FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED MINING OF GYPSUM ON PORTION 0 OF THE FARM KANAKIES 332 AREA, NEAR LOERIESFONTEIN, NORTHERN CAPE

Prepared for

Cabanga Environmental

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Section C: Faunal Assessment

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EXECUTIVE SUMMARY

The field assessment and this report was confined to the focus area. Although the MRA was briefly visited during the field assessment, it formed part of all the background and desktop data in support of the field assessment and reports within the focus area. The proposed mining activities are primarily located within the Overgrazed Vygieveld, and as such pose a lower threat to faunal species compared to mining in the more sensitive areas within the Focus Area. However, edge effects from mining activities may pose a significant risk to the surrounding habitat areas, and as such need to be managed and mitigated appropriately.

Scientific Terrestrial Services (STS) was appointed to conduct a terrestrial ecological assessment as part of the environmental assessment and authorisation process for the proposed mining of natural gypsum (Gy) on the remaining extent of the farm Kanakies 332, near Loeriesfontein, Northern Cape. The MRA is situated within the Hantam Local Municipality and within the Calvinia magisterial district. Although the proposed Mining Right Application will include the remaining extent of the farm Kanakies 332, for the purpose of this study, only the proposed mining area was assessed in detail, and is referred to as the "focus area".

Specific outcomes required from this report include the following:

- To define the Present Ecological State (PES) of the faunal ecology associated with the focus area;
- To determine and describe habitats, communities and the ecological state of the focus area;
- To conduct a faunal Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the focus area;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and

Faunal Results

- Four habitat units were identified during the field assessment, namely Intact Vygieveld, Overgrazed Vygieveld, Ephemeral Drainage Lines and Transformed areas;
- The north-western and western portions of the Focus Area comprise of the Intact Vygieveld, and although degraded by grazing, is still considered to have a higher ecological integrity than that of the Overgrazed Vygieveld, where overgrazing and habitat degradation were more evident;
- The main habitat units that will be impacted by the proposed mining activities are that of the Intact and Overgrazed Vygieveld. The open cast mining will result in vegetation clearance (habitat loss) and the displacement of faunal species from the areas of activity;
- The long term drought conditions were noted in having a significant impact on the overall habitat integrity, species diversity and species abundance of the focus area. Although some winter rains were received, they have been below average. The veld was noted to be in the beginning stages of recovery, with new plant growth (food resources) evident;
- The increased food resources following the rains has resulted in a notable increase in faunal species, notably that of the insects, however it will likely take another growing season with good rains for the full complement of faunal species to fully recover;
- Four faunal SCC were observed at the time of the assessment, namely *Ardeotis kori* (Kori bustard), *Orycteropus afer* (Aardvark), *Otocyon megalotis* (Bat-eared fox) and *Brinckiella arboricola* (Tree Winter Katydid).Taking into account habitat availability and distribution ranges, it is further considered likely that the following species have an higher probability of occurring within the focus area, namely *Felis nigripes* (Black-footed cat); *Homopus signatus* (Speckled tortoise); *Brinckiella mauerbergerorum* (Mauerberger's Winter Katydid) and *Brinckiella aptera* (Mute Winter Katydid);
- With regards to *Brinckiella arboricola*, this species lays its eggs within the ground or plant stems, with only one egg laying event per year and adults usually living for a year. As such, during vegetation clearance activities it is highly recommended that prior to clearing activities a search be conducted in order to locate and move adults out of the area to be cleared. Furthermore, cleared vegetation must be stored for a period of a year in order to allow for any eggs to hatch;
- In order to alleviate the loss of habitat in the focus area it is recommended that a clear, concise and well formulated rehabilitation plan be implemented once mining begins, focussing on faunal

species relocation where necessary, as well as the concurrent reinstatement of faunal habitat post mining activities;

SENSITIVITY

From an ecological perspective, habitat sensitivity is considered to be of a low to moderately-high level. The table below indicates the sensitivity of the habitat units along with an associated conservation objective and implications for development.

Table 1A. A summary of the sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Intact Vygieveld	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	Mining activities/ disturbance within this habitat will result in the loss of faunal habitat, resulting in a decreased abundance and diversity of species.
Overgrazed Vygieveld	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.	The faunal habitat within this area has been degraded as a result of overgrazing activities. Whilst development within this habitat will result in faunal habitat loss, it is not considered to be as significant as that of the Intact Vygieveld.
Ephemeral Drainage Lines	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.	This habitat unit does not lend itself to providing habitat to faunal species, due to the lack of any significant vegetation cover. However, this habitat unit is likely to be utilised for movement whilst also provide an important role in the transportation of stormwater.
Transformed Areas	Low	Optimise development potential.	Activities in this habitat unit are unlikely to impact on faunal species within the focus area.

Long term grazing activities have resulted in widespread habitat degradation. Habitat degradation has further been compounded by ongoing and long term dry conditions. This has resulted in the denuding of the herbaceous layer, limited vegetation growth leading to a loss of food resources for herbivorous faunal species. As the herbivorous species have declined so have the predatory species that rely on these species. Although some winter rains have been received, and the veld is showing signs of recovery, it is unlikely that the full complement of faunal species will recover within this growing season. Faunal species population numbers have a delayed reciprocatory response to the habitat, as population numbers are unable to recover at the same speed.

Impact Assessment

The tables below serve to summarise the findings of the impact study undertaken with reference to the perceived impacts stemming from the proposed mining activities of the Kanakies mine. The tables below indicate the significance of the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post mitigation impact scores will increase.

Due to the already highly degraded nature of the Transformed areas, this habitat was not included in the below impact assessment. All impacts associated with the Transformed habitat can be considered to be of very low significance throughout all phases of the proposed mining. Nonetheless, although the Transformed habitat is considered to already be in a degraded state, it is imperative that all mitigation measures still be applied in order to minimise edge effects and impacts to the surrounding habitats.

Mine Infrastructure Areas

A summary of the impact significance on faunal resources in the construction phase

Site	Impact	Unmanaged	Mitigated
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

A summary of the impact significance on faunal resources in the operational phase

Site	Impact	Unmanaged	Mitigated
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

A summary of the impact significance on faunal resources in the decommissioning/ rehabilitation phase

Site	Impact	Unmanaged	Mitigated
Overgrazed Vygieveld	Impact on faunal habitat and species diversity	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

Open Cast Mining Areas

A summary of the impact significance on faunal resources in the construction phase

Site	Impact	Unmanaged	Mitigated
Intact Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Medium Low
	Impact on faunal SCC	Medium High	Medium Low
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Medium Low
	Impact on faunal SCC	Medium High	Medium Low
Ephemeral Drainage Lines	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

A summary of the impact significance on faunal resources in the operational phase

Site	Impact	Unmanaged	Mitigated
Intact Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Medium Low
	Impact on faunal SCC	Medium High	Medium Low
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Low
	Impact on faunal SCC	Medium High	Medium Low
Ephemeral Drainage Lines	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

A summary of the impact significance on faunal resources in the decommissioning/ rehabilitation phase

Site	Impact	Unmanaged	Mitigated
Intact Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium High	Low
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium High	Low
Ephemeral Drainage Lines	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

The data in this report should be considered as the baseline to which further monitoring can be added, with the knowledge that faunal species abundance and diversity may increase further following continued rains and floral habitat recovery. It is the opinion of the ecologists that this study provides relevant information required in order to implement the principles of Integrated Environmental Management so as to ensure that the best long-term use of the ecological resources in the focus area will be made in support of the principle of sustainable development. It is recommended that, from a faunal ecological perspective, the proposed development be considered favourably provided that the recommended mitigation measures for the identified impacts are adhered to, and construction within the sensitive habitats is avoided, and where this is not possible, kept to an absolute minimum.

DOCUMENT GUIDE

The table below provides the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) Regulations 2017 (as amended in 2014) for Specialist Reports and also the relevant sections in the reports where these requirements are addressed.

NEMA Regulations (2017) - Appendix 6	Relevant section in this report
(1) A specialist report prepared in terms of these Regulations must contain -	
(a) details of -	
(i) the specialist who prepared the report; and	Appendix D
(ii) the expertise of that specialist to compile a specialist report, including a curriculum vitae;	Appendix D
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix D
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.2
(cB) a description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Appendix A
(f) details of an assessment of the specific identified sensitivity[1] of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying alternatives;	Section 3 and 4
(g) an identification of any areas to be avoided, including buffers;	Section 4
(h) a map superimposing the activity, including the associated structures and infrastructure on the environmental sensitivities of the site, including areas to be avoided, including buffers;	Section 4
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.2
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment or activities;	Section 3
(k) any mitigation measures for inclusion in the EMPr;	Section 5
(l) any conditions for inclusion in the environmental authorisation;	Section 5
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 3 and 5
(n) a reasoned opinion -	
(i) as to whether the proposed activity, activities or portions thereof should be authorised;	Section 5 and 7
(iA) regarding the acceptability of the proposed activity or activities; and	Section 5 and 7
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 7
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report	
(p) a summary and copies, if any, comments received during any consultation process and, where applicable all responses thereto; and	Section 6
(q) any other information requested by the competent authority.	

[1] Illustration of possible sensitive areas / habitats based on desktop data.

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ACRONYMS

Ad mon	Additional Monitoring
BLSA	Bird Life South Africa
EIS	Ecological Importance and Sensitivity
EN	Endangered
End and N-end	Endemic and Near endemic
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
LC	Least Concern
NT	Near Threatened
NYBA	Not yet been assessed
PES	Present Ecological State
POC	Probability of Occurrence
QDS	Quarter Degree Squares
SABAP	Southern African Bird Atlas
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services
VU	Vulnerable

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a terrestrial ecological assessment as part of the environmental assessment and authorisation process for the proposed mining of natural gypsum (Gy) on the remaining extent of the farm Kanakies 332, near Loeriesfontein, Northern Cape, henceforth referred to as "the Mining Right Area (MRA)" (Figure 1 & 2 within Section A- please refer). The MRA is situated within the Hantam Local Municipality and within the Calvinia magisterial district.

The MRA is situated approximately 41 km west of the town of Loeriesfontein, and 40 km north north-west of Niewhoudtville, and 53 km north-east of Nuwerus. The Doring River traverses the south-west corner of the MRA. The extent of the MRA is approximately 7,457 ha, while the concentrated gypsum deposit is approximately 815 ha. The area where the gypsum deposit is concentrated will henceforth be referred to as the "focus area".

The field assessment and this report was confined to the focus area. Although the MRA was briefly investigated, it formed part of all the background and desktop data in support of the field assessment and reports within the focus area.

