10 SOCIO-ECONOMIC IMPACT ASSESSMENT

This Chapter identifies and evaluates the actual and potential socio-economic consequences of the Project. Furthermore, the potential for mitigation of negative impacts and enhancement of positive impacts (DEAT, 2003) are described.

The Chapters presents impacts related to the following aspects:

- Macro-Economics;
- Social and health;
- Visual landscapes;
- Traffic volumes; and
- Cultural heritage, archaeology and palaeontology.

10.1 IMPACT ON ECONOMIC ENVIRONMENT

Aside from compatibility with planning and financial viability (and associated zinc market considerations), the following impacts were identified as relevant for assessment based on the guidelines for economic specialist input (van Zyl et al., 2005), information from consultations with I&APs and nature of the Project and receiving environment:

- Impacts on jobs and incomes linked to Project expenditure;
- Impacts on key macro-economic variables focused on foreign exchange earnings and taxes;
- Impacts on tourism;
- Impacts on other surrounding land uses; and
- Impacts on municipal finances.

The sections below provide an assessment of each of the above mentioned impacts. This assessment is provided separately for the construction, operation and decommissioning phases of the Project. A significance rating is also assigned to each impact, using accepted conventions for determining their significance (refer to *Chapter 8*), and mitigation measures to reduce the impacts are outlined below.

Please note that the quantification of economic impacts in order to inform the assessment of the significance of impacts was not possible, nor considered necessary, for all impacts. Where possible, quantification focused on impacts considered to be most important in the overall assessment. Assessments of impact significance made without quantification (and based on a consideration of the likely magnitudes of impacts and/or expert judgements) are, however, considered adequate unless otherwise specified.

10.1.1 Impacts linked to Project Expenditure

The construction and operational phases of the Project would result in spending injections that would lead to increased economic activity, best measured in terms of impacts on employment and associated incomes focusing on the local area and region as a whole.

Spending by BMM during both the construction and operation phases would be new spending as it would not displace or substitute for spending by other companies given that that there are no other existing competing production facilities in the country. All expenditures would lead to linked direct, indirect and induced impacts on employment and incomes. Taking employment as an example (refer below for specific impacts associated with employment) the following types of impacts would apply:

- there would be direct impacts whereby people are employed directly on the project in question (eg jobs such as construction workers);
- there would be indirect impacts where the direct expenditure associated with a project leads to jobs and incomes in other sectors (eg purchasing building materials maintains jobs in that sector); and
- there would be induced impacts whereby jobs are created due to the expenditure of employees and other consumers that are gained from the project.

Direct impacts are the most important of these three categories as they are the largest and more likely to be felt in the local area. Their estimation also involves the lowest level of uncertainty. The quantification of indirect and induced impacts is a far less certain exercise due to uncertainty surrounding accurate multipliers particularly at a local and regional level. This uncertainty makes it inadvisable to quantify indirect employment unless an in-depth analysis of this aspect is absolutely essential to decision making. Potential direct employment and income impacts are consequently quantified here and likely indirect impacts are borne in mind qualitatively when providing overall impact ratings.

Table 10.1 Impact Characteristics: Project Expenditure and Withdrawal Thereof

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	This phase of the project would result in spending injections that would lead to increased economic activity best measured in terms of impacts on employment and associated incomes.	This phase of the project would result in spending injections that would lead to increased economic activity best measured in terms of impacts on employment and associated incomes.	This phase of the project would result in a withdrawal of spending injections that would lead to decreased economic activity relative to the operational phase.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.

Summary	Construction	Operation	Decommissioning/ Post Closure
Stakeholders/ Receptors Affected	Direct and indirect beneficiaries of project expenditure.	Direct and indirect beneficiaries of project expenditure.	Direct and indirect beneficiaries of project expenditure.

Construction Phase Impacts

Construction expenditure would constitute a positive injection of new investment. The applicant's preliminary estimates indicate that a total of approximately R 8.235 billion would be spent on all aspects of the construction phase over roughly four years (see *Table 10.2* below) (1).

Table 10.2 Construction Phase Expenditure

Construction component	Costs in 2013 rands (excl inflation)				
	Year 1	Year 2	Year 3	Year 4	Total
Mine & Pre-Stripping	R 1 068 750 000	R 1 068 750 000	R 832 500 000	R 840 000 000	R 3 810 000 000
Concentrator plant	R 405 000 000	R 405 000 000	R 360 000 000	R 397 500 000	R 1 567 500 000
Housing	R 206 250 000	R 206 250 000	R 63 750 000	R 63 750 000	R 540 000 000
Infrastructure	R 438 750 000	R 438 750 000	R 228 750 000	R 1 211 250 000	R 2 317 500 000
Total	**R 2 118 750 000**	**R 2 118 750 000**	**R 1 485 000 000**	**R 2 512 500 000**	**R 8 235 000 000**

The Project has the potential to have a significantly positive impact on commercial activity in the local area during the construction phase given its size and resultant expenditure, as illustrated in *Table 10.3* above. During the construction phase the building, civil and other construction and specialist industrial machinery sectors would benefit substantially. The structural metal products, wholesale and retail trade and construction materials sectors would also stand to gain due to indirect linkages. The Project would therefore provide a major injection for contractors and workers in the local area, region and province leading to positive impacts.

Table 10.3 provides a tentative indication from the applicant of what proportions of construction expenditure would go to suppliers from the Khâi-Ma municipal area, the rest of the Namakwa District, rest of the Northern Cape, rest of the country and what would be imported. Imports would primarily come in the form of specialised machinery, equipment and spares and some electrical inputs that are not available in South Africa. It is anticipated that approximately R 40.5 million will be spent on suppliers or contractors from within the Khâi-Ma Municipality, the majority of which would be for housing construction. A further R 1.74 billion is expected to be spent within the Namakwa District and roughly R 1.14 billion in the Northern Cape as a whole. Note that these projections have been kept conservative at a

(1) Note that all data on Vedanta expenditure during construction and operation and its likely geographic spread were sourced from Vedanta and found to be reasonable.

local level and the intention of the applicant is to ensure that local suppliers are given preference wherever possible (refer to construction phase mitigation measures below).

Table 10.3 Construction Phase Expenditure per Geographic Area

Construction component	Anticipated spend on Khai-Ma municipal area suppliers	Anticipated spend on suppliers from the rest of the Namakwa District	Anticipated spend on suppliers in the rest of the Northern Cape	Anticipated spend on suppliers in the rest of SA	Anticipated spend on imports
Mine & Pre-Stripping	R 0	R 762 000 000	R 381 000 000	R 2 667 000 000	R 0
Concentrator plant	R 0	R 313 500 000	R 156 750 000	R 1 097 250 000	R 0
Housing	R 40 500 000	R 202 500 000	R 135 000 000	R 162 000 000	R 0
Infrastructure	R 0	R 463 500 000	R 463 500 000	R 1 158 750 000	R 231 750 000
Total	**R 40 500 000**	**R 1 741 500 000**	**R 1 136 250 000**	**R 5 085 000 000**	**R 231 750 000**

Employment during Construction

In order to estimate direct temporary employment during construction, standard construction industry estimates for labour required per spend were sourced from the Applicant. *Table 10.4* outlines the total Project. It is anticipated that approximately 3,200 contract jobs with an average duration of 19 months each would be associated with all construction expenditure. The majority of these employment opportunities would be medium and low skilled positions in keeping with the nature of the construction required.

Please note that the estimates given below are not to be regarded as being highly accurate and are merely estimates that are meant to provide the reader with an indication of potential employment impacts.

Table 10.4 Estimated Direct Temporary Employment During Construction

Construction component	Total number of workers needed				Ave duration of each employment contract within overall 36 to 42 month construction period
	Highly skilled	Medium skilled	Low skilled	Total	
Mine & Pre-Stripping	150	375	675	1200	19 months
Concentrator plant	120	300	550	970	
Housing	50	125	225	400	
Infrastructure	80	200	350	630	
Total	**400**	**1000**	**1800**	**3200**	

Based on the likely availability of labour and the experience of the applicant in the area and at other sites, approximately 357 workers would probably come from within Khâi-Ma Municipality. A further 1,335 workers would probably come from the rest of the Namakwa District and 960 workers from the rest of the Northern Cape (see *Table 10.5*). Note that these estimates are based largely on a fairly broad assessment of the availability of labour in these areas and it is

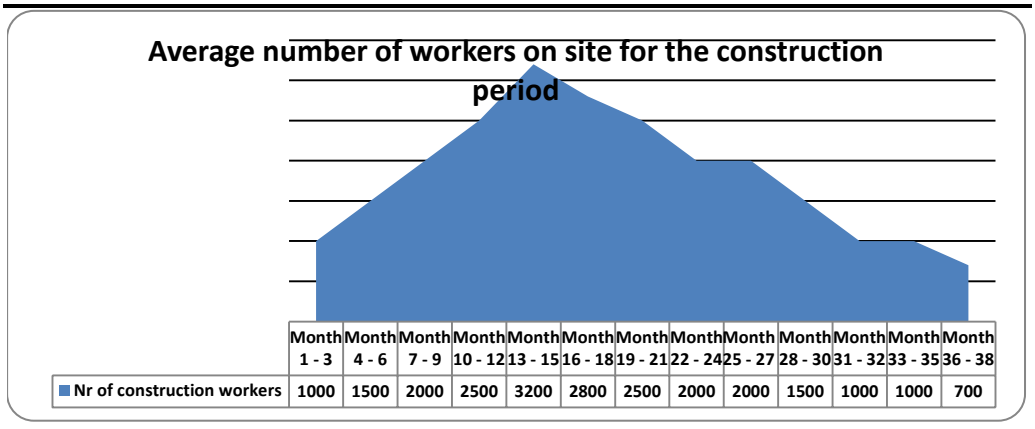
the proponent's intention to use a greater proportion of labour from Khâi-Ma Municipality and the Namakwa District, if people are available and/or willing to be trained.

Table 10.5 Likely Spread of Construction Jobs Per Area

Worker origin	Highly skilled		Medium skilled		Low skilled		All skill levels
	Likely % of workers	*Nr of workers*	*Likely % of workers*	*Nr of workers*	*Likely % of workers*	*Nr of workers*	*Nr of workers*
Khai-Ma municipal area	3.0%	12	7.5%	75	15%	270	357
Rest of the Namakwa District	15.0%	60	37.5%	375	50%	900	1 335
Rest of the Northern Cape	30.0%	120	30%	300	30%	540	960
Rest of South Africa	42.0%	168	25%	250	5%	90	508
Overseas	10.0%	40	0%	-	0%	-	40
Total	**100.0%**	**400**	**100.0%**	**1 000**	**100.0%**	**1 800**	**3 200**

In terms of the spread of construction activity over time, *Table 10.6* shows that worker numbers on site would build gradually reaching their maximum of roughly 3,200 during months 13 to 15 of the construction phase and staying above 2,000 workers until months 25 to 27 and thereafter gradually reducing until construction is completed.

Table 10.6 Average Number of Construction Workers on Site over the Construction Period



Incomes From Wages During Construction

Direct household income impacts would flow from all wages paid during construction. These were estimated by multiplying the projected number of direct jobs associated with the Project (estimated above) by assumed average monthly salaries for each skill category (ie R7,000 for low skilled, R22,500 for medium skilled and R52,000 for highly skilled employees). Again, these estimates are to be treated as indicative. The results of this exercise show that total income of R 1.01 billion would be associated with the construction phase (refer to *Table 10.7*). Approximately R80 million of this total, would probably accrue to workers currently residing in Khâi-Ma Municipality. A further R339

million would be expected to accrue to workers in the rest of the Namakwa District and R319 million to workers from the rest of the Northern Cape (see *Table 10.8*).

Table 10.7 Direct Household Income Impacts During Construction (2013 Rands)

Construction component	Total salaries per skill level over construciton period			
	Highly skilled	Medium skilled	Low skilled	Total
Mine	R 148 200 000	R 160 312 500	R 89 775 000	R 398 287 500
Concentrator plant	R 118 560 000	R 128 250 000	R 73 150 000	R 319 960 000
Housing	R 49 400 000	R 53 437 500	R 29 925 000	R 132 762 500
Infrastructure	R 79 040 000	R 85 500 000	R 46 550 000	R 211 090 000
Total	**R 395 200 000**	**R 427 500 000**	**R 239 400 000**	**R 1 062 100 000**

Table 10.8 Direct Household Income Impacts During Construction Per Area (2013 Rands)

Worker origin	Total salaries over construciton phase			
	Highly skilled	Medium skilled	Low skilled	All skill levels
Khai-Ma municipal area	11 856 000	32 062 500	35 910 000	79 828 500
Rest of the Namakwa District	59 280 000	160 312 500	119 700 000	339 292 500
Rest of the Northern Cape	118 560 000	128 250 000	71 820 000	318 630 000
Rest of South Africa	165 984 000	106 875 000	11 970 000	284 829 000
Overseas	39 520 000	-	-	39 520 000
Total	**395 200 000**	**427 500 000**	**239 400 000**	**1 062 100 000**

Indirect Opportunities During Construction

In addition to the above direct employment and associated income opportunities, a significant number of temporary indirect opportunities would be associated with the Project. These would stem primarily from expenditure by Vedanta in the local area and region, as well as expenditure by workers hired for the construction phase.

Impact Assessment and Description

Expenditure on construction would result in a **positive** impact on the economy, increasing commercial activity, creating jobs and increasing incomes. The impact will not include the loss of any irreplaceable resources. The extent of the impact is **national** (though impacts would be proportionately greater at a regional and local scale). The expected impact will be **short-term** (ie reversible). The impact will result in **notable** changes to the receptor (ie the economy). The frequency of the impact will be **once-off** but for the duration of construction. Impacts from expenditure are a **certainty** in the economy.

An assessment of the significance of the combined impacts of project-related expenditure based on the findings above is presented in the *Box 10.1* below.

Box 10.1 Summary of Construction Impact: Construction Phase Expenditure

Nature: Expenditure on construction would result in a **positive** impact on the economy, increasing commercial activity, creating jobs and increasing incomes.

Sensitivity/Vulnerability/Importance of Resource/Receptor: **Low.**
Irreplaceability: The impact will not include the loss of irreplaceable resources

Impact Magnitude: **High**
Extent: The extent of the impact is **national** (though impacts would be proportionately greater at a regional and local scale)
Duration: The expected impact will be **short-term** (ie reversible)
Scale: The impact will result in **notable** changes to the receptor (ie the economy)
Frequency: The frequency of the impact will be **once-off** but for the duration of construction
Likelihood: Impacts from expenditure are a **certainty** in the economy

IMPACT SIGNIFICANCE (PRE-MITIGATION): **MODERATE (+)**

Degree of Confidence: The degree of confidence is **high**.

Construction Phase Mitigation

The objective of mitigation is to maximise economic benefit from jobs and expenditure particularly at a local and regional scale.

Vedanta's social and labour plan (SLP) should act as a departure point and take the lead when considering and enforcing benefit enhancement measures. This plan will have to deal with and provide specific guidance on actions such as giving preference to local and historically disadvantaged individuals and companies. It will need to be drawn up with care and in full consultation with all relevant stakeholders and as per the requirements of the DMR. It will also need to recognise and deal with perceptions in the area that mines operating in it could do more for local economic development. For example, The Khâi-Ma Municipality LED Strategy mentions that "The mines are seen as important stakeholders and partners in LED. The SLP's of the mining corporations should be more vigorously enforced." (KMLM, 2011, p 64).

Some of the broad types of measures that should be considered and detailed in the SLP are listed below:

- Formal targets should preferably be set (in tender documents, for example) for how much local labour should be used based on the needs of the proponent and the availability of existing skills and people that are willing to undergo training.

- Opportunities for the training of unskilled and skilled workers from local communities during construction and operation should be maximized.

- Local sub-contractors should be used wherever possible and contractors from outside the local area that tender for work should also be required to meet targets for how many locals are given employment.

- Decisions will be required from the applicant in consultation with local communities, the authorities and building contractors as to the percentage of jobs that are to be earmarked for the local community, and the percentage of jobs that are to be granted to residents of the wider region. Employment forums have proven effective in this regard.

- The recently formed Khâi-Ma LED Forum should also play a role here and in the process of unlocking opportunities for local businesses.

- Vedanta's existing database of potential local suppliers should be updated prior to any procurement. All companies on the list should be invited to tender for work.

- Tender forms need to be kept as simple as possible so as not to act as a barrier to entry and BMM must be willing to provide assistance with tendering where required.

Operational Phase Impacts

Project Expenditure/Investment During Operations

The key operational phase impacts associated with the Project would flow from expenditure on operations at the mine and plant. Operational costs would increase in line with production from approximately R 528 million in during the first year of production to R 1.76 billion in the fifth year of production at which point it is anticipate that full production levels would achieved (see *Table 10.9 below*).

Table 10.9 Estimated Operational Expenditure

Cost categories	Operational costs in 2013 rands (excluding inflation)	
	1st year of production	*5th year - full production*
Staff	R 132 187 500	R 440 625 000
Fuels	R 105 750 000	R 352 500 000
Electricity	R 42 300 000	R 176 250 000
Water	R 15 862 500	R 52 875 000
Transport	R 15 862 500	R 52 875 000
Chemicals	R 15 862 500	R 52 875 000
Maintenance	R 79 312 500	R 264 375 000
Overheads	R 37 012 500	R 123 375 000
Outsourced activities	R 84 600 000	R 246 750 000
Total	**R 528 750 000**	**R 1 762 500 000**

Table 10.10 shows the likely spread of the above operational costs per geographical area focusing on the situation three years after the start of each phase. It is predicted that once full production is reached, roughly R 436 million per annum will be spent in the Khâi-Ma Municipality area, R 180 million in the rest of the Namakwa District and R 121 million in the rest of the Northern Cape.

Table 10.10 Operational Expenditure at Full Production per Geographical Area

Cost component	Anticipated spend in the Khai-Ma municipal area	Anticipated spend in the rest of the Namakwa District	Anticipated spend in the rest of the Northern Cape	Anticipated spend in the rest of SA	Anticipated spend on imports
Staff	R 352 500 000	R 44 062 500	R 22 031 250	R 22 031 250	R 0
Fuels	R 0	R 0	R 0	R 352 500 000	R 0
Electricity	R 0	R 0	R 0	R 176 250 000	R 0
Water	R 52 875 000	R 0	R 0	R 0	R 0
Transport	R 5 287 500	R 21 150 000	R 5 287 500	R 21 150 000	R 0
Chemicals	R 0	R 0	R 10 575 000	R 42 300 000	R 0
Maintenance	R 13 218 750	R 52 875 000	R 52 875 000	R 145 406 250	R 0
Overheads	R 0	R 12 337 500	R 6 168 750	R 98 700 000	R 6 168 750
Outsourced activities	R 12 337 500	R 49 350 000	R 24 675 000	R 148 050 000	R 12 337 500
Total	**R 436 218 750**	**R 179 775 000**	**R 121 612 500**	**R 1 006 387 500**	**R 18 506 250**

Employment during Operations

Table 10.11 outlines the operational phase employment opportunities that would be associated with the Project. During the first year of production (planned for 2015) 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 5th year of production.

Table 10.11 Operational Employment

Component of project and job type	Number of operational employees					
	1st year of production			5th year - full production		
	In house	Contractors/ outsourced	Total	In house	Contractors/ outsourced	Total
Mine						
Managers & supervisors	41	19	**60**	62	28	**90**
Operators	97	43	**140**	173	77	**250**
Admin	7	3	**10**	28	12	**40**
Cleaners	7	3	**10**	21	9	**30**
Security	7	3	**10**	21	9	**30**
Other operational worke	55	25	**80**	173	77	**250**
Total	214	96	**310**	477	213	**690**
Concentrator plant						
Managers & supervisors	28	12	**40**	55	25	**80**
Plant operators	97	43	**140**	138	62	**200**
Admin	7	3	**10**	21	9	**30**
Cleaners	7	3	**10**	10	5	**15**
Security	7	3	**10**	10	5	**15**
Other operational worke	55	25	**80**	104	46	**150**
Total	200	89.6	**290**	339	151	**490**
Transport to port						
Loaders	7	3	**10**	7	3	**10**
Drivers	14	6	**20**	28	12	**40**
Total	21	9	**30**	35	15	**50**
TOTAL	**435**	**195**	**630**	**850**	**380**	**1230**

Table 10.12 shows the likely allocation of jobs to people from different areas within the Northern Cape for both Phases once they are in full operation. 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. It is anticipated that:

- 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.

