2015

Big Syncline Prospecting Ecological Assessment

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For the Black Mountain Mine Prospecting at the Big Syncline, Aggeneys

EndemicVision Environmental Services

6/23/2015

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Declaration of Consultant Independence

The author of this report, Chrizette Neethling, does hereby declare that she is an independent consultant and has no business, financial, personal or other interest in the activity, application or appeal in respect of which she was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of the consultant performing such work. All opinions expressed in this report are her own.

Declaration of Qualifications

As a qualified ecologist and environmentalist, I present strong supporting skills and experience in project management, biophysical closure planning and management, risk management, auditing and natural resource management. My geographical area of expertise is the arid zones of Southern Africa and my qualification as a Nature Conservationist and experience in this field provides me with a foundation of understanding the biophysical environment as a general ecologist.

The following qualifications are relevant:

- Mcs – Rehabilitation (Current)
- BSC – Honors (Cum Laude) in Environmental Management
- BA with specialization in Environmental Management
- ND Nature Conservation Management
- NC Business Management

The following experience is relevant and applicable since 1995:

- Biodiversity and Conservation management - Natal Parks Board, Big Game Parks Swaziland, Cape Nature Conservation - Karoo Region and Cape Metropolis Area
- Environmental Law Enforcement - Cape Nature Conservation - Karoo Region and Cape Metropolis Area
- Environmental Training - Cape Nature Conservation - Karoo Region , Anglo American - Northern Cape
- Environmental Auditing - Anglo American , Kumba Iron Ore - Northern Cape and Polokwane , SPH Kundalila -Northern Cape
- Project Management - Cape Nature Conservation - Karoo Region & Cape Metropolis area , Kumba Iron Ore - Northern Cape, Anglo American - Northern Cape
- Operational Environmental Support - Kumba Iron Ore - Northern Cape, Xifati, - Gauteng, Anglo American -Northern Cape
- Risk Management - Anglo American -Northern Cape, Kumba Iron Ore - Northern Cape, Limpopo
- ISO 14001(2004) Environmental Management Systems - Anglo American - Northern Cape
- Mine Closure Management - Black Mountain Mine, Sishen Mine, Geosciences Division - Kumba Iron Ore
- Environmental Impact Assessments - Cape Nature Conservation - Karoo Region and Cape Metropolis Area, Solek - Northern Cape, Black Mountain Mine - Northern Cape

A detailed Curriculum Vitae is available on request

1 Terms of Reference

This study is a general biodiversity evaluation and includes:

- Desktop analysis to determine perspective of the biodiversity and related issues of the site
- Fieldwork to locate and describe the current state of vegetation on the site
- Baseline Establishment:
  - Key focus on the impact footprint(s) of the site
  - Establishing a baseline description against which impacts can be identified and measured.
- Vegetation Analysis:
  - Determine the species composition, diversity, structure and conservation status.
  - Generate a vegetation map showing the site in relation to National Vegetation Units.
  - Provide site photos that show the current state of the vegetation (i.e. natural, transformed, disturbed etc.)
  - Impact analysis on botanical aspects
- Animal Analysis:
  - Possible unique species habitats
  - Expected species, species conservation status
  - Impact analysis on faunal aspects
- River Analysis:
  - Evaluation of hydrological regime and possible impacts

2 Executive Summary

According to the fine scale biodiversity areas map generated from the fine scale vegetation map the project area does not have any critical plant populations, two important plant populations are however in close proximity towards the west of the project area. The area is outside the mountain plateau aquifer areas. The majority of the project is planned on south facing inselberg slopes with one of the drill sites planned on the steep south facing inselberg slopes that is considered an important part of the inselberg plant diversity spectrum. The access road (existing and planned extension) runs along the azonal habitats making out part of the catchment headwater system that runs into the washes at the foot of the slope. The material holding area will be marginally affecting the Bushmanland Flat Arid Grassland areas.

According to the sensitivity map generated with consideration of sensitive habitats, highly sensitive areas are engaged at boreholes PH23 and PH22 (one site) with moderately sensitive areas that require mitigation and low sensitive areas for the rest of the project.

The impact assessments indicate only flora and ecologically sensitive areas as having moderate significance during construction phase with the greatest significance rating during operational phase as Low impact significance.

The mitigations are stipulated for each area assessed and if applied, should result in little cumulative and residual impacts after the project has been completed.

3 Introduction

A generalist ecological impact assessment was undertaken by EndemicVision Environmental Service Pty (Ltd) to identify, assess and mitigate potential impacts linked to the planned prospecting works by Black Mountain Mine Pty (Ltd). This assessment is included as part of the amendment application to the department of mineral resources.

This report provides the results of the desktop review, site visit and assessment of data towards indicating the flora, fauna, biodiversity and hydrological impacts of the above mentioned project.

The impact assessment is conducted by means of a sensitivity map to be used by the project manager, as well as the assessment of impacts according to the construction and operational phase of the project. Specific mitigation measures that should be followed to reduce the impacts are presented in line with the impact assessment results.

4 Project Description

The project can be described as the prospecting for base minerals (zinc, lead and copper) on the property of Black Mountain Mine (Farm Aggeneys 56 portion 01) part of the existing new order mining right.

The prospecting project is a phased project and considers the drilling of 5 boreholes, collecting 8 geological data sets by using one borehole area for two boreholes. The phase 2 drilling of an additional 9 boreholes is foreseen should these boreholes indicate positive geological results. The total number of boreholes if all results are positive will be 14 drill sites.

Drill sites are prepared by constructing a gravel two track of approximately 800 meters, levelling a 15 meter by 15 meter area per drill site and clearing one material holding area of approximately 20 meters by 20 meters.

The drilling takes place by tracked diamond drill rigs and use existing roads as far as possible. An extension of the existing road will be constructed by digging and bulldozing a four (4) meter wide dirt road of approximately 800 meters long.

The closest town is Aggeneys (2.5km) with Upington as the closest main town (350km).

The environmental baseline for the project is described according to the construction footprint area of approximately 5000 m² and the extended area of influence of approximately 10 000m².

The objective of the prospecting works is to determine the possibility of accessing shallow ore bodies for the purpose of mining in accordance with the current mining right. Existing old boreholes and access roads will be drilled again and the additional boreholes and access road constructed to complete the drilling program.

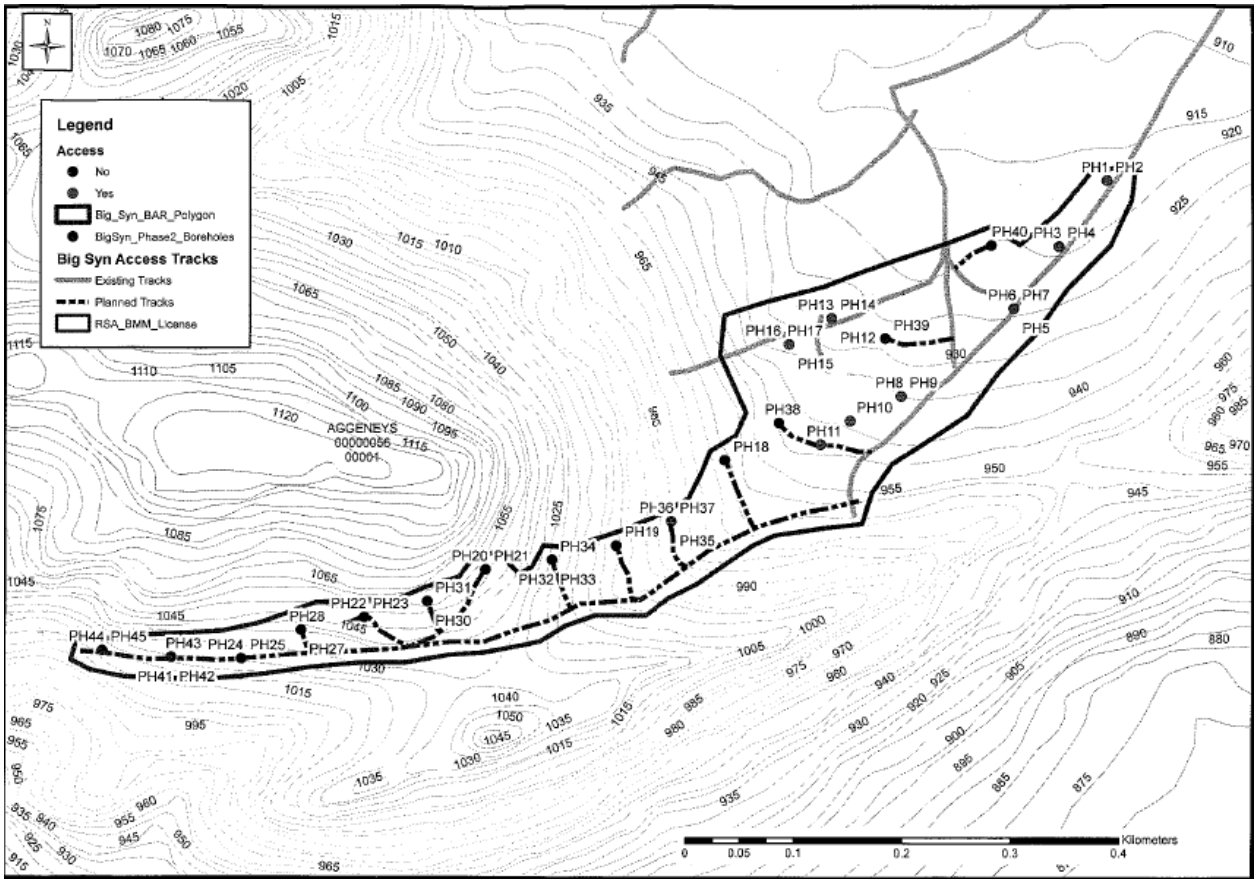

Figure 1: Project Design (existing and planned works)

5 Projected Infrastructure, Impacts and Phases

The infrastructure and impacts associated with the future drilling to be conducted essentially consists of the following:

5.1 Infrastructure

- Drilling boreholes with casing and capping for each drill site
- Cleared and leveled area for drilling (approximately 15m x 15m)
- Cleared and leveled area for material storage
- Existing roads used and/or upgraded where necessary
- Temporary water supply pipeline from existing bulk water supply to storage tanks for use
- New two track access road to boreholes
- No permanent fixtures or infrastructure development will take place.