The purpose of this report is to define the faunal ecology of the focus area as well as mapping and defining areas of increased Ecological Importance and Sensitivity (EIS) and to define the Present Ecological State (PES) of the focus area. It is the objective of this study:

- To provide inventories of faunal species as encountered within the focus area;
- To determine and describe habitat types, communities and the ecological state of the focus area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) species assessment as well as an assessment of other Species of Conservation Concern (SCC), including potential for such species to occur within the focus area;
- To provide detailed information to guide the activities associated with the proposed mining activities associated within the focus area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The faunal assessment is confined to the focus area and does not include the adjacent properties nor the entire MRA; these were however considered as part of the desktop assessment;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal and floral communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the focus area may therefore have been missed during the assessment; and
- Two field assessments for the terrestrial ecology were undertaken, the first assessment was during the summer (dry) season from 31st of January to the 2nd of February 2018 with a second follow up assessment being undertaken in the winter (wet) season from the 18th to 20th July 2018. These site assessments were undertaken in order to determine the ecological status of the focus area, whilst taking into consideration the lager MRA on a desktop level.

2 ASSESSMENT APPROACH

A dry and wet season assessments were undertaken, the first assessment in January 2018 (Dry season) and the second assessments in July 2018 (Wet Season), in order to determine the ecological status of the focus area. A reconnaissance 'walkabout' was initially undertaken to determine the general habitat types found throughout the focus area, following this, specific study sites that were selected were considered to be representative of the habitats found within the area, with special emphasis being placed on areas that may potentially support faunal Species of Conservation Concern (SCC). These sites were further investigated on foot in order to identify the occurrence of fauna within the focus area. In order to increase the overall observation time within the focus area, as well as increasing the likelihood of observing shy and elusive species, motion sensitive camera traps were strategically placed within the focus area. Sherman traps were also used to increase the likelihood of capturing and observing small mammal species, notably small nocturnal mammals.

A detailed explanation of the method of assessment is provided in Appendix A of this report. The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, general insects and arachnids.

2.1 Sensitivity Mapping

All the ecological features of the focus area were considered and sensitive areas were assessed. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map should guide the design and layout of the proposed development.

3 FAUNAL ASSESSMENT RESULTS

3.1 Faunal Habitat

The focus area comprised of two faunal habitat units. These habitat units are discussed briefly in terms of faunal utilisation and importance below. For a more detailed description and discussion of these habitat units see Section B (Floral Report).

Knersvlakte Vygieveld Habitat Unit

This habitat unit has been further broken down into 2 habitat units, namely Intact Vygieveld and Overgrazed Vygieveld. The intact Vygieveld is located in the north-western portion of the focus area and is characterized by lower levels of grazing activities as well as an increased floral species diversity. The overgrazed Vygieveld was observed to have increased levels of grazing activities, a lower diversity of floral species and as such a decreased diversity of faunal species. Overall, the Vygieveld is dominated by low karroid species interspersed with succulents. Although the MRA and focus area fall within the arid region of South Africa, the region has been experiencing drought conditions for the past 3 years, and as such even the hardiest floral species were showing signs of long term moisture stress. A second site assessment was undertaken in July 2018 (wet season), and although the focus area had received rain, it was still considered to be below average. As such, the ability of the overgrazed portions of the focus area has been compromised in terms of resource provisions with regards to the support of faunal species. The intact Vygieveld portion of the focus area, whilst also affected by the below average rainfall, did not appear to be as disturbed by grazing activities, and as such is considered to be of a marginally higher ecological value for faunal species.

Ephemeral Drainage Lines

This habitat unit is located in the southern portion of the focus area. The ephemeral drainage lines convey excess surface water away from the focus area southwards to the larger freshwater system during periods of high rainfall. These drainage lines have been significantly eroded, contain no vegetation and are considered to be highly seasonable. As such, they are not considered important for faunal habitat or the support of faunal species.

Transformed Areas

This includes all areas that have been modified/transformed as a result of human and anthropogenic activities, and includes homesteads, railways lines, roads and old borrow pits observed within the focus area.

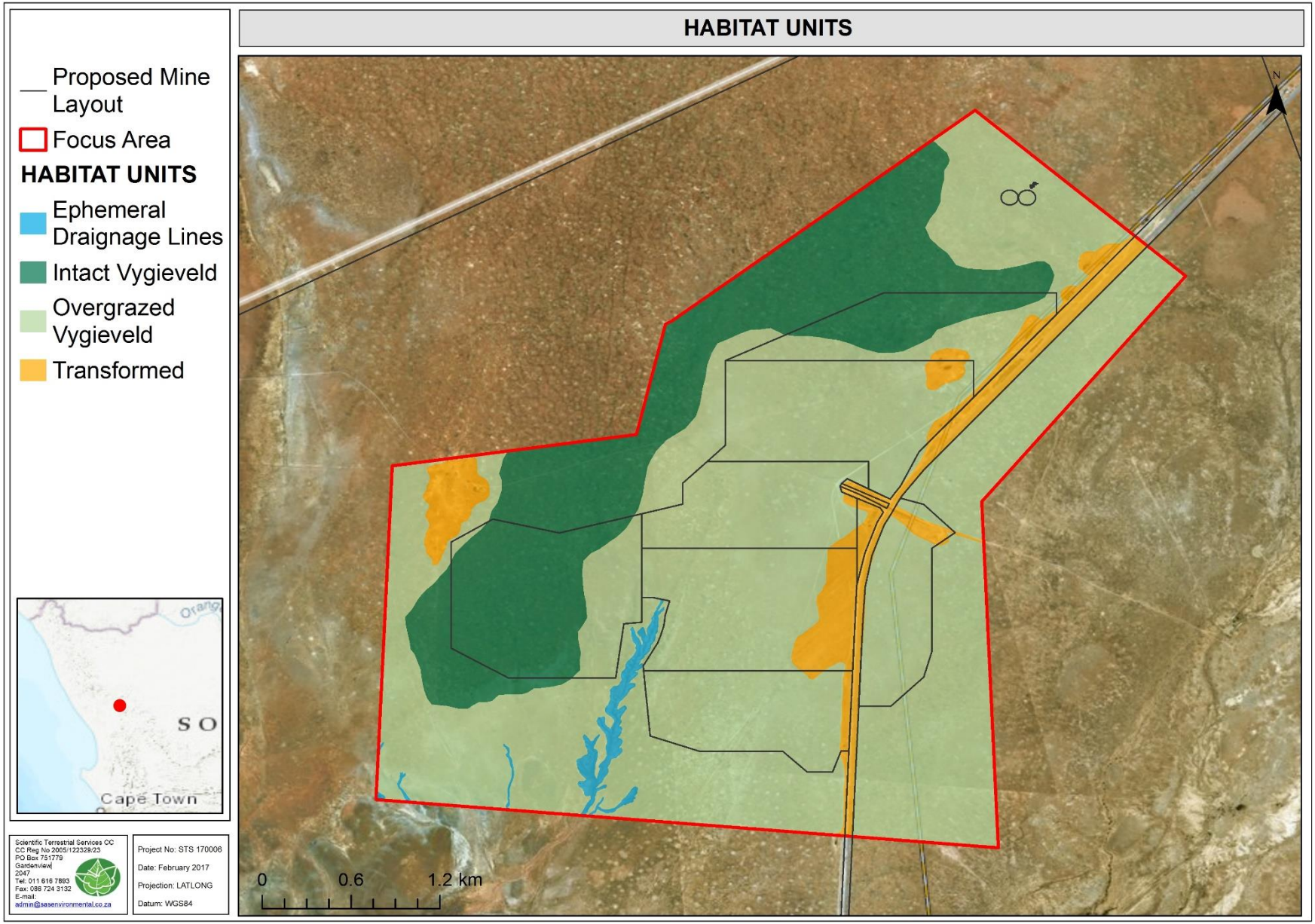


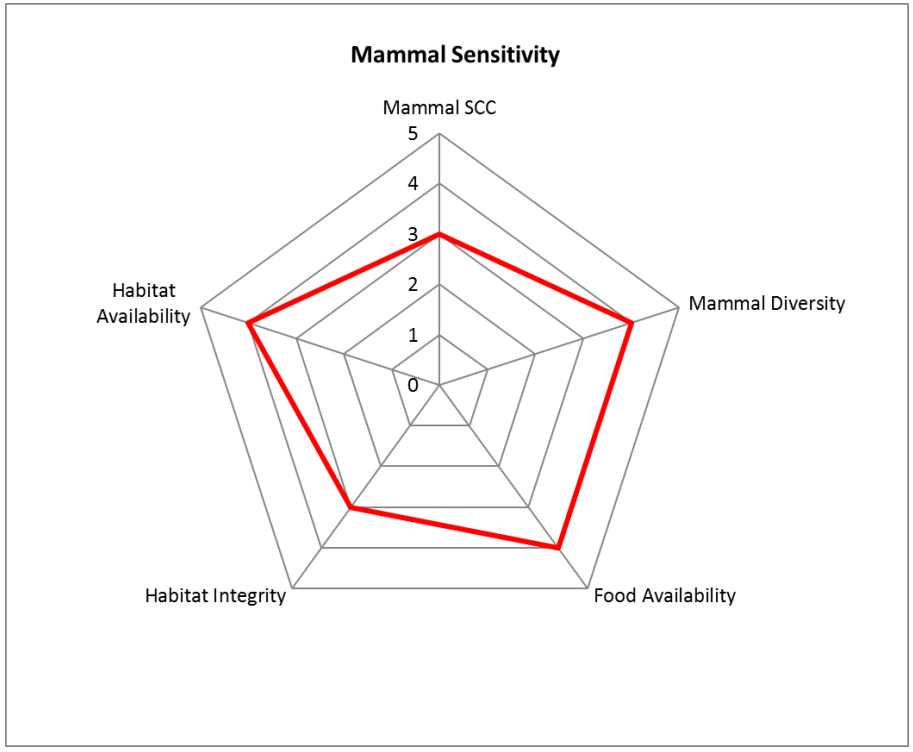
Figure 1: Ephemeral drainage line in the south of the Focus Area.

3.2 Mammals

Table 1: Field assessment results pertaining to mammal species within the focus area

Faunal Class: Mammals	Faunal Habitat Sensitivity	Moderately High
	Notes on photograph, from top left to bottom right: *Desmodillus auricularis* (Cape short-tailed Gerbil); *Hystrix africaeaustralis* (Porcupine) den; *Cynictis penicillata* (Yellow mongoose); *Orycteropus afer* (Aardvark); *Antidorcas marsupialis* (Springbok) and *Rhabdomys pumilio* (Four-striped Grass mouse).	

