	Stipagrostis uniplumis	LC		
	Themeda triandra	LC		
	Tragus berteronianus	LC		
	Tragus koelerioides	LC		
	Tragus racemosus	LC		
RHAMNACEAE	*Ziziphus mucronata*	LC		
RUBIACEAE	*Nenax microphylla*	LC		
	Oldenlandia herbacea var. herbacea	LC		
SANTALACEAE	*Thesium sp.*	-		
SCROPHULARIACEAE	*Selago saxatilis*	LC		
SOLANACEAE	***Datura ferox***	**Alien Inv.**		
	Lycium cinereum	LC		
	Lycium hirsutum	LC		
TAMARICACEAE	***Tamarix ramosissima***	**Alien Inv.**		
THYMELAEACEAE	*Lasiosiphon polycephalus*	LC		
ZYGOPHYLLACEAE	*Tribulus sp.*	-		

APPENDIX 2

Fauna species list

LIST OF MAMMALS

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CHIROPTERA	*Eidolon helvum*	African Straw-coloured Fruit-bat	**NT**	*Not listed*	Wide habitat tolerance.	High
	Neoromicia capensis	Cape Bat	LC	LC	Wide habitat tolerance, but often found in arid areas, grassland, bushveld and *Acacia* woodland. Animals roost under the bark of trees and similar vegetation.	High
	Miniopterus natalensis	Natal Long-fingered Bat	LC	*Not listed*	Mainly roosts in caves or mine shafts, but also in crevices and holes in trees.	High
	Nycteris thebaica	Common Slit-faced Bat	LC	LC	Savanna species with wide habitat tolerance. Roosts in caves, mine adits, aardvark holes, rock crevices and hollow trees in open savanna woodland.	High
	Pipistrellus hesperidus	Dusk Pipistrelle	LC	LC	Wide habitat tolerance, but close proximity to open water may be a limiting factor.	Low
	Rhinolophus clivosus	Geoffroy's Horseshoe Bat	LC	**NT**	Wide habitat tolerance.	High
	Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	LC	Wide habitat tolerance.	High

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CHRYSOCHLORIDAE	*Chlorotalpa sclateri*	Sclater's Golden Mole	LC	**DD**	Restricted to high-altitude grasslands, scrub and forested kloofs in the Nama Karoo and Grassland biomes of South Africa.	Low
MACROSCELIDIDAE	*Elephantulus myurus*	Eastern Rock Sengi	LC	LC	Rocky environments.	Low
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	*Procavia capensis*	Rock Hyrax	LC	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies.	Low

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
LAGOMORPHA	[2]*Lepus capensis*	Cape Hare	LC	LC	Dry, open regions, with palatable bush and grass.	High
	[2]*Lepus saxatilis*	Scrub Hare	LC	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Low
	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.	Low
RODENTIA	*Hystrix africaeaustralis*	Cape Porcupine	LC	LC	Catholic in habitat requirements.	High
	Xerus inauris	South African Ground Squirrel	LC	LC	Open terrain with a sparse bush cover and hard substrate.	High
	Pedetes capensis	Springhare	LC	LC	Occurs widespread: open sandy ground, sandy scrub, overgrazed grassland, edges of vleis and dry river beds.	High
	Graphiurus ocularis	Spectacled Dormouse	LC	LC	Rocky habitats, but also trees.	Low

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	*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.	High
	Malacothrix typica	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	Low
	Rhabdomys pumilio	Four-striped Grass Mouse	LC	LC	Essentially a grassland species; occurs in wide variety of habitats where there is good grass cover.	High
	Mus minutoides	Pygmy Mouse	LC	LC	Wide habitat tolerance.	High
	Mus musculus	House Mouse	LC	*Not listed*	Wide habitat tolerance.	High
	Mastomys natalensis	Natal Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	Mastomys coucha	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	Micaelamys namaquensis	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	Low
	Rattus rattus	House Rat	LC	LC	Primarily commensal, but also found in a variety of natural and semi-natural habitats.	High