5.2 Possible Impacts

- Two-track roads diverting from the existing roads into natural veldt
- Vegetation clearance for drill sites, roads and material storage area
- Hydrocarbon and hydrocarbon related pollution due to spillages during drilling
- Drill sludge and chips from drilling operations
- Ground water pollution from drilling itself
- Soil compaction and subsoil on surface where machines operated

5.3 Project Phases

Activities to be undertaken in the prospecting project and its respective construction and operational and closure phases, give rise to certain impacts. For the purpose of assessing these impacts, the project has been divided into three phases from which impacting activities can be identified, namely:

- **Construction Phase**

Construction phase consist of the construction of access roads and 15 meter x 15 meter cleared surfaces to allow for drilling over short periods of time (less than 3 months per site). Drill sites are cleared of only the necessary vegetation and topsoil is stockpiled for re-use after drilling where appropriate. Road clearance will take place mechanically to ensure safe passage of vehicles and machines. Water supply pipeline will be laid overland with minimum disturbance. Existing disturbed area will be used to store materials and allow for drill rigs to be placed on site.

- **Operational Phase**

The operational phase consist of drilling boreholes, collecting geological material, operating drilling machinery and storing drilling equipment on a temporary basis at the drill site.

- **Closure Phase**

The closure phase include the cleaning of drill sites, making drill sites safe, closing the borehole with a secure cap, replacement of topsoil and de-compaction of the site. Drill site monitoring and concurrent rehabilitation is then conducted depending on the agreed final land use and the requirements to achieve the agreed land use.

6 Trigger for Specialist Input

In accordance with the Department of Environmental Affairs and Development Planning Guideline for Biodiversity specialists (Brownlie, S. 2005) the following evaluation was used to determine the need for a specialist study.

A 'trigger' means a characteristic of either the receiving environment or the proposed project which indicates that biodiversity is likely to be a 'key issue' and may require the involvement of an appropriately qualified and experienced specialist.

Such triggers include:

Site Trigger	Applicability to Big Syncline Prospecting Project
a relatively undisturbed or 'natural' site, with indigenous vegetation	**APPLICABLE** The site has no historic disturbance where new drill sites will be placed
wetlands	**NOT APPLICABLE** No permanent or semi-permanent wetlands are present at site
river systems	**APPLICABLE** The site is in the Aggeneys mountains that forms part of the head water catchment to undetermined sheet flow in the plains below the site.
other possible significant natural feature	**NOT APPLICABLE** No other significant features in terms of flora, fauna, hydrology, micro-habitats, geology, heritage, archaeological, ground water or surface water was found on site
dune systems	**NOT APPLICABLE**
Legal Requirement in terms of biodiversity legislation	**APPLICABLE** This refers to legislation pertaining to the management of protected trees, protected fauna and flora and alien invasive species.
Lack of information about the receiving environment	**NOT APPLICABLE** This area is part of the municipal biodiversity planning domain, Succulent Ecosystem Project Planning Domain and has habitat types generally known and previously investigated.
The presence of important biodiversity pattern	**APPLICABLE** The site is on and upslope gradient of a bushmanland vegetation type Inselberg.
The presence of important ecological processes	**APPLICATION** The site is in the Aggeneys mountains that forms part of the head water catchment to undetermined sheet flow in the plains below the site.
The presence of important ecosystem goods and services;	**NOT APPLICABLE** The area does not serve as water supply for the community in any way. No grazing or any viable land-use is applicable to the site.
The potential of the specific project to pose a threat to biodiversity;	**NOT APPLICABLE** The site is very small and significant biodiversity were not found on site
The potential of biodiversity and/or ecosystems to pose a threat to the proposed project	**APPLICABLE** Access to the site is very difficult and careful risk assessments and mitigation measures must be applied to ensure a safe prospecting project.
The potential for making a significant contribution to biodiversity conservation objectives	**NOT APPLICABLE** The site is very small and significant biodiversity were not found on site. The potential to increase biodiversity value by means of alien vegetation clearing is not relevant in this case.

From the site evaluation, this assessment report and the above comparison this ecological study is considered adequate and no further species specific specialist study is proposed.

7 Desktop Analysis

7.1.1 Legal Overview

Legislation applicable to this project includes the following:

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

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

In this context ecological degradation could take place if the catchment area is permanently altered from a functional sensitive ecological state to a polluted, impacted site. It should be noted that the riverine habitat is a perennial dry riverbed, currently disturbed by the road crossing, human and livestock use of the area.

Environment Conservation Act (ECA) (No 73 of 1989 Amendment Notice No. R1183 of 1997)

ECA provides for the effective protection and controlled utilization of the environment. This Act has been largely repealed by NEMA, but certain provisions remain, in particular provisions relating to environmental impact assessments. The ECA requires that developers must undertake Environmental Impact Assessments (ESIA) for all projects listed as a Schedule 1 activity in the ESIA regulations.

In this context, the EMPR is complied with retrospectively and mitigation plans will apply to all current and future work as well as post construction maintenance.

National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004):

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Act provides for listing of species as threatened or protected, fewer than one of the following categories:

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

National Forests Act (No. 84 of 1998):

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

In this context, the nationally protected species Boscia albitrunca (Witgat boom), were encountered.

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

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

In this context, no alien invasive plants were found on the mountain site. Soil erosion protection measures are important along the steep slopes and two tracks that will be created.

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

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilization of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), Protected (schedule 2) to Common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1. A permit is required for any activities which involve species listed under Schedule 1 or 2.

It should be noted that there are no vegetation on the direct impact area of the project and this is a reflection of vegetation in the sphere of influence. In this context some indigenous genus and protected species found on and nearby the site include:

- Aloe dicotoma
- Rhus
- Galenia
- Salsola
- Ruschia
- Euphorbia
- Aizoaceae
- Drosanthemum
- Mesembreyanthea
- Chrysocoma
- Conophytum
- Eriocephalus
- Lycium
- Boscia

7.1.2 Vegetation Context

The project falls within the Succulent Karoo Biome in the Bushmanland area of the Northern Cape.

The Succulent Karoo Biome is characterized by unparalleled species diversity, endemism and limited formally conserved areas. The Succulent Karoo is predominated by low, succulent-leaved shrubs, few grasses and a scarcity of tall shrubs and trees.

The Bushmanland lies between the Orange River in the north, Namaqualand in the west, Loeriesfontein in the south and Van Wyksvlei, Verneukpan and the Hartbees River in the east. The elevation is between 900 and 1200 meters above sea level, sloping down towards the Kalahari-basin in the northwest.

Black Mountain mine is situated in the North West region of Bushmanland, an area which is marginal to the winter and summer rainfall zones. Namaqualand to the west is considered a winter rainfall area while Gordonia to the east is a summer rainfall area. Protracted droughts are a common feature, and in the recent past. The annual rainfall varies between 50 mm and 190 mm, averaging just over 90 mm.

Bushmanland is characterized by a particularly high biodiversity. It lies east of Springbok and is dominated by a sea of sandy plains out of which rise steep, quartzite-capped hills. These ancient, rocky outcrops are known as inselbergs. On the gravel plains and within the grasslands there are gravel patches with unique micro flora, including species such as Lithops Conophytum, Titanopsis, Lapidaria, Dinteranthus and Avonia. But it is the flat-topped inselbergs that are covered by a particularly rich variety

of succulents and geophytes. The isolation of populations has led to species diversification within the dwarf succulent shrub lands. The inselbergs are thus important refugia for plants and animals and act as stepping-stones for rock loving species migrating east - west across the sand covered plains of Bushmanland.