Faunal Sensitivity Graph:



Photograph:

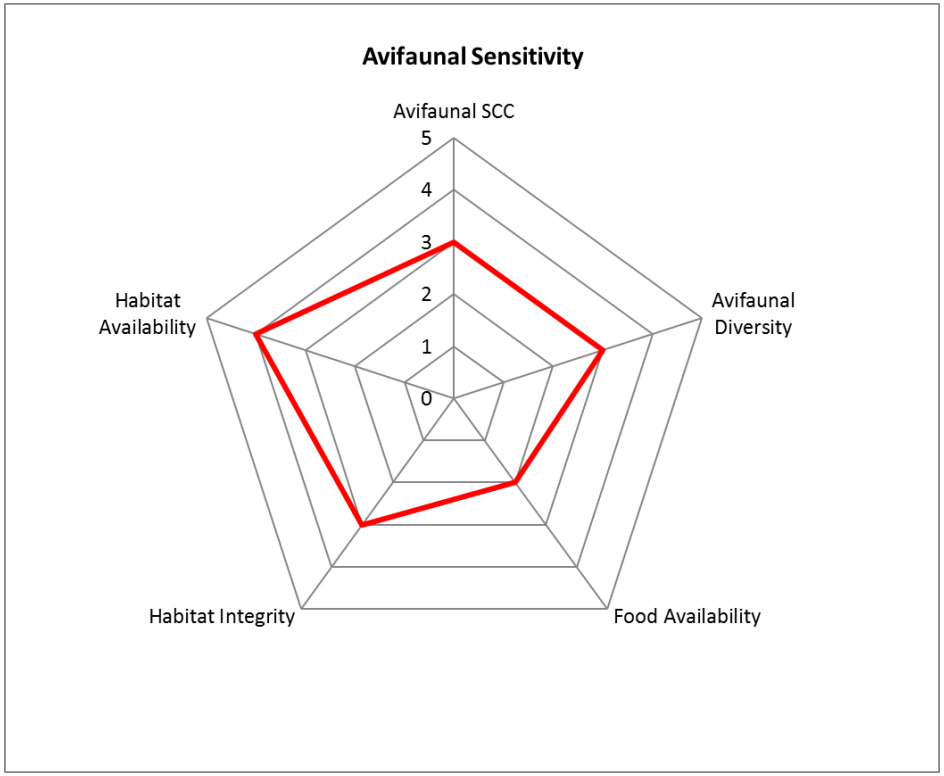
Faunal SCC/Endemics/TOPS/	Two species listed as Protected in the National Environmental Management: Biodiversity Act (Act 10 of 2004) were observed within the focus area, namely *Orycteropus afer* (Aardvark) and *Otocyon megalotis* (Bat-eared fox). Furthermore, these species are listed as Specially Protected Species, Schedule 1 of the Northern Cape Nature Conservation Act (Act No 9 of 2009) (NCNCA). Taking into consideration the available habitat and species distributions, it is further considered likely that *Felis nigripes* (Black-footed cat) may also occur within the focus area.	**General comments (dominant faunal species/noteworthy records etc.):** The initial site assessment was undertaken during the dry season within a drought period, with a second follow up site assessment undertaken during July following the winter rains, however, the rains received were noted to be below average and as such the dry period is still considered to be persisting. During both of these site assessments a number of mammals were observed within the Focus Area, although evidently the abundances of such have been affected.	**Business Case, Conclusion and Mitigation Requirements:** Taking into consideration the continued unseasonable dry conditions, the overall mammal sensitivity is considered to be moderately high. Species observations indicate that a number of mammal species inhabit and utilise the focus area, even though there has been habitat degradation from grazing activities. Mining will result in the loss of habitat and resources, and as such force mammal species into surrounding areas. This will have a knock-on effect, as these displaced species will start to compete for habitat and resources with mammals already in the surrounding habitats. This may lead to the overutilisation of resources and the likely decrease of habitat integrity. Mitigation measures should take cognisance of this, and as far as possible concurrent rehabilitation should be undertaken with mining activities. This will help alleviate the loss of habitat and food resources to a degree.
Faunal Diversity	The continued dry conditions being experienced has notably had a negative effect on mammal diversity, however, species more tolerant of these conditions were still observed, albeit in lower abundances. Species observed either directly or via spoor include *Orycteropus afer* (Aardvark), *Hystrix africaeaustralis* (Porcupine), *Cynictis penicillata* (Yellow Mongoose), *Raphicerus campestris* (Steenbok) and *Antidorcas marsupialis* (Springbok) amongst others.		
Food Availability	The ongoing dry conditions has resulted in a notable decrease of food resources. Herbivorous food material has been significantly decreased, with the grass layer currently largely denuded. Browseable material was noted to be higher and provided an increased level of nourishment for species. As with all arid regions, species are forced to forage over larger distances out of the focus area and/or turn to alternative food resources such as underground roots and tubers where available.		
Habitat Integrity	Long term sheep farming within the focus area has had a notable impact on the overall habitat integrity, as the sheep compete directly with many of the mammal species for food resources. The veld within the focus area has been subjected to high grazing levels over the years, which has decreased the habitat integrity, however the large size of the focus area and limited anthropogenic developments ensure that habitat connectivity is maintained and mammal species are capable of moving about largely unrestricted.		
Habitat Availability	The extensive size and limited development within the focus area ensures that current habitat availability for mammal species is moderately high. Although the persistent dry conditions have decreased resources this must be seen as a seasonal fluctuation and not taken as a standard for the area. As such, the focus area still provides adequate habitat for species.		

3.3 Avifauna

Table 2: Field assessment results pertaining to avifaunal species within the focus area

Faunal Class: Avifauna	Faunal Habitat Sensitivity	Intermediate
	Notes on photograph, top left and right: *Galerida magnirostris (*Large-billed Lark) and *Falco rupicoloides* (Greater Kestrel); **Bottom**: *Aquila verreauxii (*Verreauxs' Eagle)	

Faunal Sensitivity Graph:



Photograph:

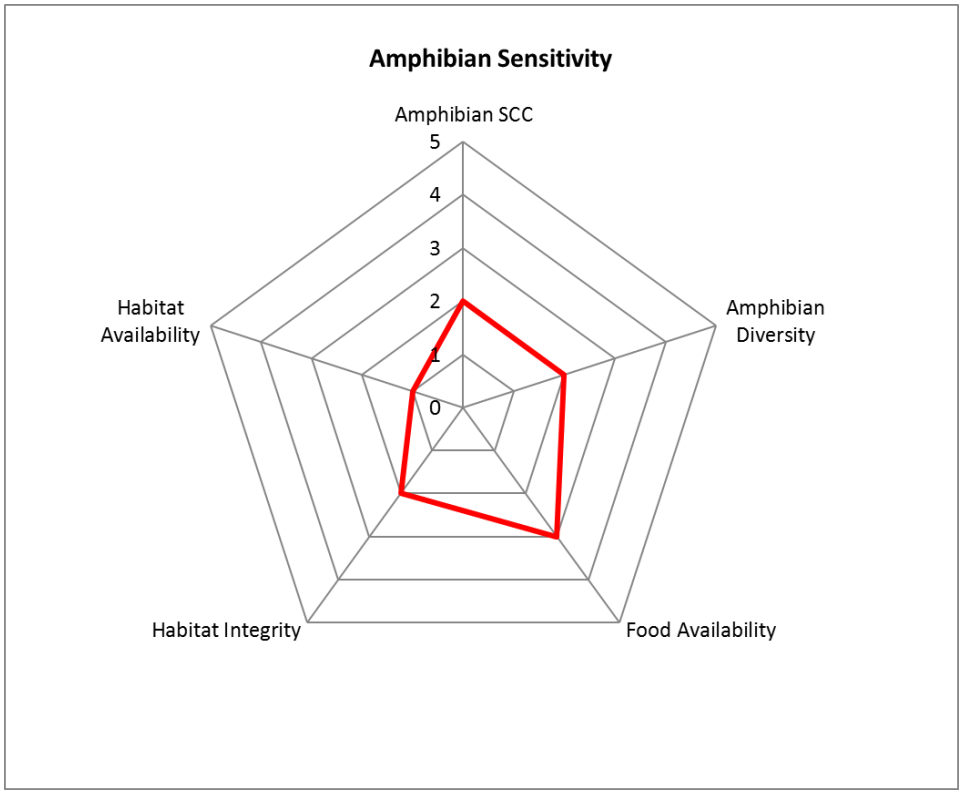
Faunal SCC/Endemics/TOPS/	During the site assessment, *Ardeotis kori* (Kori bustard) was observed to the north of the focus area, however it is considered likely that this species will also utilise the focus area for foraging. Although no other avifaunal SCC were observed during the site visit, it is considered likely that raptors may utilise the focus area during foraging forays	**General comments (dominant faunal species/noteworthy records etc.):** The initial site assessment was undertaken during the dry season within a drought period, with a second follow up site assessment undertaken during July following the winter rains, however, the rains received were noted to be below average and as such the dry period is still considered to be persisting. During both of these site assessments an intermediate diversity of avifaunal species were observed.	**Business Case, Conclusion and Mitigation Requirements:** The avifaunal habitat sensitivity for the focus area is considered to be intermediate, mainly as a result of the decreased food resources available to species in arid regions. The onset of the winter rains has allowed for an increase in vegetation growth and as such an increase in food resources, however these were still not considered sufficient to support a higher diversity and abundance of avifaunal species. The high level of grazing within the focus area has resulted in a significant food resource impact even following the receiving of rainfall. Mining activities will result in the clearance of vegetation and as result in further habitat and food resource loss. In this respect, it is important that concurrent rehabilitation be carried out as far as possible in order to limit the impacts stemming from mining activities.
Faunal Diversity	Limited avifaunal species were observed, and the overall abundance was noted to be low. The dry period had impacted the impacted food resources, although it has marginally improved with the rains, however at the time of assessment it was apparent that the avifaunal diversity has yet to fully recover.		
Food Availability	The loss of the herbaceous layer has impacted both granivorous avifauna as well as insectivorous species, as the insects also rely on the herbaceous material for food. The low food availability has resulted in many avifaunal species moving away from the focus area.		
Habitat Integrity	Overgrazing and continued dry conditions have impacted upon the habitat integrity of the focus area, although the habitat appears to be recovering since receiving small amounts of rain.		
Habitat Availability	Although habitat is available throughout the focus area, the current food resources are considered to be compromised and as such are insufficient to support a for a large avifaunal community.		

3.4 Amphibians

Table 3: Field assessment results pertaining to amphibian species within the focus area

Faunal Class: Amphibians	Faunal Habitat Sensitivity	Moderately low
	Notes on Photograph: Wetland habitat present within the Mining Rights Area (MRA).	

