

### 14.1 INTRODUCTION

The aim of the ESIA for the proposed Gamsberg mine is to provide information to inform decision-making that will contribute to environmentally and socially sound and sustainable development. This report is submitted to the DENC and DMR to enable them to consider whether or not to grant authorisation to the proposed development in terms of NEMA and MPRDA respectively and if granted, to assist them in defining under what conditions the development should go ahead.

Through the ESIA process which has included various stakeholder and specialist input, ERM has identified and assessed a number of issues relating to BMM proposed open pit mine development at Gamsberg. This Chapter provides an overview of the ESIA findings and makes recommendations regarding key mitigation measures.

### 14.2 THE PROJECT

BMM, a subsidiary of the Vedanta Resources plc, intends to establish the zinc mine and concentrator plant located in the Northern Cape Province of South Africa, between the existing town of Aggeneys and the town of Pofadder, approximately 120 km east of the Springbok, along the N14. The site is commonly referred to as Gamsberg, and is characterised by an oval shaped inselberg, that extends approximately 220 meters above the surrounding plains.

The main mine and infrastructure will include an open pit at the top of the inselberg, crusher, various stockpiles and conveyor belts, waster rock dumps, a tailing storage facility, concentrator plant, workshops, access and haul roads and other mine infrastructure as shown in *Figure 3.1* above. Off-site linear infrastructure in the form of energy and water supply as well as transport routes are also included. Residential housing and associated infrastructure in support of the project will also be established in Aggeneys. All of the above are the subject of this ESIA application.

The Port of Saldanha is currently used by BMM for exporting its products and it is intended that the Project will also utilise this Port. At this stage, only preliminary design and layout options for the expected expansions or upgrades to accommodate the additional zinc concentrate export have been undertaken. Pending outcomes from further feasibility studies and engagement with the National Ports Authority, the preferred option to accommodate the increase in zinc exports will be confirmed and this will be subject to a separate environmental application process, if required.

### 14.3

#### *ALIGNMENT WITH PROVINCIAL, DISTRICT AND MUNICIPAL PLANNING AND DEVELOPMENT STRATEGIES*

A critical aspect of economic desirability of the project is whether the proposed development complements economic planning as reflected in spatial development planning. The Northern Cape Growth and Development Strategy and Spatial Development Framework, the Namakwa District Integrated Development Plans and Spatial Development Framework and the Khâi-Ma Local Municipality Integrated Development Plan and Spatial Development Framework as a whole recognise the importance of mining for the future economic development of the area. They also recognise the need for an integrated and diversified economic development that makes optimal use of each area's comparative advantages including their natural resources, sense of place and human capital.

Given the above, the proposed project is in principle compatible with the local planning and economic development strategies. However, these documents also call for caution regarding the global and national significance of the biodiversity of the mining site in particular and recognise the importance of the biodiversity of the area and its links to potential tourism opportunities. The balance between conserving biodiversity whilst promoting economic development through the development of the mining sector is key to this ESIA.

### 14.4

#### *THE AFFECTED ENVIRONMENT*

The Gamsberg lies at the heart of what is termed the "Bushmanland Inselberg Region", which includes all the large, quartzite-capped inselbergs located in the northern Bushmanland plains in South Africa. This region is located on the boundary between winter and summer rainfall systems of southern Africa, and the overlap of two biomes is a unique feature and sets these inselbergs apart from other inselbergs elsewhere in the Nama Karoo.

The Bushmanland Inselbergs effectively comprise an archipelago of rocky islands within a vast expanse of sand. These rocky islands share common floristic affinities that are fundamentally distinct from the surrounding sandy plains. The flora of these inselbergs forms a distinct centre of plant endemism located within the larger Eastern Gariep Centre of Endemism. There are many species endemic to the Bushmanland Inselbergs and the region is defined as a distinct centre of endemism termed the "Bushmanland Inselberg Centre of Endemism". This centre of endemism is sometimes referred to as the "Gamsberg Centre of Endemism" as this inselberg lies at the floristic centre of this region and is the key biodiversity feature underpinning ecological processes/ function in this system. The endemism is associated with the inselbergs and not the sandy Bushmanland plains that comprise 90% of the region.

The biodiversity sensitivity of the Project area has been established over a number of years of research in the area associated with bioregional planning initiatives and previous EIA applications for mining activities in the Gamsberg inselberg. As a result of these processes the potential need for biodiversity offset <sup>(1)</sup> was identified at the start of the ESIA process, while recognising that an offset must be a 'last resort': every effort must be made rather to avoid and minimize potential impacts. The need to avoid irreplaceable <sup>(2)</sup> and constrained habitat was thus considered in the early planning phases of the project. A Regional Habitat Study was also commissioned by BMM to run concurrent to the ESIA process. The purpose of the Regional Study was to confirm the types of habitats present in the region and their similarity to habitat found on the Gamsberg inselberg. The Regional Habitat Study also helped inform the feasibility <sup>(3)</sup> of this biodiversity offset process, as it confirmed that most of the habitat found on the Gamsberg inselberg is present in other parts of the region.