Table 10.12 Operational Employment per Geographical Area

Component of project	Workers from Khai-Ma		Workers from the rest of the Namakwa District		Workers from the rest of the Northern Cape	
	1st year of production	*5th year - full production*	*1st year of production*	*5th year - full production*	*1st year of production*	*5th year - full production*
Mine	60	146	134	304	54	123
Concentrator plant	60	100	129	213	52	87
Transport to port	8	13	14	23	6	10
Total	**127**	**258**	**276**	**540**	**112**	**220**

Incomes from Salaries during Operations

Direct household income impacts would flow from all salaries paid during operations. These were estimated by multiplying the projected number of direct jobs associated with the Project above by assumed average yearly salaries for each skill category. Again, these estimates are to be treated as indicative. The results of this exercise, shown in *Table 10.13* below, indicate that at the start of production approximately R 138 million in salaries and sub-contractor payments would be made yearly increasing to R 256 million once full production is reached by the 5th year of production.

Table 10.13 Income from Operational Employment

Component of project and job type	Total salaries paid including contractors		Average annual salary range for job category
	1st year of production	*5th year - full production*	
Mine			
Managers & supervisors	R 36 000 000	R 54 000 000	500 000 to 700 000
Operators	R 23 100 000	R 41 250 000	150 000 to 180 000
Admin	R 1 650 000	R 6 600 000	150 000 to 180 000
Cleaners	R 700 000	R 2 100 000	60 000 to 80 000
Security	R 1 000 000	R 3 000 000	80 000 to 120 000
Other operational workers	R 10 800 000	R 33 750 000	120 000 to 150 000
Total	R 73 250 000	R 140 700 000	
Concentrator plant			
Managers & supervisors	R 24 000 000	R 48 000 000	500 000 to 700 000
Plant operators	R 23 100 000	R 33 000 000	150 000 to 180 000
Admin	R 1 650 000	R 4 950 000	150 000 to 180 000
Cleaners	R 700 000	R 1 050 000	60 000 to 80 000
Security	R 1 000 000	R 1 500 000	80 000 to 120 000
Other operational workers	R 10 800 000	R 20 250 000	120 000 to 150 000
Total	R 61 250 000	R 108 750 000	
Transport to port			
Loaders	R 1 350 000	R 1 350 000	120 000 to 150 000
Drivers	R 2 700 000	R 5 400 000	120 000 to 150 000
Total	R 4 050 000	R 6 750 000	
TOTAL	**R 138 550 000**	**R 256 200 000**	

Approximately R 23 million of salaries and payments to contractors should accrue to workers from Khâi-Ma Municipality during the first year of production increasing to R 44 million once full production is reached. A further R 50 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 R 94 million at full production (see *Table 10.14*).

Table 10.14 Incomes from Operational Employment per Geographical Area

Component of project	Total annual salaries to workers from Khai-Ma		Total annual salaries to workers from the rest of the Namakwa District		Total annual salaries to workers from the rest of the Northern Cape	
	1st year of production	*5th year - full production*	*1st year of production*	*5th year - full production*	*1st year of production*	*5th year - full production*
Mine	R 11 200 000	R 24 555 000	R 25 745 000	R 52 545 000	R 10 880 000	R 22 230 000
Concentrator plant	R 10 682 500	R 17 842 500	R 22 662 500	R 39 187 500	R 9 680 000	R 16 695 000
Transport to port	R 1 215 000	R 2 025 000	R 1 620 000	R 2 700 000	R 810 000	R 1 350 000
Total	**R 23 097 500**	**R 44 422 500**	**R 50 027 500**	**R 94 432 500**	**R 21 370 000**	**R 40 275 000**

Indirect Opportunities During Operations

In addition to the above direct employment and associated income opportunities, indirect opportunities would be associated with the operational phase of the project. These would stem primarily from increased expenditure by BMM and its employees in the local area and region.

Impact Assessment and Description

Expenditure on operations would result in a **positive** impact on the economy, increasing commercial activity, creating jobs and increasing incomes. The impact will not include the loss of **irreplaceable** resources. The extent of the impact is **national** (though impacts would be proportionately greater at a regional and local scale). The expected impact will be **long-term** for the life of mine (ie reversible). The impact will result in **notable** changes to the receptor (ie the economy). The frequency of the impact will be **periodic** with a very high frequency making it virtually constant for the period of operations as expenditure will flow on an on-going basis. Impacts from expenditure are a **certainty** in the economy.

An assessment of the significance of the combined impacts of project-related expenditure based on the findings above is presented in *Box 10.2* below.

Box 10.2 Summary of Operational Impact: Operational Phase Expenditure

Nature: Expenditure on operations would result in a **positive** impact on the economy, increasing commercial activity, creating jobs and increasing incomes.

Sensitivity/Vulnerability/Importance of Resource/Receptor: **Low.**
Irreplaceability: The impact will not include the loss of **irreplaceable** resources.

Impact Magnitude: **High.**
Extent: The extent of the impact is **national** (though impacts would be proportionately greater at a regional and local scale).
Duration: The expected impact will be **long-term** for the life of mine (ie reversible).
Scale: The impact will result in **notable** changes to the receptor (ie the economy).
Frequency: The frequency of the impact will be **periodic** with a very high frequency making it virtually constant for the period of operations as expenditure will flow on an on-going basis.
Likelihood: Impacts from expenditure are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MODERATE (+).**

Degree of Confidence: The degree of confidence is **high**.

Operational Phase Mitigation

The objective of mitigation is to maximise economic benefit from jobs and expenditure particularly at a local and regional scale.

Mitigation measures would be the same as for the construction phase focused on local employment and procurement as outlined in more detail in construction phase mitigation section. Such measures include the following:

- Formal targets should preferably be set (in tender documents, for example) for how much local labour should be used based on the needs of the proponent and the availability of existing skills and people that are willing to undergo training.

- Opportunities for the training of unskilled and skilled workers from local communities during construction and operation should be maximized.

- Local sub-contractors should be used wherever possible and contractors from outside the local area that tender for work should also be required to meet targets for how many locals are given employment.

- Decisions will be required from the applicant in consultation with local communities, the authorities and building contractors as to the percentage of jobs that are to be earmarked for the local community, and the percentage of jobs that are to be granted to residents of the wider region. Employment forums have proven effective in this regard.

- The recently formed Khâi-Ma LED Forum should also play a role here and in the process of unlocking opportunities for local businesses.

- Vedanta's existing database of potential local suppliers should be updated prior to any procurement. All companies on the list should be invited to tender for work.

- Tender forms need to be kept as simple as possible so as not to act as a barrier to entry and Vedanta must be willing to provide assistance with tendering where required.

Decommissioning and Post Closure Phase Impacts

Decommissioning and closure would essentially result in no more operational expenditure or jobs associated with the Project, which would result in negative impacts as the Project is withdrawn from the economy. The impacts of this withdrawal could be mitigated somewhat with careful planning and a focus on supporting the creation of sustainable businesses while the mine is operational. A highly significant decrease in economic activity in the area would, however, not be avoidable given the large size of the Project.

Impact Assessment and Description

Decommissioning and closure would essentially result in no more operational expenditure or jobs associated with the Project which would result in **negative** impacts as the Project is withdrawn from the economy. The impact would include the loss of mine expenditure in the area which would be **irreplaceable** to a degree. The extent of the impact is **national** (though impacts would be proportionately greater at a regional and local scale). The expected impact will be **permanent** (ie irreversible). The impact will result in **notable** changes to the receptor (ie the economy). The frequency of the impact will be **once-off**. Impacts from expenditure are a **certainty** in the economy. The degree of confidence is **medium**.

An assessment of the significance of the impacts of project-related expenditure during the decommissioning phase is presented in *Box 10.3* below.

Box 10.3 Summary of Decommissioning Impact: Impacts Linked to Withdrawal of Expenditure

Nature: Decommissioning and closure would essentially result in no more operational expenditure or jobs associated with the project which would result in **negative** impacts as the project is withdrawn from the economy.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Medium.**
Irreplaceability: The impact include the loss of mine expenditure in the area which would be **irreplaceable** to a degree.

Impact Magnitude – **Medium.**
Extent: The extent of the impact is **national** (though impacts would be proportionately greater at a regional and local scale).
Duration: The expected impact will be **permanent** (ie irreversible).
Scale: The impact will result in **notable** changes to the receptor (ie the economy).
Frequency: The frequency of the impact will be **once-off.**
Likelihood: Impacts from expenditure are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MAJOR (-).**

Degree of Confidence: The degree of confidence is **medium**.

Decommissioning and Post Closure Phase Mitigation

The objective of mitigation is to minimise the negative impacts of the withdrawal of project expenditure form the local area and region.

Mitigation measures will have to be developed and refined with time as part of the Vedanta SLP. These will probably include training and assistance with the establishment of local businesses that can continue to provide opportunities post-mining (ie businesses that do not rely on mining directly or indirectly through their customers being Vedanta employees).

Residual Impact

The implementation of the above mitigation measures would increase the positive construction phase impacts from **Moderate** to **Major** significance and the operation phase impacts from **Moderate** to **Major**. The implementation of the decommissioning phase mitigation measures would probably reduce the significance of negative impacts from **Major** to **Moderate** if they are particularly well resourced and executed. The pre- and post-mitigation impacts are compared in *Table 10.15* below.

Table 10.15 Pre- and Post- Mitigation Significance: Impacts Associated with Project Expenditure

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (+ve)**	**MAJOR (+ve)**
Operation	**MODERATE (+ve)**	**MAJOR (+ve)**

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Decommissioning and Post Closure	**MAJOR (-ve)**	**MODERATE (-ve)**

The no-go would result in no construction and operational phase impacts as outlined above. The opportunities created by the positive impacts associated with expenditure on the Project would thus not materialise.

10.1.2 Impacts on Key macro-Economic Variables

Key economic impacts associated with Project expenditure have been assessed in the preceding section. These are the positive impacts with the greatest potential to affect communities in the local area and wider region. Aside from these impacts, positive impacts are also expected to flow primarily from project income and profits which are best measured using the following macro-economic indicators:

- Increased foreign exchange earnings (current project planning is for all of the zinc concentrate produced at the mine to be exported).
- Increased tax revenues from income taxes and minerals royalty payments associated with the Project.

Table 10.16 Impact Characteristics: Impacts on Key Macro-Economic Variables

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	This phase of the project would require imported machinery and other materials resulting in relatively limited foreign exchange outflows (when compared with inflows during operations).	This phase of the project would result in significant net foreign exchange and tax earnings with positive macro-economic implications.	The closure of the project would result in decreased foreign exchange and tax earnings with negative macro-economic implications.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	Those with a stake in the macro-economic health of the country.	Those with a stake in the macro-economic health of the country.	Those with a stake in the macro-economic health of the country.

Construction Phase Impacts

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 the operational phase (ie outflows would be less than 5% to 10% of the magnitude of total inflows over time). As such, foreign exchange outflows during the construction phase are assessed to

have a negligible influence on related macro-economic conditions. Therefore, no further assessment is considered necessary.

Operational Phase Impacts

Table 10.17 shows the highly significant annual flows of foreign exchange revenues and associated taxes anticipated for the Project. These flows are then converted into present value (PV) terms, in *Table 10.18*, using a range of discount rates.

Table 10.17 Likely Foreign Revenue and Tax Flows Associated with the Project

	2015	2017	2019	2021	2025	2030	2031	2032
Mine production volumes - tpa	3 000 000	6 000 000	10 000 000	10 000 000	10 000 000	10 000 000	10 000 000	2 100 000
Concentrate sales volumes - tpa	367 751	735 503	1 225 838	1 225 838	1 225 838	1 225 838	1 225 838	257 426
Revenue / turnover in USD millions	388.1	754.5	1 257.5	1 257.5	1 257.5	1 257.5	1 257.5	264.1
Revenue / turnover in ZAR millions	2 910.9	5 658.9	9 431.5	9 431.5	9 431.5	9 431.5	9 431.5	1 980.6
Income tax in USD millions	-	-	93.8	140.8	140.8	151.3	152.8	32.1
Royalties in USD millions	19.0	37.0	61.6	61.6	61.6	61.6	61.6	12.9
Total taxes in USD millions	19.0	37.0	155.5	202.4	202.4	212.9	214.4	45.0
Total taxes in ZAR millions	142.6	277.3	1 166.0	1 517.8	1 517.8	1 596.6	1 607.9	337.6

Foreign exchange revenues are expected to start at roughly USD 385 million/yr (for 360,000 tonnes of concentrate production) in the first year of production, increasing to USD 750 million/yr (for 735,000 tonnes of concentrate production) in the third year and stabilising at roughly USD 1.257 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 USD 10.2 billion (or R 76.7 billion) using a base case discount rate of 6%.

Table 10.18 Present Values of Likely Foreign Revenue and Tax Flows Associated with the Project

Discount rate	Present Value of all revenues		Present Value of all taxes	
	USD millions	ZAR millions	USD millions	ZAR millions
2%	15 212	114 088	2 222	16 666
4%	12 402	93 015	1 778	13 333
6%	**10 226**	**76 696**	**1 437**	**10 778**
8%	8 523	63 919	1 173	8 798
10%	7 174	53 808	967	7 249

Tax payments consisting of income taxes and royalties are expected to start at roughly R 142 million/yr (for 360,000 tonnes of concentrate production) in the first year of production, increasing to R 277 million/yr in the third year, R 277 million/yr in the fifth year and stabilising at roughly R 1.52 billion/yr from the seventh year onwards. The present value of the sum of these flows should be roughly R 10.8 billion using a base case discount rate of 6%.

Impact Description and Assessment

Foreign exchange flows and tax revenues would result in a **positive** impact on the macro-economy improving the balance of payment and taxes collected. The impact will **not** include the loss of **irreplaceable** resources. The extent of the impact is **national.** The expected impact will be **long-term for the life of mine (ie reversible).** The impact will result in **notable changes** to the receptor (ie the economy). The frequency of the impact will be **periodic** with a very high frequency making it virtually constant for the period of operations as Foreign exchange and taxes will flow on an on-going basis. Impacts from expenditure are a **certainty** in the economy.

Box 10.4 Summary of Construction and Operational Impact: Impacts on Key Marco-Economic Variables

Nature: Foreign exchange flows and tax revenues would result in a **positive** impact on the macro-economy improving the balance of payment and taxes collected.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Low.**
Irreplaceability: The impact will **not** include the loss of **irreplaceable** resources.

Impact Magnitude – **High.**
Extent: The extent of the impact is **national.**
Duration: The expected impact will be **long-term for the life of mine (ie reversible).**
Scale: The impact will result in **notable changes** to the receptor (ie the economy).
Frequency: The frequency of the impact will be **periodic** with a very high frequency making it virtually constant for the period of operations as Foreign exchange and taxes will flow on an on-going basis.
Likelihood: Impacts from expenditure are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MAJOR (+).**

Degree of Confidence: The degree of confidence is **high**.

Construction and Operational Phase Mitigation

There is no scope for enhancement measures within the ESIA process.

Decommissioning and Post Closure Phase Impacts

Decommissioning and closure would essentially result in no more foreign exchange earnings and tax revenues associated with the Project, which would result in negative impacts (or a cessation of positive impacts) as the Project is withdrawn from the economy.

An assessment of the significance of the impacts of the Project on key macroeconomic variables based on the findings above is presented in *Box 10.5* below.

Impact Description and Assessment

Decommissioning and closure would result in no more foreign exchange earnings or tax revenues associated with the Project which would result in **negative** impacts as the Project is withdrawn from the economy. The activity will result in the loss of mine related benefits which would be **irreplaceable** to a degree. The extent of the impact is **national.** The expected impact will be **permanent** (ie irreversible). The impact will result in **notable changes** to the receptor (ie the economy). The frequency of the impact will be **once-off.** Impacts from expenditure are a **certainty** in the economy.

Box 10.5 Summary of Decommissioning Impact: Impacts on Key Marco-Economic Variables

Nature: Decommissioning and closure would result in no more foreign exchange earnings or tax revenues associated with the project which would result in **negative** impacts as the project is withdrawn from the economy.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Medium.**
Irreplaceability: The activity will result in the loss of mine related benefits which would be **irreplaceable** to a degree.

Impact Magnitude: Medium.
Extent: The extent of the impact is **national.**
Duration: The expected impact will be **permanent** (ie irreversible).
Scale: The impact will result in **notable changes** to the receptor (ie the economy).
Frequency: The frequency of the impact will be **once-off.**
Likelihood: Impacts from expenditure are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION): **MAJOR (-).**

Degree of Confidence: The degree of confidence is **medium to high**.

Decommissioning and Post Closure Phase Mitigation

There is no scope for mitigation within the ESIA process.

Residual Impact

No mitigation is recommended so impact significance ratings will stay the same (refer to *Table 10.19*).

Table 10.19 Pre- and Post- Mitigation Significance: Impacts on Key Marco-Economic Variables

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**NEGLIGIBLE**	**NEGLIGIBLE**
Operation	**MAJOR (+ve)**	**MAJOR (+ve)**
Decommissioning and Post Closure	**MAJOR (-ve)**	**MAJOR (-ve)**

10.1.3 Impacts on Tourism

Table 10.20 Impact Characteristics: Impacts on Tourism

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	All project aspects and activities that could impact on characteristics of the area which support tourism (ie visual quality, air quality, biodiversity, noise, etc.).	All project aspects and activities that could impact on characteristics of the area which support tourism (ie visual quality, air quality, biodiversity, noise, etc.).	Closure and rehabilitation of project aspects and activities that could impact on characteristics of the area which support tourism (ie visual quality, air quality, biodiversity, noise, etc.).
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	Tourists and those that rely on them for their livelihoods.	Tourists and those that rely on them for their livelihoods.	Tourists and those that rely on them for their livelihoods.

Tourism plays an important role in the economy of the wider area and has the potential to play an increasingly prominent role as a driver of economic development. It is thus important to consider the potential impacts of the Project on this sector.

In order to assess tourism impacts, information on current tourism use and potential future use focusing on the wider area surrounding the site was gathered. In order to verify and augment tourism issues raised during scoping, discussions were also held with tourism authorities and tourism stakeholders in order to get their views on potential impacts. These discussions confirmed that visual, air quality and traffic and habitat impacts were the key concerns for tourism. Sources of positive impacts would stem from increased potential business-related visitors to the Project.

The Tourism Development Context

The provincial, district and local municipality IDPs and SDFs all point out the importance of tourism in the wider area and focus on its future potential. Specifically at a local level the Khâi-Ma Local Municipality SDF (KMLM, 2010: p 114) reports that 'the Khâi-Ma environment is characterised by vast open land, unique topographical features (ie, mountain ranges, Bushmanland, Inselberg, wilderness areas along the Orange River, etc.) and rich heritage of the Khoi San/Nama people as well as the cathedral at Pella provides ample eco-tourism, adventure tourism and cultural tourism opportunities.' With regard to tourism corridors, the SDF advocates the prioritisation of the 'Pofadder-Onseepkans' and 'Pofadder-Witbank' tourism routes for tourism development with Pofadder, Onseepkans and Pella the identified tourism nodes. It also points out that, the tourism of Khâi-Ma should be promoted and marketed through a well-developed tourism strategy. Such a strategy should focus on tourism attractions offered by the towns, mainly Pofadder,

Onseepkans and Pella, tourism possibilities along the Orange River and proper roads linking these tourist attractions' (KMLM, 2010: p 140).

Discussions with the local tourism authorities confirmed that the focus of current tourism activity and future potential in the area near the Project site was along the identified corridors and in general along the Orange River and in the mountainous areas around Pella and Klein Pella to the north of the N14 (L van Wyk, Khâi-Ma Municipality, pers com). The Namaqua Eco Trail, for example, starts near Pella and runs roughly along the Orange River to the West ending at the sea near Alexander Bay. There are also 4X4 trails between Pella and Pofadder and hiking trails in the mountains. The N14 itself is also recognised as the most important tourism route in the area. Note that it is likely that ad-hoc specialised tours are taking place in the area to specific sites particularly in the mountains nearer the project site (eg Aggeneys and Namies mountains). However, they are likely to be small in number and have not been brought to the attention of the tourism authorities in the local municipality.

Key tourism establishments in the wider area around the site are listed below along with their basic details (room and bed numbers) and their distances from the nearest project components. The only tourism accommodation facilities identified within 15 km of the site boundaries would be guest houses in Aggeneys (roughly 8km from the site) and the Oase in de Wilderness Lodge between 9km and 11km to the north-east of the site along the road connecting the N14 to Klein Pella.