Faunal Sensitivity Graph:



Photograph:

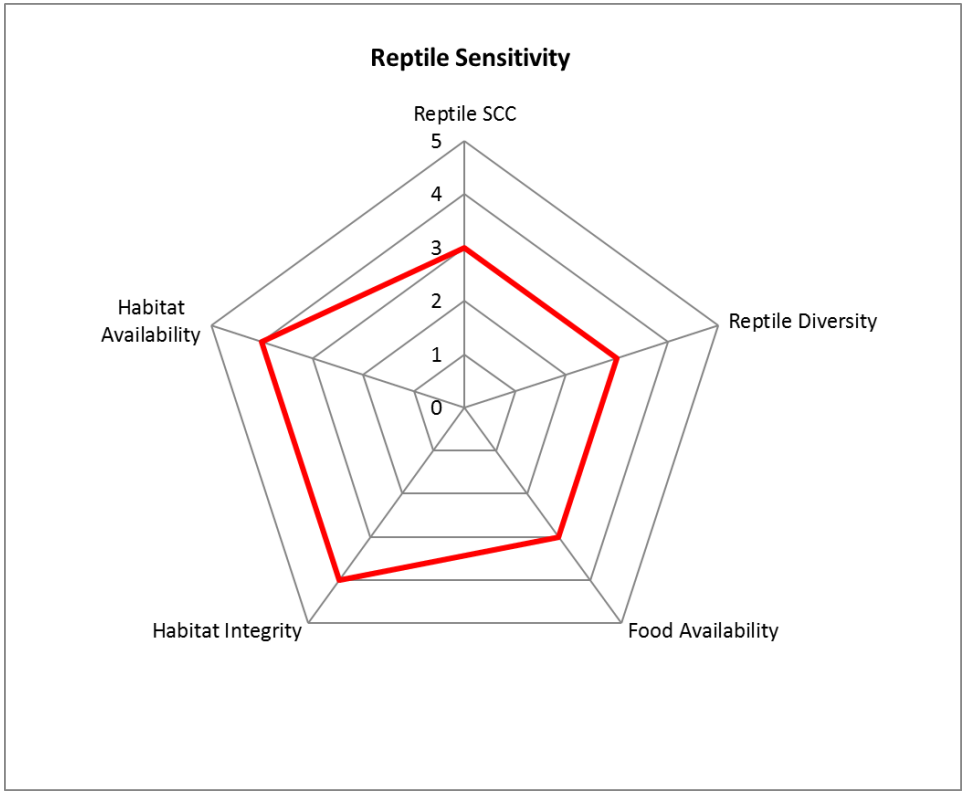
Faunal SCC/Endemics/TOPS/	No amphibian SCC were observed within the focus area, furthermore none are expected to occur either.	**General comments (dominant faunal species/noteworthy records etc.):** Amphibian species are likely to be localised around the river system to the south of the MRA, and unlikely to occur within the focus area due to the arid nature and lack of suitable areas of habitation.	**Business Case, Conclusion and Mitigation Requirements:** The focus area in itself is unlikely to provide habitat or support any amphibian species. As such, mining activities within the focus area are unlikely to impact upon amphibian species in the region. Sedimentation of the southern wetlands as a result of water runoff from the mining activities may result in habitat degradation of the wetlands, however, as the salinity of these systems is considered too high for amphibians, it is unlikely that such habitat degradation, should it occur, will impact on amphibian species within the region. It is still recommended that concurrent rehabilitation takes place, and that suitable mitigation measures are in place to minimise surface water runoff and erosional activities.
Faunal Diversity	No amphibians were observed within the focus area. The dry and arid nature precludes the existence of many amphibian species from this region. Although some amphibian species are capable of surviving within arid regions through burrowing and aestivation activities, they are still reliant on areas where seasonal pools or pans may form. No such areas exist within the focus area.		
Food Availability	Small invertebrates form the primary food source of many amphibian species. The focus area provides habitat to a number of insect species, although in low numbers at present (see table 5 below). The limited habitat availability for amphibian species is considered to be a more significant determinant to amphibian presence than food resources at present.		
Habitat Integrity	Within the focus area there were no observable areas that may provide suitable areas of habitation, however, the southern portion of the MRA did contain a number of connected wetlands, drainage systems and rivers which may be suitable.		
Habitat Availability	The focus area contained no pan (seasonal or permanent) or areas that will contain water long enough to enable the breeding of amphibian species. As such the focus area itself is considered to be largely unsuitable for amphibian habitation. Further south however in the MRA there are a number of wetland and river systems. On observation the wetland systems were noted to be highly saline, and therefore it is unlikely that amphibian species will utilise these habitats. The river system to the south is likely to provide suitable habitat for amphibian species.		

3.5 Reptiles

Table 4: Field assessment results pertaining to reptile species within the focus area

Faunal Class: Reptiles	Faunal Habitat Sensitivity	Moderately high
	Notes on Photograph: **Top:** *Psammobates tentorius* (Karoo Tent Tortoise); **Bottom:** *Pedioplanis burchelli* (Burchell's Sand Lizzard)	

Faunal Sensitivity Graph:



Photograph:

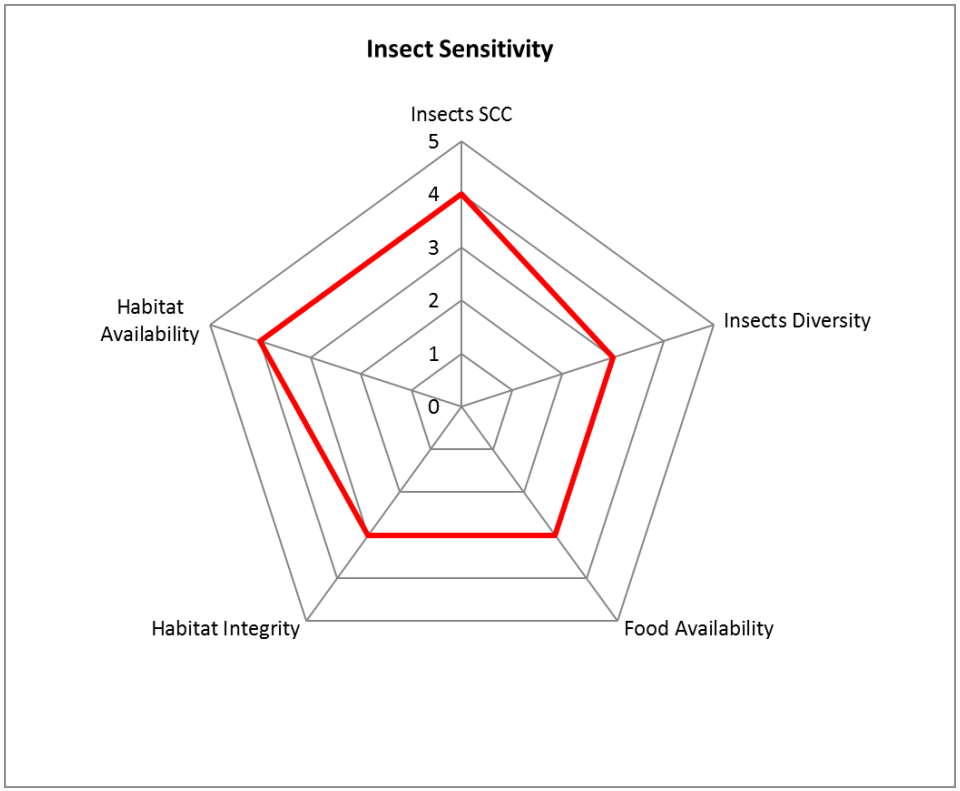
Faunal SCC/Endemics/TOPS/	No reptile SCC were observed within the study are, however it is possible that *Homopus signatus* (Speckled tortoise, VU) may occur within the larger MRA, notably in the southern portion where the rocky outcrops occur.	**General comments (dominant faunal species/noteworthy records etc.):** The initial site assessment was undertaken during the dry season within a drought period, with a second follow up site assessment undertaken during July following the winter rains, however, the rains received were noted to be below average and as such the dry period is still considered to be persisting. During the winter assessment a large number of *Psammobates tentorius* (Karoo Tent Tortoise) shells were found. It is highly likely that these individuals had all succumb to the extended dry conditions and resultant lack of adequate food resources.	**Business Case, Conclusion and Mitigation Requirements:** A limited reptile assemblage was present at the time of the assessment, however there remains the possibility that reptile SCC may occur within/utilise the focus area. As such it is important to ensure that mining activities do not lead to unnecessary disturbance. The mining footprint is to remain as small as possible, whilst concurrent rehabilitation and relocation of species where necessary is to take place as mining activities progress.
Faunal Diversity	Reptile diversity is considered to be intermediate, however in these arid and extensive areas it is notably difficult to locate species. A number of small sand lizards and plated lizards such as *Gerrhosaurus typicus* (Namaqua plated lizard) were observed scurrying from bush to bush. Excavated burrows near the bases of bushes are likely those of *Agama aculeata* (Ground Agama). Furthermore, it is likely that species such as *Pachydactylus mariquensis* (Marico Gecko) and *Bitis caudalis* (Horned Adder) amongst others, may occur within the area.		
Food Availability	Reptiles are predatory species feeding on, amongst other things, invertebrates and small mammals. The notable low abundance of these prey items at the time of the assessment has resulted in low food availability for reptile species.		
Habitat Integrity	Although the focus area has been intensively grazed over the years, this has not served to decrease the overall habitat integrity for reptile species.		
Habitat Availability	Overall the habitat for reptile species has not been significantly impacted upon, and the focus area is largely suited to reptile species, as they are largely mobile and capable of surviving within arid regions.		

3.6 Insects

Table 5: Field assessment results pertaining to insect species within the focus area

Faunal Class: Insects	Faunal Habitat Sensitivity	Intermediate
	Notes on Photograph: **Top:** *Brinckiella arboricola* (Tree Winter Katydid) and *Brinckiella* sp (Spring katydids); **Middle:** (Left) Desiccated remains of *Psammodes striatus* (Striped Toktokkie), (Right) *Sphingonotus scabriculus* (Blue Wing); **Bottom:** (Left) *Zophosis testudinaria* (Frantic Tortoise Beetle), (Right) *Apis mellifera* (Honey Bee).	

Faunal Sensitivity Graph:



Photograph:

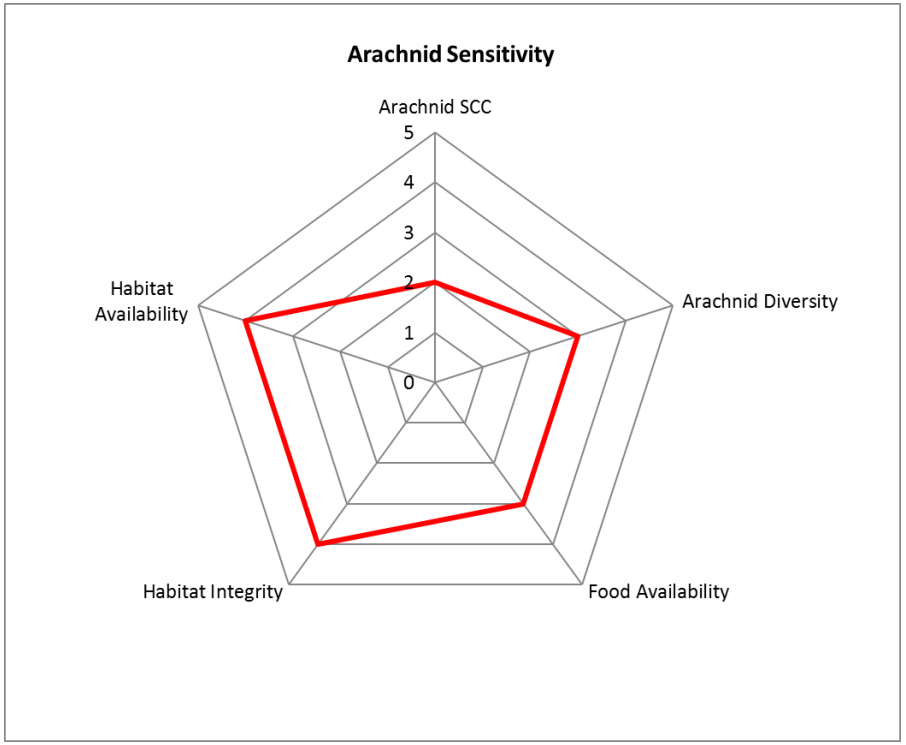
Faunal SCC/Endemics/TOPS/	One insect SCC was observed within the focus area during the winter assessment, namely *Brinckiella arboricola* (Tree Winter Katydid, EN). Furthermore, from analysis of distribution maps and habitat suitability, there is an increased probability that *Brinckiella mauerbergerorum* (Mauerberger's Winter Katydid, VU),) and *Brinckiella aptera* (Mute Winter Katydid, VU) may also occur within the focus area.	**General comments (dominant faunal species/noteworthy records etc.):** Periods of higher rainfall which stimulate the growth of the herbaceous layer and controlled grazing activities will likely result in a significant increase in insect diversity of the focus area. Many insects are generally capable of surviving independently of water bodies (resources), satisfying their water requirements through the vegetation the consume. The ongoing dry conditions resulting in severe moisture stress of the soils and vegetation has a significant impact on the overall insect diversity and abundance of the focus area.	**Business Case, Conclusion and Mitigation Requirements:** The focus area is considered to be of intermediate habitat sensitivity for insects. A limited insect assemblage was observed during the initial assessment, however, the second site visit, following the winter rainfall yielded a far higher diversity as more food resources were available within the focus area. Mining activities will result in the loss of habitat, impacting on insect abundance within not just the focus area but also the MRA. Insects provide a staple diet for many reptile, small mammal, amphibian and avifaunal species. A decreased abundance therefore of insect species will have a significant knock on effect for all species within the ecosystem. In order to attempt to alleviate this effect as far as possible, it is recommended that the mining footprint is kept as small as possible, whilst concurrent rehabilitation activities are implemented in order to ensure that the habitat availability of the focus area is not significantly compromised over the period of mining activities. With regards to *Brinckiella arboricola*, this species lays its eggs within the ground or plant stems, with only one egg laying event per year, with adults usually only living for a year. As such, during vegetation clearance activities it is highly recommended that prior to clearing activities a search be conducted in order to locate and move adults out of the area to be cleared. Furthermore, cleared vegetation must be stored for a period of a year in order to allow for any eggs to hatch.
Faunal Diversity	Overall, the insect diversity of the focus area is considered to be intermediate. The lower than expected insect diversity observed during the site assessment can be attributed to the continuing dry conditions, as below average rainfall was received. These extenuating factors have likely led to lower reproductive and hatching rates for insects. During periods of higher rainfall it is likely that the overall insect diversity and abundance will increase.		
Food Availability	Due to the ongoing grazing activities of sheep, the overall food availability of the focus area was limited. The herbaceous layer as observed during the site assessment has been significantly impacted upon, however the small amount of rainfall has stimulated the growth of many small forbs and flowering species which provides an additional source of food to insects.		
Habitat Integrity	Although the focus area is largely intact in terms of habitat connectivity with limited anthropogenic activities, the net result of long term grazing activities is undeniable.		
Habitat Availability	The focus area is considered to have a moderately high habitat availability score, largely due to limited habitat loss and anthropogenic activities, however, long term grazing activities and isolated erosional effects have contributed to a lower habitat availability. These activities, if left unchecked will continue to decrease habitat availability of the focus area.		

3.7 Arachnids

Table 6: Field assessment results pertaining to arachnid species within the focus area

Faunal Class: Arachnids	Faunal Habitat Sensitivity	Intermediate
	Notes on Photograph: **Top:** *Parabuthus capensis* caught within a pitfall trap; **Below:** Burrow of a baboon spider, possibly *Harpactira namaquensis* (Namaqua Baboon Spider)	

Faunal Sensitivity Graph:



Photograph:

Faunal SCC/Endemics/TOPS/	No arachnid SCC were observed within the focus area, nor are any expected to occur there.	**General comments (dominant faunal species/noteworthy records etc.):** Arachnids can be notoriously hard to observe in the field due to their cryptic nature. It is likely that the focus area will be inhabited by common arachnid species.	**Business Case, Conclusion and Mitigation Requirements:** The focus area is considered to be of intermediate habitat sensitivity for arachnids. Very few arachnid species were observed during the assessment which can possibly be attributed to a number of causes: the below average rainfall; increased predatory pressures from small mammals and decreased food resources for arachnids. Regardless of these, mining activities will result in the loss of habitat and as such arachnid abundance and diversity of both the focus area and the MRA. It is recommended that vegetation clearing activities take place in a phased manner, that the mining footprint is kept as small as possible and concurrent rehabilitation activities are implemented.
Faunal Diversity	During the site assessment *Parabuthus capensis* was caught within one of the pitfall traps. Furthermore, a burrow possibly of *Harpactira namaquensis* (Namaqua Baboon Spider) was observed. Additional arachnid species likely to occur within the focus area include, *Opistophthalmus pallipes*, *Uroplectes carinatus* and *Parapalystes* species (Huntsman Spiders) amongst others. Furthermore, arachnid species diversity and abundance is likely to be further affected during dry periods as small mammalian species have limited food options and therefore may targeted arachnid species more aggressively		
Food Availability	Invertebrates and small reptiles are the predominant food sources for arachnid species. The seasonal shift and increased rainfall has allowed for an increase of food resources necessary for the continued survival of arachnid within the focus area.		
Habitat Integrity	Although the focus area is largely intact in terms of habitat connectivity with limited anthropogenic activities, the net result of long term grazing activities is noted.		
Habitat Availability	The focus area, due to its size and limited transformation in terms of anthropogenic developments remains largely intact, providing ample habitat opportunities for arachnid species. Although the focus area is largely suitable in terms of habitat availability, the general and seasonal abundance of food resources is a significant determining factor with regards actual arachnid habitation and habitat utilisation.		

3.8 Faunal Species of Conservational Concern Assessment

During the field assessment, it is not always feasible to identify or observe all species within the focus area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the focus area. Species listed in Appendix B with known distribution ranges and habitat preferences include the focus area were taken into consideration. The species listed below are considered to have an increased probability of occurring within the focus area.

Table 7: Faunal SCC Probability of Occurrence Score (POC) for the focus area.

Scientific name	Common Name	POC %
Felis nigripes	Black-footed cat	80%
*Orycteropus afer**	Aardvark	100%
*Otocyon megalotis**	Bat-eared fox	100%
*Ardeotis kori**	Kori bustard	100%
Homopus signatus	Speckled tortoise	60%
Brinckiella mauerbergerorum	Mauerberger's Winter Katydid	60%
*Brinckiella arboricola**	Tree Winter Katydid	100%
Brinckiella aptera	Mute Winter Katydid	60%

***Species observed during field assessment**

From the above list of species, it is evident that the focus area has the potential to provide habitat to a number of faunal SCC. The continued dry conditions has largely limited the abundance and diversity of faunal species, impacted upon food resources and degraded the available habitat. As such, although four SCC were observed within the focus area, it is likely that a number of faunal SCC have temporarily migrated to more suitable habitat areas, notably along watercourses in the south of the larger MRA outside of the focus area, where suitable food and water resources can be found.

4 SENSITIVITY MAPPING

The figures below conceptually illustrate the areas considered to be of increased faunal ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for faunal SCC, habitat integrity, levels of disturbance and overall levels of diversity. The table below presents the sensitivity of each area along with an associated conservation objective and implications for development.

Table 8: A summary of the sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Intact Vygieveld	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	Mining activities/ disturbance within this habitat will result in the loss of faunal habitat, resulting in a decreased abundance and diversity of species.
Overgrazed Vygieveld	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.	The faunal habitat within this area has been degraded as a result of overgrazing activities. Whilst development within this habitat will result in faunal habitat loss, it is not considered to be as significant as that of the Intact Vygieveld.
Ephemeral Drainage Lines	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.	This habitat unit does not lend itself to providing habitat to faunal species, due to the lack of any significant vegetation cover. However, this habitat unit is likely to be utilised for movement whilst also provide an important role in the transportation of stormwater.
Transformed Areas	Low	Optimise development potential.	Activities in this habitat unit are unlikely to impact on faunal species within the focus area.

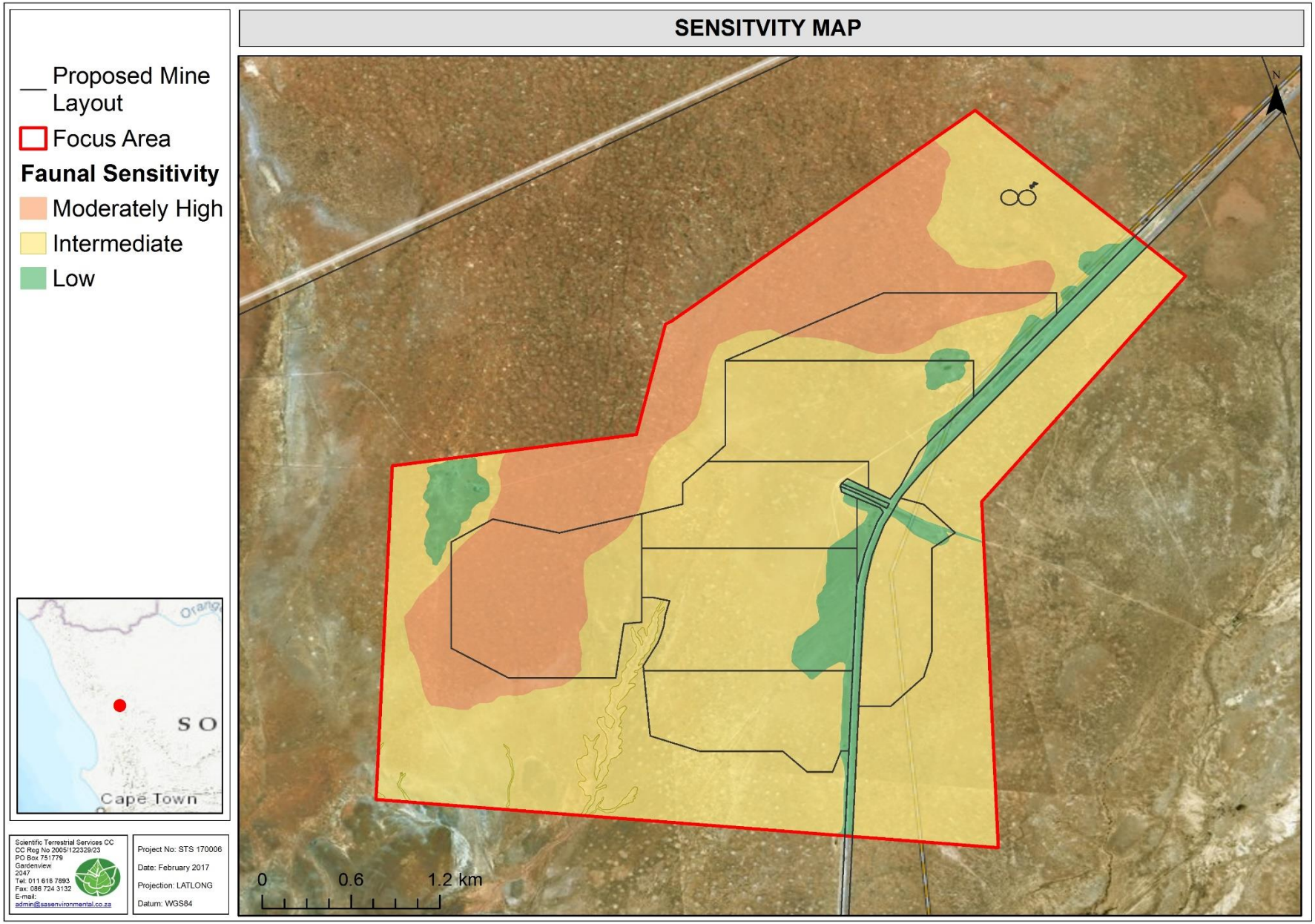


Figure 2: Sensitivity map for the focus area.