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	*Otomys irroratus*	Southern African Vlei Rat	LC	LC	Known from grassland and marshes in areas of dense vegetation cover and higher moisture content. It also occurs in pine plantations.	Moderate
	Desmodillus auricularis	Cape Short-tailed Gerbil	LC	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	Low
	Gerbillurus paeba	Pygmy Hairy-footed Gerbil	LC	LC	Associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover.	Moderate
	Gerbilliscus leucogaster	Bushveld Gerbil	LC	**DD**	Sandy soils; wooded and more open grassland; areas of cultivation.	High
	Gerbilliscus brantsii	Highveld Gerbil	LC	LC	Sandy soils; wooded and more open grassland; areas of cultivation.	High
PRIMATES	*Papio ursinus*	Chacma Baboon	LC	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Low
	Chlorocebus pygerythrus	Vervet Monkey	LC	LC	Woodland savanna, riverine woodland, isolated stands of trees along river courses.	Low

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	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.	Low
EULIPOTYPHLA	*Crocidura cyanea*	Reddish-Grey Musk Shrew	LC	DD	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	Low
	Suncus varilla	Lesser Dwarf Shrew	LC	**DD**	Generally associated with termite mounds, grassland habitat.	High
	[1]*Atelerix frontalis*	South African Hedgehog	LC	**NT**	Generally found in semi-arid and sub-temperate environments with ample ground cover.	Moderate

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CARNIVORA	*Proteles cristata*	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes.	Moderate
	Caracal caracal	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	Moderate
	Felis silvestris	African Wild Cat	LC	LC	Wide habitat tolerance.	High
	Felis nigripes	Black-footed cat	**VU**	LC	Associated with arid country, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	Moderate
	Genetta genetta	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	Low
	Suricata suricatta	Suricate	LC	LC	Open arid country with hard and stony substrate. Occur in Nama- and Succulent Karoo but also fynbos.	Moderate

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CARNIVORA	*Cynictis penicillata*	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	High
	Galerella pulverulenta	Cape (Small) Grey Mongoose	LC	LC	Wide habitat tolerance.	High
	Herpestes sanguineus	Slender Mongoose	LC	LC	Wide habitat tolerance, but areas with adequate cover.	High
	Atilax paludinosus	Water (Marsh) Mongoose	LC	LC	Associated with well-watered areas, along rivers and streams, around dams, lakes, estuaries and swamps wherever there is cover.	Low
	Vulpes chama	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	Moderate
	Canis mesomelas	Black-backed Jackal	LC	LC	Wide habitat tolerance.	Moderate
	Aonyx capensis	Cape Clawless Otter	**NT**	LC	Rivers, marshes, dams and lakes; dry stream beds if pools of water exist.	Low

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CARNIVORA	*Hydrictis maculicollis*	Spotted-necked Otter	**NT**	**NT**	Larger rivers or rivers with permanent pools; lakes, dams and well-watered swamps.	Low
	Hyaena brunnea	Brown Hyena	**NT**	**NT**	Found in dry areas, generally with annual rainfall of 100 - 700 mm, particularly along the coast, semi-desert, open scrub and open woodland savanna.	Low
	[1]*Otocyon megalotis*	Bat-eared Fox	LC	LC	Open country with mean annual rainfall of 100-600 mm.	Moderate
	Poecilogale albinucha	African Striped Weasel	LC	**DD**	Wide habitat tolerance, but most common in grassland areas.	High
	Ictonyx striatus	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	Mellivora capensis	Honey Badger	LC	**NT**	Wide habitat tolerance.	High

LIST OF MAMMALS (Continued)

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

	Scientific name	Common name	IUCN	RDB	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]*Connochaetes gnou*	Black Wildebeest	LC	LC	Open plains grasslands and karoo shrublands of South Africa and Lesotho.	Low
	[2]*Connochaetes taurinus*	Blue Wildebeest	LC	LC	Open savanna woodland and open grassland with access to drinking water.	Low
	[2]*Alcelaphus caama*	Red Hartebeest	LC	LC	Open savanna country and open woodland.	Low
	[2]*Damaliscus pygargus phillipsi*	Blesbok	LC	LC	Open grassland with water.	Low
	[2]*Antidorcas marsupialis*	Springbok	LC	LC	Open arid plains with short vegetation	Low
	[2]*Raphicerus campestris*	Steenbok	LC	LC	Inhabits open country.	Moderate
	Sylvicapra grimmia	Common Duiker	LC	LC	Presence of bushes are important.	Moderate