Table 10.21 Key tourism Establishments Nearby the Site

Area and name of establishment	Nr units/rooms	Nr of beds	Distance to closest element of project in km
Aggeneys			
Guest houses and B&Bs	20 - 30 rooms	40 to 60	8
Pella & Klein Pella area			
Pella River Resort	20+ rooms and camping	40+	25
Klein Pella Guest Farm	7 rooms, 4 rondavels, 20 camp sites	30	17 to 19
Oase in de Wilderness	6 -10 rooms	12 to 20	9 to 11
AmAm Lodge	2 units	8	25
Pofadder			
Pofadder Hotel	34 rooms	70	33
Guest houses and B&Bs	30 - 40 rooms	60 - 80	33
Total		**284**	

Visual Impacts

A review of the visual specialist study alongside the tourism context revealed that the following points made in the visual specialist study are particularly important when considering tourism impacts (NLA, 2013):

Visual Resource Value/Scenic Quality and Sense of Place:

- The overall study area can be regarded as having a high visual

resource value with its relatively unspoilt, vast, arid pains and rugged, rocky koppies contrasting dramatically with the blue skies.

- Although the study are evokes a distinct sense of place, it is not unique to the district or region. Nevertheless, the landscape quality or visual resource of the study area is considered to be high.

Sensitive Receptors:

- The vast majority of the views to the Project will be experienced from the N14 as motorists travel past the site in an easterly or westerly direction. This makes views from the N14 road important and perhaps the most sensitive to the proposed intervention.

- Other primary views of the Project would be from the mining town of Aggeneys, to the west of the Project, and from farmsteads nearby.

- Sensitive viewer locations would be views from tourists travelling long the N14 and views from the farmstead of the farm Achab.

Landscape Impact:

- The landscape impact (ie the change to the fabric and character of the landscape caused by the physical presence of a development) of the Project will be high as the physical impact of the construction, operation, decommissioning and closure of the mining activities will disturb a great percentage of the Project site.

Visibility and Visual Exposure Levels:

- The project's 'zone of potential influence' was established at 15km by the visual specialist noting that beyond 15km the impact of the proposed activities would have diminished

Overall Significance of Impacts:

- The overall significance of the visual impact is rated as being high.
- Even after mitigation measures are implemented, the significance of the visual impact will remain high as that waste rock dumps and tailings dam would remain.

Drawing on the above findings in particular in the visual impact assessment combined with tourism usage patterns and potential in the area, the following observations are made with regard to impacts for areas of tourism sensitivity:

Pella, Klein Pella including the gravel road to Klein Pella:
None of these areas would be within the 15km visual impact 'zone of potential influence' as outlined in the visual specialist study. Impact are therefore likely

to be minimal and restricted to temporary impacts on those visitor that drive past the project site on the N14 in order to access these areas.

Aggeneys and surrounds:
Aggeneys would fall within the low exposure area of the projects visual 'zone of potential influence'. This along with the mining town nature of Aggeneys should limit impacts. Tourists exploring the Aggeneys Mountains would, for the most part, be shielded from views of the Project.

The N14:
Visual risks along this key route would be particularly prominent. Impacts would be mitigated by the temporary nature of visual exposure, ie they would be limited to a relatively short period of time when motorists are passing the project area. Visual exposure would be moderate or higher for a 10-11km stretch of the road (ie for 5-7 minutes of driving time) and low beyond this distance implying lower impacts.

Overall:
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 highly significant. Impacts on specific tourism facilities and key tourism areas would be limited, however, given the project's location relative to these. Visual exposure from the N14 would be high although temporary in nature for passing motorist 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.

Loss of Conservation Worthy Land and Conservation Off-sets

Any significant loss of highly conservation worthy land such as that found on the Project site has potential implications for tourism. This is because conservation worthy lands has appeal to tourists and is becoming increasingly scarce. As outlined in the vegetation specialist study, the mine and plant site's high species diversity and number of rare species are of high conservation value and are reflected in its importance in local and regional conservation planning (see Desmet, 2013).[1] Should the Project proceed on the site, a significant portion of highly conservation worthy land would be sacrificed. This is a highly significant loss as recognised in the vegetation specialist study and will trigger the need for a biodiversity/conservation offset which conserves and safeguards appropriate conservation worthy land elsewhere. With pro-active planning there may be possibilities to allow controlled eco-tourism activities on an offset site. An investigation of appropriate options in this regard should ideally form part of offset selection and planning.

[1] Note that the fauna and flora specialist report concentrated on assessing the impacts of supporting infrastructure (such as extension to the waste water treatment works, housing, switching yard, power lines, offtake water pipeline) and found that impacts would be low with mitigation as the areas affected have relatively low conservation status (see Todd, 2013).

Without the Project and its conservation offset one can only speculate regarding future use of the site and its potential implications for tourism. For example, it the status quo is maintained, the most likely scenario is that the land would probably remain a private underground with no access for tourists, but with views of the site in an undisturbed state. This scenario would limit tourism risks from aesthetic degradation of the area but is not likely to secure tourism opportunities through access to the site. In the longer term this potential for future mining seems set to remain given the size and quality of the deposit and as zinc reserves continue to be depleted elsewhere thereby increasing pressure for the mining of the site.

Air Quality and Noise Considerations

Negative impacts on air quality have the potential to impact on the experience of tourists particularly if significant direct nuisance is caused (primarily from dust) and if decreased air quality feeds into deteriorated visual quality in the area. With regards to overall air quality impacts, the key findings of the air quality specialist study is that with mitigation, air quality impacts would be negligible during construction and minor during operations implying minimal risks for tourism (see DDA, 2013).

It should be recognised that some level of nuisance from dust outside the boundaries of the Project site would be unavoidable. Considering the above findings, however, it seems reasonable to conclude that risks specific to tourism from air quality impacts would be of a low significance with mitigation.

Noise impacts also have the potential to impact on tourism if they are shown to be particularly severe and to affect tourism receptors. The key findings of the noise specialist study indicate that, with mitigation, noise impacts are expected to be of a very low significance and generally highly localised within the project site with no impacts on sensitive tourism receptors identified (DDA, 2013a).

Potential for Increased Business Tourism

Experience indicates that a number of technical, management and sales staff generally associated with the numerous companies involved in the construction of a project of the large and complex nature proposed by BMM is 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 such as restaurants, transport, retail, etc. These opportunities would primarily be available to businesses in the Khâi-Ma Municipality area and in larger towns such as Springbok.

Although the short term magnitude of impacts are likely to be greater during construction given the level of activity at the site, increased business tourism flows are also likely during operations particularly given the presence of new

technology requiring suppliers, servicing, etc. This positive impact should be taken into account although it is difficult to accurately estimate the number of business visitors that would need to go to site and the durations of their stays. At a minimum the positive impacts associated with business tourism will act as a partial counter to negative impacts on tourism. Bear in mind also that trips for business purposes can also lead to return visits for leisure as business people are exposed to the attractions of the area.

Overall Impacts and Significance

An assessment of the significance of the un-mitigated impacts of the construction and operation of the Project on tourism based on the findings above is presented in the Boxes below.

The no-go alternative would not result in impacts on tourism as it would maintain the status quo.

Box 10.6 Summary of Construction Phase Impacts: Impacts on Tourism

Nature: Biophysical impacts would impact on the tourism appeal of the area resulting in overall **negative impacts** notwithstanding the potential for increased business tourism.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will result in the loss of tourism resources with medium level of **irreplaceability.**

Impact Magnitude – Medium.

- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **short-term (ie reversible).**
- Scale: The impact will result in **notable changes** to the receptor.
- Frequency: The frequency of the impact will be **once-off.**
- Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **medium**.

Box 10.7 Summary of Operational Phase Impact: Impacts on Tourism

Nature: Biophysical impacts would impact on the tourism appeal of the area resulting in overall **negative impacts** notwithstanding the potential for increased business tourism.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will result in the loss of tourism resources with medium level of **irreplaceability.**

Impact Magnitude – High.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **long-term for the life of mine (ie reversible).**
- Scale: The impact will result in **notable changes** to the receptor.
- Frequency: The frequency of the impact will be **periodic.**
- Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE TO MAJOR (-).

Degree of Confidence: The degree of confidence is **medium**.

Construction and Operational Phase Mitigation:
Impacts on tourism are primarily dependent on how BMM's operations are designed, constructed and operated to minimise negative biophysical and social impacts and enhance positive ones. The measures recommended in other specialist studies to minimise negative impacts (primarily visual, air quality, noise, traffic and ecological habitat measures) and enhance positive impacts would thus also reduce impacts on tourism and should be implemented. These measures are not repeated here.

With pro-active planning there may be possibilities to allow controlled eco-tourism activities on the biodiversity offset area. An investigation of appropriate options in this regard should ideally form part of offset selection and planning.

Decommissioning and Post Closure Phase Impacts

Decommissioning would essentially result in the reduction or removal of tourism risks as project elements are closed. The eventual significance of impacts will be highly dependent on rigorous rehabilitation of the Project site. Closure would also result in a reduction in business tourism to the area that would be linked to the presence of the Project. An assessment of the significance of the impacts based on the findings above is presented in the Box below.

Box 10.8 Summary of Decommissioning Phase Impacts: Impacts on Tourism

Nature: Biophysical impacted that affected the tourism appeal of the area would cease and/or reduce resulting in overall **positive impacts** notwithstanding the potential for decreased business tourism.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will result in the loss of tourism resources with medium level of **irreplaceability.**

Impact Magnitude – Low.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent (ie not reversible).**
- Scale: The impact will result in **notable changes** to the receptor.
- Frequency: The frequency of the impact will be **periodic.**
- Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (+).

Degree of Confidence: The degree of confidence is **medium**.

Decommissioning Phase Mitigation:

If one takes a sample of mines throughout South Africa it is clear that rehabilitation effort and the success associated with it can be highly variable even if all mines are required to abide by the same regulations (see van Zyl et al., 2012). This variability can be seen when comparing both operating and closed mines. It therefore stands to reason that, with regards to minimising impacts, much will depend on how BMM EMPr is conceived and implemented in partnership with the DMR, DENC and other local stakeholders. If rehabilitation is rigorously applied and well-funded both concurrently and at closure to avoid visual scarring along with air pollution control measures, impacts are likely to be significantly less.

Residual Impact

The implementation of the above mitigation measures would decrease the negative construction phase impacts from **Moderate** to **Minor** significance and the operation phase impacts from **Moderate/Major** to **Moderate**. The implementation of the decommissioning phase mitigation measures would probably introduce positive impacts of a **Moderate** significance if they are particularly well resourced and executed. The pre- and post-mitigation impacts are presented below.

Table 10.22 Pre- and Post- Mitigation Significance: Impacts on Tourism

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (-ve)**	**MINOR (-ve)**
Operation	**MODERATE TO MAJOR (-ve)**	**MODERATE (-ve)**
Decommissioning and Post Closure	**MINOR (+ve)**	**MODERATE (+ve)**

10.1.4 Impacts on Surrounding Land Uses

Table 10.23 Impact Characteristics: Impacts on Surrounding Land Uses

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	All project aspects and activities that could impact on the current and future use and economic potential of surrounding lands.	All project aspects and activities that could impact on the current and future use and economic potential of surrounding lands.	Closure and rehabilitation of project aspects and activities that could impact on the current and future use and economic potential of surrounding lands.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	Surrounding land owners and those that rely on them for their livelihoods.	Surrounding land owners and those that rely on them for their livelihoods.	Surrounding land owners and those that rely on them for their livelihoods.

Current use of lands immediately surrounding the site (and therefore potential impacted on due to activities on the site) is focused on agriculture primarily in the form of low potential grazing. Although projects are yet to be established, the potential for surrounding lands and those in the wider area to be used for renewable energy projects has also been recognised. Among others, there is an application pending for the use of a portion of Farm RE 1/57 adjacent to the site for a solar energy project. Given these land use options, this section focuses on potential risks to agriculture and solar development potential in particular. It also comments on potential risks to property values.

Hydrological and Hydrogeological Impacts

Impacts on the hydrological environment can have implications for agricultural production and, if severe enough, for access to water for households. The findings of the hydrogeological specialist study indicate that (ERM, 2013a):

- Decreases in groundwater depths of between 5 and 10m are anticipated 100 years after mine closure extending up to 3,000m from the site boundary in all direction excluding to the west. There are currently two existing boreholes in this area that would be potentially affected.

Given the above findings, overall risk to groundwater levels with serious implications for farming on adjacent lands area are considered low and mostly expected to manifest in the long term.

The findings of the hydrological specialist study indicates that, with adequate mitigation, impacts on surface water flows on neighbouring farms are likely to be minor (HHO Africa, 2013). It therefore stands to reason that the risk of

negative impacts on current agricultural practice or production would be minor.

Air Quality Impacts

With regard to air quality impacts on neighbouring lands, the air quality specialist study has divided impact into those associated with particulate matter and dust deposition:

- Dust deposition was light (< 250 mg/m^2/d) around the N14, and moderate (250-500 mg/m^2/d) around the Loop 10 road.

- Heavy dust fall (> 500 mg/m^2/d) occurred mainly within the mining area and along the haul roads.

- The SANS residential guideline of 600 mg/m^2/d was not exceeded at any of the sensitive receptors.

Based on these findings it is considered unlikely that air quality impacts (mainly from dust deposition) would translate into material impacts on the grazing potential of land outside the Project boundaries. Impacts on the potential of neighbouring lands to be used for solar projects are also considered minor and confined to the narrow areas along the Loop 10 Road (where dust deposition was found to be moderate) and, to a lesser degree, the N14 (where dust deposition was found to be light). The possibility of impact should not, however, be ignored and the environmental quality monitoring plan should include the monitoring of air quality and any associated impacts.

Noise and Social Impacts

The noise specialist study found that noise impacts would have a very low overall significance and that the Project did not pose significant noise risks to sensitive receptors nearby. Based on these findings, unacceptable noise and related nuisance impacts on surrounding farms are not predicted. There is also no reason to suspect that noise impacts would translate into property value impacts particularly with respect to farm houses.

The social specialist study conducted an assessment of the potential for the influx of people associated with the Project to result in an increase in so-called social pathologies (see ERM, 2013). It found that the significance of this group of impacts would be moderate without mitigation and minor to moderate with mitigation. Among the risks identified, a general increase in crime including stock theft would be of particular concern to neighbouring land owners. Based on experiences elsewhere it stands to reason that some level of stock loss would be inevitable. Mitigation including compensation mechanisms would thus be important in this regard.

Visual Impacts

Visual impacts will not impact on productive potential of surrounding lands. These impacts do, however, have the potential to impact on the amenity value of surrounding land and farmsteads in particular. Based on a matching of the visual exposure map produced by the visual specialist with mapped farmstead locations, two farmsteads belonging to neighbours would be within the visual zone of influence of the Project and close enough to be affected as follows:

- The farmstead on Portion 1/57 would be roughly 2.8km to the south-west of the tailings dam and was found to have a medium significance visual exposure by the visual specialist.

- The farmstead on Portion 2/57 would be roughly 7.5km to the north-east of the tailings dam and was found to have a low significance visual exposure by the visual specialist.

Other farmstead to the east of the site such as those on RE/59, Portion 1/87, Portion 2/87 and RE/87 would be shielded from views of the site.

Property Value Implications of Impacts

The value of surrounding agricultural land is primarily driven by the productive potential of the land and, to a lesser degree, by its other 'lifestyle' or non-productive factors which essentially determine how pleasant it is to live on the land. These can include visual appearance, noise levels, pollution levels, etc.

Based on the synopsis of impacts above, it seems most reasonable to conclude that there would be a minor to moderate risks of decreases in value related to losses in production or productive potential with mitigation. While risks to neighbouring land owners with mitigation seem manageable, uncertainties regarding these risks remain. It is therefore clear that risks would need to be monitored and systems put in place to deal with impacts should they arise. It will be particularly important that these systems are devised with inputs from neighbouring land owners and that they are highly explicit regarding actions required from the applicant should negative impacts arise.

With respect to non-productive factors, the findings of the air quality and noise specialist studies do not indicate significant concern regarding impacts on neighbouring farmsteads. Visual impacts are a relatively greater source of concern as they would result in impacts on the overall sense of place of the area that would change significantly given the introduction of a large mining/industrial project in an areas dominated by agriculture. For the whole surrounding area, risk from this source should be low to medium in magnitude given the extensive size of farms. They would be particularly focused on the farmsteads on Portion 1/57 (roughly 2.8km to the south-west of the tailings dam) and, to a lesser degree, on Portion 2/57 (roughly 7.5km to

the north-east of the tailings dam) which would have views over the project site.

The value of farms adjacent to the site may also be impacted on due to negative perceptions. Portion 1/57 would be particularly at risk as it would effectively be 'sandwiched' between the Gamsberg project and the existing mining operations at Black Mountain. Even in the absence of verifiable negative environmental impacts from the Project, this position is likely to result in the risk of significant property values loss primarily as it would be associated with negative perceptions among potential buyers. These would probably include perceptions regarding pollution levels as well as concerns regarding social nuisances such as perceived increased potential for stock theft. On the whole, the actual change in the character of the area that will be associated with the mine combined with negative perceptions should result in very limited interest in nearby properties from buyers that place importance on lifestyle factors.

Overall Impacts and Significance

An assessment of the significance of the un-mitigated impacts of the construction and operation of the Project on surrounding land uses based on the findings above is presented in the Boxes below. The no-go alternative would not result in impacts on surrounding land uses as it would maintain the status quo.

Box 10.9 Summary of Construction Phase Impacts: Impacts on Surrounding Land Uses

Nature: Biophysical and social impacts would impact on current and future potential land uses surrounding the site resulting in overall **negative impacts**.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will result in the loss of surrounding land use potential and resources with a low level of **irreplaceability.**

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **short-term (ie reversible).**
- Scale: The impact will result in **notable changes** to the receptor.
- Frequency: The frequency of the impact will be **once-off.**
- Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **medium**.

Box 10.10 Summary of Operational Phase Impact: Impacts on Surrounding Land Uses

Nature: Biophysical and social impacts would impact on current and future potential land uses surrounding the site resulting in overall **negative impacts**.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will result in the loss of surrounding land use potential and resources with a low level of **irreplaceability.**

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **long-term for the life of mine (ie reversible).**
- Scale: The impact will result in **notable changes** to the receptor.
- Frequency: The frequency of the impact will be **periodic.**
- Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **medium**.

Construction and Operational Phase Mitigation:

Impacts on surrounding land uses and land owners are primarily dependent on how BMM's operations are designed, constructed and operated to minimise negative biophysical and social impacts and enhance positive ones. The measures recommended in other specialist studies to minimise negative impacts (primarily visual, air quality, ground and surface water, noise, traffic and social measures) and enhance positive impacts would thus also reduce impacts on surrounding land uses and should be implemented. These measures are not repeated here.

Although significant impact on surrounding lands are not predicted at present, it should be recognised that these may arise in time and that principles and systems to deal with such eventualities should ideally be established before mining commences in consultation with those potentially affected. In other mining areas (Sishen, for example), a lack of clarity regarding who is responsible for impacts combined with unclear processes for dealing with compensation for impacts (without landowners having to resort to legal action) has cause high levels of tension between mines and surrounding land owners.

BMM should therefore actively engage with surrounding land owners and establish a clear policy for dealing with complaints. At a minimum this will require a forum that could meet regularly to discuss concerns.

In order to avoid confusion and contention regarding the source of impacts, it will also be critically important to set up monitoring systems for impacts such as those that may affect ground and surface water quantity/quality, air quality, etc. These systems need to be set up in such a way that, where impacts occur due to mining, these can be easily understood and ascribed to mining or not. BMM should also realise that they are introducing an activity

with potentially high risks for surrounding land owners into the area and therefore the risks should be transferred to BMM where possible.

A memorandum of understanding and clear protocols for dealing with potential impacts should also be established. This should be between BMM and surrounding land owners, but should also include relevant authorities such as those is agriculture, water affairs who have an interest and can play a role in policing and/or conflict resolution if needed. For example, it should be agreed that if farmer's boreholes lose pressure or need to be drilled deeper then BMM should carry out the necessary work or provide adequate funds.

There should also be a protocol established that makes it clear to all parties under what conditions and how the purchase of surrounding lands will be handled should the need arise. This will ensure clarity and build trust with surrounding land owners.

Decommissioning and Post Closure Phase Impacts

Decommissioning would essentially result in the reduction or removal of risks to surrounding land uses as project elements are closed. The eventual significance of impacts will be highly dependent on rigorous rehabilitation of the project sites. Impacts on the recovery of groundwater in particular will be important to continued agriculture in the area. An assessment of the significance of the impacts based on the findings above is presented in the Box below.

Box 10.11 Summary of Decommissioning Phase Impacts: Impacts on Surrounding Land Uses

Nature: Biophysical impacted that affected surrounding land uses would cease and/or reduce assuming adequate mitigation and closure resulting in overall **positive impacts**.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will result in the loss of surrounding land use potential and resources with a low level of **irreplaceability.**

Impact Magnitude – Small to medium.

- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent (ie not reversible).**
- Scale: The impact will result in **notable changes** to the receptor.
- Frequency: The frequency of the impact will be **periodic**.
- Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR TO MODERATE (+).

Degree of Confidence: The degree of confidence is **medium**.

Decommissioning Phase Mitigation:

If one takes a sample of mines throughout South Africa it is clear that rehabilitation effort and the success associated with it can be highly variable.

This variability can be seen when comparing both operating and closed mines. It therefore stands to reason that, with regards to minimising impacts, much will depend on how BMM EMPr is conceived and implemented in partnership with the DMR, DENC and other local stakeholders. If rehabilitation is rigorously applied and well-funded both concurrently and at closure to avoid external environmental costs, impacts are likely to be significantly less than the case of BMM simply doing the minimum to satisfy DMR and DENC requirements.

Residual Impact

The implementation of the above mitigation measures would decrease the negative construction phase impacts from **Moderate** to **Minor** significance and the operation phase impacts from **Moderate** to **Minor**. At an aggregate level, risks could be reduced to a low level with mitigation although there are instances (such as farm Portion 1/57) where risks would be higher for specific reasons. The implementation of the decommissioning phase mitigation measures would probably result in positive impacts which could have a **Moderate** significance if they are particularly well resourced and executed.

Table 10.24 Pre- and Post- Mitigation Significance: Impacts on Surrounding Land Uses

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (-ve)**	**MINOR TO MODERATE (-ve)**
Operation	**MODERATE (-ve)**	**MINOR TO MODERATE (-ve)**
Decommissioning and Post Closure	**MINOR (+ve)**	**MINOR TO MODERATE (+ve)**

10.1.5 Impacts on Municipal Services

Table 10.25 Impact Characteristics: Impacts on Municipal Services

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Overall project has the potential to improve whilst also straining the financial position of the local and district municipality.	Overall project has the potential to improve whilst also straining the financial position of the local and district municipality.	Withdrawal of project has the potential to improve whilst also straining the financial position of the local and district municipality.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	The municipality and those who finance it (primarily its residents and national government).	The municipality and those who finance it (primarily its residents and national government).	The municipality and those who finance it (primarily its residents and national government).

New development projects have the potential to improve the financial positions of local municipalities where they are located through net increases in rates and other income. Despite this, large developments of this nature can

also place greater strain on municipal services and lead to overall negative impacts on municipal finances. Note that cases where this has occurred are especially likely to be found in rapidly growing communities (see Altshuler et al. 1993, Ladd 1992 and RKG Associates 1989 cited in Fausold & Lilieholm 1996).

In order to assess what may happen to municipal finances it is necessary to understand the basics of the overall municipal financial planning process associated with new development projects. When a developer proposes a new project, a process of negotiation is entered into with the municipality aimed at determining the financial or other contributions needed from the developer in order to cover the increased cost of the provision of services to the site (ie to extend the existing network of services and to account for increased use of existing services). Services may include roads, sewerage, water, electricity, waste collection, and an accurate estimation of this contribution by the municipality is a key to ensuring cost recovery. If it is an underestimation, some of the costs associated with the development will not be recovered from the developer and will have to be covered using other sources (most often municipal ratepayers in general). The ability of the municipality to negotiate favourable contributions and extract these contributions is also a key determinant of whether the overall financial position of the municipality improves, stays the same or deteriorates.

In addition to the estimation of the costs of additional services to the development site, it is necessary for the municipality to get an accurate understanding of the potential implications of a project for population movement in the municipality. How many workers from outside the municipality are expected and where will they live? These are some of the key considerations that allow for municipal planning to proceed. This, in turn, determines how municipal services can be charged for and across what number of households. Thereby it provides the municipality with an understanding of how its rates base will be improved and where.

Based on the description above it is clear that in the case of this Project, or any other large development project, the municipality bears ultimate responsibility for ensuring that the Project contributes to the financial sustainability of the Khâi-Ma Municipality and the wider district and does not burden them 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. Discussions with the Khâi-Ma Municipality revealed that they are well aware of the need to recover costs and would endeavour to ensure that BMM not only covers their own costs, but also make a 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 BMM in this regard. They also have confirmed that no decisions have yet been made pending the outcome of the EIA process and the provision of more detailed project information to the municipality as it becomes available (P van der Merwe, Khâi-Ma Municipality, pers. com.). 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.

Construction and Operational Phase Impacts

An assessment of the significance of the un-mitigated impacts during the construction and operational phases of the Project on municipal finances, based on the findings above, is presented in *Box 10.12* below. For both phases, inadequate management, limited co-operation between the municipality and the proponent, along with un-controlled in-migration, could lead to overall moderate negative impacts on municipal finances.

The no-go alternative would maintain the status quo and would not provide the opportunity to raise added funds for the municipality, but would also not introduce the risk of not covering increased service costs.

Impact Description and Assessment

Without mitigation the project has the potential to result in an overall **negative impact** on municipal finances notwithstanding its potential to also improve the financial position of the local and district municipality. The impact will not include the loss of irreplaceable resources. The extent of the impact is **local**. The impact will result in **notable changes** to the receptor. The frequency of the impact will be **once-off** during the construction phase and **periodic** during operation. Impacts are a **certainty** in the economy.

Box 10.12 Summary of Overall Impact Significance (Construction and Operational Phases): Impacts on Municipal Services

Nature: Without mitigation the project has the potential to result in an overall **negative impact** on municipal finances notwithstanding its potential to also improve the financial position of the local and district municipality.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Low.**
Irreplaceability: The impact will **not** include the loss of **irreplaceable** resources.

Impact Magnitude – **Medium.**
Extent: The extent of the impact is **local.**
Duration: The overall expected impact will be **long-term for the life of mine (ie reversible).**
Scale: The impact will result in **notable changes** to the receptor.
Frequency: The frequency of the impact will be **once-off** during the construction phase and **periodic** during operation.
Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MODERATE (-).**

Degree of Confidence: The degree of confidence is **medium**.

Construction and Operation Phase Mitigation

The municipality should continue to take responsibility for ensuring that the Project contributes to municipal financial sustainability and does not burden it with increased costs.

The proponent will need to engage with the municipality in good faith and with the intention to ensure that it does not burden the municipality with additional costs.

The mitigation measures contained in the social specialist study aimed at limiting the influx of job seekers to the area would need to be implemented in order to ensure that their impacts on services provision costs remain as low as possible.

Decommissioning and Post Closure Phase Impacts

Decommissioning would essentially result in the reduction or removal of Project related contributions to municipal finances as well as potential strains on these finances as project elements are closed. The eventual significance of impacts will be highly dependent on rigorous rehabilitation of the project sites as inadequate rehabilitation has the potential to transfer costs onto the local municipality (eg clean-ups). An assessment of the significance of the impacts based on the findings above is presented in the Box below.

Impact Description and Assessment

Without mitigation the withdrawal of the Project has the potential to result in an overall **negative impact** on municipal finances. The impact will **not** include the loss of **irreplaceable** resources. The extent of the impact is **local.** The expected impact will be **permanent** (ie not reversible). The impact will result in **notable changes** to the receptor. The frequency of the impact will be **periodic**. Impacts are a **certainty** in the economy.

Box 10.13 Summary of Decommissioning Impact: Impacts on Municipal Services

Nature: Without mitigation the withdrawal of project has the potential to result in an overall **negative impact** on municipal finances.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Low.**
Irreplaceability: The impact will **not** include the loss of **irreplaceable** resources.

Impact Magnitude – **Medium.**
Extent: The extent of the impact is **local.**
Duration: The expected impact will be **permanent (ie not reversible).**
Scale: The impact will result in **notable changes** to the receptor.
Frequency: The frequency of the impact will be **periodic**.
Likelihood: Impacts are a **certainty** in the economy.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MODERATE (-).**

Degree of Confidence: The degree of confidence is **medium**.

Decommissioning and Post Closure Phase Mitigation

The principles that should govern adequate mine and plant decommissioning and closure as outlined in the section above on tourism impacts would also apply to limiting impacts on municipal finances.

BMM will need to ensure continuous engagement with the municipality and keep it informed of any closure plans well in advance of them occurring.

The municipality, in turn, should be pro-active and plan for changes well in advance of potential mine closure.

Residual Impact

The implementation of the above mitigation measures would decrease the negative construction phase impacts from **Moderate negative** to **Moderate positive** significance and the operation phase impacts from **Moderate negative** to **Moderate positive**. The implementation of the decommissioning phase mitigation measures are relatively uncertain, not primarily under the control of BMM and in the distant future implying that impact would remain **Moderate negative** with mitigation if one takes a conservative view. The pre- and post-mitigation impacts are compared in *Table 10.26* below.

Table 10.26 Pre- and Post- Mitigation Significance: Impacts on Municipal Services

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (-ve)**	**MODERATE (+ve)**
Operation	**MODERATE (-ve)**	**MODERATE (+ve)**
Decommissioning and Post Closure	**MODERATE (-ve)**	**MODERATE (-ve)**

10.2 IMPACT ON SOCIAL ENVIRONMENT

The potential for social and economic impacts will arise through a range of direct Project activities as well as indirect activities. This section provides an assessment of the key socio-economic issues identified during the study. The identification of key issues was based on:

- the Final Scoping Report;
- a review of project related information, including other specialist studies;
- interviews with key informants as well as focus group meetings with interested and affected parties (I&APs);
- comments received from I&APs through the public participation process;
- experience of the authors with the area and local conditions; and
- experience with other mining projects.

The identified impacts will occur as a result of direct Project activities, including the presence of a large workforce, as well as the in-migration of job-seekers to the broader area. The impacts assessed in this chapter include:

- economic impacts as related to:
  - employment;
  - training and skills development;
  - procurement of goods and services; and
  - economic diversification; and
  - unmet expectations and associated social unrest.

- infrastructure and services impacts as related to direct Project activities:
  - increased pressure on infrastructure and services;
  - groundwater resources; and
  - road infrastructure.

- infrastructure and services impacts as related to influx of job-seekers:
  - increased pressure on infrastructure and services; and
  - road infrastructure.

- health impacts as related to direct Project activities:
  - communicable diseases; and
  - road traffic accidents.

- health impacts as related to influx of job-seekers:
  - communicable diseases; and
  - road traffic accidents.

- Quality of Life and Cultural Heritage Impacts
  - relations between locals and migrants;
  - social pathologies; and
  - cultural and social values.

10.2.1 Key Social Considerations

Impacts Associated with Influx

One of the most significant factors that will cause/exacerbate some of the identified socio-economic impacts will be the in-migration of workers and job-seekers to the area. They are likely to originate from other areas in the NDM, province, as well as the rest of South Africa and internationally.

The majority of the migrants will anticipate opportunities linked to employment, procurement, small business development and other general community benefits. *Section 10.2.2* provides detail on the expected number of job opportunities that will be created for the construction and operation phases as well as the proportion of local workers and those who are likely to originate from other areas. Taking into account the family members or

dependants who might relocate with the workers and the job-seekers, the population in the LM is likely to increase significantly.

Given the length of the Project life and the number of migrant workers expected, the presence of in-migrants will have an impact on the local communities in the direct area of influence. Where relevant, the impacts associated with the influx of job-seekers have been assessed as discrete impacts to those associated with the in-migration of Project-related workers. Given the distribution of the settlements (see *Figure 6.2*) in relation to the Project site, impacts resulting from the influx of job-seekers will primarily be experienced in the settlements of Pofadder and Pella; whereas, impacts associated to the in-migration of workers will be experience in Aggeneys. The specific impacts that will be exacerbated by the influx of job-seekers include:

- infrastructure impacts as related to:
  - housing;
  - health and education;
  - water and sanitation;
  - electricity; and
  - refuse removal;
- health impacts as related to:
  - increase in communicable diseases; and
  - increase in the risk of traffic accidents due to increase in traffic volumes;
- unmet expectations and associated social unrest;
- increased tension between locals and in-migrants;

Socio-economic Impacts

During the expected lifespan, the Project is expected to contribute positively to the local, regional and national economy in the following ways:

- creation of direct and indirect employment
- training and development opportunities
- procurement of goods and services; and
- increased economic diversification.

The project has an anticipated operational lifespan of 19 years. During this time the economic impacts of the project will be positive; however, Project decommissioning and closure will impact on the economy negatively as a result of economic divestment, job losses and decreased income in the local economy.

10.2.2 Employment

Table 10.27 Impact Characteristics: Employment Opportunities

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Creation of employment opportunities.	Creation of employment opportunities.	Loss of employment opportunities.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect
Stakeholders/ Receptors Affected	Job seekers.	Job seekers.	Job seekers.

Employment opportunities will be generated through direct, indirect and induced employment opportunities during all Project phases.

- direct opportunities are those jobs with BMM, both permanent and temporary;
- indirect opportunities are the jobs with the contractors and suppliers; and
- induced employment arises from increased spending in the local area as a result of increased disposable income and demand for additional goods and services.

The Project is expected to create an estimated 3,200 employment opportunities during the construction phase. The construction phase jobs are expected to last an average of 19 months over a period of 36 to 42 months. Approximately 850 permanent positions will be created by the Project during the operation phase. The Project will require highly skilled, semi-skilled and unskilled workers to undertake the construction; see *Chapter 3* for the Project description.

There are high expectations amongst the local population associated with employment opportunities that will be brought about by the Project. Illiteracy and a lack of skills are, very high in the area with the majority of the population having some secondary schooling and only 18 percent of the LM having completed high school. The lack of other industries and formal employers in the LM means that the pool of experience in the local workforce is limited. In addition, there are currently no accredited professional training opportunities in the LM. An influx of migrant job-seekers into the area will increase competition for employment opportunities. It is likely that migrant job-seekers will come from other areas of NDM such as Steinkopf, Nababeep and Kleinsee, where there have been recent mine closures as well as from other parts of the Province such as Kathu, Postmasburg and Kuruman all of which are mining areas. These migrant job-seekers will have gained skills in mining and construction in large-scale projects, which will be an advantage in seeking work positions within the Project. As such, they are likely to out-compete local job-seekers.

In essence, local workers are expected to be qualified to fill unskilled positions at first, whilst a limited number of people will be sufficiently qualified for the semi-skilled and highly skilled positions. According to the Economic Specialist Study (See *Annex G*) it is estimated that 11 percent of workers will come from the LM across all skills levels for the construction phase. Technically skilled personnel required for the construction and operation of the Project are limited in the LM and estimated to contribute three percent towards the highly skilled labour of the Project. Other parts of the NDM, Province and country make up 87 percent of the labour requirement and ten percent of the highly skilled labour is expected to come from other countries.

In addition to the direct employment opportunities available to local people, there will be a number of indirect and induced employment opportunities generated through the Project for both the construction and operation phases. Indirect employment will be created through the supply chain and procurement of local goods and services. Induced employment will also be created through increased spending in the economy by people employed to work on the Project. However, given the limited goods and services available to the Project in the LM, it means that indirect employment opportunities are likely to be limited. There will however be induced employment due to an increase in services linked to greater demand. Such services include informal (spaza) shops, salons, restaurants, accommodation, petrol attendants etc.

Mine decommissioning and closure will result in the loss of jobs for those employed to work for the Project, as it scales down. The job losses will not only be experienced by the direct employees of the Project, but those employed in the supply chain as the procurement needs of the Project will change. Previously induced employment opportunities, also risk job losses as a result of diminished demand. During the same time, some new temporary employment opportunities will arise for those who specialise in mine decommissioning and closure processes; however, these will be limited and highly specialised jobs.

Impact Assessment

Construction

The impact will be **positive** and **direct** as related to the creation of direct employment opportunities and **indirect** as it relates to indirect and induced jobs. The magnitude of the impact will be **medium** during the construction phase. The magnitude is linked to the duration of the employment opportunities, quality/level of employment, and the degree to which local workers will secure the employment opportunities. The duration will be short term as jobs will last on average 19 months. The impact will be experienced at the local, regional, national and international levels as the employment opportunities will be extended to people from outside the country. The scale of the impact will be **medium** as the Project will provide employment to an area with limited opportunities. However, based on the employment estimates above, approximately 350 employment opportunities will be made available at the local level; thus the number of people locally who will be

employed during the construction phase is likely to be low in comparison with the number of job-seekers in the Project area. The frequency of employment opportunities will be occasional as these opportunities will become available on average once every 19 months when contracts come to an end. The sensitivity of people locally will be **medium** for despite the exceptionally high unemployment rate, the skills levels are such that local people will not be able to take up the employment opportunity. The sensitivity will be **medium** for people at the regional level and negligible at other levels. The pre-mitigation significance level is likely to be ***moderate positive*** during the construction phase.

Box 10.14 Summary of Construction Impacts: Employment Opportunities

Nature: Construction activities would result in a **positive direct** impact on employment opportunities

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **International.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **Medium changes** to the resource/ receptor.
- Frequency: The frequency of the impact will be **occasional.**
- Likelihood: Employment opportunities will **definitely** be generated.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (+).

Degree of Confidence: The degree of confidence is **high**.

Operation

The impact of employment creation at the operational phase will be **positive** and **direct** as well as **indirect** as it relates to indirect and induced employment. The magnitude of the impact will be **medium** as is linked to the duration of the employment opportunities, quality/level of employment, and the degree to which local workers will secure the employment opportunities. The duration will be long term for those employed during the operation phase and the extent will be international because employment will extend to people at all levels. The scale of the impact will be medium for the operation phase as the Project will aim to create the majority of employment opportunities at the local and regional levels, areas with limited opportunities. The number of people who will be employed during the operational phase is low in comparison to construction phase; however these jobs will be permanent. The frequency of the impact will be constant. The sensitivity will be **medium** at the local and regional level as a key contributor to employment but **low** at the national and international level. The pre-mitigation significance level is likely to be ***moderate positive*** during the construction phase.

Box 10.15 Summary of Operation Impacts: Employment Opportunities

Nature: Construction activities would result in a **positive direct** impact on employment opportunities.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **International.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **Medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Employment opportunities will **definitely** be generated.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (+).

Degree of Confidence: The degree of confidence is **high**.

Decommissioning and Closure

The impact on employment will be **negative**, **direct** and **indirect** as related to supply chain job losses as well as **induced** because of reduced demand for services in the local communities The magnitude of the impact will be **large** due to the limited opportunities available at the local and regional levels. This is also linked to the extent, duration, scale and frequency. The extent of the impact will be local, regional and to a limited degree national and international. The duration of the impact will be permanent and the scale will be large at the local and regional level but minor at the national and international level. The frequency will be constant. The sensitivity of people at the local and regional level will be **high** in general but **low** for those at the national and international level. The pre-mitigation impact significance is rated as ***major negative.***

Box 10.16 Summary of Decommissioning Impacts: Employment Opportunities

Nature: Decommissioning activities would result in a **negative direct** impact on employment opportunities.

Sensitivity/Vulnerability/Importance of Resource/Receptor – High – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Large.
- Extent: The extent of the impact is **International.**
- Duration: The expected impact will be **permanent.**
- Scale: The impact will result in **Large changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Employment opportunities will **definitely** be generated.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation and Enhancement Measures

The mitigation and enhancement measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objective of the mitigation and enhancement measures is to optimise opportunities for employment of local people (LM) and of South Africans in general as well as to assist employees and local communities to prepare for closure.

General: Enhancement Measures

- BMM will establish a recruitment and human resources management policy that is aligned with South African labour legislation and ILO requirements. The policy should address but not be limited to the following:
    - specific labour requirement such as the number of people, professions and specific skills required;
    - establishment of a recruitment committee consisting of local community representatives, the LM, BMM and Vedanta with the aim of identifying and employing local people for available employment opportunities;
    - transparency in the recruitment procedures as well as monitoring to ensure those that are employed are eligible for employment;
    - the monitoring function will either by conducted by the recruitment committee or by an independent consultant as is appropriate;
    - promote the employment of women as a means to ensure gender equality is attained in accordance with Broad-based Black Economic Empowerment (BBBEE) policies of South Africa; and
    - prioritisation of residents in the LM over people from other parts of the NDM and country should the necessary skills be available.
- BMM will partner with the NDM and LM to establish a labour centre. The centre will focus on the following services:
    - posting of employment opportunities;
    - compilation of a database of the local and regional labour force (skilled, semi-skilled and skilled); and

- providing basic training (including labour laws and financial management training). The training course will be targeted mainly to people from the NDM and LM.

- All contractors will be required to recruit and manage personnel in terms of BMM's recruitment and human resources management policy, where practical.

- BMM will provide all its local workers with induction/orientation. As part of the orientation process, brochures will be provided on financial management and the country's labour laws. The brochure must be in the local languages spoken by employees, simple and easy to understand.