5 FAUNAL IMPACT ASSESSMENT

The proposed mining infrastructure areas and open cast mining activities will occur primarily within the Overgrazed Vygieveld, however there are areas of the Intact Vygieveld that will also be affected by the afore mentioned open cast activities. Many of the more mobile faunal species are likely to self-relocate at the first sign of disturbance related activities and vegetation clearing, however the smaller faunal species or those which are slow, young, subterranean / fossorial and/or philopatric should be relocated outside of the disturbance footprint by a suitably qualified ecologist or mine representative. As part of the rehabilitation actions, disturbed areas must be rehabilitated appropriately in accordance to the pre-mining habitat units and vegetation community in which each disturbance occurs.

Impact on Faunal Diversity and Habitat

The proposed infrastructure areas are located within the Overgrazed Vygieveld, whilst the open cats mining activities are located within both the Overgrazed and Intact Vygieveld habitat units. The initial site assessment was undertaken during the drier summer months and as such the habitat availability and faunal diversity was not observed to be very high. This was further compounded as a result of the ongoing dry conditions as a result of the below average rainfall. Although the second assessment was undertaken during the winter (wet) period, once again below average rainfall had been received. However, the veld condition had notably improved from that of the summer assessment, and as such allowed for the sampling of species previously not identified during that of the summer assessment. The construction of the proposed infrastructure areas is not expected to have a significant impact on faunal habitat or species diversity, due to the limited footprint of the area as well as its location within the already degraded Overgrazed Vygieveld habitat unit. Loss of habitat in this area will have a minimal impact on the overall faunal species diversity within the focus area, nonetheless it is imperative that all mitigation measures are implemented to ensure that no further areas outside if the infrastructure footprint are disturbed. The open cast mining activities will have a significantly higher impact on the Intact and Overgrazed Vygieveld habitats, as well as the Ephemeral Drainage lines. The open cast mining activities will result in significant areas of vegetation being cleared, resulting in large areas of habitat loss and a decreased faunal diversity. It is imperative that areas only be cleared where active mining will occur, and that no further areas are cleared unnecessarily, in order to minimise the impact on faunal species through habitat loss. Furthermore, concurrent rehabilitation and habitat reinstatement is crucial in order to ensure that displaced species are able to recolonise areas post mining activities. All edge effects, erosion and stormwater runoff are to be managed notably in the vicinity of the

ephemeral drainage lines in order to ensure that downstream impacts to the freshwater systems does not occur.

Impact on Faunal SCC

Several faunal SCC are associated with the proposed areas of mining activities. As such, construction/operational activities and vegetation clearance may result in the loss of faunal SCC from the footprint areas as well as reduced numbers in the surrounding habitats which are impacted by edge effects. Species likely to be directly impacted upon as a result of the mining activities include:

- *Felis nigripes* (Black-footed cat);
- *Ardeotis kori* (Kori bustard, observed);
- *Homopus signatus* (Speckled tortoise);
- *Orycteropus afer* (Aardvark);
- *Otocyon megalotis* (Bat-eared fox);
- *Brinckiella mauerbergerorum* (Mauerberger's Winter Katydid);
- *Brinckiella arboricola* (Tree Winter Katydid, observed); and
- *Brinckiella aptera* (Mute Winter Katydid).

The above listed species are specifically at risk from vegetation clearance and the loss of habitat as they all utilise the habitat within the Overgrazed and Intact Vygieveld for movement, food resources and areas of refuge. Furthermore, a number of these species are small and slow moving and as such may not always be able to self-relocate once clearing activities commence, as their natural instincts will be to seek refuge in dense vegetation and under scrub bushes, increasing the risk of mortality from clearance activities.

The following table indicates the perceived risks to faunal species associated with the activities pertaining to the mining activities, access roads and infrastructure area.

Table 9: Aspects and Activities register considering faunal resources

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive or unnecessary clearing of vegetation outside of the demarcated infrastructure areas, mining footprint and access roads	Clearing of vegetation leading to loss of habitat, faunal species and faunal SCC	Potential ineffective rehabilitation post construction leading to proliferation of alien plant species in the disturbed areas	Potential ineffective rehabilitation will lead to the proliferation of alien and invasive plant species and further habitat and species loss
	Excavation of soils leading to increased runoff and sedimentation of downslope habitat	Potential erosion stemming from bare soil areas leading to sedimentation of surrounding faunal habitat	Bare soil areas, if not rehabilitated will lead to increased runoff, erosion and the sedimentation of downslope habitats
	Dust generated by clearance activities may impact upon faunal habitat and species	Potential noise and vibration disturbances experienced as a result of the drilling activities affecting faunal species and SCC	Potential continued loss of habitat will result in a further loss of faunal species and SCC
	Runoff/disposal of concrete and construction materials from the infrastructure areas into the surrounding habitat leading to surface hardening, decreased vegetation growth and loss of faunal habitat	Potential hunting/trapping/killing of faunal species by personnel	Permanently altered habitat may result in the alteration of faunal species assemblages, abundance and diversity of which a number are endemic to the region
	Potential hunting/trapping/killing of faunal species by construction personnel	Footprint creep resulting in additional faunal habitat loss	Potential hunting/trapping/killing of faunal species by personnel
	Collision of faunal species with construction vehicles		

5.1 Assessment Summary

The tables below serve to summarise the findings of the impact study undertaken with reference to the perceived impacts stemming from the proposed mining activities of the Kanakies mine as found in Appendix E. The tables below indicate the significance of the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post mitigation impact scores will increase. Due to the already highly degraded nature of the Transformed areas, this habitat was not included in the below impact assessment. All impacts associated with the Transformed habitat can be considered to be of very low significance throughout all phases of the proposed mining. Nonetheless, although the Transformed habitat is considered to already be in a degraded state, it is imperative that all mitigation measures still be applied in order to minimise edge effects and impacts to the surrounding habitats.

Mine Infrastructure Areas

The following tables represent the findings of the impact assessment pertaining to the proposed infrastructure areas.

Table 10: A summary of the impact significance on faunal resources in the construction phase

Site	Impact	Unmanaged	Mitigated
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

Table 11: A summary of the impact significance on faunal resources in the operational phase

Site	Impact	Unmanaged	Mitigated
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

Table 12: A summary of the impact significance on faunal resources in the decommissioning/ rehabilitation phase

Site	Impact	Unmanaged	Mitigated
Overgrazed Vygieveld	Impact on faunal habitat and species diversity	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

Open Cast Mining Areas

The following tables represent the findings of the impact assessment pertaining to the proposed open cast mining

Table 13: A summary of the impact significance on faunal resources in the construction phase

Site	Impact	Unmanaged	Mitigated
Intact Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Medium Low
	Impact on faunal SCC	Medium High	Medium Low
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Medium Low
	Impact on faunal SCC	Medium High	Medium Low
Ephemeral Drainage Lines	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

Table 14: A summary of the impact significance on faunal resources in the operational phase

Site	Impact	Unmanaged	Mitigated
Intact Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Medium Low
	Impact on faunal SCC	Medium High	Medium Low
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium High	Low
	Impact on faunal SCC	Medium High	Medium Low
Ephemeral Drainage Lines	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

Table 15: A summary of the impact significance on faunal resources in the decommissioning/ rehabilitation phase

Site	Impact	Unmanaged	Mitigated
Intact Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium High	Low
Overgrazed Vygieveld	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium High	Low
Ephemeral Drainage Lines	*Impact on faunal habitat and species diversity*	Medium Low	Low
	Impact on faunal SCC	Medium Low	Low

5.2 Integrated Impact Mitigation

The table below highlights the key integrated mitigation measures that are applicable to the infrastructure layout and open cast mining areas as well as the access roads in order to suitably manage and mitigate the ecological impacts that are associated with the construction and operation phases of the proposed activities. Provided that all the management and mitigation measures as stipulated in this report are implemented the overall risk to faunal diversity, habitat and faunal SCC can be adequately mitigated and minimised.

Table 16: A summary of the mitigatory requirements for faunal resources

Project phase	*Construction Phase*
Impact Summary	*Loss of faunal habitat, species and faunal SCC*
Management Measures	***Proposed mitigation and management measures:*** - Vegetation outside of the footprints is not to be cleared; - It is recommended that site clearing take place in a phased manner to allow for any faunal species present to move away from the focus area naturally; - As far as possible the infrastructure areas and open cast areas should be accessed through the existing road network; - Vegetation clearance and commencement of construction activities should either be scheduled to coincide with low rainfall (summer months) when erosive stormwater is anticipated to be limited. Alternatively, stormwater controls must be established at the start of construction and dust suppression implemented; - Excavated topsoil must be stored with associated native vegetation debris for subsequent use in rehabilitation; - Revegetation of disturbed areas should be carried out in order to restore habitat availability and minimise soil erosion and surface water runoff whilst re-instating faunal habitat; - When rehabilitating an open cast footprint site, it is imperative that as far as possible the habitat that was present prior to disturbances is recreated, so that faunal species that were displaced by vegetation clearing and mining activities are able to recolonize the rehabilitated area; - A suitable rescue and relocation plan should be developed and overseen by a suitably qualified specialist or nominated mine personnel in order to ensure that species loss during construction activities is kept to a minimum; - Spills and /or leaks from mine equipment must be immediately remedied and cleaned up so as to ensure that these chemicals/hydrocarbons do not contaminate the soils; - Smaller species such as scorpions, reptiles and insects are likely to be less mobile and at higher risk from vegetation clearing. As such, should any be observed in the construction site during clearing and construction activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Construction personnel are to be educated about these

	species and the need for their conservation. Smaller scorpion species and harmless reptiles should be carefully relocated by a suitably nominated construction person or nominated mine official. For larger venomous snakes, a suitably trained mine official should be contacted to effect the relocation of the species, should it not move off on its own;
	- Lighting pollution and its effect on fauna (with special mention of invertebrates, bats and avifauna) must be effectively mitigated with the following guidelines in mind with due cognizance of health and safety requirements:
	  - Downward facing lights must be installed and limited to absolutely essential areas; and
	  - Covers/light diffusers must be installed to lessen the intensity of illumination if at all possible.
	- No hunting/trapping or collecting of faunal species is allowed;
	- No informal fires by construction personnel are allowed; and
	- Initiate an alien and invasive plant control plant.