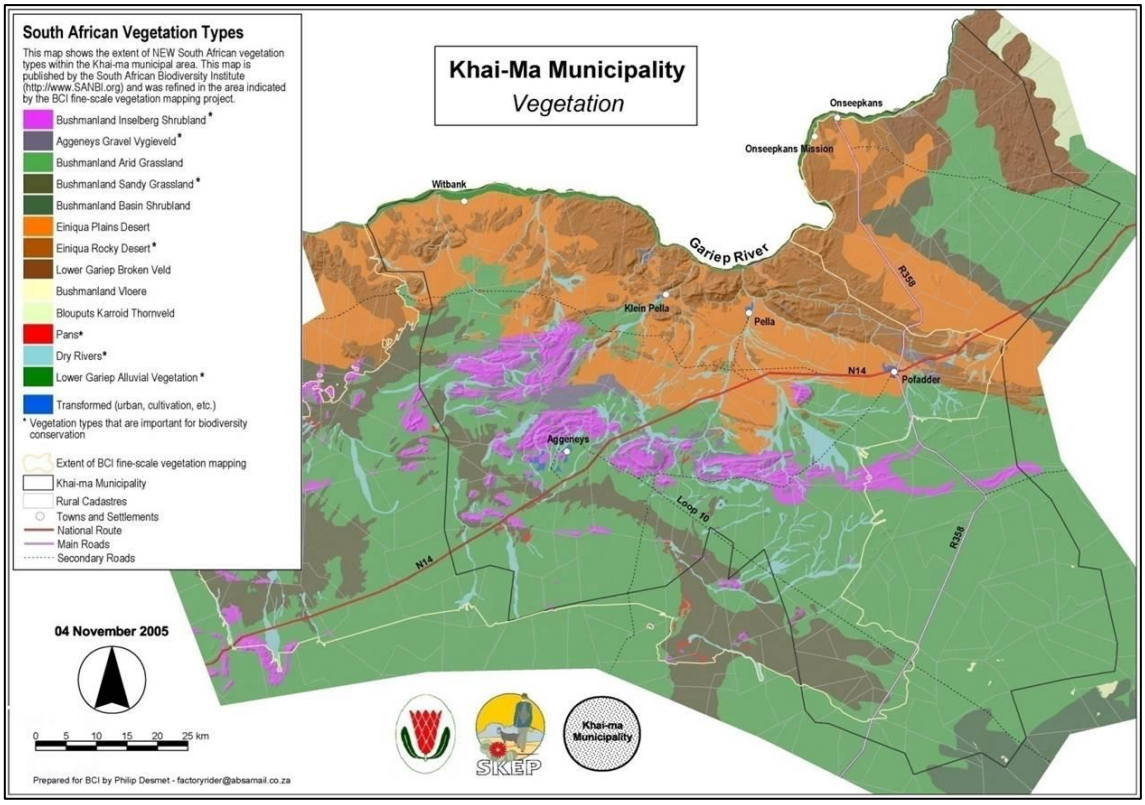

Figure 2: Vegetation Topographical Map in municipal context

7.1.3 Flora

According to Mucina and Rutherford (2006), the project falls primarily within vegetation units SKr 18 Bushmanland Inselberg Shrubland (drill sites); NKb 4 the Bushmanland Flat Arid Grassland (plains area towards drill site) and the recently described vegetation type, Inselberg Succulent Shrubland.

The main vegetation type is the Bushmanland inselberg Shrubland characterized by its extra zonal nature. A unit of succulent karoo embedded with transitional desert elements indicating extreme rainfall variations (Mucina & Rutherford, 2011). The mountain substrate results in dwarf and succulent flora dominance. This vegetation type also has very tight topographic links to the Desert Biome with south facing slopes characteristically more karoo-like and north facing slopes characteristically more like Gariep rocky desert vegetation. Inselbergs dominating the bushmanland area is normally a host to numerous endemices, especially succulents of the families' aizoaceae, /apocynaceae, Crassulaceae, Portulaceae and Didiereaceae (Mucina & Rutherford, 2011)

The project site is along a group of prominent solitary mountains (inselbergs), in this case the Aggeneys mountains with altitude ranges from 600 – 1 180 m. Here shrub land with both succulent (Aizoaceae, Asphodelaceae, Crassulaceae, Didiereaceae, Euphorbiaceae and Zygophyllaceae) as well as non-succulent (mainly Asteraceae) elements and with sparse grassy undergrowth (Aristida, Eragrostis, Stipgrostis) are found on steep slopes.

The study area is in a unique position as a considerable amount of botanical work has previously been done in the study area and regionally. The previous EIA and the Bushmanland Conservation Initiative (BCI) generated amongst other products that are available to this project:

- A regional context study quantifying the floristic relationships in the region (Desmet, 2000);
- Regions of Floristic Endemism in Southern Africa (van Wyk, A. and Smith, G. 2001);
- The succulents of Northern Bushmanland: their distribution and implications for conservation (Desmet 2000);
- A fine-scale vegetation map of the whole Bushmanland Inselberg Region (BIR) mapping habitat features found on the Gamsberg at a regional scale (Desmet *et al.*, 2005)
- Floral specialist study (Desmet, 2010).

7.1.4 Fauna

The project area is zoned mining with no farming activities taking place and free roaming wildlife utilizing the area. Considering the aridity of the area, fauna populations are relatively low, but with heterogeneity and diversity adapted to the harsh environments.

Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various spatial databases.

Table 1: List of Fauna Species expected to occur in the areas

Scientific Name	Common Name
Macroscledidea (Elephant Shrews):	
Macroscelides proboscideus	Round-eared Elephant Shrew
Elephantulus rupestris	Western Rock Elephant Shrew
Tubulentata:	
Orycteropus afer	Aardvark
Hyracoidea (Hyraxes)	
Procavia capensis	Rock Hyrax
Lagomorpha (Hares and Rabbits):	
Pronolagus rupestris	Smith's Red Rock Rabbit
Lepus capensis	Cape Hare
Rodentia (Rodents):	
Hystrix africaeaustralis	Cape Porcupine
Petromus typicus	Dassie Rat
Xerus inauris	South African Ground Squirrel
Graphiurus platyops	Rock Dormouse
Rhabdomys pumilio	Four-striped Grass Mouse
Thallomys paedulcus	Acacia Tree Rat
Thallomys nigricauda	Black-tailed Tree Rat
Aethomys namaquensis	Namaqua Rock Mouse
Parotomys brantsii	Brants' Whistling Rat
Parotomys littledalei	Littledale's Whistling Rat
Desmodillus auricularis	Cape Short-tailed Gerbil
Gerbillurus paeba	Hairy-footed Gerbil
Gerbillurus tytonis	Dune Hairy-footed Gerbil
Gerbilliscus leucogaster	Bushveld Gerbil
Gerbilliscus brantsii	Higheld Gerbil
Saccostomus campestris	Pouched Mouse
Malacothrix typica	Gerbil Mouse
Petromyscus collinus	Pygmy Rock Mouse
Primates:	

Papio ursinus	Chacma Baboon
Cercopithecus mitis	Vervet Monkey
Eulipotyphla (Shrews):	
Crocidura cyanea	Reddish-Grey Musk Shrew
Carnivora:	
Proteles cristata	Aardwolf
Caracal caracal	Caracal
Felis silvestris	African Wild Cat
Panthera pardus	Leopard
Felis nigripes	Black-footed cat
Genetta genetta	Small-spotted genet
Suricata suricatta	Meerkat
Cynictis penicillata	Yellow Mongoose
Herpestes pulverulentus	Cape Grey Mongoose
Atilax paludinosus	Marsh Mongoose
Vulpes chama	Cape Fox
Canis mesomelas	Black-backed Jackal
Otocyon megalotis	Bat-eared Fox
Aonyx capensis	African Clawless Otter
Ictonyx striatus	Striped Polecat
Rumanantia (Antelope):	
Tragelaphus strepsiceros	Greater Kudu
Oryx gazella	Gemsbok
Sylvicapra grimmia	Common Duiker
Antidorcas marsupialis	Springbok
Raphicerus campestris	Steenbok
Oreotragus oreotragus	Klipspringer
Chiroptera (Bats)	
Sauromys petrophilus	Flat-headed free-tailed bat
Tadarida aegyptiaca	Egyptian Free-tailed Bat
Nycteris thebaica	Egyptian Slit-faced Bat
Cistugo seabrae	Angolan hairy bat
Eptesicus hottentotus	Long-talied serotine bat
Rhinolophus clivosus	Geoffroy's horsehoe bat
Rhinolophus capensis	Cape horseshoe bat
Rhinolophus darlingi	Darling's Horsehoe Bat

7.1.5 Ecological sensitive areas

The ecological status, considering the biotic and abiotic elements and the way they interact is considered for this assessment.

Specific habitats that affect flora and fauna interactions with the environment are found on the site including the steep southern slopes; the upland-lowland gradient along the mountain slope, the azonal habitats and catchment area headwaters, the washes in the plains at the foot of the mountain slope.

Ecological sensitive areas are investigated and presented spatially to assist in the evaluation of the baseline area and possible impacts. Information is integrated by focusing on the following aspects:

- Southern Slope habitat areas as mapped in the Black Mountain Fine Scale conservation plan
- Catchment areas and catchment streams supplying important ecological functions
- Location of important species and populations (unique populations of species of conservation concern)
- Protected species that will affect legal complianc (Boscia albitrunca species location)

The map depicts areas according to categories Low (for low biodiversity impact), Medium or High (for high biodiversity impact)

- Low Sensitivity Rating
  - Low ecological sensitivity
  - Previously disturbed areas
  - Negligible impact on ecological processes and terrestrial biodiversity
  - Extent of impact is little, temporal and insignificant in context of the extend of biodiversity
- Medium Sensitivity Rating
  - Moderate ecological sensitivity
  - Relatively undisturbed sites showing signs of extensive indirect disturbance (over grazing, excessive fires, trampling)
  - Little ecological impact provided that all mitigation measures are fully complied with
  - Secondary impacts of development will be low (like erosion, ground water plumes)
- High Sensitivity Rating
  - High ecological sensitivity and high biodiversity value
  - Undisturbed, intact areas
  - Development is undesirable here and should only proceed with caution where all other alternatives have been investigated and failed
  - Ecological impact will be high with little possibility of recovering the area to its original state
- Critical Sensitivity Rating
  - Conservation priority or species priority area with unique habitat types or critical ecological services provided
  - Undisturbed, intact areas of high biodiversity importance beyond the local scale
  - Development should be avoided and area is essentially a no-go area

7.1.6 Biodiversity Management

Biodiversity management of the area must also be considered with this assessment. According to the fine scale biodiversity areas map generated from the fine scale vegetation map the project area does not have any critical plant populations, two important plant populations are however in close proximity towards the west of the project area. The area is outside the mountain plateau aquifer areas. The majority of the project is planned on south facing inselberg slopes with one of the drill sites planned on the steep south facing inselberg slopes that is considered an important part of the inselberg plant diversity spectrum. The access road (existing and planned extension) runs along the azonal habitats making out part of the catchment headwater system that runs into the washes at the foot of the slope. The material holding area will be marginally affecting the Bushmanland Flat Arid Grassland areas.