LIST OF REPTILES

Reptils protected according to FSNCO are indicated with their respective Schedule no. in superscript

Family	Scientific name	Common name	IUCN status
AGAMIDAE	*Agama aculeata aculeata*	Western Ground Agama	LC
	Agama aculeata distanti	Eastern Ground Agama	LC
	Agama atra	Soutern Rock Agama	LC
COLUBRIDAE	*Dasypeltis scabra*	Rhombic Egg-eater	LC
CORDYLIDAE	[1]*Karusasaurus polyzonus*	Southern Karusa Lizard	LC
ELAPIDAE	*Naja nivea*	Cape Cobra	LC
GEKKONIDAE	*Chondrodactylus bibronii*	Bibron's Gecko	LC
	Pachydactylus capensis	Cape Gecko	LC
LACERTIDAE	*Nucras holubi*	Holub's Sandveld Lizard	LC
	Nucras intertexta	Spotted Sandveld Lizard	LC
	Pedioplanis lineoocellata lineoocellata	Spotted Sand Lizard	LC
LAMPROPHIIDAE	*Aparallatus capensis*	Black-headed Centipede-eater	LC
	Boaedon capensis	Common House Snake	LC
	Lamprophis aurora	Aurora Snake	LC
	Lycophidion capense capense	Cape Wolf Snake	LC
	Psammophis notostictus	Karoo Sand Snake	LC
	Psammophis trinasalis	Fork-marked Sand Snake	LC
	Psammophis tritaeniatus	Striped Grass Snake	LC
	Prosymna bivittata	Two-striped Shovel-snout	LC
	Pseudaspis cana	Mole Snake	LC
LEPTOTYPHLOPIDAE	*Leptotyphlops scutifrons scutifrons*	Peters' Thread Snake	LC
	Atractaspis bibronii	Bibron's Stiletto Snake	LC
PELOMEDUSIDAE	*Pelomedusa subrufa*	Marsh Terrapin	LC
SCINCIDAE	*Acontias gracilicauda*	Thin-tailed Legless Skink	LC
	Trachylepis capensis	Cape Skink	LC
	Trachylepis punctatissima	Speckled Rock Skink	LC
	Trachylepis punctulata	Speckled Sand Skink	LC
	Trachylepis sulcata sulcata	Western Rock Skink	LC
	Trachylepis varia	Variable Skink	LC
	Trachylepis variegata	Variegated Skink	LC
TESTUDINIDAE	[1]*Homopus femoralis*	Greater Dwarf Tortoise	LC
	[1]*Psammobates oculifer*	Serrated Tent Tortoise	LC
	[1]*Stigmochelys pardalis*	Leopard Tortoise	LC
TYPHLOPIDAE	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	LC
VARANIDAE	*Varanus albigularis albigularis*	Southern Rock Monitor	LC
VIPERIDAE	*Bitis arietans arietans*	Puff Adder	LC

LIST OF AMPHIBIANS

Family	Scientific name	Common name	IUCN status
BUFONIDAE	*Amietophrynus gutturalis*	Guttural Toad	LC
	Amietophrynus poweri	Western Olive Toad	LC
	Amietophrynus rangeri	Raucous Toad	LC
	Poyntonophrynus vertebralis	Southern Pygmy Toad	LC
HYPEROLIIDAE	*Kassina senegalensis*	Bubbling Kassina	LC
PHRYNOBATRACHIDAE	*Phrynobatrachus natalensis*	Snoring Puddle Frog	LC
PIPIDAE	*Xenopus laevis*	Common Platanna	LC
PYXICEPHALIDAE	*Amietia poyntoni*	Poynton's River Frog	LC
	Amietia fuscigula	Cape River Frog	LC
	Amietia quecketti	Common River Frog	LC
	Cacosternum boettgeri	Boettger's Caco	LC
	Pyxicephalus adspersus	**Giant Bullfrog**	**NT**
	Tomopterna cryptotis	Tremolo Sand Frog	LC
	Tomopterna tandyi	Tandy's Sand Frog	LC