- BMM will implement a grievance procedure that is easily accessible to stakeholders, through which complaints related to contractor or employee road use infringements (eg speeding, accidents) can be lodged and responded to. BMM will respond to all such complaints. Key steps of the grievance mechanism include:

  - circulation of contact details of 'grievance officer' or other key contact;

  - awareness raising among local communities (including all directly affected and neighbouring farmers) regarding the grievance procedure and how it works; and

  - establishment of a grievance register to be updated by BMM, including all responses and response times.

Construction: Enhancement Measures

- BMM will advertise job opportunities and criteria for skills and experience needed through local, regional and national media (including radio), at least three months ahead of recruitment. This information should also be provided to all relevant authorities, community representatives and organisations on the stakeholder database.

- No employment will take place at the entrance to the site. Only formal channels for employment will be used, however these channels need to be accessible.

- BMM to ensure that all local workers open banking accounts, into which their wages will be paid.

Operational: Enhancement Measures

- BMM will implement a skills and development training programme;
- BMM will implement a bursary scheme aimed at members from the local community.

Decommissioning and Closure: Mitigation Measure

- BMM will start conversations about the closure process with all employees at the peak of the operations.

Residual Impacts

Assuming that the above mitigation measures are implemented, the anticipated impact on employment creation at the local level is likely to increase over time. The significance rating of the construction and operation phase will be ***major positive***. The decommissioning and closure the significance rating will decrease to ***moderate negative***.

Table 10.28 Pre- and Post- Mitigation Significance: Employment opportunities

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (+ve)**	**MAJOR (+ve)**
Operation	**MODERATE (+ve)**	**MAJOR (+ve)**
Decommissioning and Post Closure	**MAJOR (-ve)**	**MODERATE (-ve)**

10.2.3 Training and Skills Development

Table 10.29 Impact Characteristics: Training and Skills Development

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increase training and skills development.	Increase training and skills development.	Increase training and skills development.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	Mine employees.	Mine employees.	Mine employees.

Those people who are employed via the Project (directly and indirectly) will also 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 [(1)] , 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.

Long lasting and sustained benefits can be expected for businesses and their employees that have the opportunity to form part of the Project's supply chain, in the form of:

(1) The on-the-job training will be limited to health and safety training as well as induction training (pers. com. Ralph Losper, 11 February 2013).

- enhanced work experience;
- delivery capacity; and
- training.

This will result in an increase in the percentage of local people employed in semi-skilled and skilled jobs over the Project's lifespan.

Decommissioning and closure will involve large scale downscaling and retrenchment of the workforce over a number of years. By that time however, a large number of local, regional and national professionals will have worked on the Project, and will be equipped to work on other such projects. Closure will have a considerable impact on the youth, as they will be in the prime of their working lives at the time of decommissioning, with significant earning potential, and demands on their income (ie. young families). Because training and skills development will cease after closure of the Project, there is little value in rating the 'impact' for the decommissioning and closure phase separately. It should be noted that those that have benefitted during the construction and operation phases of the Project will continue to benefit as they would have become more employable. This is assuming that there are other mining or industrial projects that could absorb the workforce at the time of decommissioning. The former Project workers are likely to have a significant advantage when competing for similar types of employment opportunities as a result of their training and skills developed.

Impact Assessment

Construction, Operation, Decommissioning and Closure
The enhancement and upgrade of skills resulting from the Project will be experienced as a **positive** impact through **direct** opportunities (permanent and temporary) at the mine and **indirect** opportunities through the supply chain. The magnitude of this impact is linked primarily with the type, manner and style of training, as well as the opportunity to practice the skills learnt; as such it is rated as **small** during the construction and operation phases of the Project. This impact will be experienced locally as related to the Project, and regionally, nationally and internationally as related to the supply chain. Skills development will be experienced in the short term as related to the construction and decommissioning activities, and during the operation phase this impact will be long term. The scale of the impact will be medium, given the poor skills at the local level, but the frequency will be occasional as the available information suggests that training will be focussed on induction training as well as health and safety training.

People will be able to adapt to the opportunity as long as they are provided with correctly targeted skills training (given the low baseline literacy and skills levels), making them of **medium** sensitivity to this impact. It is likely that sensitivity amongst people from Pofadder and Pella will be higher given their higher levels of vulnerability. The pre-mitigation significance level will be ***minor positive*** for the life of the Project.

Box 10.17 ***Summary of Construction, Operational and Decommissioning Impacts: Training and Skills Development***

Nature: Construction, operation and decommissioning activities would result in a **positive direct** impact on training and skills development.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Small.
- Extent: The extent of the impact is **local – international.**
- Duration: The expected impact will be **short to long term.**
- Scale: Medium.
- Frequency: Occasional.
- Likelihood: Likely.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (+).

Degree of Confidence: The degree of confidence is **medium**.

Mitigation Measures

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objectives:
The objective of the mitigation measures is to ensure the enhancement and upgrade of skills and experience, accrued through working for the Project or in the supply chain. In addition, it is to maximise the number of local and regional employees during the operation phase.

General: Mitigation Measures

- BMM, in partnership with the local municipality, local education and training NGOs and CBOs, will develop a Training Plan that enhances skills in the area. The Plan should:
    - identify the skills gaps (between existing skills and Project needs) and initiate mechanisms to train local people to meet the Project's needs;
    - identify the particular needs of the youth and women, based on feedback from stakeholders; and
    - prioritise the youth and women for training programs.
- All capacity building and skills development initiatives and commitments for core and non-core mining skills (including sustainable alternative

livelihoods) will be defined as commitments in the Mine's Social and Labour Plan (SLP).

- BMM will support the development of literacy enhancement programmes for the local community, in coordination with the local authorities, as part of the community development plans.

- BMM will provide local and national scholarships throughout the life of the project to recognised public and private universities for courses that are related to both core and non-core mining skills.

Construction: Enhancement Measures

- BMM will begin training potential candidates from the LM for the construction phase during the pre-construction phase to maximise local employees during the construction phase.

- BMM will begin training potential candidates from the LM and NDM for operation phase positions during the construction phase. Those candidates who display sufficient capacity to develop their skills and deliver high performance will be given priority.

Operation: Enhancement Measures

- On-the-job performance and training will be monitored through performance reviews. Training needs will be identified and provided on an on-going basis to foster continuous learning during the operation phase.

- BMM will begin training potential candidates from the LM and NDM for operation phase positions during the construction phase. Those candidates who display sufficient capacity to develop their skills and deliver high performance will be given priority.

Decommissioning and Closure: Enhancement Measures

BMM will identify and provide training to support sustainable alternative livelihoods (preferably aligned with priority areas as defined in the Integrated Development Plan) related to other sectors in the LM such agriculture and tourism in order to build skills that are not dependant on mining activities.

Residual Impacts

With the implementation of the above mitigation measures, the anticipated impact on enhancement and upgrade of skills and experience will increase from ***moderate positive*** significance for Project construction and operation. No further enhancements will be experienced during decommissioning and closure of the Project.

Table 10.30 Pre- and Post- Mitigation Significance: Training and Skills Development

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction, Operation and Decommissioning and Post Closure	**MINOR (+ve)**	**MODERATE (+ve)**

10.2.4 Procurement of Goods and Services

Table 10.31 Impact Characteristics: Procurement and Services

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increase in procurement and services.	Increase in procurement and services.	Increase in procurement and services.
Impact Type	Direct.	Direct.	Direct.
Stakeholders/ Receptors Affected	Local and regional communities.	Local and regional communities.	Local and regional communities.

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 LM and NDM.

However, locally owned businesses in the LM 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 estimated expenditure of the Project across geographic areas for the construction phase is reflected below.

Table 10.32 Construction Phase Expenditure per Geographic Area

Construction component	Anticipated spend on Khai-Ma municipal area suppliers	Anticipated spend on suppliers from the rest of the Namakwa District	Anticipated spend on suppliers in the rest of the Northern Cape	Anticipated spend on suppliers in the rest of SA	Anticipated spend on imports
Mine & Pre-Stripping	R 0	R 762 000 000	R 381 000 000	R 2 667 000 000	R 0
Concentrator plant	R 0	R 313 500 000	R 156 750 000	R 1 097 250 000	R 0
Housing	R 40 500 000	R 202 500 000	R 135 000 000	R 162 000 000	R 0
Infrastructure	R 0	R 463 500 000	R 463 500 000	R 1 158 750 000	R 231 750 000
Total	**R 40 500 000**	**R 1 741 500 000**	**R 1 136 250 000**	**R 5 085 000 000**	**R 231 750 000**

Source: Economic Specialist Study (Independent Economic Researchers, 2013).

The Project expenditure during the construction phase will primarily be for the construction of temporary worker accommodation. It is expected that

R40.5 million of the total procurement spend will be spent in the LM during the construction phase. In comparison to the expenditure in other areas this amounts to approximately 0.5 percent of the total (See *Table 10.32*). The procurement of services and consumables will be managed to ensure that high standards of quality and health and safety are maintained. Consumables (eg. food) will need to be purchased in large quantities while meeting stringent quality, health and safety standards. This requirement will mean that it is unlikely that local suppliers will be able to demonstrate an appropriate level of quality, health and safety management.

There is a general lack of established businesses that have the capabilities to deliver large quantities and meet the strict health and safety criteria in the LM thus the overall benefits to the LM will be limited. It is likely that many of the specialised procurement needs of the operation will be fulfilled by national companies. While the smaller and less experienced local and regional (LM and NDM level) businesses will supply goods and services such as: civils and construction materials, hospitality services (eg. accommodation, catering), transport, vehicle servicing and security services. For those local and regional companies from which goods and services are procured, there will be long lasting and sustained benefits to the businesses and their employees. The benefits will be through increased experience, capacity building and training, particularly in having to meet more stringent international requirements.

The operational cost will increase with the increase in production. According to the Economic Specialist study (see *Annex G*) the operational costs will increase from R528 million during the first year to R1.7 billion in the fifth year when full production levels are anticipated. *Table 10.33* below shows the estimated operational expenditure for each of the geographical areas.

Table 10.33 Estimated Operational Expenditure at Full Production per Geographic Area

Cost component	Anticipated spend in the Khai-Ma municipal area	Anticipated spend in the rest of the Namakwa District	Anticipated spend in the rest of the Northern Cape	Anticipated spend in the rest of SA	Anticipated spend on imports
Staff	R 352 500 000	R 44 062 500	R 22 031 250	R 22 031 250	R 0
Fuels	R 0	R 0	R 0	R 352 500 000	R 0
Electricity	R 0	R 0	R 0	R 176 250 000	R 0
Water	R 52 875 000	R 0	R 0	R 0	R 0
Transport	R 5 287 500	R 21 150 000	R 5 287 500	R 21 150 000	R 0
Chemicals	R 0	R 0	R 10 575 000	R 42 300 000	R 0
Maintenance	R 13 218 750	R 52 875 000	R 52 875 000	R 145 406 250	R 0
Overheads	R 0	R 12 337 500	R 6 168 750	R 98 700 000	R 6 168 750
Outsourced activities	R 12 337 500	R 49 350 000	R 24 675 000	R 148 050 000	R 12 337 500
Total	**R 436 218 750**	**R 179 775 000**	**R 121 612 500**	**R 1 006 387 500**	**R 18 506 250**

Source: Economic Specialist Study (Independent Economic Researchers, 2013).

The operational phase activities associated with the Project will provide opportunities for local business growth and development. It is estimated that at full production approximately R436 million will be spent in the LM per year

(approximately 25 percent of total operational expenditure). This compares to 10 percent in the NDM and seven percent in the Province. Procurement locally will assist in creating income and building a more stable and diverse economy. Furthermore, as the Project develops and there is increased demand for goods and services, employees and in-migrants will have the opportunity to establish local businesses (see *Section 10.2.5* as related to economic diversification). The induced employment opportunities (as mentioned in *Section 10.2.2*) will be aligned with this expenditure and growth at the local, regional and national levels.

The procurement needs for decommissioning and closure has not yet been defined and therefore cannot be assessed at this time.

Impact Assessment

Construction

Given the current scarcity of suitably resourced and qualified local business, the **positive** and **direct** impact associated with procurement will primarily be experienced at the regional, national and international level. The magnitude of the procurement impact will be **small** at the local level but **large** at the regional and national levels. Procurement during the construction phase will be short to medium term. The extent of the impact will be international. The scale of the impact will be medium across all levels in the context of current procurement activities at each level. The frequency will be constant. The sensitivity will be high in the LM but medium across other levels. The impact significance is rated as ***moderate positive*** during the Construction

Box 10.18 Summary of Construction Impacts: Procurement and Services

Nature: Construction activities would result in a **positive direct** impact on procurements and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – High.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources

Impact Magnitude – Small – Large.

- Extent: The extent of the impact is **local – international.**
- Duration: The expected impact will be **short-medium term.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Increase in procurement will **definitely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (+).

Degree of Confidence: The degree of confidence is **high**.

Operation

The impact on procurement of goods and services during operation will be **positive** and **direct**. The magnitude of the impact is **medium** as a function of the duration, extent, scale and frequency. The duration of the operation phase impact will be medium to long term. The extent of the impact will be

international and the scale of the impact will be large at the local level given that 25 percent of the total procurement spend will be in the LM. The frequency of the impact will be constant. The sensitivity will be high for businesses in the LM but medium to low with widening extent. The overall significance of the impact is rated as ***moderate positive***.

Box 10.19 Summary of Operation Impacts: Procurement and Services

Nature: Operational activities would result in a **positive direct** impact on procurements and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low – High.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **international.**
- Duration: The expected impact will be **medium - long term.**
- Scale: The impact will result in **large changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Increase in procurement will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (+).

Degree of Confidence: The degree of confidence is **medium**.

Enhancement Measures

The enhancement measures presented below indicate general enhancement measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objectives are to optimise opportunities for procurement of goods and services from vendors and suppliers in the LM and NDM, where possible; and to build capacity of the local supply chain in line with BMM's local procurement policy.

General: Enhancement Measures

- BMM will disseminate information regarding procurement opportunities and specific health, safety and quality requirements during pre-construction phase in a manner that is accessible.

- BMM will establish a local business development centre through which assistance is provided to local business to meet the necessary tender requirements.

- BMM will assist with building supplier capability. This will entail the following:

- audit of suppliers in the LM and NDM;
- identify skills gaps and development needs;
- develop a supplier training programme; and
- target vulnerable groups to benefit from the supplier training initiative.

Construction: Enhancement Measures

- BMM will split certain contracts to allow a number of small businesses that are BBEE compliant to provide goods and services as far as possible, to facilitate partnerships between large and small contractors. Rather than allow the supply to be monopolised by one large contractor.

Operation: Enhancement Measures

- As part of the tendering process, large companies will need to demonstrate how they will partner with local or regional companies to jointly supply a service if it is not possible to split a contract

- Through a tendering process, the Project will invite recognised national and international organisations, institutions or NGOs to prepare and implement a programme for training, promoting and supporting entrepreneurship and small business development.

Residual Impact

Assuming that the above mitigation measures are implemented, the anticipated impact on procurement is likely to increase over time at the local level to ***major positive*** significance during the construction and ***major positive*** for the operation phase.

Table 10.34 Pre- and Post- Mitigation Significance: Procurement and Services

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (+ve)**	**MAJOR (+ve)**
Operation	**MODERATE (+ve)**	**MAJOR (+ve)**

10.2.5 Economic Diversification

Table 10.35 Impact Characteristics: Economic Diversification

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increase in demand for goods and services.	Increase in demand for goods and services.	Increase in demand for goods and services.
Impact Type	Direct and indirect.	Direct and indirect.	Direct.
Stakeholders/ Receptors Affected	Local and regional communities.	Local and regional communities.	Local and regional communities.

As the Project develops, the increased demand for goods and services from the Project, employees and in-migrants should create commercial opportunities for local businesses/ entrepreneurs. These commercial opportunities will result in diversification of the economy of the LM and NDM. People will have access to economic opportunities associated with the Project, its supply chain and in the businesses providing goods and services. Although construction activities will provide a lot of opportunity for economic and business development, other constraints such as access to finance, transport, and limited infrastructure and skills, will continue to constrain the level and sophistication of local development. Larger business from outside the local area, including chain stores and foreign-owned companies, could potentially take up the opportunity that the Project provides and are likely to establish a presence in the settlements of Pofadder and Aggeneys.

The influx of migrant job-seekers will bring people with different experiences, knowledge and demands. This will supplement the existing economic and livelihood activities serving to diversify the local economy. It is expected that local economic development policies will be implemented throughout the life of the Project, in line with the proposed social and labour plan (SLP) that is being developed for the Project. The SLP will in part focus on economic diversification in advance of mine closure. BMM anticipate that the SLP will build local resilience to change in anticipation of mine closure.

At the time of decommissioning and closure, it is likely that there will be a high reliance on the Project supply chain and the demand for goods and services created by the Project employees and their families. The Project and its employees will no longer be contributing towards the economy in the same way. This impact will be acutely experienced by the youth who will be at the prime of their wage-earning lives at the time of closure, and are likely to have a particularly high demand for goods and services that they would have become accustomed to.

Construction and Operation

Economic development and diversification will be experienced as a **positive** impact for the majority of stakeholders (ie those who value the change and development, specifically the youth). This impact will be **direct** as related to the Project activities and demands and **indirect** as related to job-seekers. The overall magnitude of this impact will be **medium** for the life of the Project. The impact will be experienced for the long term. Economic diversification is likely to occur at the local and regional level. For those who will take up business opportunities, the scale will be medium**.** The frequency of the impact will be constant for the construction and operation phase. The sensitivity of communities in settlements in the LM and NDM will be **low** because the Project will not result in the development of various industries, instead there will be greater markets to support the existing economic activities. The significance rating will be ***minor positive*** for construction and operation phases of the Project.

Box 10.20 *Summary of Construction and Operational Impacts: Economic Diversification*

Nature: Construction and operational activities would result in a **positive direct** impact on economic diversification.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local – regional.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Economic diversification will **likely** be improved.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (+).

Degree of Confidence: The degree of confidence is **high**.

Decommissioning and Closure

The decommissioning ad closure phase will result in a decrease in the economic diversification of the LM. The impact on economic diversification will be **direct and negative.** The magnitude will be **medium** as related to the duration, extent, scale and frequency. The impact will be permanent for the LM. The scale of the impact will be medium as the economic diversity will not have changed significantly, although more employment opportunities would have resulted from the Project. The frequency will be constant. The sensitivity at the local level will be **high** given the dependency on the supply chain of the Project as well as the induced economic spin-offs. The impact significance is rated as ***major negative*** for the decommissioning and closure phase of the Project.

Box 10.21 *Summary of Decommissioning Impacts: Economic Diversification*

Nature: Decommissioning activities would result in a **negative direct** impact on economic diversification.

Sensitivity/Vulnerability/Importance of Resource/Receptor – High.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Economic diversification will **likely** be lost.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation and Enhancement Measures

The mitigation and enhancement measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The main objective is to enhance economic diversification in the LM and the NDM.

General: Enhancement Measures

- BMM will assist relevant authorities to update their local economic development plans for the LM and NDM.

- BMM will support the relevant authorities as far as possible in implementing selected components of the local economic development plans.

Construction and Operation: Mitigation Measures

Implement all mitigation measures stipulated to enhance the levels of employment, skills development and procurement in the LM and NDM, giving priority to vulnerable groups such as women, and ensuring that the youth are empowered to maximise these opportunities.

Decommissioning and Closure: Enhancement Measures

- BMM will invest in and promote sustainable projects, training and education to help communities to develop alternative livelihoods and to ensure that economic dependence on the Project is limited.

Residual Impact

With implementation of the above mitigation measures, the anticipated impact will remain as ***minor positive*** significance for the construction and operation phases of the Project and ***moderate negative*** for the decommissioning and closure phases of the Project. Without implementing the mitigation measures the impact significance will decrease adding no benefit or value to the LM.

Table 10.36 Pre- and Post- Mitigation Significance: Economic Diversification

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MINOR(+ve)**	**MINOR (+ve)**
Operation	**MINOR (+ve)**	**MINOR (+ve)**
Decommissioning and Post Closure	**MAJOR (-ve)**	**MODERATE (-ve)**

10.2.6 Unmet Expectations and Potential for Social Unrest

Table 10.37 Impact Characteristics: Unmet Expectations and Associated Social Unrest

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Unmet expectations for employment.	Unmet expectations for employment.	Unmet expectations for employment.
Impact Type	Indirect.	Indirect.	Indirect.
Stakeholders/ Receptors Affected	Local communities.	Local communities.	Local communities.

The communities of the settlements in the LM settlements have high expectations of benefitting from the Project, specifically related to economic opportunities (such as employment and procurement). There is likely to be disappointment, anger and resentment (specifically with the communities in the LM) if these employment and procurement opportunities do not materialise and meet the high expectations. In the context of limited skills and experience in the LM, it is probable that there will be high levels of unmet expectations.