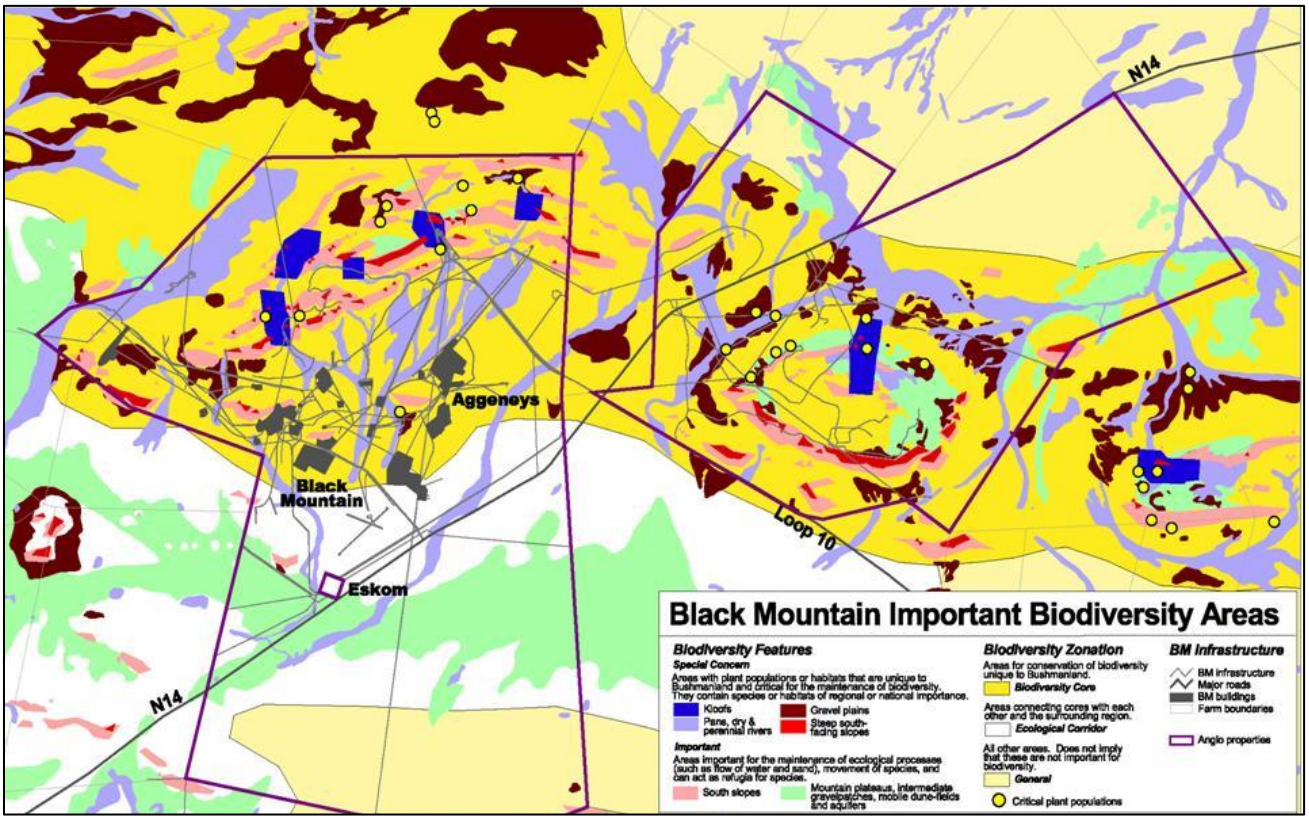

Figure 3: Fine Scale Biodiversity Areas Map for Black Mountain (BCI)

7.1.7 Hydrology

The rainfall patterns, driving the hydrological cycles, indicate a relatively low rainfall of between 100mm and 200mm per year. The rainfall events are erratic and annual rainfall seldom results in river systems flowing. Extreme rain events or a good rainfall year with sufficient follow-up rain could result in the Aggeneys berge catchment flowing out towards the lower lying plains.

Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).

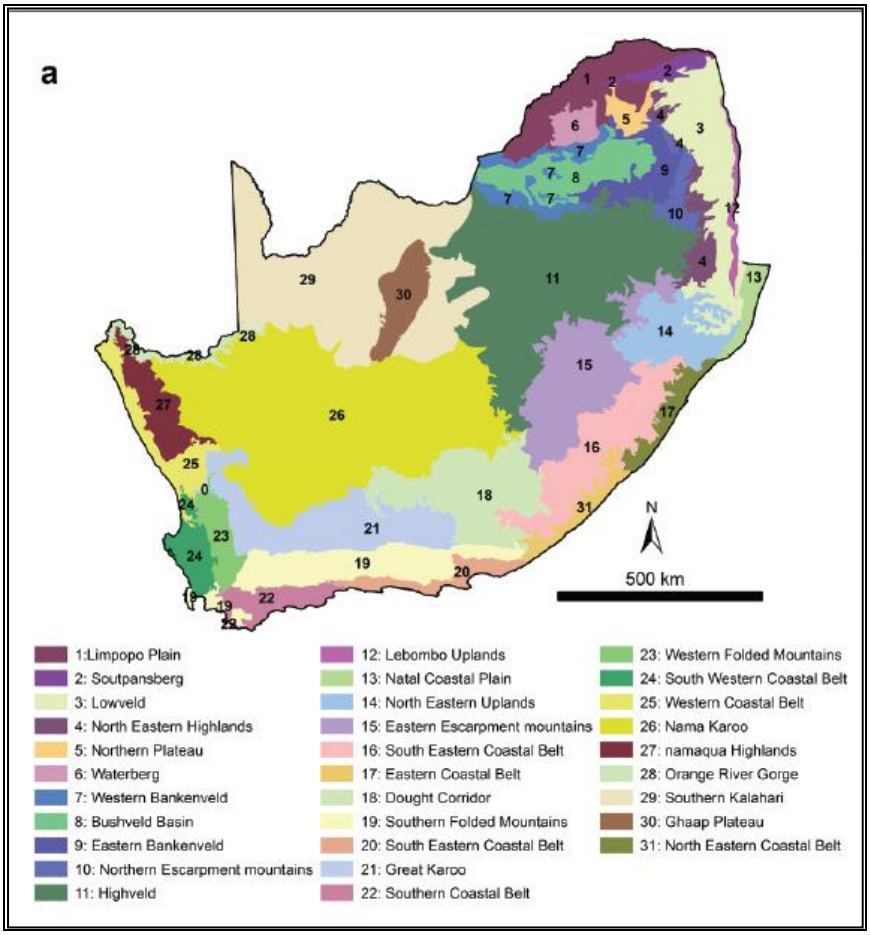

Figure 4: National Freshwater Priority Areas

Black Mountain mine falls within the Orange River Gorge (28) freshwater priority area.

In terms of surface hydrology categories by the Department of Water Affairs South Africa is divided into a number of drainage regions. The Aggeneys farm 56 within the Lower Orange water management area and the Big Syncline Valley sub-catchment. In the event of a rain storm water discharges from this area through two valleys towards Aggeneys. The discharge is then diverted to the north and south of the township by man-made storm water walls before running to the Koa River Valley system, as clean water. A minor water channel on the outside slopes of the western side of the Big Syncline tends towards the mining area but is diverted to the west by a storm water wall to prevent contamination from the mine area.

Figure 5: Big Syncline in relation to the Koa River System and surface flow satellite display

8 Environmental Baseline Determination

A site visit for the assessment took place on 12 and 13 May 2015. It should be noted that the area is familiar to the consultant from historic visits. During the site visit, the footprint of the proposed infrastructure was investigated in detail. The entire impact area was walked and photo records generated of each proposed drill site, the 800 meter road area and laydown area was also investigated.

8.1 Onsite vegetation description

The area under investigation is along the steep south facing slope habitat characterized by steep, winter-shaded mountain slopes. The vegetation is dense with many succulents and shrubs present. Many bulbs, small succulents and moss are found in the shaded cracks between rocks. Large stem succulents are generally absent.

The site can be considered very mountainous with steep slopes facing South-South East. The vegetation is dominated by Euphorbia and Crassula species and a high percentage of shrub elements (mainly Asteraceae). Sparse grassy undergrowth occurs and can be seen being utilized by local klipspringer and dassie. Dominant tree elements include Aloe dicotoma; Boscia albitrunca; Boscia foetida and Ceraria namaquensis.