The sensitivity of the biodiversity of the region is contrasted by the high unemployment rates at municipal, district and provincial level at 22.9%, 20.1% and 27.4% respectively. This rate increases if discouraged work-seekers are included in estimates to 31.2%, 27.1% and 34.1% respectively. Mining activities form the cornerstone of the local economy, contributing over 50% to the GDP of the Namakwa District in 2007. The next closest contributor to the local GDP is the trade, catering and accommodation sector at just over 10% with agriculture and fishing at below 5%. Renewable energy is seen as a potential key contributor in the future.

The dominant sector in terms of employment in the Namakwa District is mining which provided 21.3% of all employment opportunities in 2007 followed by agriculture and fishing which provided 18% of all jobs. Whilst these two sectors remain the major sources of employment, their relative contribution has declined between 1995 and 2007 by roughly 5%. The wholesale retail trade, catering and accommodation sector showed the greatest proportional increase in job creation over this period up from 11% of employment in 1995 to 14% in 2007.

## 14.5

### *CONSIDERATION OF ALTERNATIVES AND AVOIDANCE OF IMPACTS*

As a result of the high biodiversity sensitivity of the project area of influence it was important to demonstrate that the mitigation hierarchy of, avoid at source, abate on site, abate at receptor, repair (including rehabilitation) or

(1) According to the Business and Biodiversity Offset Program, a biodiversity offset is defined as the following: "the measurable conservation outcomes resulting from actions designed to compensate for significant negative residual impacts on biodiversity.

(2) "Irreplaceable habitat" is equivalent to the IFC PS6 definition of "critical habitat", while "constrained and flexible habitat" are equivalent to the "natural habitat" definition.

(3) Note that this excludes the process of securing the relevant properties and reaching mutual consensus on purchase agreement.

remedy and finally compensate (including offsets) in kind; was robustly adopted. A key driver in terms of avoiding the impact on biodiversity is the size and location of the mine footprint. Prior to considering the detail of the mine layout, it was recognised that underground mining would result in a smaller footprint than open pit mining. BMM's base case for this project, however, included the open pit mining option. As a result, and to adhere to the mitigation hierarchy of firstly striving to avoid the impacts, BMM was requested to consider the potential of adopting an underground mining technique.

BMM appointed AMEC Engineers to undertake a Technical Feasibility Study to consider the technical and commercial viability of undertaking underground mining. At this early stage, no environmental costs were considered in the Technical Feasibility Study for the underground options. The first priority was to establish if the underground mining options was feasible irrespective of any environmental or social mitigation. It was, however, acknowledged upfront, that an open pit mine may result in greater impacts on biodiversity and that a biodiversity off-set was highly likely to be required. The associated off-set costs would need to be considered as part of the overall feasibility of the open pit option. However, the first step in the process was to establish if underground mining would be feasible based on the existing site conditions. The study concluded that the underground mining option was not viable under the present circumstances; BMM supported this conclusion and maintained the open pit mining option as their base case to be assessed as part of this ESIA. The overall feasibility of the open pit option will be tested once the costs of mitigation included in this ESIA are considered in final feasibility calculations.

To avoid significant biodiversity impacts associated with the open pit mine option, a number of alternative locations for key mine infrastructure were considered. This was done by providing a detailed habitat sensitivity map (*Figure 4.2*) to the engineering team and working with them to assess each alternative against a number of criteria (*Table 4.5*). The primary criterion for selecting the preferred alternative was based on the avoidance of irreplaceable and where possible constrained habitat. Alternative locations were assessed for the following mine components: waste rock dump, tailings dam, contractors camp, ore crusher, engineering workshop, access road to the inselberg (are where open pit is located), and concentrator plant. Other infrastructure such as the expansion of the Aggeneys town and associated wastewater treatment plant were not considered as these areas were not established within irreplaceable/constrained vegetation.

The process of considering alternative locations for the key mine infrastructure (excluding the pit and the north-western waste rock dump), allowed for the avoidance of significant amounts of irreplaceable habitat with some impact remaining on constrained and flexible habitat. However, due to the shape and dimensions of the mineral reserve, avoidance of irreplaceable and constrained habitat when designing the open pit was not possible. A

small section of irreplaceable habitat on the western edge of the north-western waste rock dump was also not possible due to engineering constraints. The footprint impact of the pit and western edge of the north-western waste rock dump represents the only important impact on irreplaceable habitat with the remaining area of the pit and other infrastructure impacting on constrained and flexible habitat. The process of avoidance and consideration of alternative locations resulted in a final mine layout plan (*Figure 3.1*) that has been the subject of this ESIA.