Increasingly, in South Africa unmet expectations, lead to unrest and conflict. It is important for BMM to proactively manage these expectations, as levels of conflict and tension can escalate to conditions of unmanageable disruption which could affect BMM's social license to operate.

Impact Assessment

Construction and Operation

The impact of unmet expectations will be experienced as an **indirect** and **negative** impact. The magnitude of the impact is expected to be **medium**. The impact will be localised to the communities in the settlements of Pofadder and Pella and to some extent Witbank and Onseepkans (1). The duration of the impact will be short to long–term for the construction phase and throughout the operational phase. The scale of the impact will be medium to large as people might feel that the Project has not benefited them or are not satisfied with the degree of benefits derived from the Project. The frequency of the impact is likely to be often at first but reduce to occasional as the communities derive greater benefits from the Project and the relationship with BMM matures. The sensitivity of the receptors is considered to be **high** and the impact is likely to occur because of the disparity between the skills available in the LM and the skills required for the Project. Overall the impact is rated as being of a ***major negative*** significance**.** The impact is however variable depending on the receptors and their sensitivity.

(1) Pers. Com. Aurelia J. Jossop, Khai Ma Mayor, 21 June 2012, Pofadder.

Box 10.22 ***Summary of Construction and Operational Impacts: Unmet Expectations and Associated Social Unrest***

Nature: Construction and operational activities would result in a **negative direct** impact in the form of unmet expectations.

Sensitivity/Vulnerability/Importance of Resource/Receptor – High.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **medium - large changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **often.**
- Likelihood: Unmet expectations will **likely b**e experienced.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR (-).

Degree of Confidence: The degree of confidence is **high.**

Decommissioning and Closure

In the absence of other major economic activities planned in the area and uncertainty of the mineral resources base as well as the remoteness of the area it is likely that the decommissioning of the Project will result in a decline in the social fabric of the settlements in the LM. Unmet expectations as related to the plans for decommissioning and closure cannot be assessed at this stage as the decommissioning and closure plans have yet to be drafted.

Mitigation Measures

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:

The objective is to proactively manage stakeholder expectations throughout the life of the Project.

General: Mitigation Measures

- BMM will develop a detailed Stakeholder Consultation and Engagement Plan (SCEP) that identifies all stakeholders, defines methods and frequency for engagement and defines responsibility for these activities. This plan should be updated on an annual basis.

- BMM will keep the communities regularly informed of on-going Project activities through the ward councillors and community leaders. Method and frequency to be defined in the above-mentioned SCEP.

Construction and Operation: Mitigation Measures

- All concerns regarding jobs and other expectations will be addressed in accordance to the grievance procedure.

- Maximise local employment and procurement.

- Along with the measures undertaken to address the employment and procurement impacts, the following measures should be implemented to manage the impact of unmet expectations.

- clearly advertise criteria for skills and experience needed for available jobs through local, regional and national media; and clearly advertise experience, quality and volume requirements from the supply chain.

Residual Impact

Proactive and effective management of expectations is important. The above mitigation measure will assist in managing expectations. The residual impact will range from ***minor*** *to* ***moderate negative*** significance depending how effectively BMM manages their operation, social projects/initiatives and on-going engagement.

Table 10.38 Pre- and Post- Mitigation Significance: Unmet Expectations and Associated Social Unrest

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MAJOR (-ve)**	**MINOR (-ve) to MODERATE (-ve)**
Operation	**MAJOR (-ve)**	**MINOR (-ve) to MODERATE (-ve)**

10.2.7 Increased Pressure on Infrastructure and Services (Direct)

Table 10.39 Impact Characteristics: Increased Pressure on Infrastructure and Services

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increased pressure on public services by the work force.	Increased pressure on public services by the work force.	Increased pressure on public services by the work force.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	Local municipal area.	Local municipal area.	Local municipal area.

The impact on infrastructure and services as related to Project activities specifically refers to the increase in pressure on infrastructure and services in Aggeneys. In general, the local municipality is characterised by poor public infrastructure and services, with the exception of Aggeneys. The infrastructure systems that specifically require upgrading include the

Aggeneys wastewater treatment works and power infrastructure in order to meet the requirements of the Project. BMM currently supplies all bulk infrastructure and services for Aggeneys.

Despite the quality of infrastructure and services provided by BMM in Aggeneys, most are currently operating at capacity. For example, Aggeneys currently has a housing shortage for BMM workers; however the housing backlog is being addressed through housing and transport subsidies which allow BMM employees to live in other settlements. Workers that cannot be accommodated in Aggeneys live in the local communities or in Springbok.

The pressure on bulk infrastructure and services as related to the direct Project activities will largely be addressed by the client as part of their embedded mitigation measures. Upgrade to all bulk infrastructure and services noted below will be required in order to accommodate the growth in population as related to the Project.

The public infrastructure and services that are expected to be impacted include:

- housing;
- healthcare and education;
- water and sanitation infrastructure and supply;
- electricity; and
- refuse removal.

More detail on each of the infrastructure impacts for the different phase of the project life cycle are provided below.

Box 10.23 Housing

The construction phase housing requirement will be for a workforce of approximately 3,200 workers over a period of 36 to 42 months. These workers will be housed in a contractors camp located on the Project site.

An additional 1,000 permanent housing units are projected for the operation phase of the project; these are to be constructed in Aggeneys. The current housing tenure structure is that the existing housing units belong to BMM; however this is set to change. BMM intends to institute a worker ownership scheme in order to decrease the dependency on BMM. The change to the ownership scheme will likely be beneficial for the workers as they will gain an asset. Details of the proposed scheme were not available at the time of this assessment and therefore cannot be commented on further.

Typically the decommissioning and closure phase of a mine results in out-migration from the area in search of employment opportunities elsewhere. The demand for housing will therefore decrease significantly. The proposed changes to the housing tenure scheme will mean that employees will have an asset at the end of the Project life-cycle. It may, however, be difficult to sell the house given the lack of activity in the area and the value of the property is likely to decrease. It is also possible that employees may still owe money on the house, but would likely be without employment as a result of retrenchment.

It should be noted that it may be possible for the community of Aggeneys to derive a positive benefit from the impact on housing in that they may end up with a valuable asset, however this

depends on a number of factors, most importantly whether the town of Aggeneys will be sustainable post-closure and whether there will be other major economic activities in the area; all of which are unknown at this stage and thus cannot be rated.

Box 10.24 Health Care and Education

Health care and education infrastructure and services are limited in the LM. *Chapter 6* provides detail of the health care facilities in each settlement in the LM. The Project will result in an influx of workers. During the construction phase workers will likely move to the area without their families as they will be employed on a temporary basis. In comparison, the long term contract or permanent workers are more likely to move to the areas with their families during the operation phase.

The influx of workers during the construction phase will significantly increase the pressure on health care and education facilities. The pressure on the health care system will be as a result of the increase in the number of people in the area. *Chapter 6* provides further detail on the impact of health, which predicts an increase in the communicable diseases and other health disorders as well as an increase in social ills. These impacts will all lead to further pressure on an already limited health care system. During the operation phase less pressure is expected on the health care system because of a dramatic reduction in the number of workers.

The education system will be impacted primarily during the operation phase by an increase in the learner-teacher ratio, affecting the quality of education of each learner. There is only one high school in Aggeneys, which will be significantly impacted as a result of the expected increase in the population size. Linked to the increase in social ills, female learners are at an increased risk of early pregnancy thus exacerbating the already high drop-out rate (See Chapter 6).

The demands on the health and education systems is expected to decrease during decommissioning and post closure as people are expected to migrate elsewhere in search of economic opportunities. The services offered will likely exceed the demands of the local community. Maintaining education and health infrastructure during the decommissioning and closure phase may demand resources that the LM is unable to provide as a result of reduced income resulting from the decrease in the number of ratepayers. The local community would have grown accustomed to a certain level of service which would have been attainable through the assistance of BMM, but it is likely that without such assistance the quality of education and health infrastructure would depreciate over time.

Box 10.25 Water and Sanitation Infrastructure and Supply

The Project will require approximately 730,000 m^3 per annum for the construction phase and 9.12 million m^3 per annum during the operation phase. The Final Scoping Report notes that Pelladrift Water Board is planning to expand and upgrade the water infrastructure in response to growing demand from the settlements of Pofadder, Pella and Aggeneys as well to meet the water demands of the Project.

Project related activities that will require either water or sanitation services include:

- contractor camp;
- temporary housing;
- permanent housing;
- dust suppression dams;
- engineering workshop;
- open pit;

- concentrator plant; and
- construction staff.

Direct impacts as related to the workers will be minimal as worker needs will be accommodated by BMM.

The project activities during the decommissioning phase are similar to those in the construction phase of the project. The closure of the mine will result in workers leaving the area in search of employment elsewhere. The out-migration will result in less pressure on water and sanitation resources. This also translates into a reduction of the number of ratepayers thereby limiting the LM ability to address any water and sanitation upgrade requirements.

Box 10.26 Electricity

The increase in demand for electricity is set to grow as a result of the influx of job-seekers and Project-related workers to the LM. The settlements of Pofadder and Aggeneys will be more sensitive to increased pressure, due to current electricity backlogs and the addition of 1,000 housing units in Aggeneys. The project activities require 10 MW and 70 MW for construction and operation, respectively. A new substation and power line will be constructed for the purposes of the mine activities; this will not be of benefit to the local communities or the LM. As such, the influx of job-seekers will be the primary cause of the additional pressure.

Closure of the mine usually leads to the out-migration of people in search of employment opportunities elsewhere which may result in the stagnation of the settlements. Initially there will be increased pressure on electricity but as people leave the area, the LM will struggle to maintain the service levels as a consequence of a reduced income. In addition, the municipality will no longer have the assistance provided by the Project that they have become accustomed to.

Box 10.27 Refuse Removal

Refuse removal services are limited, similar to the other infrastructure services provided by the municipality. There are four waste facilities which are located in Aggeneys, Pofadder, Pella and Onseepkans. Of these only the Aggeneys waste management facility is registered. Less than 25 t of waste is produced per day in the LM. More detail on the current volumes and types of waste generated is provided in Waste Specialist Report (see Annex G). In addition it should be noted that there are no hazardous waste management facilities in the Northern Cape Province and the closest facility if Vissershoek in Cape Town, Western Cape Province.

The waste that is likely to be generated by the Project will largely be hazardous and the general waste generated is predicted to exceed the capacity of the registered waste management facility. The Waste Specialist Study suggests that the waste management facilities be upgraded and registered. Generally, with an increase in income levels, waste generation per person increases. According to the Waste Specialist report (see *Annex G*) the construction phase is expected to result in the production of an additional 10 t of general waste per day related to Project-related workers.

During the decommissioning and closure phase, less waste will be generated as people migrate out of the LM. The number of ratepayers will decrease which will limit the LM's ability to maintain the service provided. Poor waste management service can impact the health of the local communities. The LM will also be responsible for providing waste management services to the community of Aggeneys post closure placing additional pressure on the LM.

Construction

The impact on public infrastructure during the construction phase will be **negative** and **direct** as it is related to the Project activities. The expected activities for each of the public infrastructure components are noted above, but in general the magnitude of the impact to public infrastructure and services will be **medium.**

The extent of the impacts will be local, confined to the LM; with the greatest impacts being felt in Aggeneys. The duration will be short term for the construction phase but will extend into the future Project phases. It is expected that the scale of the impacts to housing, electricity, refuse removal, water and sanitation associated with the Project will be small as the Project is expected to cater for the needs of the Project and its workers through making the necessary upgrades required. Other public infrastructure and services such as health and education may have a greater direct impact initially as the Project may share these resources with the general public as there is little information available to suggest otherwise. The frequency of the impact on infrastructure and services is likely to be constant.

The sensitivity of receptors will be **low** as most of the activity will be experienced on-site during the construction phase. The impact significance is rated as ***minor negative***, given the current lack of infrastructure and services to accommodate the workers.

Box 10.28 Summary of Construction Impacts: Increased Pressure on Infrastructure and Services (Influx)

Nature: Construction activities would result in a **negative direct and indirect** impact on public infrastructure and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.

- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Public infrastructure and services will **likely** experience increased pressure.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-).

Degree of Confidence: The degree of confidence is **high.**

Operation

The impacts on public infrastructure during the operation phase will be **negative**, **direct** as it relates to Project activities and workers. It is expected that impacts to housing, electricity, water and sanitation as well as refuse removal will be minimal from the Project as the Project is expected to cater for

all these needs, however these measures are not yet in place. The impacts to education and health care will remain strained. At the time of the study there was no information available on any proposed embedded mitigation measures to alleviate the pressure on education and health infrastructure. The impact on these services is expected to be greater during the operations phase because workers will likely migrate with their dependants, dramatically increasing the number of people relying on the infrastructure and services. The magnitude of the impact is expected to be **medium** given the existing lack of infrastructure and services**.** The magnitude of the impact is a function of the extent, duration, scale, likelihood and frequency. The extent of the impact is local, limited to the LM, specifically Aggeneys. The duration of the impact will be long term for the duration of the Project life cycle and the scale of the impact will be medium. The frequency of the impact will be constant and the impact is likely to occur.

The sensitivity of the receptors will be **low** due to the significant increase in the population and thus the impact significance is rated to be ***minor negative***.

Box 10.29 ***Summary of Operation Impacts: Increased Pressure on Infrastructure and Services***

Nature: Operational activities would result in a **negative direct and indirect** impact on public infrastructure and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Public infrastructure and services will **likely** experience increased pressure.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-).

Degree of Confidence: The degree of confidence is high.

Decommissioning and Closure

The impacts on infrastructure and services during the decommissioning and closure phase will be **indirect** and **negative**. With decommissioning, Project activities will cease and it is likely that people will migrate out of the area in search of employment opportunities elsewhere. The magnitude of the impact will be **small**. This is as a function of extent, duration, scale, frequency and likelihood. The extent of the impact will be local, limited to the LM and the impact will be permanent. The scale of the impact is likely to be small as the LM together with BMM would have catered for a larger population size, but with out-migration the number of ratepayers would have decreased thus impacting the LM's ability to maintain the public infrastructure and services. The LM's ability to maintain the public infrastructure and services would also be limited without the support of BMM as it is likely that BMM would have

provided considerable support to the LM throughout the Project life. The frequency of the impact would be short to long-term depending how long it takes for the LM to adjust to the change.

The sensitivity of stakeholders, most notably the LM as well as the communities of Aggeneys will be **high**. This is due to the high dependency on BMM by the community of Aggeneys and the LM. In addition the LM will be expected to take over the provision of bulk infrastructure and service to the community of Aggeneys. The impact significance is rated as ***moderate negative*** for decommissioning and closure.

Box 10.30 ***Summary of Decommissioning Impacts: Increased Pressure on Infrastructure and Services***

Nature: Operational activities would result in a **negative indirect** impact on public infrastructure and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – High.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Small.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Public infrastructure and services will **likely** experience increased pressure.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation and Enhancement Measures

It is important to emphasise that the Project, while meeting its own infrastructure and service requirements, should not take on the LM's responsibility to develop local infrastructure. BMM will form partnerships with the LM and other relevant stakeholders to support the improvements in infrastructure and services. The mitigation measures and enhancement measures presented below indicate general measures that are applicable to all phases followed by specific measures for each phase of the project.

Objectives:
The key objectives of the mitigation measures are as follows:

- limit the extent of the impact on local infrastructure and services in the LM, specifically for Aggenys,;

- meet all the bulk infrastructure requirements for the Project and workers for all phases of the Project;

- enhance the sustainability of the affected communities beyond closure; and

- encourage and support government in improving the levels of infrastructure and services provided in the Project area.

General: Mitigation and Enhancement Measures

- Assist the LM with engineering and town planning services to improve services provided as the LM currently does not have a town planner and is heavily reliant on consulting services, thus limiting their ability to deliver services.

Health and Education

- Provide assistance to the Provincial Department of Health to improve the quality of services and equipment and infrastructure in state facilities.

- Provide assistance to the Further Education and Training (FET) colleges to expand and offer more accredited courses to communities in the LM.

- Provide support and encourage learners to attend school, for example providing transport, career guidance and access to information.

- Extend the internship programme to learners outside of Aggeneys and provide learners with the necessary support to be able to participate in the internship programme.

- Provide bursaries to learners from Grade 10 onwards to attend FET colleges in study areas that are non-mining related but will support sustainable livelihoods locally.

Water

- BMM will apply water saving technology wherever possible.

- BMM will monitor and report on Project water usage and associated effects on the surrounding communities/ farmers. If communities and farmers are negatively affected as a direct result of the Project, immediate and appropriate action will be taken (in collaboration with the relevant authorities).

- BMM will continue to liaise with the Pelladrift Water Board to ensure that the expansion and upgrade of the water infrastructure takes place.

- Raise awareness of the scarcity of water resources in order to encourage people to save water as far as possible as a measure to manage demand.

Refuse Removal

- Employ an on-site waste management company to ensure compliance of general housekeeping rules as well as to manage the waste streams during all phases of the Project.

- Hazardous waste will be collected and disposed of in a registered hazardous waste facility.

- Appropriate waste management facilities will be provided by the Project to minimise the strain on public facilities.

- BMM will institute a recycling facility to collect waste oil, cans, paper and plastics. Local community members are to be employed resulting in job creation.

- Recycle as far as possible.

Construction: Mitigation and Enhancement Measures

Housing

- Appropriate housing and recreational facilities will be provided to Project related staff to minimise the strain on public facilities.

Health

- BMM will provide health care facilities that have the personnel and equipment to handle all worker related illnesses and injuries. If workers require further specialist attention they will be transported to appropriate hospitals. No additional strain will be placed on the local clinic/ facilities.

Education

- Build new or expand educational facilities in Aggeneys to accommodate the children of Project-related workers to ensure that no additional strain is placed on public infrastructure.

Water

- All water and sanitation needs of the Project and workers will be taken care of by BMM and BMM will not exceed their legal water allocation. In doing so BMM will ensure that no additional strain is put on public infrastructure.

Electricity

- BMM will investigate the feasibility of reducing their power demand through renewable energy off-sets.

- BMM will use alternative energy sources and energy efficient technology for non-essential Project components eg. Solar water heaters for houses, energy efficient lighting, etc.

Operation: Mitigation and Enhancement Measures

Housing

- Finalise and implement the new housing tenure system. The formulation of the system will take into account the possible impacts on the property prices following Project closure.

- Implement change management support systems to assist the community of Aggeneys to adapt to the new housing tenure system.

- Assist the community of Aggeneys to manage and maintain their houses such that it retains its value.

Decommissioning and Closure: Mitigation and Enhancement Measures

- Provide capacity building and training to the LM staff. This capacity building should start early in the operational phase so that there is a clear understanding of the mandate of the LM and their responsibilities post closure.

- Investigate training options from institutions such as the Centre for Sustainability at the University of Stellenbosch and the Development Bank of South Africa, who are currently providing such training.

- Provide additional training with to the LM to ensure that there is a clear understanding of the mandate of the LM and their responsibilities post closure.

Residual Impact

The residual impact will be negative direct as it relates to Project activities and workers. The impact significance will be reduced from ***minor*** to ***negligible negative*** for the construction phase and from ***minor*** to ***negligible negative*** for the operation phase of the Project. The decommissioning and closure phase will be reduced from ***moderate*** to ***minor negative***. This is assuming that all of the mitigation measures outlined above are implemented.

Table 10.40 Pre- and Post- Mitigation Significance: Increased Pressure on Infrastructure and Services

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MINOR (-ve)**	**NEGLIGIBLE (-ve)**
Operation	**MINOR (-ve)**	**NEGLIGIBLE(-ve)**

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Decommissioning and Post Closure	**MODERATE (-ve)**	**MINOR (-ve)**

10.2.8 Road Infrastructure and Transport (Direct)

Table 10.41 Impact characteristics: Road infrastructure and transport network

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increased traffic volumes and impact to road quality.	Increased traffic volumes and impact to road quality.	Increased traffic volumes and impact to road quality.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	Existing road users.	Existing road users.	Existing road users.

The primary access route to the Project site is the N14 national road that connects the Project site to major economic centres of Springbok to the West and Upington to the East. The N14 links to the N7 which is the access route to the Port of Saldanha Bay. The N7 is the main road along the west coast of South Africa into Namibia. Due to the limited rail infrastructure the majority of goods are transported by road, thus the N7 has high volumes of road freight traffic. The N14 is considered to be a high order road carrying long distance and local traffic. According to the Traffic Specialist Study (see *Annex G*) the N14 has considerable reserve capacity due to the low traffic volumes. The current traffic volumes are in the order of 600 vehicles per day in each direction, with the highest volumes reaching 100 vehicles per hour.