Figure 6: Bushmanland inselberg Shrubland at proposed prospecting area

Azonal species are depicted along the headwater dry rivulets indicating some tree elements in the form of Ozoroa dispar, Rhus undulata, Boscia albitrunca and Pappea capensis as well as , pelargonium-; orthonigalum-; Brunsvigia-species and greater grass element.

Figure 7: Azonal Areas

The Bushmanland flat arid grasslands vegetation type consists of plains and washes habitats. The mountain slope is accessed from the plains area. This area has sand dominated substrate with a greater proportion of grass elements and shrub elements with very little succulent species present. Along the plains greater grass elements dominated by Stipagrostis cilliaris; Stipagrostis obtuse and Schmidtia kalahariensis occur along with memsembryanthemum species and small shrubs.

Figure 8: Bushmanland flat arid grasslands at proposed material holding area

The below plant species list indicate species found on site as well as what can be expected to occur on site because of suitable habitat. Species genus, species and protected status is presented. This is not an all-inclusive list.

Table 2: Plant Species list

Species Name	Status	Present in impact area	Suitable Habitat Present
Adromischus alstonii	Protected Schedule 2	0	1
Adromischus diabolicus	Protected Schedule 2	1	1
Agroderma sp	Protected Schedule 2	1	1
Aizoon asbestinum	Protected Schedule 2	1	1
Aloe dichotoma	Specially Protected Schedule 1	1	1
Aloe gariepensis	Protected Schedule 2	1	1
Anacampseros baeseckei	Protected Schedule 2	0	1
Anacampseros filamentosa	Protected Schedule 2	0	1
Antherothamnus pearsonii	Protected Schedule 2	0	1
Antimima leucanthera	Protected Schedule 2	0	1
Antimima vanzylii	Protected Schedule 2	0	1
Aptosimum spinescens	Protected Schedule 2	1	1
Aridaria spp	Protected Schedule 2	1	1
Aristida congesta subsp. congesta	Protected Schedule 2	1	1
Avonia albissima brown	Protected Schedule 2	0	1
Avonia papyracea subsp. papyracea	Protected Schedule 2	0	1
Berkheya canescens	Protected Schedule 2	1	1
Blepharis micra	Protected Schedule 2	0	1
Boscia albitrunca var. albitrunca	Protected Schedule 2	1	1
Boscia foetida subsp. foetida	Protected Schedule 2	1	1
Brownanthus ciliatus	Protected Schedule 2	0	1
Brownanthus pseudoschlichtianus	Protected Schedule 2	0	1
Brunsvigia sp.	Protected Schedule 2	0	1
Cadaba aphylla	Protected Schedule 2	1	1
Ceraria namaquensis		1	1
Chlorophytum sp.	Protected Schedule 2	0	1
Chrysocoma ciliata	Protected Schedule 2	1	1

Chrysocoma sparsifolia	Protected Schedule 2	0	1
Conophytum fulleri	Protected Schedule 2	1	1
Conophytum lydiae (cf)	Protected Schedule 2	1	1
Cotyledon orbiculata var. orbiculata	Protected Schedule 2	1	1
Crassula columnaris subsp. prolifera	Protected Schedule 2	1	
Crassula corallina subsp. macrorrhiza	Protected Schedule 2	0	1
Dianthus namaensis	Protected Schedule 2	0	1
Didelta carnosa var. carnosa	Protected Schedule 2	0	1
Digitaria eriantha	Protected Schedule 2	1	1
Diospyros ramulosa	Protected Schedule 2	1	1
Drimia sp.	Protected Schedule 2	0	1
Drosanthemum spp	Protected Schedule 2	1	1
Dyerophytum africanum	Protected Schedule 2	0	1
Ehretia rigida	Protected Schedule 2	0	1
Enneapogon scaber	Protected Schedule 2	1	1
Eriocephalus microphyllus var. pubescens	Protected Schedule 2	1	1
Eriocephalus scariosus	Protected Schedule 2	0	1
Eriospermum pusillum	Protected Schedule 2	1	1
Euclea undulata	Protected Schedule 2	1	1
Euphorbia gariepina	Protected Schedule 2	1	1
Euphorbia gregaria	Protected Schedule 2	1	1
Euphorbia mauritanica	Protected Schedule 2	1	1
Euphorbia virosa	Protected Schedule 2	0	1
Euryops namibensis	Protected Schedule 2	0	1
Euryops subcarnosus subsp. vulgaris	Protected Schedule 2	0	1
Felicia cf. clavipilosa	Protected Schedule 2	0	1
Felicia muricata	Protected Schedule 2	1	1
Fockea comaru	Protected Schedule 2	0	1
Galenia aficana	Protected Schedule 2	1	1
Galenia fruticosa	Protected Schedule 2	1	1
Gazania lichtensteinii	Protected Schedule 2	0	1
Helichrysum spp	Protected Schedule 2	1	1

Hermannia spinosa	Protected Schedule 2	1	1
Hermannia stricta	Protected Schedule 2	1	1
Hesperantha rupicola	Protected Schedule 2	0	1
Hirpicium alienatum	Protected Schedule 2	0	1
Huernia campanulata subsp. ingeae	Protected Schedule 2	0	1
Hypertelis salsoloides	Protected Schedule 2	1	1
Jamesbrittenia albiflora	Protected Schedule 2	1	1
Jamesbrittenia aridicola	Protected Schedule 2	0	1
Jamesbrittenia maxii	Protected Schedule 2	0	1
Lavrania marlothii	Protected Schedule 2	0	1
Lessertia brachypus	Specially Protected Schedule 1	0	1
Limeum aethiopicum subsp. namaense var. lanceolatum	Protected Schedule 2	0	1
Lithops olivacea var. olivacea	Protected Schedule 2	0	1
Lycium cinereum	Protected Schedule 2	1	1
Mesembryanthemum guerichianum	Protected Schedule 2	1	1
Ornithogalum glandulosum	Protected Schedule 2	1	1
Osteospermum armatum	Protected Schedule 2	0	1
Osteospermum scariosum	Protected Schedule 2	0	1
Othonna abrotanifolia	Protected Schedule 2	0	1
Othonna protecta	Protected Schedule 2	0	1
Oxalis annae	Protected Schedule 2	0	1
Oxalis obtusa	Protected Schedule 2	0	1
Oxalis pulchella	Protected Schedule 2	0	1
Ozoroa dispar	Specially Protected Schedule 1	1	1
Pappea capensis	Protected Schedule 2	0	1
Pelargonium spp	Specially Protected Schedule 1	1	1
Pentatrichia petrosa	Protected Schedule 2	0	1
Pentzia argenteus	Protected Schedule 2	1	1
Pentzia lanata	Protected Schedule 2	1	1
Phyllobolus lignescens	Protected Schedule 2	0	1
Polygala seminuda	Protected Schedule 2	0	1

Pteronia ciliata	Protected Schedule 2	1	1
Pteronia glauca	Protected Schedule 2	1	1
Pteronia leucoclada	Protected Schedule 2	0	1
Pteronia mucronata	Protected Schedule 2	1	1
Quaqua mammillaris	Protected Schedule 2	1	1
Rhigozum trichotomum	Protected Schedule 2	0	1
Rhus incisa	Protected Schedule 2	0	1
Rhus undulata	Protected Schedule 2	1	1
Ruschia robusta	Protected Schedule 2	1	1
Salsola aphylla	Protected Schedule 2	1	1
Sarcocaulon crassicaule	Protected Schedule 2	1	1
Sarcostemma viminale	Protected Schedule 2	0	1
Schwantesia pillansii	Protected Schedule 2	0	1
Selago namaquensis	Protected Schedule 2	0	1
Selago namaquensis	Protected Schedule 2	1	
Sericocoma avolans	Protected Schedule 2	1	1
Sesamum capense	Protected Schedule 2	1	1
Solanum burchellii	Protected Schedule 2	1	1
Stachys rugosa	Protected Schedule 2	1	1
Stipagrostis brevifolia	Protected Schedule 2	1	1
Stipagrostis ciliata	Protected Schedule 2	1	1
Sutera tomentosa	Protected Schedule 2	0	1
Tetragonia spicata	Protected Schedule 2	0	1
Tetragonia spicata	Protected Schedule 2	2	
Thesium lineatum	Protected Schedule 2	1	1
Trachyandra cf. jacquiniana	Protected Schedule 2	1	1
Trianthema parvifolium	Protected Schedule 2	1	1
Tribulus cf. zeyheri	Protected Schedule 2	1	1
Trichodesma africanum	Protected Schedule 2	1	1
Trichodiadema obliquum	Protected Schedule 2	0	1
Tripteris microcarpa subsp. microcarpa	Protected Schedule 2	0	1
Tripteris sinuata	Protected Schedule 2	0	1

Tylecodon paniculatus	Protected Schedule 2	0	1
Tylecodon sulphureus var. sulphureus	Protected Schedule 2	0	1
Tylecodon wallichii	Protected Schedule 2	1	1
Vernonia obionifolia subsp. obionifolia	Protected Schedule 2	1	1
Viscum capense	Protected Schedule 2	0	1
Zygophyllum sp	Protected Schedule 2	1	1

8.2 Onsite Fauna Description

Fauna activity was evident by spoor (Klipspringer); middens (Dassie); sightings (numerous avi-fauna with Marshall Eagle nests in close vicinity).