#### 14.6 SUMMARY OF BIOPHYSICAL IMPACTS

A number of biophysical impacts were assessed as part of the ESIA including the following:

- Impact on air quality;
- Impacts on groundwater;
- Impacts on biodiversity;
- Impacts on surface hydrology;
- Noise and vibration impacts; and
- Impact on climate change and GHG emissions.

Each of the above impact types was assessed for the construction, operation and decommissioning phases of the proposed project. Appropriate mitigation was recommended according to the mitigation hierarchy as referred to in Chapter 4. Detailed measures recommended to minimise negative impacts or enhance positive impacts were provided and included in a detailed EMPR in *Annex D*. The residual impact was then assessed and an impact significance rating given. The summary of biophysical impacts of the project is included in *Table 14.1* below:

Table 14.1 Summary of Impact Assessment (pre and post mitigation)

Primary/Secondary Impact	Construction Phase		Operational Phase		Decommissioning Phase	
	Pre-mitigation Significance	Residual Impact Significance	Pre-mitigation Significance	Residual Impact Significance	Pre-mitigation Significance	Residual Impact Significance
<b>Biophysical Impacts</b>						
<b>Impact on Air Quality</b>						
Impact on Air Quality	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	MINOR (-ve)	MINOR (-ve)	N/A	N/A
<b>Impact on Groundwater</b>						
Impact of Drawdown on Groundwater Resource	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	MODERATE (-ve)	MODERATE (-ve)	MODERATE (-ve)	MODERATE (-ve)
Impact of Drawdown on Groundwater Users	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	MODERATE (-ve)	NEGLIGIBLE (-ve)
Impact on Groundwater Quality	MINOR (-ve)	NEGLIGIBLE (-ve)	MODERATE (-ve)	MODERATE (-ve) to MINOR (-ve)	MODERATE (-ve)	MODERATE (-ve) to MINOR (-ve)
Impact of Water Quality on Groundwater Users	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)
<b>Impact on Biodiversity</b>						
Habitat Loss Caused by the Mine Footprint and Associated Activities	MAJOR (-ve)	MODERATE (-ve) to MAJOR (-ve)	MAJOR (-ve)	MODERATE (-ve) to MAJOR (-ve)	MAJOR (-ve)	MODERATE (-ve) to MAJOR (-ve)
Impacts Resulting from Habitat Degradation from Dust Deposition	MODERATE (-ve)	MODERATE (-ve)	MAJOR (-ve) (Low confidence)	MAJOR (-ve) (Low confidence)	MODERATE (-ve) (Low confidence)	MODERATE (-ve) (Low confidence)
Impacts on Habitat resulting from Groundwater Drawdown	MAJOR (-ve)	MODERATE (-ve)	MAJOR (-ve)	MAJOR (-ve)	MAJOR (-ve)	MAJOR (-ve)
Impacts Arising from Habitat Fragmentation	MODERATE (-ve)	MODERATE (-ve)	MAJOR (-ve)	MODERATE (-ve)	MAJOR (-ve)	MODERATE (-ve)
Impacts on Species Diversity as a result of Mining-related Activities	MODERATE (-ve)	MINOR (-ve)	MAJOR (-ve)	MODERATE (-ve)	MAJOR (-ve)	MODERATE (-ve)
Impacts from Encroachment of Alien Species	MODERATE (-ve)	MODERATE (-ve)	MODERATE (-ve)	NEGLIGIBLE (-ve)	MINOR (-ve)	NEGLIGIBLE (-ve)
Impacts of Human Influx on Biodiversity	MODERATE (-ve)	MINOR (-ve)	MINOR (-ve)	MINOR (+ve)	MINOR (-ve)	MINOR (+ve)
<b>Impact on Surface hydrology</b>						
Removal and alteration of natural water courses	MODERATE (-ve)	MINOR (-ve)	N/A	N/A	N/A	N/A
Impact of reduced peak runoff and discharge volumes on water courses	MODERATE (+ve)	MODERATE (+ve)	MODERATE (+ve)	MODERATE (+ve)	MODERATE (+ve)	MODERATE (+ve)
Impact of Reduction in Mean Annual Runoff on Downstream Surface Water Resources	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)
Impact of Increased Sediment Yield on Surface Water Quality	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)
Impact of Increased Pollutant Load on Surface Water Quality	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)
<b>Noise and Vibration Impacts</b>						
Noise and Vibration Impacts	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	N/A	N/A
<b>Impact on Climate Change and GHG emissions</b>						
Impact of Project GHG Emissions on South Africa's National Emissions	N/A	N/A	MODERATE (-ve)	MINOR (-ve)	N/A	N/A
<b>Socio-Economic Impacts</b>						
<b>Impact on Economic Environment</b>						
Impacts linked to Project expenditure	MODERATE (+ve)	MAJOR (+ve)	MODERATE (+ve)	MAJOR (+ve)	MAJOR (-ve)	MODERATE (-ve)