The Project will be ramped up in several phases and the associated traffic volumes are shown below.

Table 10.42 Traffic Volumes Associated with the Project Ramp Up during Operation

Phase	Road Volume	Rail Volume	Tonnage (mpta)
1 (Year one and two)	27 trucks per day	-	0.335
2 (Year three and four)	27 trucks per day	20 wagons per day	0.670
3 (Year five to 17)	35 trucks per day	52 wagons per day	1.000

Source: Traffic Specialist Report (Phillips, 2013).

Impact Assessment

Construction

Heavy haul traffic and abnormal loads will be prominent on the N14 and the N7 for the duration of the construction phase. Based on the Traffic Specialist Study the increase in traffic has been modelled to be 155 vehicles per day for Project activities alone, taking into account vehicle trips to transport workers to and from the site. This will have a significant impact on the quality of the roads and will result in rapid deterioration of the roads if it is not maintained.

The impact on the roads during the construction phase will be **negative** and **direct** as it pertains to the Project's transport activities. The magnitude of the impact on the road infrastructure will be **medium**. The extent of the impact extends to the international level because of the use of the N7. The scale of the impact on road infrastructure will be medium due to the existing volumes of the heavy haul traffic and construction vehicles. The frequency of the impact will be constant over the short term for the duration of the construction phase.

The sensitivity of receptors is **medium** as the N14 and N7 are relatively well maintained, and due to the relatively low traffic volumes there is likely to be sufficient reserve to accommodate the increase in the traffic volumes. The impact significance is rated as a ***moderate negative*** impact.

Box 10.31 Summary of Construction Impacts: Road Infrastructure and Transport Network

Nature: Construction activities would result in a **negative direct** impact on existing traffic volumes and road quality.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **International.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Increased traffic volumes and deterioration to the road network will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **high.**

Operation

The proposed transport option for the Project is to truck the zinc concentrate to the Port of Saldanha Bay via the N14 and N7 and to transport the zinc concentrate via a gravel road to loop 10 siding of the Sishen- Saldanha railway line and rail the product to the Port of Saldanha. The gravel road to loop 10 is owned and maintained by BMM. Initially only road transport will be used but both transport options will need to be used as the Project ramps up to its full production capacity of 10 million tons per annum (mpta) which translates into one mpta of zinc concentrate.

The impact on the roads will be **negative and direct** as it pertains to the Project's transport activities. The magnitude of the impact on the road infrastructure will be **medium.** The extent of the impact extends to the international level as the zinc concentrate will be hauled via 32 ton trucks (axel load) to the Port of Saldanha Bay thus impacting other international and national road users. The scale of the impact on road infrastructure will be

medium during the operational phase if the rail transport option is used and as road users become accustomed to the heavy haul traffic. The frequency of the impact will be constant over the long term for the duration of the operational phase.

The sensitivity of receptors is **low** as the N14 and N7 are relatively well maintained, and given the reserve capacity for the N14 and N7. The overall impact significance is rated as a ***minor negative*** impact.

Box 10.32 *Summary of Operation Impacts: Road Infrastructure and Transport Network*

Nature: Operational activities would result in a **negative direct** impact on existing traffic volumes and road quality.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **International.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Increased traffic volumes and deterioration to the road network will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-).

Degree of Confidence: The degree of confidence is **high.**

Decommissioning and Closure

Project activities associated with the decommissioning and closure phase are similar to those during the construction phase of the Project.

The impact on roads will be **direct and negative**. The magnitude of the impact will be **small** over a short term for the duration of the decommissioning phase. The impact on roads may extend nationally depending on the location of future waste management facilities and the scale of the impact will be small by virtue of the activities. The frequency will change from constant to occasional for the decommissioning phase. The sensitivity of receptors will be **low** because they would have adapted to the busy road traffic resulting from the mining activities. The overall impact is rated ***negligible negative.***

Box 10.33 Summary of Decommissioning Impacts: Road Infrastructure and Transport Network

Nature: Decommissioning activities would result in a **negative direct** impact on existing traffic volumes and road quality.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Small.
- Extent: The extent of the impact is **nationally.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Increased traffic volumes and deterioration to the road network will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – NEGLIGIBLE (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objectives of the mitigation measures are to limit the impact on the road quality as well as to decrease the impact on road users.

General: Mitigation Measures

- All vehicles will be regularly checked and maintained, including tyre wear.
- Contact details will be displayed on project vehicles to allow other road users to report bad driving at any time.
- All project drivers will be sensitised about potential accident risks to local users and will be periodically checked for alcohol consumption.
- BMM will ensure that vehicles are correctly and safely loaded to avoid accidents, and all loads are secured and covered where they pose a risk of windblown dust or material spillage.
- BMM will work in conjunction with SANRAL to erect appropriate road traffic signage and road markings at the intersections of loop 10 and the Aggeneys access road with the N14.

- BMM and the appointed contractors will develop an induction programme, including a Code of Conduct, for all workers directly related to the Project. A copy of the Code of Conduct shall be presented to all workers and signed by each person. The Code of Conduct must address the following with regards to road traffic management:
  - respect for local residents;
  - compliance with the Traffic Management Plan and all road regulations; and
  - description of disciplinary measures for infringement of the Code and company rules.
  - Workers found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, will face disciplinary procedures that could result in dismissal.

- BMM will implement a grievance procedure.

- Movement of heavy vehicles through or close to residential areas in Aggeneys will be avoided or minimised to reduce potential impact on local residents, specifically children.

Construction: Mitigation Measures

- BMM will develop a traffic management plan to limit the disruption of the roads when high volumes of abnormal freight are expected on the N14 and N7. The traffic management plan should, at a minimum, address the following:
  - observation of traffic rules (eg speed limits, over-taking, extra precautions through populated areas);
  - night-time driving;
  - vehicles maintenance and regular checks;
  - loading; and
  - non-compliance with the traffic management plan.

- During the construction phase, heavy loads should be planned to avoid weekends and start and end of school holidays, when the potential to impact on other road users is likely to be higher.

Operation: Mitigation Measures

- BMM will work closely with the South African National Road Agency Limited (SANRAL) to monitor the impact on the road quality and upgrade roads periodically for roads within the Project area.

- BMM will work with SANRAL to install traffic calming measures on roads through settlements along the N7 and N14 where appropriate.

Decommissioning and Closure: Mitigation Measures

- BMM will develop a traffic management plan to limit the disruption of the roads when high volumes of abnormal freight are expected on the N14 and N7. The traffic management plan should, at a minimum, address the following:
  - observation of traffic rules (eg speed limits, over-taking, extra precautions through populated areas);
  - night-time driving;
  - vehicles maintenance and regular checks;
  - loading; and
  - non-compliance with the traffic management plan.

Residual Impact Assessment

The impact on road infrastructure will continue to be **direct** and **negative** as it relates to the Project activities. Assuming that the mitigation measures are implemented the impact significance will reduce to ***minor negative*** for the construction. The impact for the operation phase as well as the decommissioning and closure phase of the Project will change to ***negligible negative*** significance. It should be noted that if the mitigation measures for the decommissioning and closure phase are not implemented there is a risk that the impact significance rating may increase.

Table 10.43 Pre- and Post- Mitigation Significance: Road Infrastructure and Transport Network

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (-ve)**	**MINOR (-ve)**
Operation	**MINOR (-ve)**	**NEGLIGIBLE (-ve)**
Decommissioning and Post Closure	**NEGLIGIBLE (-ve)**	**NEGLIGIBLE (-ve)**

10.2.9 Health Impact: Communicable Diseases (Direct)

Table 10.44 Impact Characteristics: Communicable Diseases

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Mine workers and in-migrants would result in an increase on the spread of communicable diseases.	Mine workers and in-migrants would result in an increase on the spread of communicable diseases.	Mine workers and in-migrants would result in an increase on the spread of communicable diseases.
Impact Type	Direct and indirect.	Direct and indirect.	Direct and indirect.
Stakeholders/ Receptors Affected	Mine workers, in-migrants and surrounding towns.	Mine workers, in-migrants and surrounding towns.	Mine workers, in-migrants and surrounding towns.

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. Transmission of communicable diseases may occur through various pathways including:

- physical contact with infected individuals;
- liquids;
- foods;
- bodily fluids;
- contaminated objects; and
- air-borne inhalation.

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 LM. The rate of infection in the local communities is uncertain and inferred from the known rates of the NDM (See Chapter 6).

Impact Assessment

Construction

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. A key contributor to the spread of communicable diseases in particular relate to housing and living conditions. During the construction phase, a worker camp will be constructed on the Project site. The worker camp will consist of 500 units over an area of 32 ha that will be accessed from the N14. The presence of approximately 3200 construction workers who are predominantly male will likely result in the proliferation of communicable diseases.

The impact of increased spread of communicable diseases is **negative** and **direct** as it relates to Project-related workers. The magnitude will be **large** as a function of the extent, duration, scale, frequency and likelihood. The extent of the impact is local and regional as it relates to the impact on communities of Aggeneys, Pofadder and Pella as well as workers who come from the NDM. The duration of the impact is short term for the duration of the construction phase. The scale of the impact will be large because the local communities of Pofadder and Pella are vulnerable due to the existing prevalence of communicable diseases in the local community, poor education levels, access to healthcare and poor living conditions. The frequency of the impact will be constant.

The sensitivity of Project-related workers will be **medium** compared to the local communities which will be **high**. The significance of the impact is rated as ***major negative*** for both Project-related workers and the local communities.

Box 10.34 Summary of Construction Impacts: Communicable Diseases

Nature: Construction activities would result in a **negative direct** and **indirect** impact with regard to an increase in communicable diseases.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium – High.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Large.
- Extent: The extent of the impact is **local – regional.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **large changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The spread of communicable diseases will **likely** increase.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR (-).

Degree of Confidence: The degree of confidence is **high.**

Operation

During the operations phase the impact will decrease as a result of a decrease in the number of Project-related workers. These workers will then be housed in Aggeneys. The Aggeneys community will become more sensitive to the increase in the spread of the diseases as the population size is expected to increase substantially with 1,000 housing units planned, approximately double the number of houses there currently.

The impact of increased spread of communicable diseases is **negative** and **direct** as it relates to Project-related workers. The magnitude will be **medium** as a function of the extent, duration, scale, frequency and likelihood. The extent of the impact is local as it relates to the impact on community of Aggeneys. The duration of the impact is long term as the spread of disease is likely to be on-going for the duration of the operations phase. The scale of the impact will be medium because the standard of living and the levels of education of the local community would likely have improved to some extent, although certain sectors of the community will continue to disproportionately vulnerable such as women and the youth. The frequency of the impact will be constant.

The sensitivity of Project-related workers will be **low** compared to the local community which will be **medium**. The significance of the impact is rated as ***minor to moderate negative*** for both Project-related workers and the local community of Aggeneys.

Box 10.35 Summary of Operation Impacts: Communicable Diseases

Nature: Operational activities would result in a **negative direct** and **indirect** impact with regard to an increase in communicable diseases.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **medium changes** to the resource/ receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The spread of communicable diseases will **likely** increase.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR - MODERATE (-).

Degree of Confidence: The degree of confidence is **high.**

Decommissioning and Closure

The spread of communicable diseases is expected to diminish substantially during the decommissioning and closure phases due to the likely out-migration as people look for economic opportunities elsewhere. It is possible that during the construction phase several initiatives would have been implemented to improve the standards of living, the quality of infrastructure and services as well as awareness raising campaigns associated to certain diseases and health risks.

The impact during the decommissioning and closure phase will be **negative direct** as it relates to Project-related workers. The magnitude will be **small** as it relates to the extent, duration, scale, frequency and likelihood. The extent of the impact will be local and regional as Project-related workers migrate back to their places of origin. The Project workers at the stage of decommissioning and closure are expected to be primarily from the NDM in keeping with BMM's policies of local procurement and skills development. The duration is expected to be temporary related to a short increase in Project activity related to decommissioning. The scale of the impact will be small in comparison to that of the construction and operation phase and people would have been the recipients of increased living conditions, improved education and training as well as improved access to healthcare and technologies. The frequency of the impact will be occasional. The sensitivity of receptors will be **low** at this late stage in the Project. The impact significance is rated as ***negligible negative*** impact.

Box 10.36 Summary of Decommissioning Impacts: Communicable Diseases

Nature: Construction activities would result in a **negative direct** and **indirect** impact with regard to an increase in communicable diseases.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Small.
- Extent: The extent of the impact is **local – regional.**
- Duration: The expected impact will be **temporary.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **occasional.**
- Likelihood: The spread of communicable diseases will **likely** increase.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – NEGLIGIBLE (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation Measures

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objective is to minimise the transmission of diseases, through effective control measures and to reduce the impact of the diseases on the health of Project-related workers and affected local communities to the lowest possible degree.

General: Mitigation Measures

- Support the Provincial Department of Health in their awareness raising campaigns related to communicable diseases.

- All contractors and BMM employees should adhere to the Code of Conduct, and in term of health and safety, which will include a zero tolerance of illegal activities by construction personnel including: prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling and/fighting. Any employee or contractor found in violation of the Code shall face disciplinary hearing which may result in a dismissal.

Construction: Mitigation Measures

- BMM will develop an HIV/AIDS Prevention Programme that covers the following key areas:

  Prevention

- raise awareness (address the facts and fiction of HIV transmission);
- get the message out (make use of local languages or non-written forms of communication);
- go beyond the workplace;
- de-stigmatise the disease;
- peer education (train and support peer educators);
- review occupational health and safety procedures;
- distribute male and female condoms;
- promote circumcision;
- establish voluntary HIV testing and counselling centres;
- institute a post exposure prophylaxis programme for all employees with potential exposure to blood or body fluids;
- establish a prevention programme to prevent Mother-to-Child Transmission;
- train managers and supervisors - to improve programme success; and
- work with and support the Provincial Department of Health to establish similar programmes in the local communities.

Treatment/ Management and Care

- dispense Anti-Retroviral Treatment (ARV) to workers;
- establish an ARV programme for family members;
- monitor and promote adherence to treatment regime;
- ensure dispensing of medication is controlled;
- provide nutritional programme in addition to treatment regime; and
- provide terminal and home-based care.

<u>Operation: Mitigation Measures</u>

- BMM will establish a TB treatment programme similar to that of the HIV/AIDS programme. Specific measures include:
  - dispense TB Treatment to workers;
  - establish a TB programme for family members;
  - monitor and promote adherence to treatment regime;
  - ensure dispensing of medication is controlled;

- provide nutritional programme in addition to treatment regime; and
- provide terminal and home-based care.

Further to the HIV/AIDS and TB prevention and treatment programme, the following measures will be undertaken:

- All initiatives shall address the symptoms as well as behaviour change issues around the transmission and infection of HIV/AIDS as well as other sexually transmitted infections. The programs will need to be developed and carried out in partnership with health services (at various levels) and will not be the sole responsibility of BMM, but of the local government and NGOs operating in the area.

Residual Impact

The residual impact is based on the assumption that the mitigation measures will be implemented and all role players will bring their part to ensure the successful implementation of the proposed mitigation measures. The residual impact for the construction phases will be ***moderate negative*** and ***minor*** to ***negligible negative*** for the operation and ***negligible negative*** decommissioning and closure phases of the Project.

Table 10.45 Pre- and Post- Mitigation Significance: Communicable Diseases

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MAJOR (-ve)**	**MODERATE (-ve)**
Operation	**MINOR (-ve) to MODERATE (-ve)**	**MINOR (-ve) to NEGLIGIBLE (-ve)**
Decommissioning and Post Closure	**NEGLIGIBLE (-ve)**	**NEGLIGIBLE (-ve)**

10.2.10 Health Impact: Road Traffic Accidents (Direct)

Table 10.46 Impact Characteristics: Road Traffic Accidents

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increase in road accidents.	Increase in road accidents.	Increase in road accidents.
Impact Type	Direct.	Direct.	Direct and indirect.
Stakeholders/ Receptors Affected	Road users.	Road users.	Road users.

The Project activities will necessitate a significant increase in transport in the LM. Based on the Traffic Specialist Report, it is predicted that the construction phase will generate 155 vehicle trips per day. The vehicle trips predicted for the construction phase is predicted to increase from 40 vehicle trips per day during the first year to 75 vehicle trips per day in year five once they have

ramped up to full capacity. The transport activities will result in an increase in the number of heavy haul vehicles, abnormal loads and general traffic in the area. There are two transport options proposed to get the zinc concentrate to the Port of Saldanha. The first is road transport via the N14 and N7. The second transport option is to transport the product via a gravel road to loop 10 and then rail it to the Port of Saldanha on the Sishen Saldanha railway line. This option may only become available later in the operation phase, thus there will be a strong reliance on road transport in the construction phase and the early operation phase. Currently there are low levels of traffic volumes (600 vehicles per day), but heavy haul vehicles are common place due to existing mining activities and the N14 is an important economic corridor connecting Johannesburg, Upington and Springbok. The communities of Aggeneys and Pofadder are accustomed to heavy haul traffic to some extent by virtue of being a mining town and the N14 bisecting the town, respectively. The community of Pella does not experience heavy haul traffic as it is located approximately 10 km away from the N14.

The N14 is currently used by the automotive industry to test cars at high speed but this is only for certain periods of the year for approximately one month at a time (1) . The gravel road to loop ten is used by a few farmers as an access road. This road is currently used to transport zinc concentrate to loop ten from mining activities in the LM.

The construction and operation phases will occur concurrently after the first two years of construction as the Project ramps up in a phased approach. However for the first two years there will only be construction related traffic which involves a number of abnormal loads for the delivery of construction materials. Thus it is expected that there will be a sharp increase in traffic in the first two years. The Project site is relatively removed from the local communities in the LM, thus the traffic related to the construction of the Project will be experienced primarily between Springbok and the Project site as well as between Aggeneys and the Project site. The impacts to the rest of the local communities will be experienced as a result of the increase in general traffic as result of influx into the LM.

Impact Assessment

Construction and Operation

The increase in traffic will increase the risk of traffic accidents in the area. Due to low volumes, the cars that use the N14 tend to drive at high speed, often exceeding the speed limit of 120 km per hour. The change in the traffic volumes and the speed at which the construction vehicles generally travel, changes the dynamic of traffic on the N14 considerably. It is this change that increases the risk of accidents. Road accidents could result in serious injury or fatalities given the speeds at which road users generally travel on the N14. There are instances where emergent farmers use the road reserve of the N14 as grazing land for livestock. Road users of the N7 will also experience an

(1) Pers. Com. Hugo van Zyl, 11 February 2013.

increase in the risk of accidents as related to the increase in traffic volumes, however the risk is less because the change between the current traffic volumes and those predicted is not as great compared to that of the N14. Farmers who use the gravel road as an access route will also be affected by an increase risk as volumes increase, however they are relatively accustomed to heavy haul traffic.

The increase in the risk of traffic accidents will have a **negative direct** impact on the local communities. The magnitude of the impact will be **medium** given the extent, duration, scale, frequency and likelihood on the increased risk. The extent of the impact will be local and regional, concentrated at the local level, especially the community of Pofadder as most of the residents are pedestrians. The duration will be long term for the life of the project. The scale of the impact will be large initially but will diminish over time as people become accustomed to traffic volumes and change behaviours to mitigate for the risk of accidents. The frequency will be constant and it is likely that traffic impacts associated with the Project will increase the risk of accidents. The sensitivity of receptors will be **medium** at the local level but **low** at the regional level. The overall impact significance is rated as ***moderate negative***.

Box 10.37 Summary of Construction and Operational Impacts: Road Traffic Accidents

Nature: Construction and operational activities would result in a **negative direct** impact on the number of road traffic accidents.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local – regional.**
- Duration: The expected impact will be **Long term.**
- Scale: The impact will result in **large changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: An increase in road traffic accidents will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **high.**

Decommissioning and Closure

The decommissioning phase will result in a short spate of increased traffic which will decrease as decommissioning activities slow down. The local communities of Pofadder, Pella, and Aggeneys would be used to the impact of traffic in the LM and would have developed behavioural changes to minimise the risk of accidents. Traffic is then expected to decrease substantially post closure, thus having a limited impact on the local communities, thus further minimising the risk of accidents.

The impact will be a **negative direct** as it relates to decommissioning activities and indirect as related to the out-migration of people post closure. The

magnitude of the impact will be **negligible** in relation to the extent, duration, scale, frequency and likelihood. The extent of the impact will be local as well as regional because the closest hazardous waste facilities is in Cape Town, however this may change as other hazardous waste facilities may be established during the life of the mine. The duration will short term for the length of the decommissioning phase and at a small scale in comparison to risks associated during the operation phase. The frequency will be often and there will be a likely risk of accidents. The sensitivity of receptors will be **low**. The overall impact significance is rated as ***negligible negative***.