LIST OF BIRDS

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

Scientific name	Common name	IUCN status	SA RDB
[1] *Accipiter melanoleucus*	Black Sparrowhawk	LC	LC
[1] *Acrocephalus arundinaceus*	Great Reed-Warbler	LC	LC
[1] *Acrocephalus baeticatus*	African Reed-Warbler	LC	LC
[1] *Acrocephalus gracilirostris*	Lesser Swamp-Warbler	LC	LC
[1] *Acrocephalus palustris*	Marsh Warbler	LC	LC
[1] *Actitis hypoleucos*	Common Sandpiper	LC	LC
[1] *Actophilornis africanus*	African Jacana	LC	LC
[1] *Alcedo cristata*	Malachite Kingfisher	LC	LC
[2] *Alopochen aegyptiacus*	Egyptian Goose	LC	LC
[1] *Amadina erythrocephala*	Red-headed Finch	LC	LC
[1] *Amaurornis flavirostris*	Black Crake	LC	LC
[1] *Anas capensis*	Cape Teal	LC	LC
[2] *Anas erythrorhyncha*	Red-billed Teal	LC	LC
[1] *Anas hottentota*	Hottentot Teal	LC	LC
[1] *Anas smithii*	Cape Shoveler	LC	LC
[1] *Anas sparsa*	African Black Duck	LC	LC
[2] *Anas undulata*	Yellow-billed Duck	LC	LC
[1] *Anhinga rufa*	African Darter	LC	LC
[1] *Anthoscopus minutus*	Cape Penduline-Tit	LC	LC
[2] *Anthropoides paradisea*	Blue Crane	**NT**	**NT**
[1] *Anthus cinnamomeus*	African Pipit	LC	LC
[1] *Anthus crenatus*	African Rock Pipit	**NT**	**NT**
[1] *Anthus leucophrys*	Plain-backed Pipit	LC	LC
[1] *Anthus similis*	Long-billed Pipit	LC	LC
[1] *Anthus vaalensis*	Buffy Pipit	LC	LC
[1] *Apus affinis*	Little Swift	LC	LC
[1] *Apus apus*	Common Swift	LC	LC
[1] *Apus barbatus*	African Black Swift	LC	LC
[1] *Apus bradfieldi*	Bradfield's Swift	LC	LC
[1] *Apus caffer*	White-rumped Swift	LC	LC
[1] *Apus horus*	Horus Swift	LC	LC
[1] *Aquila rapax*	Tawny Eagle	**VU**	**EN**
[1] *Ardea cinerea*	Grey Heron	LC	LC
[1] *Ardea goliath*	Goliath Heron	LC	LC
[1] *Ardea melanocephala*	Black-headed Heron	LC	LC
[1] *Ardea purpurea*	Purple Heron	LC	LC
[1] *Ardeola ralloides*	Squacco Heron	LC	LC
[1] *Ardeotis kori*	Kori Bustard	**NT**	**NT**
[1] *Asio capensis*	Marsh Owl	LC	LC
[1] *Batis pririt*	Pririt Batis	LC	LC