<i>Impacts on key macro-economic variables</i>	NEGLIGIBLE	NEGLIGIBLE	MAJOR (+ve)	MAJOR (+ve)	MAJOR (-ve)	MAJOR (-ve)
<i>Impacts on tourism</i>	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve) TO MAJOR (-ve)	MODERATE (-ve)	MINOR (+ve)	MODERATE (+ve)
<i>Impacts on surrounding land uses</i>	MODERATE (-ve)	MINOR (-ve) TO MODERATE (-ve)	MODERATE (-ve)	MINOR (-ve) TO MODERATE (-ve)	MINOR (+ve)	MINOR (+ve) TO MODERATE (+ve)
<i>Impacts on municipal services</i>	MODERATE (-ve)	MODERATE (+ve)	MODERATE (-ve)	MODERATE (+ve)	MODERATE (-ve)	MODERATE (-ve)
<b>Impact on Social Environmental</b>						
<i>Employment opportunities</i>	MODERATE (+ve)	MAJOR (+ve)	MODERATE (+ve)	MAJOR (+ve)	MAJOR (-ve)	MODERATE (-ve)
<i>Training and skills development</i>	MINOR (+ve)	MODERATE (+ve)	MINOR (+ve)	MODERATE (+ve)	MINOR (+ve)	MODERATE (+ve)
<i>Procurement and services</i>	MODERATE (+ve)	MAJOR (+ve)	MODERATE (+ve)	MAJOR (+ve)	N/A	N/A
<i>Economic diversification</i>	MINOR (+ve)	MINOR (+ve)	MINOR (+ve)	MINOR (+ve)	MAJOR (-ve)	MODERATE (-ve)
<i>Unmet Expectations and Potential for Social Unrest</i>	MAJOR (-ve)	MINOR (-ve) to MODERATE (-ve)	MAJOR (-ve)	MINOR (-ve) to MODERATE (-ve)	N/A	N/A
<i>Increased Pressure on Infrastructure and Services (Direct)</i>	MINOR (-ve)	NEGLIGIBLE (-ve)	MINOR (-ve)	NEGLIGIBLE (-ve)	MODERATE (-ve)	MINOR (-ve)
<i>Road Infrastructure and Transport (Direct)</i>	MODERATE (-ve)	MINOR (-ve)	MINOR (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)
<i>Health Impacts: Communicable diseases</i>	MAJOR (-ve)	MODERATE (-ve)	MINOR (-ve) to MODERATE (-ve)	MINOR (-ve) to NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)
<i>Health Impacts: Road traffic accidents</i>	MODERATE (-ve)	MINOR (-ve) to MODERATE (-ve)	MODERATE (-ve)	MINOR (-ve) to MODERATE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)
<i>Impact in Relations between Locals and In-migrants</i>	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)
<i>Impact on Social Pathologies</i>	MODERATE (-ve)	MINOR (-ve) to MODERATE (-ve)	MODERATE (-ve)	MINOR (-ve) to MODERATE (-ve)	MODERATE (-ve)	MINOR (-ve) to MODERATE (-ve)
<i>Impact on Sense of Place</i>	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)
<i>Local Cultural and Social Values</i>	MINOR (+ve)	MINOR (+ve)	MINOR (+ve)	MINOR (+ve)	MINOR (+ve)	MINOR (+ve)
<i>Increased Pressure on Infrastructure and Services (Indirect resulting from Influx)</i>	MINOR (-ve)	MINOR (-ve)	MINOR (-ve)	MINOR (-ve)	MINOR (-ve)	MINOR (-ve)
<i>Increased Pressure on Infrastructure and Services (Indirect resulting from Influx)</i>	MAJOR (-ve)	MODERATE (-ve)	MODERATE (-ve)	MINOR (-ve)	MINOR (-ve)	NEGLIGIBLE (-ve)
<i>Communicable Diseases (Indirect resulting from Influx)</i>	MAJOR (-ve)	MODERATE (-ve)	MINOR (-ve) to MODERATE (-ve)	MINOR (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)
<b>Impact on Visual Resources</b>						
<i>Impact on the Aesthetic Value of the Landscape</i>	MAJOR (-ve)	MAJOR (-ve)	MAJOR (-ve)	MAJOR (-ve)	MAJOR (-ve)	MAJOR (-ve)
<b>Impact on Traffic and Transport</b>						
<i>Impact on Traffic and Transport Networks</i>	MINOR (-ve)	NEGLIGIBLE (-ve)	MINOR (-ve)	MINOR (-ve)	MINOR (-ve)	NEGLIGIBLE (-ve)
<b>Impact on heritage, Palaeontology and Archaeology</b>						
<i>Impact on Archaeology</i>	MAJOR (-ve)	MODERATE (-ve)	MAJOR (-ve)	MODERATE (-ve)	N/A	N/A
<i>Impact on Cultural Heritage and Sense of Place</i>	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)	MODERATE (-ve)	MINOR (-ve)
<i>Impact on Palaeontology</i>	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	NEGLIGIBLE (-ve)	N/A	N/A

It is evident from *Table 14.1* that there are several residual negative impacts of moderate and high significance remaining after mitigation. Each of the impacts is discussed below.