One herpetofauna specimen were found on site during the site evaluation, it is expected that it is a Ground Agama (*Agama aculeata*) with no conservation status according to the Northern Cape Nature Conservation (Act 9 of 2009).

Figure 9: Common Ground Agama Observed in the Area

8.3 Onsite Hydrology Description

Hydrology is not evaluated in terms of water management or engineering control measures, but merely as important ecological process element and its contribution to unique habitats and ecological functioning.

The Aggeneys Mountains indicate historic importance as a catchment area, with the local "water fall" directly South-West of the project area.

The current impacts indicating water flow and flooding is however very limited with the dry climate for this area. Mapped streams indicate that flows occur erratic (only when sufficient rains occur in a dry season, not necessarily annually). The road construction tries to follow easiest access gradient of the existing road along the rivulets. The extension of the existing road is further along the catchments area.

Two habitat types are present in this regard, azonal areas (areas different from other habitats because of micro organization of the landscape, but not clearly defined) and the washes (areas of sheet flow overland) along the plains where water is dispersed from the mountain slope runoff.

The project area falls outside the mountain plateau aquiver areas and is considered at high altitude with low probability that the boreholes will intercept water.

Figure 10: Depiction of Catchment Area and Mountain slopes with rivulets

Figure 11: Mountain with plains washes evident down slope

8.4 Ecological Sensitivity Mapping

The following areas or habitats can be demarcated for the project site and directly adjacent to the site that affects the sensitivity mapping results for the area:

- The azonal areas as part of the catchment
- The southern steep slopes as unique habitats
- The inselberg succulent shrub land as unique habitats
- The Boscia albitrunca vegetation line depicted by the dominance of these trees
- The rivulets as mapped for the area

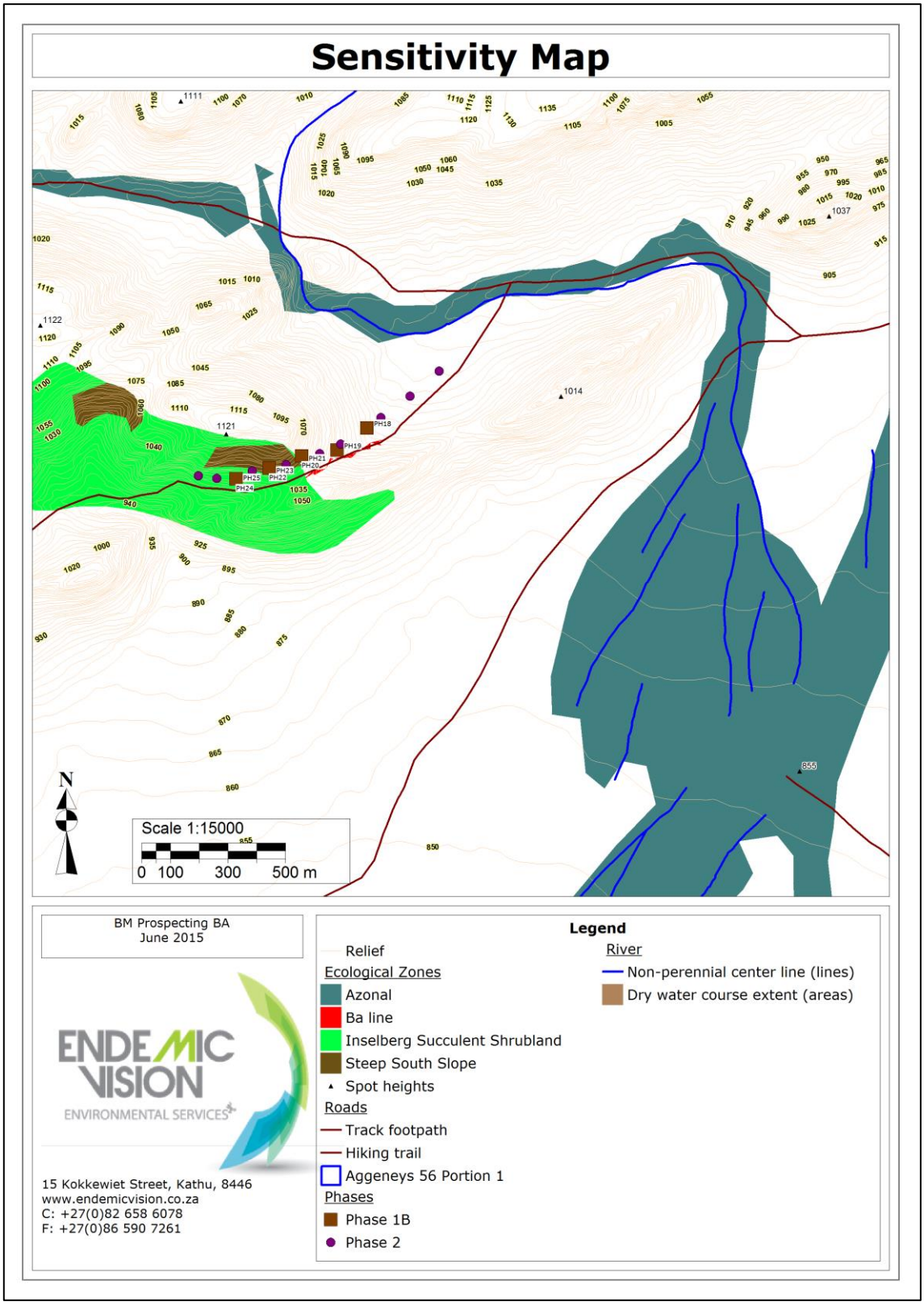

Figure 12: Sensitivity map indicating planned boreholes, roads on ecological sensitive areas

According to the above map the road is developing over sensitive areas namely the steep southern slope areas, Boscia albitrunca growth line and the azonal, rivulet areas.

Boreholes PH22 and 23 will take place on sensitive steep southern slope areas with unique habitats for inselberg succulent thicket vegetation. All other boreholes occur on the relatively well represented Bushmanland inselberg shrub land vegetation type and Bushmanland plains grassland. From the above data the following ecological zones are presented for this project.

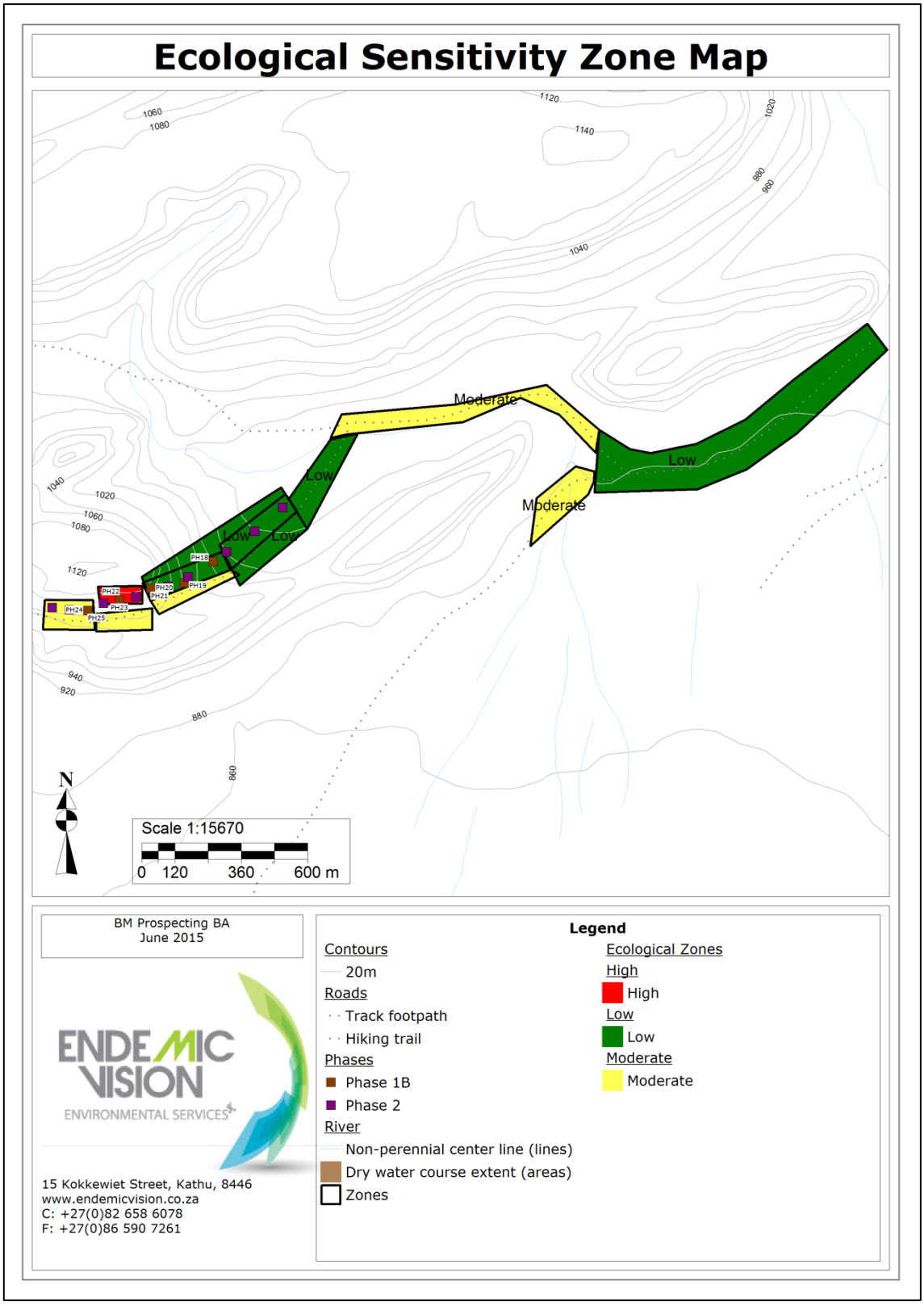

Figure 13: Ecological Sensitivity zones

The majority of the project is presented in the low ecological impact zone primarily because of the extent of the footprint, project impact and duration in relation to the represented vegetation type in the area.