LIST OF BIRDS

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Scientific name	Common name	IUCN status	SA RDB
[1] *Bostrychia hagedash*	Hadeda Ibis	LC	LC
[1] *Bradornis infuscatus*	Chat Flycatcher	LC	LC
[1] *Bradornis mariquensis*	Marico Flycatcher	LC	LC
[1] *Bubo africanus*	Spotted Eagle-Owl	LC	LC
[1] *Bubo lacteus*	Verreaux's Eagle-Owl	LC	LC
[1] *Bubulcus ibis*	Cattle Egret	LC	LC
[1] *Burhinus capensis*	Spotted Thick-knee	LC	LC
[1] *Buteo rufofuscus*	Jackal Buzzard	LC	LC
[1] *Buteo vulpinus*	Steppe Buzzard	LC	LC
[1] *Butorides striatus*	Green-backed Heron	LC	LC
[1] *Calandrella cinerea*	Red-capped Lark	LC	LC
[1] *Calendulauda africanoides*	Fawn-coloured Lark	LC	LC
[1] *Calendulauda sabota*	Sabota Lark	LC	LC
[1] *Calidris alba*	Sanderling	LC	LC
[1] *Calidris ferruginea*	Curlew Sandpiper	LC	LC
[1] *Calidris minuta*	Little Stint	LC	LC
[1] *Campethera abingoni*	Golden-tailed Woodpecker	LC	LC
[1] *Caprimulgus europaeus*	European Nightjar	LC	LC
[1] *Caprimulgus pectoralis*	Fiery-necked Nightjar	LC	LC
[1] *Caprimulgus rufigena*	Rufous-cheeked Nightjar	LC	LC
[1] *Cercomela familiaris*	Familiar Chat	LC	LC
[1] *Cercomela schlegelii*	Karoo Chat	LC	LC
[1] *Cercomela sinuata*	Sickle-winged Chat	LC	LC
[1] *Cercotrichas coryphoeus*	Karoo Scrub-Robin	LC	LC
[1] *Cercotrichas paena*	Kalahari Scrub-Robin	LC	LC
[1] *Certhilauda chuana*	Short-clawed Lark	LC	**NT**
[1] *Ceryle rudis*	Pied Kingfisher	LC	LC
[1] *Charadrius asiaticus*	Caspian Plover	LC	LC
[1] *Charadrius hiaticula*	Common Ringed Plover	LC	LC
[1] *Charadrius pallidus*	Chestnut-banded Plover	**NT**	**NT**
[1] *Charadrius pecuarius*	Kittlitz's Plover	LC	LC
[1] *Charadrius tricollaris*	Three-banded Plover	LC	LC
[1] *Chersomanes albofasciata*	Spike-heeled Lark	LC	LC
[1] *Chlidonias hybridus*	Whiskered Tern	LC	LC
[1] *Chlidonias leucopterus*	White-winged Tern	LC	LC
[1] *Chrysococcyx caprius*	Diderick Cuckoo	LC	LC
[1] *Ciconia abdimii*	Abdim's Stork	LC	**NT**
[1] *Ciconia ciconia*	White Stork	LC	LC
[1] *Ciconia nigra*	Black Stork	LC	**VU**

LIST OF BIRDS

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Scientific name	Common name	IUCN status	SA RDB
[1] *Cinnyris fusca*	Dusky Sunbird	LC	LC
[1] *Cinnyris talatala*	White-bellied Sunbird	LC	LC
[1] *Circaetus pectoralis*	Black-chested Snake-Eagle	LC	LC
[1] *Circus aeruginosus*	Western Marsh-Harrier	LC	LC
[1] *Circus macrourus*	Pallid Harrier	**NT**	**NT**
[1] *Circus maurus*	Black Harrier	**VU**	LC
[1] *Circus pygargus*	Montagu's Harrier	LC	LC
[1] *Circus ranivorus*	African Marsh-Harrier	**EN**	**EN**
[1] *Cisticola aridulus*	Desert Cisticola	LC	LC
[1] *Cisticola fulvicapillus*	Neddicky	LC	LC
[1] *Cisticola juncidis*	Zitting Cisticola	LC	LC
[1] *Cisticola textrix*	Cloud Cisticola	LC	LC
[1] *Cisticola tinniens*	Levaillant's Cisticola	LC	LC
[1] *Clamator glandarius*	Great Spotted Cuckoo	LC	LC
[1] *Clamator jacobinus*	Jacobin Cuckoo	LC	LC
Colius colius	White-backed Mousebird	LC	LC
[1] *Columba guinea*	Speckled Pigeon	LC	LC
Columba livia	Rock Dove	LC	LC
[1] *Coracias caudata*	Lilac-breasted Roller	LC	LC
[1] *Coracias garrulus*	European Roller	LC	**NT**
Corvus albus	Pied Crow	LC	LC
Corvus capensis	Cape Crow	LC	LC
[1] *Cossypha caffra*	Cape Robin-Chat	LC	LC
[2] *Coturnix coturnix*	Common Quail	LC	LC
[1] *Creatophora cinerea*	Wattled Starling	LC	LC
[1] *Cuculus solitarius*	Red-chested Cuckoo	LC	LC
[1] *Cursorius rufus*	Burchell's Courser	LC	**VU**
[1] *Cursorius temminckii*	Temminck's Courser	LC	LC
[1] *Cypsiurus parvus*	African Palm-Swift	LC	LC
[1] *Delichon urbica*	Common House-Martin	LC	LC
[1] *Dendrocygna bicolor*	Fulvous Duck	LC	LC
[1] *Dendrocygna viduata*	White-faced Duck	LC	LC
[1] *Dendropicos fuscescens*	Cardinal Woodpecker	LC	LC
[1] *Dicrurus adsimilis*	Fork-tailed Drongo	LC	LC
[1] *Egretta alba*	Great Egret	LC	LC
[1] *Egretta ardesiaca*	Black Heron	LC	LC
[1] *Egretta garzetta*	Little Egret	LC	LC
[1] *Egretta intermedia*	Yellow-billed Egret	LC	LC
[1] *Elanus caeruleus*	Black-shouldered Kite	LC	LC