### **Impact on Groundwater**

The first of these impacts relates to the groundwater quality and quantity which are assessed to have a moderate negative residual impact at various stages of the project. In an arid environment where water is scarce the management of any groundwater impacts is important.

The groundwater quality impacts are primarily linked to the acid mine drainage potential of the tailings that emanate from the concentrator plant and the waste rock dump. The area of impact (dispersion plume), as modelled in a worst case scenario, at the end of the life of mine is contained within the tailing facility and waste rock dump footprint. Modelling to 100 years post mine closure shows a marginal difference with both plumes remaining within the mine license area. No impact on any groundwater users is expected. The mitigation measures recommended for the impact on groundwater quality relate to the design of the tailings storage facility and the associated engineering design measures to minimise contamination of the groundwater. On-going water quality monitoring and management of the tailings storage facility will continue through the life of mine and into mine closure phase.

The residual negative impact associated with the drawdown of groundwater as a result of the open pit is considered to be moderate through the operation to the decommissioning phases and cannot be mitigated. However, it should be noted that alternative water sources can be provided to farmers dependant on groundwater in the vicinity of the mine if they are impacted by drawdown and the impact on groundwater drawdown is therefore assessed to be negligible. The impact of groundwater drawdown on biodiversity is considered in the next section.

### **Impact on Biodiversity**

The negative impact on biodiversity is primarily a result of the footprint of the mine infrastructure, the drawdown of the groundwater and the impact of dust as a result of the mine activities.

The footprint of the mine infrastructure, and specifically the open pit, result in an irreversible negative impact on constrained and irreplaceable vegetation. There is no mitigation for this impact and the residual impact remains major; the impact can only be addressed through a biodiversity offset. The headwater seep represents a unique habitat that is considered non-offsetable. The residual negative impact significance for loss of this habitat remains major irrespective of any mitigation. The loss of the seep area would require ecological compensation through conserving 'unlike' habitat of conservation priority.



Further impacts on irreplaceable habitat are incurred through the drawdown of groundwater as a result of the open pit. The aquatic habitats within the inselberg will be irreversibly lost resulting in a residual negative impact of major significance. The Kloof is considered to be an irreplaceable habitat and considered non-offsettable. As for the seep habitat, some form of ecological compensation will be required.

The impact of dust on the irreplaceable and constrained habitats around the mine pit and associated infrastructure is also considered to have residual negative impact of major significance. The key driver of this impact is the sensitivity of some of the tiny but threatened succulent plants (particularly within the fine grain quartz gravel plains) which could be highly sensitive to dust deposition. The dust fall out may change the physical structure of the gravel substrate as well as the chemical composition of the soil surface from the acid forming dust. However, it is recognised that there is a high degree of uncertainty in understanding the actual impacts of the physical and chemical properties of the dust on these habitats. The actual dust footprint of the mine, the colour and the chemical composition of the dust is also uncertain. In light of the uncertainty and the extreme sensitivity of the affected ecology, a precautionary approach has been adopted. Certain irreplaceable and constrained habitats that are considered to be impacted by dust are partially offsettable and have been included in the offsets calculations.

The impact arising from habitat fragmentation and species diversity is considered to have a residual negative impact of moderate significance. Inselbergs within the Bushmanland Inselberg Region represent an archipelago of rocky islands within a vast expanse of sand. These inselbergs serve as stepping stones for many species that hop from one inselberg to another and represent an important ecological corridor. The Gamsberg is located at the centre of this floristic centre of endemism and is the key biodiversity feature underpinning the ecological connectivity of the greater system. Mining will reduce the Gamsberg's ecological function as a corridor for species between inselbergs. Impacts on habitat fragmentation can be mitigated by safeguarding the remaining landscape linkages and associated habitat through the design of the offset.

The Gamsberg supports a high diversity of species, but particularly the many endemic, rare, threatened, protected and some undescribed species that are currently not adequately understood. A number of species within the Gamsberg are considered to be at risk due to the proposed mining activities. Mitigation measures recommended in this regard together with the proposed offset that would result in the acceptable reduction of this impact's significance.