All rivulet and azonal habitats as well as south facing inselberg slopes are seen as moderately sensitive. Moderate ecologically zoned areas are highlighted with important mitigation measures that must be followed, amongst others, specifically pollution

control, erosion control and avoiding the destruction of nationally protected species where possible in the Boscia albitrunca growth line and azonal areas.

High ecologically sensitive areas is the site where two sensitive habitats overlap, namely the Southern steep slope habitat types occurring due to higher moisture and micro-habitats and the Inselberg succulent thicket vegetation type that is an important habitat type with conservation importance as far as irreplaceability and current threat from mining (habitat loss projections) is concerned.

9 Impact Assessment

The biodiversity impact assessment considers the flora, fauna, biodiversity and hydrological results as described above, only construction and operational impacts are considered as closure and rehabilitation is considered a positive impact (relative to the construction and operational phases).

The impact characteristics are presented below indicating the project aspect and impact type.

Table 3: Impact Characteristics for Flora, Fauna, Biodiversity and Hydrology

	Construction	**Operation**
Project Aspect/ activity	(i) Clearing of soils and overburden (ii) Erosion of topsoil (loss of ecological functioning and habitat fragmentation). (iii) Movement of heavy vehicles. (iv) Construction activities such as material handling and earthworks.	(i) Disturbance and vegetation clearing required for drilling activities (ii) Movement of vehicles and drill rigs. (iii) Presence of temporary water supply pipelines (iv) Presence of materials and waste
Impact Type	Direct Negative (i) Loss of vegetation (ii) Loss of protected species (iii) Generation and accumulation of construction related waste (iv) Disruption of game grazing freely in the area Indirect Negative (v) Possible substrate loosening during construction (catchment flow) resulting in increased sedimentation when a rain event occurs. (vi) Loss of vegetation cover over the long term (lack of recovery)	Direct negative (i) On-site soils and vegetation. (ii) Disruption of game grazing freely in the area (iii) Compaction of soils (iv) Generation and accumulation of general and hazardous waste (v) Generation and accumulation of mineral waste Indirect Negative (i) Possible substrate loosening during construction (catchment flow) resulting in increased sedimentation when a rain event occurs. (ii) Loss of vegetation cover over the long term (lack of recovery)

9.1 Construction Phase Impacts

9.1.1 Flora – Construction Phase Impact Assessment

Some loss of vegetation is an inevitable consequence of the development. The majority of the impact occurs in the Bushmanland inselberg shrub land, followed by the recently described Inselberg succulent shrub land and Bushmanland flat arid grasslands. The plant species of concern on the site include, but is not limited to:

Table 4: Specially protected species

Family	Species Name	Status	Present in impact area	Suitable Habitat Present
Asphodelaecea	Aloe dichotoma	Specially Protected Schedule 1	1	1
Fabaceae	Lessertia brachypus	Specially Protected Schedule 1	0	1
Anacandaceae	Ozoroa dispar	Specially Protected Schedule 1	1	1
Geraniaceae	Pelargonium spp	Specially Protected Schedule 1	1	1

Flora Impact Assessment

Nature: The construction phase will require clearing of soils for infrastructure, resulting in **direct negative and indirect negative** impacts on the flora of the site.

Impact Magnitude –**Medium**
- **Extent**: The extent of the impact is **site specific** as the impacts will be limited to the boundaries of the site.
- **Duration**: The duration would be **medium term** considering long period required for sites to recover.
- **Intensity/ Severity**: The intensity is **medium** given the diverse and sensitive habitats affected.

Likelihood – The impact has a **high probability** of occurring.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE

Table 5: Flora Construction Impact Assessment before mitigation

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Construction					
Flora	**1**	**3**	**6**	**4**	**40**
	Site	Medium term	Medium	Highly probable	**Moderate**

Mitigation Measures

Mitigation objective

To minimise destruction or degradation of flora and ensure legal compliance in this regard

Mitigation measure(s)

- All indigenous species is retained as far as possible and where alien species are encountered they are removed.
- The selection of laydown areas will consider already disturbed areas first.
- Any nationally protected trees within close proximity of the development footprint as no-go areas.

- Given the hyper-arid nature of the area active re-vegetation of disturbed areas is not recommended on account of the very low success that is likely to result. It is rather recommended that adequate and appropriate surface preparation which will encourage natural regeneration of the vegetation and ensure long-term vegetation recovery is performed.
- Along areas with deep sandy soils the topsoil should be put aside and replaced after disturbance.
- All construction staff should undergo an environmental induction from a suitably qualified person regarding the importance of footprint management.
-

9.1.2 Fauna – Construction Phase Impact Assessment

Although limited indigenous fauna and evidence of indigenous fauna was found on site, the precautionary measures for possible presence of some fauna are incorporated. The construction of the drill site pads and associated two track road will result in temporary habitat loss for resident domestic and/or indigenous fauna and temporary increased levels of noise, pollution, disturbance and human presence during construction will affect fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some mammals and reptiles such as lizards and tortoises would be vulnerable to illegal collection or poaching during the construction phase by the construction personnel.

Direct and indirect impacts of the development on avifauna are expected to be negligible as the site is intermittently frequented by avifauna for feeding, perching, sleeping. No nests or evidence of breeding by avi-fauna was found on site.

Construction Impact: Fauna

Nature: The construction phase will result in noise, disturbance, and fauna habitat impact, resulting in **direct negative and indirect negative** impacts on the status quo of the site.

Impact Magnitude –**Low**
- **Extent**: The extent of the impact is **site specific** as the impacts will be limited to the boundaries of the site.
- **Duration**: The duration would be **short-term**
- **Intensity**: The intensity is **low** given the scale of the proposed development and nature of impacted environment.

Likelihood – The impact has a **definite** likelihood of occurring.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – LOW

Table 6: Fauna Construction Impact Assessment

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Construction					
Fauna	**1**	**1**	**2**	**5**	**20**
	Site	Short term	Low	Definite	**Low**

Mitigation Measures

Mitigation objective

To minimise destruction or degradation of biodiversity

Mitigation measure(s)

- Any rubble and other drilling materials and litter removed from the site.
- Any fauna directly threatened by the construction activities should be removed to a safe location by a person suitable to do so.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander away from the construction area into the natural veldt.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises, as well as to minimize dust generation.
- All vehicles and drill rigs to remain on demarcated roads and access routes.

9.1.3 Ecological – Construction Phase Impact Assessment

Ecological impacts translate the sensitivity mapping into the impact assessment and present this with specific mitigation measures to address potential impacts on ecologically sensitive areas.

Construction Impacts - Ecological

Nature: The construction phase will require clearing of areas for infrastructure, resulting in **direct negative and indirect negative** impacts on the different ecological niches or habitats.

Impact Magnitude –**Medium**
- **Extent**: The extent of the impact is **site specific** as the impacts will be limited to the boundaries of the site.
- **Duration**: The duration would be **medium term** considering long period required for sites to recover.
- **Intensity/ Severity**: The intensity is **medium** given the diverse and sensitive habitats affected.

Likelihood – The impact has a **high probability** of occurring.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE

Table 7: Ecological Construction Impact Assessment

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Construction					
Ecology	**1**	**3**	**6**	**4**	**40**
	Site	Medium term	Medium	Highly probable	**Moderate**

Mitigation Measures

Mitigation objective

To minimise destruction or degradation of sensitive habitats and ecological processes

Mitigation measure(s)

- Avoidance and reduced activity (in terms of activities, extent and duration) should be applied to highly sensitive ecological areas as mapped on the sensitivity mapping.
- Habitat fragmentation (by cross cutting any one habitat type) should be avoided as far as possible.
- No fires should be allowed on-site.
- No fuel wood collection should be allowed on-site.
- In order to minimize the disturbed area and disturbance impact the project should be completed as soon as possible and return to a state of recovery before the next rain season. It should be endeavored that the construction site and loose material will not be exposed to rain resulting in excessive erosion, siltation and general disturbance down slope.

9.1.4 Hydrological – Construction Phase Impact Assessment

Hydrological impacts are generally low, but with medium term impacts considering the extended impact on catchment runoff where the road construction is expected to take place.

Construction Impacts - Hydrological

Nature: The construction phase will require clearing of soils, creation of roads (water flow channels) for infrastructure, resulting in **direct negative and indirect negative** impacts on the surface hydrology of the site.

Impact Magnitude –**Low**
- **Extent**: The extent of the impact is **local** as impacts affect surrounding local area.
- **Duration**: The duration would be **medium term** considering long period required for sites to recover.
- **Intensity/ Severity**: The intensity is **Low** given the limited functionality of the hydrological areas and short term of the impact.