LIST OF BIRDS

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Scientific name	Common name	IUCN status	SA RDB
[1] *Emberiza capensis*	Cape Bunting	LC	LC
[1] *Emberiza flaviventris*	Golden-breasted Bunting	LC	LC
[1] *Emberiza impetuani*	Lark-like Bunting	LC	LC
[1] *Emberiza tahapisi*	Cinnamon-breasted Bunting	LC	LC
[1] *Eremomela icteropygialis*	Yellow-bellied Eremomela	LC	LC
[1] *Eremopterix leucotis*	Chestnut-backed Sparrowlark	LC	LC
[1] *Eremopterix verticalis*	Grey-backed Sparrowlark	LC	LC
[1] *Estrilda astrild*	Common Waxbill	LC	LC
[1] *Estrilda erythronotos*	Black-faced Waxbill	LC	LC
Euplectes afer	Yellow-crowned Bishop	LC	LC
Euplectes orix	Southern Red Bishop	LC	LC
Euplectes progne	Long-tailed Widowbird	LC	LC
[1] *Eupodotis afraoides*	Northern Black Korhaan	LC	LC
[1] *Eupodotis caerulescens*	Blue Korhaan	**NT**	LC
[1] *Eupodotis ruficrista*	Red-crested Korhaan	LC	LC
[1] *Falco amurensis*	Amur Falcon	LC	LC
[1] *Falco biarmicus*	Lanner Falcon	**VU**	**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
[2] *Fulica cristata*	Red-knobbed Coot	LC	LC
[1] *Galerida magnirostris*	Large-billed Lark	LC	LC
[1] *Gallinago nigripennis*	African Snipe	LC	LC
[1] *Gallinula chloropus*	Common Moorhen	LC	LC
[1] *Glareola nordmanni*	Black-winged Pratincole	**NT**	**NT**
[1] *Granatina granatina*	Violet-eared Waxbill	LC	LC
[1] *Gyps africanus*	White-backed Vulture	**CR**	**CR**
[1] *Gyps coprotheres*	Cape Vulture	**EN**	**EN**
[1] *Halcyon albiventris*	Brown-hooded Kingfisher	LC	LC
[1] *Haliaeetus vocifer*	African Fish-Eagle	LC	LC
[1] *Hieraaetus pennatus*	Booted Eagle	LC	LC
[1] *Himantopus himantopus*	Black-winged Stilt	LC	LC
[1] *Hippolais icterina*	Icterine Warbler	LC	LC
[1] *Hirundo albigularis*	White-throated Swallow	LC	LC
[1] *Hirundo cucullata*	Greater Striped Swallow	LC	LC
[1] *Hirundo dimidiata*	Pearl-breasted Swallow	LC	LC
[1] *Hirundo fuligula*	Rock Martin	LC	LC
[1] *Hirundo rustica*	Barn Swallow	LC	LC
[1] *Hirundo semirufa*	Red-breasted Swallow	LC	LC