Based on the need for offsets, a Regional Habitat Study was undertaken in parallel to the ESIA process together with a detailed Offsets Study. Through these two studies, it was established that a biodiversity offset is feasible and

land parcels within the vicinity of the mine exist with suitably intact habitat. However, as mentioned earlier, some non-offsetable habitats will be lost and would require ecological compensation through conserving 'unlike' habitat of conservation priority. The acceptability of this loss will need to be tested through engagement with key stakeholders and authorities.

## 14.7

### *SUMMARY OF SOCIO-ECONOMIC IMPACTS*

A number of socio-economic impacts were assessed as part of the ESIA including the following:

- Impact on economic environment;
- Impact on social environment;
- Visual impacts;
- Impacts on traffic and transport infrastructure; and
- Impact on heritage, palaeontology and archaeology.

Each of the above impact types were assessed for the construction, operation and decommissioning phases of the proposed project. Appropriate mitigation was recommended according to the mitigation hierarchy as referred to in Chapter 4. Detailed measures recommended to minimise negative impacts or enhance positive impacts were provided and included in a detailed EMPR in *Annex D*. The residual impact was then assessed and an impact significance rating given. The summary of socio-economic impacts of the proposed project is included in *Table 14.1* above:

It is evident from *Table 14.1* that there are several residual positive and negative impacts of moderate and high significance remaining after mitigation. Each of the impacts is discussed below.

#### **Impact on Economic Environment**

The benefits linked to project spending and impacts on key macro-economic variables during the construction and operational phases of the project are considered to have a residual positive impact of major significance.

The project would have a positive impact on economic activity in the local area and region given the sizes of the new spending injections associated with it. Preliminary estimates indicate that a total of approximately R8.35 billion would be spent on all aspects of the construction phase. It is anticipated that approximately 3,200 contract jobs with an average duration of 19 months each would be associated with all construction expenditure. Based on the likely availability of labour and the experience of the BMM in the area and at other sites, approximately 357 workers would probably come from within Khâi-Ma Municipality, a further 1,335 workers from the rest of the Namakwa District and 960 workers from the rest of the Northern Cape. Direct household income impacts would flow from all wages paid during construction. Total incomes of R1.01 billion would be associated with the construction phase. Approximately

R80 million of this total would probably accrue to workers currently resident in Khâi-Ma Municipality, a further R339 million to workers in the rest of the Namakwa District and R319 million to workers from the rest of the Northern Cape.

Operational expenditure would increase in line with production from approximately R528 million per year during the first year of production to R1.76 billion in the fifth year of production at which point it is anticipated that full production levels would be achieved. During the first year of production approximately 630 jobs would be created (of which, roughly 195 would be outsourced to contractors) increasing to 1,230 jobs (of which, 380 would be outsourced to contractors) once full production is reached by the 5<sup>th</sup> year of production. Out of these total jobs, it is anticipated that <sup>(1)</sup>:

- Khâi-Ma Municipality residents would benefit from 127 jobs in the first year of production and 258 jobs once full production is reached.
- Residents in the rest of the Namakwa District would benefit from 276 jobs in the first year of production and 540 jobs once full production is reached.
- Residents in the rest of the Northern Cape would benefit from 112 jobs in the first year of production and 220 jobs once full production is reached.

At the start of production approximately R138 million in total salaries and sub-contractor payments would be made yearly increasing to R256 million once full production is reached by the 5<sup>th</sup> year of production. Approximately R23 million of these salaries and payments to contractors should accrue to workers from Khâi-Ma Municipality during the first year of production increasing to R44 million once full production is reached. A further R50 million of salaries and payments to contractors should accrue to workers from the rest of the Namakwa District during the first year of production increasing to R94 million at full production.

Positive macroeconomic impacts are also expected to flow from the project and have been quantified focusing on increased foreign exchange earnings and tax revenues. Foreign exchange revenues are expected to start at roughly USD385 million/yr (for 360,000 tonnes of concentrate production) in the first year of production, increasing to USD750 million/yr (for 735,000 tonnes of concentrate production) in the third year and stabilising at roughly USD1.257 billion/yr (for 1,225,000 tonnes of concentrate production) from the fifth year onwards. The present value of the sum of these flows over the project's life should be roughly USD10.2 billion (or R76.7 billion) using a base case discount rate of 6%. Note that during the construction phase, foreign exchange outflows would occur in order to import key project components. However, these outflows would be minor when compared to inflows during operations

(1) Note that these estimates are based largely on a fairly broad assessment of the availability of labour in these areas and it is the proponent's intention to use a greater proportion of labour from Khâi-Ma Municipality and the Namakwa District if people are available and/or willing to be trained.

(ie outflows would be less than 5% - 10% of the magnitude of total inflows over time).

Tax payments consisting of income taxes and royalties are expected to start at roughly R142 million/yr (for 360,000 tonnes of concentrate production) in the first year of production, increasing to R277 million/yr in the third year, R277 million/yr in the fifth year and stabilising at roughly R1.52 billion/yr from the seventh year onwards. The present value of the sum of these flows should be roughly R10.8 billion using a base case discount rate of 6%.