Project phase	*Operational and Closure Phase*
Impact Summary	*Loss of faunal habitat, species and faunal SCC*

Management Measures	**Proposed mitigation and management measures:**
	- When accessing the mining areas vehicles are to utilise the existing roads;
	- Continually monitor the operational areas and ensure that further disturbance of the surrounding habitat is not occurring;
	- Ensure adequate dust suppression is taking place;
	- Ensure that no unnecessary clearing of faunal habitat occurs;
	- No hunting/trapping or collecting of faunal species is allowed;
	- No informal fires by construction personnel are allowed;
	- Lighting pollution and its effect on fauna (with special mention of invertebrates, bats and avifauna) must be effectively mitigated with the following guidelines in mind with due cognizance of health and safety requirements:
	  - Downward facing lights must be installed and limited to absolutely essential areas; and
	  - Covers/light diffusers must be installed to lessen the intensity of illumination if at all possible.
	- Following heavy rains, access roads and areas of disturbance are to be inspected for signs of erosion, which if found must be immediately rectified through appropriate erosion control measures;
	- Monitor the success of rehabilitation efforts of open cast mining areas and access roads seasonally; and
	- Continue with and update the alien and invasive plant control plan accordingly.

5.3 Probable Latent Impacts

Even with extensive mitigation, significant latent impacts on the receiving faunal ecological environment are deemed highly likely. The following points highlight the key latent impacts that have been identified:

- Continued loss of faunal habitat diversity;
- Continued loss of and altered faunal species diversity;
- Continued loss of faunal SCC and suitable habitat; and
- Disturbed areas are highly unlikely to be rehabilitated to baseline levels of ecological functioning and significant loss of faunal habitat, species diversity and faunal SCC will most likely be permanent.

The abovementioned latent impacts are likely to occur due to ineffective rehabilitation and uncontrolled edge effects, leading to areas surrounding the mining being further disturbed. Such latent impacts will have a significant impact on the biodiversity of the region if not managed and mitigated appropriately.

5.4 Cumulative Impacts

The proposed infrastructure areas and open cast pits will result in further clearance of indigenous vegetation within the demarcated focus area. This will lead to the further displacement of faunal species currently inhabiting these areas, pushing them out into the surrounding vegetated areas. This is likely to result in an increased abundance of species within the surrounding habitats, leading to increased competition for territories, breeding sites and food resources, which are already limited. As such, there is likely to be a knock-on dispersal affect, leading to increased resource competition and possible increased mortality rates, resulting in a decreased species abundance and further loss of species diversity. These cumulative impacts may lead to a decreased biodiversity within the MRA, and possibly place additional stresses on resources and species in the larger regional area.

6 PUBLIC PARTICIPATION

The Scoping Phase Public Meeting was held on the 9th of February 2018, and the Scoping Report was made available for public review between the 27th of March – 29th of April 2018, whereby Interested and Affected Parties (I&APs) were allowed to comment on the proposed project. A second Public Meeting is scheduled for the 29th of August 2018 to summarise the findings from the specialist studies for I&APs, which will be held concurrently with the public review of the EIA EMP report. Any comments received during the second round of public review will be addressed accordingly.

6.1 Brief Summary of Concerns and Issues Raised By I&APs

The following table summarises the issues raised by I&AP's during the Scoping phase public consultation on the relevant specialist report.

Comment received by I&AP's during Scoping Phase	Response
Proximity of the Kalk Gat Reserve to the proposed operations. This is a protected area. Appropriate buffer zones must be recommended and established	With reference to the comments concerning the Kalk Gat Private Reserve, although the western portion of the MRA does border the reserve, the actual focus area is located approximately 6km north-east of this reserve, and as such mining activities, provided mitigation measure are suitable implemented, are unlikely to impact upon the reserve, provided that all mitigation measures are timeously and suitably implemented According to the NEMA Regulations 2017, "buffer" means an area extending 5km from the proclaimed boundary of nature reserve or that defined as such for a biosphere.
Certain areas have been mapped as areas of biodiversity importance appropriate ecological buffers should be recommended by the specialists and implemented	Refer to Section 4.2.2 for requirements on the buffer zones.
Waste generation and management	Refer to Section 5.5.3. for mitigation on contamination management.

7 CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a terrestrial ecological assessment as part of the environmental assessment and authorisation process for the proposed mining of natural gypsum on the remaining extent of the farm Kanakies 332, the larger MRA was refined down to the proposed active mining area, referred to as the “Focus Area” The findings of the field assessment indicate that the focus is characterised by four habitat units, namely Intact Vygieveld, Overgrazed Vygieveld, Ephemeral Drainage Lines and Transformed Areas. The intact Vygieveld is characterised by lower levels of grazing activities as well as an increased faunal species diversity, notably that of invertebrate and avifaunal species. The overgrazed Vygieveld was observed to have increased levels of grazing activities and as such a decreased diversity of faunal species. The Transformed areas include all areas that have been modified/transformed as a result of human and anthropogenic activities and provide minimal habitat to faunal species.

As such, the data in this report should be considered as the baseline to which further data and studies can be added, with the knowledge that faunal species abundance and diversity may increase further following continued rains and floral habitat recovery. It is the opinion of the ecologists that this study provides relevant information required in order to implement the principles of Integrated Environmental Management so as to ensure that the best long-term use of the ecological resources in the focus area will be made in support of the principle of sustainable development. It is recommended that, from a faunal ecological perspective, the proposed development be considered favourably provided that the recommended mitigation measures for the identified impacts (as outlined in Sections 3 and 5) are adhered to, and construction within the sensitive habitats is avoided, and where this is not possible, kept to an absolute minimum.

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APPENDIX A: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the focus area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations. In order to increase overall observation time within the focus area, as well as increasing the likelihood of observing shy and hesitant species, camera traps were strategically placed within the focus area. Sherman traps were also used to increase the likelihood of capturing and observing small mammal species, notably small nocturnal mammals.

Mammals

Small mammals are unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door (Figure B1). Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. In the event of capturing a small mammal during the night, the animal would be photographed and then set free unharmed early the following morning. Traps were baited with a universal mixture of oats, peanut butter, and fish paste.

Figure A1: Sherman trap and bait used to capture and identify small mammal species.

Motion sensitive infrared camera traps were used to capture medium to large mammal species (Figure B). These cameras were placed along trails and near suitable habitat areas and left for the full duration of the field site visit.

Figure A2: Field cameras used to document medium to large mammal species.

Medium to large mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Specific attention was given to mammal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the focus area. Field surveys were undertaken utilising a pair of Bushnell 10x50 binoculars and bird call identification techniques were utilised during the assessment in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles

Reptiles were identified during the field survey. Suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected and all reptiles encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the focus area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians

Identifying amphibian species is done by the use of direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the focus area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates

Whilst conducting transects through the focus area, all insect species visually observed were identified, and where possible photographs taken. Due to the vegetation layer at the time of assessment (No herbaceous layer and low karoid scrub), sweep netting was not conducted. Pitfall traps in combination with drift fences were utilised at selected spots within the focus areas.

It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the focus area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids

Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC scorpions within the focus area. Furthermore, pitfall traps in combination with drift fences were utilised at selected spots within the focus areas.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC was determined using the following four parameters:

- Species distribution;
- Habitat availability;
- Food availability; and
- Habitat disturbance.

The accuracy of the calculation is based on the available knowledge about the species in question. Therefore, it is important that the literature available is also considered during the calculation.
Each factor contributes an equal value to the calculation.

Scoring Guideline				
Habitat availability				
No Habitat	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Food availability				
No food available	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Habitat disturbance				
Very High	**High**	**Moderate**	**Low**	**Very Low**
1	2	3	4	5
Distribution/Range				
Not Recorded		**Historically Recorded**		**Recently Recorded**
1		3		5

[Habitat availability + Food availability + Habitat disturbance + Distribution/Range] / 20 x 100 = POC%

Faunal Habitat Sensitivity

The sensitivity of the focus area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the focus area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the focus area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the suitability and sensitivity of the focus area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the focus area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table A1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX B: Impact Assessment Methodology

Ecological Impact Assessment Method

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[2]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the Table D1. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary[3].

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National

[2] The definition has been aligned with that used in the ISO 14001 Standard.

[3] Some risks/impacts that have low significance will however still require mitigation.

Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table B1: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / Linear developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected <	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected <	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table B2: Significance Rating Matrix.

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	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

Table B3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction; and
  - Operation.
- If applicable, transboundary or global effects were assessed.
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

Mitigation measure development

According to the DEA *et al.,* (2013) "Rich biodiversity underpins the diverse ecosystems that deliver ecosystem services that are of benefit to people, including the provision of basic services and goods such as clean air, water, food, medicine and fibre; as well as more complex services that regulate and mitigate our climate, protect people and other life forms from natural disaster and provide people with a rich heritage of nature-based cultural traditions. Intact ecological infrastructure contributes significant savings through, for example, the regulation of natural hazards such as storm surges and flooding by which is attenuated by wetlands".
According to the DEA *et al.,* (2013) Ecosystem services can be divided into 4 main categories:

- Provisioning services are the harvestable goods or products obtained from ecosystems such as food, timber, fibre, medicine, and fresh water;
- Cultural services are the non-material benefits such as heritage landscapes and seascapes, recreation, ecotourism, spiritual values and aesthetic enjoyment;
- Regulating services are the benefits obtained from an ecosystem's control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards; and
- Supporting services are the natural processes such as nutrient cycling, soil formation and primary production that maintain the other services.

Loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces socio-economic options for future generations. This is of particular concern for the poor in rural areas who have limited assets and are more dependent on common property resources for their livelihoods. The importance of maintaining biodiversity and intact ecosystems for ensuring on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.
Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act), and is fundamental to the notion of sustainable development. In addition, International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa (DEA *et al.,* 2013).
The primary environmental objective of the Mineral and Petroleum Resources Development Act (MPRDA) is to give effect to the environmental right contained in the South African Constitution. Furthermore, Section 37(2) of the MPRDA states that "any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations".
Pressures on biodiversity are numerous and increasing. According to the DEA *et al.,* (2013) Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and much of the world. The most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including[4]:

- Cultivation and grazing activities;
- Rural and urban development;
- Industrial and mining activities, and
- Infrastructure development.

Impacts on biodiversity can largely take place in four ways (DEA *et al.,* 2013):

- **Direct impacts:** are impacts directly related to the project including project aspects such as site clearing, water abstraction and discharge of water from riverine resources;
- **Indirect impacts:** are impacts associated with a project that may occur within the zone of influence in a project such as surrounding terrestrial areas and downstream areas on water courses;
- **Induced impacts:** are impacts directly attributable to the project but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries; and

[4] Limpopo Province Environment Outlook. A Report on the State of the Environment, 2002. Chapter 4.

- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining operations within the same drainage catchment or numerous residential developments within the same habitat for faunal or floral species.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted the definition of a clear mitigation strategy for biodiversity impacts.
'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.
The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated (DEA *et al.,* 2013):

- **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
- **Minimise impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
- **Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation tool as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
  - **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
  - **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources on the focus area supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
  - **Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended post closure land use; and
  - **Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
- **Offset impact:** refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or

irreplaceable biodiversity the residual impacts should be considered to be of *very high significance* and when residual impacts are considered to be of *very high significance*, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.[5]

In light of the above discussion the following points present the key concepts considered in the development of mitigation measures for the proposed development.

- Mitigation and performance improvement measures and actions that address the risks and impacts[6] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation wherever possible.

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[5] Provincial Guideline on Biodiversity Offsets, Western Cape, 2007.

[6] Mitigation measures should address both positive and negative impacts

APPENDIX C: Faunal SCC

Table B1: TOPS list of faunal species expected to occur within the Northern Cape.

Scientific Name	Common Name	Threat Status
Neophron percnopterus	Egyptian Vulture	CR
Opistophthalmus ater	Steinkopf Burrowing Scorpion	CR
Aquila rapax	Tawny Eagle	EN
Aegypius tracheliotos	Lappet-faced Vulture	EN
Gyps africanus	White-backed Vulture	EN
Gyps coprotheres	Cape Vulture	EN
Neotis ludwigii	Ludwig's Bustard	EN
Polemaetus bellicosus	Martial Eagle	EN
Terathopius ecaudatus	Bateleur	EN
Acinonyx jubatus	Cheetah	VU
Manis temminckii	Pangolin	VU
Homopus signatus	Speckled tortoise	VU
Pachydactylus goodi	Good's Gecko	VU
Ceratotherium simum	Southern White Rhinoceros	P
Crocuta	Spotted Hyaena	P
Felis nigripes	Black-footed Cat	P
Hyaena brunnea	Brown Hyaena	P
Anthropoides paradiseus	Blue Crane	P
Ardeotis kori	Kori Bustard	P
Cordylus macropholis	Large-scaled Lizard	P
Cordylus imkeae	Rooiberg Girdled Lizard	P

CR= Critically Endangered, EN=Endangered, P=Protected

Avifaunal Species for the pentads 3055_1855 and 3100_1855 within the QDS 3018DD and 3118BB

http://sabap2.adu.org.za/pentad_info.php?pentad=3055_1855#menu_top
http://sabap2.adu.org.za/pentad_info.php?pentad=3100_1855#menu_top

APPENDIX D: Faunal Species List

Table D1: Mammal species recorded during the field assessment, with SCC indicated in bold.

Scientific Name	Common Name	IUCN Status
Desmodillus auricularis	Cape short-tailed Gerbil	LC
Hystrix africaeaustralis	Cape Porcupine	LC
Cynictis penicillata	Yellow mongoose	LC
Otomys unisulcatus	Bush Vlei Rat	LC
Orycteropus afer	**Aardvark**	**TOPS / NCNCA 2009**
Antidorcas marsupialis	Springbok	LC
Raphicerus campestris	Steenbok	LC
Rhabdomys pumilio	Four-striped Grass mouse	LC
Otocyon megalotis	**Bat-eared fox**	**TOPS / NCNCA 2009**
Lepus saxatilis	Scrub Hare	LC

LC – Least Concern, NYBA – Not Yet Been Assessed

Table D2: Avifaunal species recorded during the survey, with SCC indicated in bold.

Scientific name	English name	IUCN Status
Eupodotis vigorsii	Karoo Bustard	LC
Corvus capensis	Cape Crow	LC
Ardeotis kori	**Kori bustard**	**NT**
Cercomela schlegelii	Karoo Chat	LC
Elanus caeruleus	Black-shouldered Kite	LC
Galerida magnirostris	Large-billed Lark	LC
Falco rupicoloides	Greater Kestrel	LC
Aquila verreauxii	Verreauxs' Eagle	LC
Cercomela familiaris	Familiar Chat	LC
Crithagra albogularis	White-throated Canary	LC
Calendulauda albescens	Karoo Lark	LC
Passer melanurus	Cape Sparrow	LC
Buteo rufofuscus	Jackal Buzzrd	LC
Chersomanes albofassciata	Spike-heeled Lark	LC
Prinia maculosa	Karoo Prinia	LC
Corvus albus	Pied Crow	LC
Cercotrichas coryphoeus	Karoo Scrub-robin	LC
Parisoma subcaeruleum	Chestnut-vented Tit-babbler	LC
Streptopelia capicola	Cape Turtle-dove	LC
Motacilla capensis	Cape Wagtail	LC
Lanius collaris	Common Fiscal	LC
Batis pririt	Pirit Batis	LC

End = Endemic, N-End Near-endemic, br = Breading, CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened, VU = Vulnerable

Table D3: Reptile species recorded during the field assessment.

Scientific name	Common Name	IUCN Status
Psammobates tentorius	Karoo Tent Tortoise	LC
Pedioplanis burchelli	Burchell's Sand Lizzard	LC

LC = Least Concern, NYBA = Not Yet Been Assessed

Table D4: Insect species observed during the field assessment with SCC in bold

Scientific Name	Common Name	IUCN Status
Brinckiella arboricola	**Tree Winter Katydid**	**EN**
Belenois aurota	Brown-veined White	NYBA
Brinckiella sp	Spring Katyids	NYBA
Psammodes striatus (	Striped Toktokkie	NYBA
Sphingonotus scabriculus	Blue Wing	NYBA
Zophosis testudinaria	Frantic Tortoise Beetle	NYBA
Apis mellifera	Honey Bee	NYBA
Acanthoproctus cervinus	Corn Cricket	NYBA
Hetrodes pupus	Corn Cricket	NYBA
Zehntneria mystica	N/A	NYBA
Danaus chrysippus	African Monarch	LC
Alogenius cavifrons	Pitted Darkling Beetle	NYBA
Eurychora sp	Mouldy Beetles	NYBA
Schistocerca gregaria	Desert Locust	NYBA
Family Psychidae	Bagworms	NYBA
Pontia helice	Meadow White	LC
Agdistis sp	Pustule Plume Moth	NYBA
Cyntia cardui	Painted Lady	LC
Sytoechus sp	Woolly Bee Flies	NYBA
Protostrophus sp	Beaded Weevils	NYBA

LC = Least Concern, NYBA = Not yet been assessed by the IUCN

Table D5: Arachnid species recorded during the site assessment

Common Name	Scientific Name	IUCN Status
Parabuthus capensis	Thick-tailed Scorpion	LC
**Harpactira namaquensis*	Namaqua Baboon Spider	LC

LC = Least Concern, NYBA = Not Yet Been Assessed, *unconfirmed

APPENDIX E: Faunal Impact Assessment Tables

E1. Impact assessment pertaining to the proposed infrastructure areas

The following tables highlight the perceived impact pertaining to the relevant habitats affected by the proposed mining infrastructure areas, namely the Overgrazed Vygieveld Habitat.

Table 17: Impact on faunal habitat and species diversity of the Overgrazed Vygieveld

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	2	3	8	8	64 (Medium Low)
Operational phase	5	3	3	2	4	8	9	72 (Medium Low)
Decommissioning and Closure	3	3	3	2	5	6	11	66 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	2	1	2	8	5	40 (Low)
Operational phase	3	3	2	1	4	6	7	42 (Low)
Decommissioning and Closure	2	3	2	1	3	5	6	30 (Low)

Table 18: Impact on faunal SCC in the Overgrazed Vygieveld

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	2	3	8	8	64 (Medium Low)
Operational phase	5	3	3	2	4	8	9	72 (Medium Low)
Decommissioning and Closure	4	3	3	2	5	7	10	70 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	2	1	2	8	5	45 (Low)
Operational phase	4	3	2	1	4	7	7	49 (Low)
Decommissioning and Closure	3	3	2	1	3	6	6	36 (Low)

E1. Impact assessment pertaining to the proposed mining activities

The following tables highlight the perceived impacts pertaining to the relevant habitats affected by the planned open cast mining activities, namely the Overgrazed and Intact Vygieveld Habitats.

Table 19: Impact on faunal habitat and species diversity of the Intact Vygieveld

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	4	3	9	11	99 (Medium High)
Operational phase	5	4	4	3	4	9	11	99 (Medium High)
Decommissioning and Closure	3	4	3	4	5	7	12	84 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	3	3	2	9	8	72 (Medium Low)
Operational phase	3	4	3	3	3	7	9	63 (Medium Low)
Decommissioning and Closure	2	4	2	2	3	6	7	42 (Low)

Table 20: Impact on faunal SCC in the Intact Vygieveld

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	4	3	9	11	99 (Medium High)
Operational phase	5	4	4	3	4	9	11	99 (Medium High)
Decommissioning and Closure	3	4	3	4	5	7	12	84 (Medium High)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	3	3	2	9	8	72 (Medium Low)
Operational phase	3	4	3	3	3	7	9	63 (Medium Low)
Decommissioning and Closure	2	4	2	2	3	6	7	42 (Low)

Table 21: Impact on faunal habitat and species diversity of the Overgrazed Vygieveld

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	4	3	8	10	80 (Medium High)
Operational phase	5	3	3	3	4	8	10	80 (Medium High)
Decommissioning and Closure	3	3	3	4	5	6	12	72 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	2	3	3	8	8	64 (Medium Low)
Operational phase	3	3	2	2	4	6	8	48 (Low)
Decommissioning and Closure	2	3	2	2	3	5	7	35 (Low)

Table 22: Impact on faunal SCC in the Overgrazed Vygieveld

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	4	4	3	8	11	88 (Medium High)
Operational phase	5	3	4	3	4	8	11	88 (Medium High)
Decommissioning and Closure	4	3	3	4	5	7	12	84 (Medium High)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	3	3	8	9	72 (Medium Low)
Operational phase	4	3	3	2	4	7	9	63 (Medium Low)
Decommissioning and Closure	3	3	2	2	3	6	7	42 (Low)

Table 23: Impact on faunal habitat and species diversity of the Ephemeral Drainage Lines

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	2	3	8	8	64 (Medium Low)
Operational phase	5	3	3	2	4	8	9	72 (Medium Low)
Decommissioning and Closure	3	3	3	2	5	6	11	66 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	2	1	2	8	5	40 (Low)
Operational phase	3	3	2	1	4	6	7	42 (Low)
Decommissioning and Closure	2	3	2	1	3	5	6	30 (Low)

Table 24: Impact on faunal SCC in the Ephemeral Drainage Lines

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	2	3	8	8	64 (Medium Low)
Operational phase	5	3	3	2	4	8	9	72 (Medium Low)
Decommissioning and Closure	4	3	3	2	5	7	10	70 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	2	1	2	8	5	45 (Low)
Operational phase	4	3	2	1	4	7	7	49 (Low)
Decommissioning and Closure	3	3	2	1	3	6	6	36 (Low)