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Scientific name	Common name	IUCN status	SA RDB
[1] *Hirundo spilodera*	South African Cliff-Swallow	LC	LC
[1] *Indicator indicator*	Greater Honeyguide	LC	LC
[1] *Indicator minor*	Lesser Honeyguide	LC	LC
[1] *Ixobrychus minutus*	Little Bittern	LC	LC
[1] *Lagonosticta senegala*	Red-billed Firefinch	LC	LC
[1] *Lamprotornis nitens*	Cape Glossy Starling	LC	LC
[1] *Laniarius atrococcineus*	Crimson-breasted Shrike	LC	LC
[1] *Lanius collaris*	Common Fiscal	LC	LC
[1] *Lanius collurio*	Red-backed Shrike	LC	LC
[1] *Lanius minor*	Lesser Grey Shrike	LC	LC
[1] *Larus cirrocephalus*	Grey-headed Gull	LC	LC
[1] *Leptoptilos crumeniferus*	Marabou Stork	LC	**NT**
[1] *Limosa limosa*	Black-tailed Godwit	**NT**	LC
[1] *Macronyx capensis*	Cape Longclaw	LC	LC
[1] *Malcorus pectoralis*	Rufous-eared Warbler	LC	LC
[1] *Megaceryle maxima*	Giant Kingfisher	LC	LC
[1] *Melierax canorus*	Southern Pale Chanting Goshawk	LC	LC
[1] *Melierax gabar*	Gabar Goshawk	LC	LC
[1] *Merops apiaster*	European Bee-eater	LC	LC
[1] *Merops bullockoides*	White-fronted Bee-eater	LC	LC
[1] *Merops hirundineus*	Swallow-tailed Bee-eater	LC	LC
[1] *Merops persicus*	Blue-cheeked Bee-eater	LC	LC
[1] *Milvus aegyptius*	Yellow-billed Kite	-	LC
[1] *Milvus migrans*	Black Kite	LC	LC
[1] *Mirafra africana*	Rufous-naped Lark	LC	LC
[1] *Mirafra cheniana*	Melodious Lark	LC	LC
[1] *Mirafra fasciolata*	Eastern Clapper Lark	LC	LC
[1] *Monticola brevipes*	Short-toed Rock-Thrush	LC	LC
[1] *Motacilla aguimp*	African Pied Wagtail	LC	LC
[1] *Motacilla capensis*	Cape Wagtail	LC	LC
[1] *Motacilla flava*	Yellow Wagtail	LC	LC
[1] *Muscicapa striata*	Spotted Flycatcher	LC	LC
[1] *Mycteria ibis*	Yellow-billed Stork	LC	**EN**
[1] *Myrmecocichla formicivora*	Anteating Chat	LC	LC
[1] *Neotis ludwigii*	Ludwig's Bustard	**EN**	**EN**
[1] *Netta erythrophthalma*	Southern Pochard	LC	LC
[1] *Nilaus afer*	Brubru	LC	LC
[1] *Numenius arquata*	Eurasian Curlew	**NT**	**NT**
[1] *Numenius phaeopus*	Common Whimbrel	LC	LC
[2] *Numida meleagris*	Helmeted Guineafowl	LC	LC

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Scientific name	Common name	IUCN status	SA RDB
[1] *Nycticorax nycticorax*	Black-crowned Night-Heron	LC	LC
[1] *Oena capensis*	Namaqua Dove	LC	LC
[1] *Oenanthe monticola*	Mountain Wheatear	LC	LC
[1] *Oenanthe pileata*	Capped Wheatear	LC	LC
[1] *Oriolus oriolus*	Eurasian Golden Oriole	LC	LC
[1] *Ortygospiza atricollis*	African Quailfinch	LC	LC
[1] *Oxyura maccoa*	Maccoa Duck	**NT**	**NT**
[1] *Pandion haliaetus*	Osprey	LC	LC
[1] *Parisoma layardi*	Layard's Tit-Babbler	-	LC
[1] *Parisoma subcaeruleum*	Chestnut-vented Tit-Babbler	LC	LC
[1] *Parus cinerascens*	Ashy Tit	LC	LC
[1] *Passer diffusus*	Southern Grey-headed Sparrow	LC	LC
Passer domesticus	House Sparrow	LC	LC
Passer melanurus	Cape Sparrow	LC	LC
[1] *Passer motitensis*	Great Sparrow	LC	LC
[1] *Pelecanus rufescens*	Pink-backed Pelican	LC	**VU**
Phalacrocorax africanus	Reed Cormorant	LC	LC
Phalacrocorax lucidus	White-breasted Cormorant	LC	LC
Philetairus socius	Sociable Weaver	LC	LC
[1] *Philomachus pugnax*	Ruff	LC	LC
[1] *Phoenicopterus minor*	Lesser Flamingo	**NT**	**NT**
[1] *Phoenicopterus ruber*	Greater Flamingo	**NT**	**NT**
[1] *Phragmacia substriata*	Namaqua Warbler	LC	LC
[1] *Phylloscopus trochilus*	Willow Warbler	LC	LC
[1] *Platalea alba*	African Spoonbill	LC	LC
[2] *Plectropterus gambensis*	Spur-winged Goose	LC	LC
[1] *Plegadis falcinellus*	Glossy Ibis	LC	LC
Plocepasser mahali	White-browed Sparrow-Weaver	LC	LC
Ploceus velatus	Southern Masked-Weaver	LC	LC
[1] *Podiceps cristatus*	Great Crested Grebe	LC	LC
[1] *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
[1] *Porphyrio madagascariensis*	African Purple Swamphen	LC	LC
[1] *Porzana pusilla*	Baillon's Crake	LC	LC
[1] *Prinia flavicans*	Black-chested Prinia	LC	LC
[1] *Psophocichla litsipsirupa*	Groundscraper Thrush	LC	LC
[2] *Pternistis natalensis*	Natal Francolin	LC	LC
[1] *Pternistis swainsonii*	Swainson's Spurfowl	LC	LC