The significant macro-economic and socioeconomic benefits associated with the mine during the construction and operational phases of the project are contrast with the potential significant negative impact once the mine closes. These negative impacts will be managed through a well structure Mine Closure Plan and Social and Labour Plan that BMM has developed as part of the overall project. On-going refinement and planning for mine closure will need to be undertaken throughout the life of mine to mitigate this impact.

### **Impacts on Tourism as a Result of Impact on Sense of Place and Loss of Biodiversity**

Key impacts on tourism would relate to visual impacts and to the loss of conservation worthy areas. With regard to the former, the combined scale of the project elements and their visual impacts indicate that overall changes to the visual sense of place which supports tourism will be significant. However, impacts on specific tourism facilities and key tourism areas would be limited, given the project's location relative to these. Visual exposure from the N14 would be high although temporary in nature for passing motorists who would largely still be able to enjoy the key attractions and tourist facilities in the wider area which are relatively far removed and screened from the project.

Any significant loss of highly conservation worthy land such as that found on the site and particularly on the Gamsberg Inselberg has potential implications for tourism. This is because conservation worthy lands have appeal to tourists and are becoming increasingly scarce. However, the need for a biodiversity offset and the associated conservation benefits may enhance the tourism potential of the area with pro-active planning that may allow controlled eco-tourism activities on the offset site.

With regard to positive tourism impacts, experience indicates that increased business tourism would be associated with the project as a number of technical, management and sales staff would be required to periodically visit the project site to conduct business. These staff generally fall into middle to higher income brackets and will require accommodation for their stays thereby creating opportunities for accommodation and other tourist facilities and services.

## **Impact on Municipal Services**

Ultimately it is the Khâi-Ma Municipality and, to a lesser degree, the Namakwa District Municipality's responsibility to ensure that the proposed project contributes to the financial health of the municipal area and does not burden the municipality with increased costs. These potential cost should be viewed at a broad scale and include costs associated with potential influxes of workers and job seekers as well as any other impacts that could impose costs on the municipality. The Khâi-Ma Municipality revealed that they are well aware of the need to recover costs and would endeavour to ensure that Vedanta not only covers their own costs, but also make a positive contribution to the development of the area. The municipality has confirmed that they are currently in the early stages of a process of negotiation with Vedanta in this regard. No clear conclusions regarding impacts on municipal finances are therefore possible at this stage. It is, however, safe to predict overall positive impacts on finances provided these negotiations proceed well and in-migration is managed. This kind of outcome would be consistent with other smaller municipalities that have benefited from increased incomes among its residents and an in-flux of new residents with jobs. With sound municipal management, both of these trends tend to increase municipal income from existing residents and provide municipalities with a wider rates resulting in healthier municipal finances.

## **Training and Skills Development and Procurement and Services**

Those people who are employed via the Project (directly and indirectly) will receive training and that will significantly enhance their skills, thus improving their potential for future employment. This will be achieved by on-the-job training, as well as through training courses on production and on Health, Safety and Environment (HSE) standards required for the Project, as are common to the mining sector. This will also be a positive impact amongst employees of the suppliers and contractors, who will have to meet particular production, operational, and quality standards as required by the Project.

The planning, design, construction and operation of the Project will require the purchase of equipment and other goods and services and will generate large contracts, particularly during construction. The majority of these will be for highly specialised and technical work and will be provided by specialist providers of goods and services. There is potential to feed into this supply chain for local businesses in the Khâi-Ma Municipality and Namakwa District Municipality. However, locally owned businesses in the Khâi-Ma Municipality will have limited capacity to meet the standards of quality and sophistication required by the Project. Despite this, the Project will provide a major boost to suppliers in the LM during construction phase. The implementation of enhancement measures in terms of both skills development and support of local suppliers will rest in a residual positive impact of moderate significance.

## **Health Impacts: Communicable Diseases**

Communicable diseases are also known as infectious or contagious diseases, due to their potential for transmission from one person to another or from one species to another. The increase in the spread of communicable diseases in the context of the Project is closely linked to population size, living conditions as well as social ills, all of which makes people pre-disposed to the spread of communicable diseases. The rapid increase in the population will be a key driver in the spread of communicable diseases as it impacts on both living conditions as well as the likely increase in social ills. Communicable diseases such as HIV/AIDS and TB are prevalent in the Khâi-Ma Municipality.

The most significant increase in the spread of communicable diseases is expected during the construction phase of the project, when a rapid increase in the population size is expected. During the construction phase, a worker camp will be constructed to accommodate approximately 3200 construction workers who are likely to be predominantly male. Apart from the actual construction workers, job-seekers are likely to migrate to the area and settle in Pofadder and Pella. The communities of Pofadder and Pella will thus also be at risk to the increase in the spread of communicable diseases. The development and implementation of an HIV/AIDS and TB Prevention Programme will partly mitigate these impacts.