Likelihood – The impact has a **definite** likelihood of occurring.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – LOW

Table 8: Hydrological Construction Impact Assessment

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Construction					
Hydrology	**2**	**3**	**2**	**5**	**35**
	Local	Medium term	Low	Definite	**Low**

Mitigation Measures

Mitigation objective

To minimise negative impacts on surface hydrology

Mitigation measure(s)

- Within the catchment head water areas and washes area itself (outflow from mountain slope), measures to ensure that the development footprint is minimized should be taken. This include:
  - Evaluating and installing erosion control measures upfront;

- Reduce silt / soil generating within the stream itself by using the existing tracks, landscape contours as far as possible;
- minimizing construction vehicle activity in these areas as well as
- Demarcating the final footprint upfront to limit extended impacts.

- The access roads and all other hardened surfaces (drill pads) should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion during construction to ensure that no erosion problems have developing as result of the construction disturbance.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and re-vegetation techniques.
- Once construction activities have been completed the disturbed areas should be stabilized to allow site hydrology to continue with limited erosion.

9.2 Operational Phase Impacts

The operational phase will include most of the construction activities, as applicable to each drill site that must be established as well as the impacts of the actual drilling. The major impacts are the generation of waste and possible pollution because of spillages. The increased erosion potential due to lack of road / site maintenance must also be considered.

9.2.1 Flora - Operational Phase Impact Assessment

The extent of the impact is **local** as the impacts will be limited to the boundaries of the sites. The duration will be **short-term** with impact less than one rainy season (less than 12 months). The intensity is **low** with the majority of the impacts already taking place at construction. Existing controls are considered in terms of waste generation and this further result in low intensity impact rating. The impact is **certain**.

Operational Impact Statement: Flora

Nature: Drilling, possible pollution and related waste generation.

Impact Magnitude –**Low**
- **Extent**: The extent of the impact is **site specific** as the impacts will be limited to the boundaries of the site.
- **Duration**: The duration will be **medium-term** as soils polluted will result in medium term impacts on vegetation recovery
- **Intensity**: The intensity is **low**
-

Likelihood – The impact has a **highly probable** likelihood to occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – LOW

Table 9: Flora Operational Phase Impact Assessment

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Operational					
Flora	**1**	**3**	**2**	**4**	**24**
	Site	Medium term	Low	Highly probable	**Low**

Mitigation Measures

Mitigation objective

To minimise biodiversity impact, soil erosion in the proposed development area.

Mitigation measure(s)

Mitigation includes all of the construction mitigation measures listed above with the addition of the following:

- General waste accumulating on site should be sorted, stored and deposed of at a registered waste facility
- Sanitary waste must be contained in mobile toilets and removed from site by a competent contractor.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. The material and its waste must be placed on a PVC liner, in a bunded area with a lid to contain the material.
- Mineral waste in the form of drill sludge should be contained and removed from site to allow for site recovery.
- Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.

9.2.2 Fauna - Operational Phase Impact Assessment

Operational impact considers the impact of fauna movement and probability of conflict between people and fauna for the duration of the operational phase.

Operational Impact: Fauna

Nature: Drilling, noise, disturbance on site and possible pollution and related waste generation.

Impact Magnitude –**Low**
- **Extent**: The extent of the impact is **site specific** as the impacts will be limited to the boundaries of the site.
- **Duration**: The duration will be **short-term** as operational impacts stop immediately with end of operations
- **Intensity**: The intensity is **low**
-

Likelihood – The impact has a **highly probable** likelihood to occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – NEGLIGIBLE

Table 10: Fauna Operational Impact Assessment

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Operational					
Fauna	**1**	**1**	**2**	**4**	**16**
	Site	Short term	Low	Highly probable	**Negligible**

Mitigation Measures

Construction mitigation measures apply verbatim to fauna operational phase mitigation measures.

9.2.3 Ecological Sensitive areas - Operational phase impact assessment

Sensitive areas are deemed more sensitive to the additional impacts that could occur during the operational phase and is evaluated in line with the sensitivity mapping. Operational phase impacts are however considered of lesser degree of impact as construction phase in terms of sensitive areas.

Operational Impact Statement: Ecological

Nature: Drilling, possible pollution and related waste generation.

Impact Magnitude –**Low**
- **Extent**: The extent of the impact is **site specific** as the impacts will be limited to the boundaries of the site.
- **Duration**: The duration will be **medium-term** as soils polluted will result in medium term impacts on habitats
- **Intensity**: The intensity is **low**
-

Likelihood – The impact has a **highly probable** likelihood to occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – LOW

Table 11: Ecological Operational Phase Impact Assessment

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Operational					
Ecology	**1**	**3**	**2**	**4**	**24**
	Site	Medium term	Low	Highly probable	**Low**

Mitigation Measures

Mitigation objective

To minimise ecological sensitive area impact in the proposed development area.

Mitigation measure(s)

Mitigation includes all of the construction mitigation measures listed above with the addition of the following:

- Any maintenance activities required should maintain the low footprint of the pipeline and disturbance within the sensitive parts of the pipeline route should be avoided as much as possible.

- Contaminated soils or water should be contained and treated on-site with approved amelioration chemicals / bacteria or removed from site as hazardous waste or treated on-site at a licensed bio-remediation site.

9.2.4 Hydrological - Operational Phase Impact Assessment

Operational phase has reduced impacts compared to construction phase, but with accumulation of dust, loose soils and possible increased erosion potential increasing as the project continues over time.

Operational Impact: Hydrology

Nature: Drilling, noise, disturbance on site and possible pollution and related waste generation.

Impact Magnitude –**Low**
- **Extent**: The extent of the impact is **local** as the impacts will affect local sphere of influence.
- **Duration**: The duration will be **short-term** as operational impacts stop immediately with end of operations
- **Intensity**: The intensity is **low**
-

Likelihood – The impact has a **highly probable** likelihood to occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – LOW

Table 12: Hydrological Operational Impact Assessment

ASPECT	CONSEQUENCE OF IMPACT			LIKELIHOOD	SIGNIFICANCE
Type	**Scale**	**Duration**	**Magnitude**	**Probability**	**Without Mitigation**
Operational					
Hydrology	**2**	**1**	**2**	**4**	**20**
	Local	Short term	Low	Highly probable	**Low**

Mitigation Measures

Construction mitigation measures apply verbatim to hydrological operational phase mitigation measures.

9.3 Decommissioning Impacts

Decommissioning phase impacts have not been explicitly assessed for the impacts on biodiversity, as they are likely to be similar to that of the potential construction phase impacts.

9.4 Cumulative Impacts

9.4.1 Cumulative Impacts from Construction Phase

The development would contribute to cumulative habitat loss and degradation in the area. Cumulatively, the planned exploration activities can result in mining of the area.

The primary avenue for cumulative impact on fauna will be through cumulative habitat loss for fauna, extensive un-impacted south slope areas are however still intact on the same mountain. Direct impacts on fauna during construction will be transient and could temporarily result in short term cumulative impact.

The construction and soil disturbance will result in cumulative habitat degradation over the short term with potential long term erosion and siltation of catchment rain water down slope.

The contribution to cumulative impact is likely to be relatively low if all the mitigation measures are put in place.

9.4.2 Cumulative impacts from Operational Phase

The extended disturbed area associated with the access road and new drill sites operated could contribute towards cumulative habitat loss where pollution takes place in addition to the site clearance. The compliance to mitigation measures during operation is thus important to limit cumulative impacts.

Cumulative impact during operational phase could be the increased road kills for fauna and disruption of avi-fauna breeding where nests could occur in the area. Cumulative flora impacts from operational phase could be loss of seed bank where poor topsoil management takes place.

The contribution to cumulative impact is likely to be relatively low if all the mitigation measures are put in place.

9.5 Residual Impacts

9.5.1 Residual Impacts from Construction Phase

The loss of indigenous plant species from the development footprint cannot be fully mitigated. Assuming the above mentioned mitigation measures are implemented, the construction phase impact significance would be reduced to Low.

Not all faunal impacts can be mitigated and there will be some residual impact resulting from noise, disturbance and mortality of species unable to flee the drilling activities. Assuming the above mentioned mitigation measures are implemented, the construction phase impact significance will remain at Low.

9.5.2 Residual impacts from Operational Phase

There will be minimal residual impact from the operation of drill sites as the majority of the impact occur during construction, the impact significance will remain at Minor.

After mitigation the residual impact of the drill pads and associated infrastructure should be relatively low with all the required mitigation measures applied. Assuming the above mentioned mitigation measures are implemented, the impact significance will remain at Minor.

10 Summary of Results

The impact assessments indicate only flora and ecologically sensitive areas as having moderate significance during construction phase with the greatest significance rating during operational phase as Low impact significance.

The mitigations are stipulated for each area assessed and if applied, should result in little cumulative and residual impacts after the project has been completed.

The summary of results is tabled below indicating the impact assessment results when all mitigation measures are in place.

Table 13: Summary of Results

ASPECT	SIGNIFICANCE	
Type	Without Mitigation	With Mitigation
Construction		
Flora	40	20
	Moderate	Low
Fauna	20	16
	Low	Negligible
Ecology	40	20
	Moderate	Low
Hydrology	35	28
	Low	Low
Operational		
Flora	24	24
	Low	Low
Fauna	16	16
	Negligible	Negligible
Ecology	24	24
	Low	Low
Hydrology	20	15
	Low	Negligible

Provided that the mitigation measures as suggested can be implemented, the overall impact of the development would be of a low significance if all mitigation measures are applied.

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