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Scientific name	Common name	IUCN status	SA RDB
[1] *Pterocles namaqua*	Namaqua Sandgrouse	LC	LC
[1] *Ptilopsus granti*	Southern White-faced Scops-Owl	LC	LC
Pycnonotus nigricans	African Red-eyed Bulbul	LC	LC
[1] *Pytilia melba*	Green-winged Pytilia	LC	LC
Quelea quelea	Red-billed Quelea	LC	LC
[1] *Rallus caerulescens*	African Rail	LC	LC
[1] *Recurvirostra avosetta*	Pied Avocet	LC	LC
[1] *Rhinopomastus cyanomelas*	Common Scimitarbill	LC	LC
[1] *Rhinoptilus africanus*	Double-banded Courser	LC	LC
[1] *Riparia cincta*	Banded Martin	LC	LC
[1] *Riparia paludicola*	Brown-throated Martin	LC	LC
[1] *Riparia riparia*	Sand Martin	LC	LC
[1] *Rostratula benghalensis*	Greater Painted-snipe	LC	**NT**
[1] *Sagittarius serpentarius*	Secretarybird	**VU**	**VU**
[1] *Sarkidiornis melanotos*	Comb Duck	LC	LC
[1] *Saxicola torquata*	African Stonechat	LC	LC
[2] *Scleroptila levaillantoides*	Orange River Francolin	LC	LC
[1] *Scopus umbretta*	Hamerkop	LC	LC
[1] *Serinus albogularis*	White-throated Canary	LC	LC
[1] *Serinus atrogularis*	Black-throated Canary	LC	LC
[1] *Serinus canicollis*	Cape Canary	LC	LC
[1] *Serinus flaviventris*	Yellow Canary	LC	LC
[1] *Sigelus silens*	Fiscal Flycatcher	LC	LC
[1] *Spizocorys conirostris*	Pink-billed Lark	LC	LC
[1] *Sporopipes squamifrons*	Scaly-feathered Finch	LC	LC
Spreo bicolor	Pied Starling	LC	LC
[1] *Stenostira scita*	Fairy Flycatcher	LC	LC
[1] *Sterna caspia*	Caspian Tern	LC	LC
Streptopelia capicola	Cape Turtle-Dove	LC	LC
[1] *Streptopelia semitorquata*	Red-eyed Dove	LC	LC
Streptopelia senegalensis	Laughing Dove	LC	LC
[1] *Struthio camelus*	Common Ostrich	LC	LC
[1] *Sylvia borin*	Garden Warbler	LC	LC
[1] *Sylvietta rufescens*	Long-billed Crombec	LC	LC
[1] *Tachybaptus ruficollis*	Little Grebe	LC	LC
[1] *Tachymarptis melba*	Alpine Swift	LC	LC
[2] *Tadorna cana*	South African Shelduck	LC	LC
[1] *Tchagra australis*	Brown-crowned Tchagra	LC	LC
[1] *Telophorus zeylonus*	Bokmakierie	LC	LC
[1] *Terpsiphone viridis*	African Paradise-Flycatcher	LC	LC

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

APPENDIX 3

A photographic guide for species of conservation concern that are known from the study area

Helichrysum lucilioides

(All *Helichrysum* spp. are protected in terms of Schedule 6 of the FSNCO)

Euphorbia spartaria

(All *Euphorbia* spp. are protected in terms of Schedule 6 of the FSNCO)