### **Increased Pressure on Infrastructure and Services due to the Possible Influx of Job-seekers**

The possible influx of people into the local area will increase pressure on public infrastructure and services. Job-seekers migrating to the area are likely to settle as close as possible to the Project area, thus the settlements of Pofadder and Pella, in particular, are likely to experience in-migration as migrants will not be allowed to settle in Aggeneys. Pofadder is more vulnerable to the influx of job-seekers as it is located on the N14, as compared to Pella, which is located approximately 10 km from the N14. There is a risk that job-seekers may try to establish an informal settlement close to Aggeneys, in order to be closer to the Project site to improve their chances of deriving benefits from the Project.

Public service backlogs pertain to access to water, sanitation, waste management services and housing. The number of informal houses increased threefold between 2001 and 2011 in the Khâi-Ma Municipality. Upgrades to public infrastructure and services are hampered by a number of challenges including a lack of funds and capacity by the Khâi-Ma Municipality.

Based on the current public infrastructure and service backlogs the additional pressure will further exacerbate the challenges faced by the Khâi-Ma Municipality. It is unlikely that the Khâi-Ma Municipality will be able to cope with the increased pressure and demand resulting from the indirect influx of people and are already unable to meet their current obligations. Regular and

on-going support and collaboration with the Khâi-Ma Municipality will mitigate this impact to some extent.

### **Impact on Archaeology**

Archaeological artefacts are considered, in each instance, a unique and non-renewable resource. The Project will result in losses to archaeological artefacts during both the construction and operational phases. The impacts can be seen as permanent and irreversible. Based on the findings of the site visit undertaken, areas of archaeological importance have been ranked according to the northern slope, southern slope and the inselberg basin.

Artefacts that occur in the project area have been mapped and include some of the following:

- A mid-twentieth century drilling site - low archaeological significance;
- series of dome-shaped bedrock outcrops around which are clustered an abundance of Ceramic Later Stone Age artefacts (stone artefacts, pottery, ostrich eggshell) - high archaeological significance (unlikely to be impacted);
- individual instance of an isolated Earlier Stone Age cleaver - low archaeological significance (likely to be impacted by power lines);
- grave site, surface scatter of Ceramic Later Stone Age material - high archaeological significance (may be impacted by power lines);
- Kloof area in which the suspected history of San genocide occurred - high heritage importance (unlikely to be impacted);
- indications of is ephemeral Later Stone Age occupation - low archaeological importance (likely to be impacted during the construction and operation of the primary crusher and conveyor system);
- Middle Stone Age artefact site - low archaeological importance(likely to be impacted during the construction and operation of the primary crusher and conveyor system); and
- Middle Stone Age workshop - high heritage importance (impacted by operational phase – waste rock dump).

Various mitigation measures in terms of the national Heritage Resource Act will mitigate these impacts to some extent.

The Project will undoubtedly have a positive impact on the macro-economics of South Africa as a country. Local economic benefits will also be felt with a significant contribution to the Namakwa District GDP and significant benefits at the Khâi-Ma Municipality level during the life of mine. As a result, the project will generate significant job opportunities at the provincial, district and local municipal level in an area of high unemployment.

In contrast, the project will also result in significant negative impacts on the biodiversity of the region. Biodiversity offsets are possible to remedy most of the predicted residual impacts, and form a key part of the mitigation measures of this project. The offsets required would result in the protection of irreplaceable and other habitats within the Bushmanland Inselberg Region that have not previously been afforded conservation status and thus formal protection. The implementation of the EMPR is likely to provide additional protection to the remaining sensitive biodiversity on the site and adequately mitigate other impacts associated with the mine development. However, there are habitat components within the Gamsberg Inselberg that are unique and irreplaceable and their loss cannot be offset. While BMM will be required to provide compensation in this regard, these habitats will be permanently lost.

The impacts resulting post closure of the mine will also need to be carefully considered. On-going and detailed mine closure planning, combined with a robust Social and Labour Plan will need to accommodate these impacts.

When considering the quantifiable as well as more qualitative costs and benefits of the project it is considered more likely that it would achieve a net benefit at a provincial, regional and local scale provided the financial projections of the applicants prove reasonably accurate and provided the EMPR and Offsets Plan are robustly implemented. However, the cost resulting from the loss of unique biodiversity in the Gamsberg Inselberg cannot be offset and the trade-off between this and the significant local economy benefits and associated job opportunities needs to be considered. The acceptability of this trade-off needs to be tested through open and transparent stakeholder and authority consultation. This report will be made available for stakeholder and authority comment for a period of 40 days. These comments will be collected and analysed and incorporated into the final conclusion for submission DENC and DMR for final decision making.