Box 10.38 Summary of Decommissioning Impacts: Road Traffic Accidents

Nature: Decommissioning activities would result in a **negative direct** and **indirect** impact on the number of road traffic accidents.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Negligible.
- Extent: The extent of the impact is **local – regional.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **often.**
- Likelihood: An increase in road traffic accidents will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – NEGLIGIBLE (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation Measures

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objective is to limit the risks of damage to property, injury and death faced by communities and livestock that may arise from an increase to road traffic, speeding and to maintain roads surfaces.

General: Mitigation Measures

- BMM will develop a road Traffic Management Plan and the following provisions will be implemented by BMM or its contractors:
    - Liaise with SANRAL and reach agreement on collaborating to maintain and upgrade roads should they further deteriorate as a result of BMM vehicles.

- Define and visibly display speed limits along all routes within the direct area of influence and enforce these amongst all project-related vehicles.

- All Project drivers will be sensitised about potential accident risks to local users and will be periodically checked for alcohol consumption.

- All vehicles will be regularly checked and maintained, including tyre wear.

- Traffic calming measures will be constructed on the road sections through Pofadder and Aggeneys in order to reduce speeding. In addition speed calming measures will be constructed, as appropriate, as vehicles approach to the mine entrance (loop 10 road) and the turn-off to Aggeneys from the N14.

- Vehicles will be correctly and safely loaded to avoid accidents, and all loads are secured and covered where they pose a risk of windblown dust or material spillage.

- BMM will work with the LM and Provincial Traffic Department to implement an education and awareness programme around health and safety including a focus on traffic risks and road safety for pedestrians.

All concerns regarding traffic management or accidents will be addressed in accordance to the grievance procedures.

Construction: Mitigation Measures

- Workers are to adhere to a Code of Conduct. If found to be in contravention of the Code of Conduct, they will face disciplinary procedures that could result in dismissal.

Operation: Mitigation Measures

- BMM will develop a policy and procedure for assessing all damages and losses (eg damage to property, injury or death of people or livestock resulting from negligent Project vehicle) and to determine appropriate measures to compensate for these losses. This will be implemented in consultation with the affected parties and other relevant stakeholders, including the local authorities.

Residual Impact

The increase in traffic increases the risk of traffic accidents to the local communities and road users of the N14, and N7 in particular. With the implementation of the above measures the impact significance can be reduced to a ***minor to moderate negative*** during the construction and operation phases

and remain ***negligible negative*** impact during the decommissioning and closure phase of the Project.

Table 10.47 Pre- and Post- Mitigation Significance: Road Traffic Accidents

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (-ve)**	**MINOR (-ve) to MODERATE (-ve)**
Operation	**MODERATE (-ve)**	**MINOR (-ve) to MODERATE (-ve)**
Decommissioning and Post Closure	**NEGLIGIBLE (-ve)**	**NEGLIGIBLE (-ve)**

10.2.11 Impact in Relations between Locals and In-migrants

The in-migration of Project workers and job-seekers will likely lead to tension with the local population as they compete for employment opportunities and other Project-related benefits. In addition, tension may arise where in-migrants may be blamed for the increase in the social pathologies experienced by the local communities. It is important to note the relative homogeneity of communities in the local settlements, they are predominantly Coloured and Afrikaans-speaking. This could contrast with Project-related workers and job-seekers who are likely to be African from various parts of the Province and the country or possibly from India. The in-migrants will differ culturally from the locals compounding tensions.

Impact Assessment

Construction and Operation:
During the construction phase the majority of the workforce is expected to be from outside the LM due to the limited skills available locally. This will lead to the perception that in-migrants are taking local jobs, this is likely to result in resentment towards migrant workers. The workforce required during the operational phase will be significantly smaller with higher skill levels. As such, the number of local people that are eligible for employment is significantly less, further exacerbating the perception that in-migrants are taking local jobs and escalating tensions.

In addition to the migrant workforce, the influx of job-seekers is likely to have a compounding effect as they compete directly with the community for limited resources and increase the pressure on public infrastructure and resources.

The social tension between in-migrants and the local community will be **negative** and **direct** as related to Project workers and **indirect** as it related to job-seekers. The magnitude is expected to be **medium**. The extent of the impact will be local and the duration of the impact is expected to be long term lasting throughout the operation phase. It is expected that there will be constant tension between locals and in-migrants as they will be perceived to reap greater benefits from the project, however the scale of the tension will

vary throughout the project life-cycle depending on the issues causing the tension. The sensitivity of the local community is **medium** as they are still able to adapt to the changes brought on by the Project, although some may feel disillusioned by the perceived limited benefits, such as employment. Given the length of the operation phase, it is likely that tensions will dissipate over time. The overall significance of the impact of increased tension between locals and in-migrants is rated as a ***moderate negative***.

Box 10.39 ***Summary of Construction and Operational Impacts: Relations between the Locals and In-migrants***

Nature: Construction and operational activities would result in a **negative direct and indirect** impact to social integration of locals and in-migrants.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **Medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The impact will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **medium.**

Decommissioning and Closure:
It is likely that tensions between the local communities and in-migrants will abate as migrants would have assimilated into the community or would be migrating out of the area.

The impact will be **negative**, and both **direct** and **indirect** as it relates to migrant workers and job-seekers, respectively**.** The magnitude is expected to be **negligible** during the decommissioning and closure phase of the Project. The extent of the impact is local and the duration is temporary as the tension abates with people migrating out of the area. The scale of the impact is small in comparison with tensions in the construction and operation phases. The sensitivity is **low** as the community would have grown accustomed to the migrants who are likely to have assimilated into the community. The significance rating for tensions between the local community and in-migrants is ***negligible negative***.

Box 10.40 Summary of Decommissioning Impacts: Relations between the Locals and In-migrants

Nature: Decommissioning activities would result in a **negative direct and indirect** impact to social integration of locals and in-migrants.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Negligible.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **temporary.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **occasional.**
- Likelihood: The impact will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – NEGLIGIBLE (-).

Degree of Confidence: The degree of confidence is **medium.**

Mitigation

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objective of the mitigation measures are to:

- monitor the effects of in-migration to the Project area; and
- monitor relations between the local community and the migrants in order to put measures in place as is required to address specific tensions that may arise.

General: Mitigation Measures

- BMM will assist government in developing the following documentation in order to better manage migration into the area:
    - A Migration Situation Analysis Report: this report will show the migration trend of the Local and District municipalities as well as the Province over the past five years. This report is to be updated every five years.
    - A Regional Migration Plan: this plan will outline strategies, programmes and measures to be implemented in order to better manage the levels of migration into the LM and NDM.
    - A Migration Monitoring Programme: this program will outline steps needed to effectively monitor the migration trends.

- BMM will implement the grievance mechanism and address grievances in a timely manner (see Section 10.2.2 for further detail).

Construction and Operation: Mitigation Measures

- BMM will manage expectations of the local communities in terms of the employment and procurement opportunities available to them.

- BMM will communicate with the local communities on all aspects where the community stand to benefit from the project.

- When tensions over a specific issue reach a point where social unrest between the local community and the migrants is imminent, BMM will work with relevant stakeholders and proactively intervene to avoid social unrest.

- Where possible, BMM should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks;

Residual Impact Assessment

With the implementation of the above-mentioned mitigation measures, it is possible for BMM to reduce the significance of the impact to ***minor negative*** for the construction and operation phases and retain ***negligible negative*** significance during the decommissioning phase of the Project. It is important to implement mitigation measures to avoid an increase in the impact significance at the decommissioning and closure phase.

Table 10.48 Pre- and Post- Mitigation Significance: Relations between the Locals and In-migrants

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (-ve)**	**MINOR (-ve)**
Operation	**MODERATE (-ve)**	**MINOR (-ve)**
Decommissioning and Post Closure	**NEGLIGIBLE (-ve)**	**NEGLIGIBLE (-ve)**

10.2.12 Impact on Social Pathologies

Table 10.49 Impact Characteristics: Social Pathologies

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increase in social pathologies.	Increase in social pathologies.	Increase in social pathologies.
Impact Type	Indirect.	Indirect.	Indirect.

Summary	Construction	Operation	Decommissioning/ Post Closure
Stakeholders/ Receptors Affected	Surrounding communities.	Surrounding communities.	Surrounding communities.

The presence of construction workers poses a potential risk to family structures and social networks in the area, specifically local communities in local towns of Pofadder, Pella and Aggeneys. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can affect the local communities. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential behaviour of male construction workers, including:

- an increase in alcohol and drug use;
- an increase in crime levels;
- an increase in teenage and unwanted pregnancies;
- an increase in prostitution; and
- an increase in sexually transmitted diseases (STDs).

Social pathologies such as drug and alcohol abuse, neglect of children, teenage pregnancies, domestic violence, and crime are pervasive in the local communities. Crimes at the local level include rape, statutory rape, stock theft and domestic violence; it is believed that alcohol abuse is the primary contributing factor in all socially deviant behaviour. It is reported that drugs are brought into the community by outsiders that have come into the area for seasonal or temporary work. In addition, influx of people into an area typically brings about social change.

These changes have been known to cause an increase in vulnerability and increase peoples' susceptibility to social pathologies such as those that are already in existence in the local community. Key concerns raised by stakeholders through the public consultation process linked to social pathologies include the possible increase in drugs, stock theft, as well as the increase threat to personal security for the farming community.

Impact Assessment

Construction, Operation, Decommissioning and Closure:
Given that many of the possible social pathologies already exist, it is likely that these will be exacerbated further by Project activities. It is likely that substance abuse and domestic violence in particular are set to rise significantly because of the increased availability of alcohol and drugs as well as the increase in disposable income. Stock theft and robbery are also likely to increase given the significant increase in population and increased population movement in the local area. Although prostitution has not been identified to be an issue in the local communities, it may well become one, given the

propensity of girls and boys to engage in sexual activity at an early age in exchange for material things.

The increase in social pathologies is an **indirect** and **negative** impact. The magnitude of the impact is **medium** as related to the duration, extent, scale and frequency. The extent of the impact is local and regional as many of the migrant employees would periodically go home and the increase in disposable income may well contribute to social pathologies in the labour-sending areas. The duration of the impact will be permanent as these pathologies are set to continue after closure of the mine. The scale of the impact is medium because these social pathologies already exist and the frequency is constant. The sensitivity of people in the local area is moderate because of existing vulnerabilities linked to poverty, low education and substance abuse issues in the local community. The impact significance is rated to be a ***moderate negative*** impact.

Box 10.41 Summary of Construction, Operational and Decommissioning Impacts: Social Pathologies

Nature: Construction, operational and decommissioning activities would result in a **negative direct** impact in terms of increased social pathologies.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local and regional.**
- Duration: The expected impact will be **permanent(ie irreversible).**
- Scale: The impact will result in **Medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The increase in social pathologies will likely occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objectives:
The objectives of the mitigation measures are to:

- curb the exacerbation of current social pathologies;
- educate workers and the community on the impacts related to substance abuse; and

- support the South African Police Service (SAPS) to fight against social pathologies prevalent in the local community.

General: Mitigation Measures

- BMM to support SAPS through working with Provincial structures to ensure that the appropriate number of police are deployed to the area in line with the expected increase in the population size.

- BMM will ensure that their security personnel work in close collaboration with the police to monitor any illegal activity.

- The BMM should consider the establishment of a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors, farmers, and BMM. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers.

Construction and Operation: Mitigation Measures

- BMM and its appointed contractors are to develop an induction programme and a Code of Conduct for all workers directly or indirectly employed by the Project. The Code of Conduct is to form part of induction of all employees related to the Project and it is to be signed by each employee. The Code of Conduct should be available in all relevant languages and at a minimum, English, Afrikaans and Setswana. The Code of Conduct should address the following aspects:

    - respect for local residents;

    - respect for farm infrastructure and agricultural activities;

    - no unauthorised taking of natural resources;

    - respect for the natural environment and no littering or illegal dumping;

    - zero tolerance of illegal activities by Project related employees including: soliciting prostitutes; illegal sale and purchase of alcohol; sale, purchase or consume drugs; illegal gambling or fighting; and engaging in sexual acts with minors;

    - compliance with the traffic regulations on site and all road traffic regulations; and

- description of disciplinary measures for infringement of the Code of Conduct and company rules.

- If workers are found to be in contravention of the Code of Conduct, which they have signed, they will face disciplinary procedures. If the breach of the code of conduct warrants a dismissal, the dismissal must comply with the South African labour legislation.

- The movement of construction workers on and off the site should be closely managed and monitored by BMM/contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis.

- BMM/contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks.

- The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks

Residual Impacts

Social pathologies already exist in the local communities of the LM and are expected to be exacerbated as a result of the influx of in-migrants linked to this Project. However, assuming the mitigation measures are successfully implemented, these pathologies can be curbed. The post-mitigation impact significance is rated as ***minor*** to ***moderate negative*** for all phases of the Project.

Table 10.50 Pre- and Post- Mitigation Significance: Social Pathologies

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MODERATE (-ve)**	**MINOR (-ve) to MODERATE (-ve)**
Operation	**MODERATE (-ve)**	**MINOR (-ve) to MODERATE (-ve)**
Decommissioning and Post Closure	**MODERATE (-ve)**	**MINOR (-ve) to MODERATE (-ve)**

10.2.13 Impact on Sense of Place

Table 10.51 Impact characteristics: Sense of Place

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Change to sense of place.	Change to sense of place.	Change to sense of place.
Impact Type	Indirect.	Indirect.	Indirect.
Stakeholders/ Receptors Affected	Surrounding communities.	Surrounding communities.	Surrounding communities.

Landscapes are considered to be human artefacts; through the influence of human contact there is a continuous change to the landscapes and hence on sense of place. As such, a change in sense of place is therefore inevitable as a result of any human contact and it is experienced in different ways by different people.

Impact Assessment

Construction and Operation, Decommissioning and Closure:

The Project will result in a change in the sense of place because it will significantly increase the footprint of human influence on the landscape. The change will also be brought about as a result of the in-migration of Project workers and job-seekers into the area; they will have their own cultural and social values that will affect the existing values and sense of identity. There has already been significant in-migration into parts of the Project area as a result of existing mining activities and to some extent as a result of seasonal work on commercial farms. The local communities in the settlements of Pofadder and Pella are relatively sheltered as in-migrants tend to live in Aggeneys or on the farm which they work on. The majority of BMM employees live in Aggeneys which is relatively cosmopolitan in comparison.

While the likely changes resulting from in-migration are discussed in *Section 10.2.14,* the visual impact of the Project (as described in *Section 10.3*) also contributes to the change in the sense of place together with noise, vibration and air quality impacts. Receptors that will be sensitive to change in the sense of place include the communities of the settlements of Pofadder, Pella, and the surrounding farming community and to some extent the community of Aggeneys. These receptors are sensitive because they are at greater risk of being impacted due to their proximity to the Project. Despite existing mining activities in the area, the sensitivity of the receptors is increased, because their ability to adapt will be compromised due to the scale of the Project which will be approximately three to four times larger than existing Deeps mine. The change in the sense of place is considered to be both a positive and a negative impact depending on the receptors. Receptors that would be negatively affected by the change to the sense of place include the surrounding farming community and the older generation.

Some people are well equipped to maximise the benefits of the Project (eg. through employment or small business development), and will see the Project as an opportunity to escape their rural identity and become more urbanised. In particular, it is expected that the youth will value the opportunities that the Project provides, to expand their livelihood options and lifestyle for the future, through opportunities that were not previously available to them. These changes in cultural and social values are likely to be embraced as a positive impact.

Change to the Sense of Place as a Negative Impact

The change to the sense of place will be experienced as a **negative** and **indirect** impact. The magnitude of the impact will be **medium** given the extent, duration, scale and frequency of the impact. The extent of the impact will be local and duration will be permanent as the change in sense of place is not reversible. The scale of the impact will be medium for the construction phase but will decrease to a small scale for the other phases of the Project life-cycle. The frequency of the impact is expected to be constant. The sensitivity of receptors who would view the change in sense place as a negative impact is **medium**. The significance of the impact is rated as ***moderate negative***.

Box 10.42 Summary of Construction, Operation and Decommissioning Impacts: Negative Impact to Sense of Place

Nature: Construction activities would result in a **negative indirect** impact to sense of place.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent(ie irreversible).**
- Scale: The impact will result in **small to medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The impact will **likely** be experienced.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **high.**

Change to the Sense of Place as a Positive Impact

To the youth in particular, the change in the sense of place will be experienced as a **positive** and **indirect** impact. The magnitude of the impact will be **medium** given the extent, duration, scale and frequency of the impact. The extent of the impact will be local and duration will be permanent. The scale of the impact will be large for the construction phase but will decrease to a small scale for the other phases of the Project life-cycle. The frequency of the impact is expected to be constant. The sensitivity of receptors who would view the change in sense place as a positive impact is **low** as they currently do not have

the means to maximise the potential benefits. The significance of the impact is rated as ***minor positive***.

Box 10.43 Summary of Construction, Operation and Decommissioning Impacts: Positive Impact to Sense of Place

Nature: Construction activities would result in a **positive indirect** impact to sense of place.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent(ie irreversible).**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The impact will **likely** be experienced.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (+).

Degree of Confidence: The degree of confidence is **high.**

Mitigation and Enhancement Measures

The mitigation and enhancement measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objective of the mitigation and enhancement measures are to assist those affected negatively by the change in the sense of place and to enhance the sense of benefits brought on by the Project.

General: Mitigation Measures

- Other mitigation measures linked to impacts on air quality, noise and vibration as well as visual impacts should be implemented to limit the change to the sense of place.

- As per the mitigation measures linked to increased social tensions, BMM will monitor the impacts associated with the influx of people and to minimise the impacts associated to the change in the sense of place (See *Section 10.2.11*).

- BMM will address concerns raised through a grievance.

Construction and Operation: Enhancement Measures

- BMM will ensure that locals are given priority in terms of employment opportunities (where possible) and are offered training which will make them more employable.

- BMM will invest in and promote sustainable projects, training and education to help communities to develop alternative livelihoods and to ensure that economic dependence on the Project is limited.

- BMM to facilitate cultural or sporting events to encourage interaction between migrants and locals.

Residual Impact

The residual impact will be ***minor negative*** for the farming community and the older generation who view the change in the sense of place as a negative impact. To the youth of the local communities and others that view the change in the sense of place as a positive impact, the residual impact significance will be rated as ***minor positive***. These ratings are based on the assumptions that the mitigation and enhancement measures are implemented. The mitigation measures are implemented to ensure that the significance of the positive impact will not decrease.

Table 10.52 Pre- and Post- Mitigation Significance: Sense of Place

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction, Operation and Decommissioning and Post Closure (Negative Impact).	**MODERATE (-ve)**	**MINOR (-ve)**
Construction, Operation and Decommissioning and Post Closure (Positive Impact).	**MINOR (+ve)**	**MINOR (+ve)**

10.2.14 Local Cultural and Social Values

Table 10.53 Impact Characteristics: Local Cultural and Social Values

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Loss of local cultural and social values.	Loss of local cultural and social values.	Loss of local cultural and social values.
Impact Type	Indirect.	Indirect.	Indirect.
Stakeholders/ Receptors Affected	Surrounding communities.	Surrounding communities.	Surrounding communities.

Most people in the local communities of Pofadder and Pella are of Nama decent, but instead would describe themselves as Coloured. There have been efforts made to revitalise the Nama culture but with limited success. The

Nama culture in the local communities of Pofadder and Pella exists as a relic (it is very diluted) of the Nama culture elsewhere in the NDM.

The local community is relatively urbanised despite the rural context. There is a general sense that the social fabric is eroding because of the social pathologies prevalent in the local communities. Although cultural values and identities are dynamic and are constantly subject to change; it is likely that the Project will indirectly present challenges to cultural and social values. It is expected that the extent and pace of change will be high.

Impact Assessment

Construction, Operation, Decommissioning and Closure
The cultural and social values of newcomers to the area may clash with those held within the local communities. This could cause tension and conflict, particularly among those who perceive their sense of identity and sense of belonging to be under threat. People that are likely to be most vulnerable include the elderly, women, and unskilled or unemployed people who are unable to adapt to the changes. Throughout the project area there is a high level of sensitivity in this regard. Over the project lifetime, culture, social values and traditional structures will continue to change as the population grows (through in-migration of Project employees and job-seekers), becomes more educated and there is increased exposure to different cultures and world views.

The pace at which cultural and social values are likely to change is expected to be significantly less dramatic subsequent to the construction phase. People will have adapted, to some degree, and assimilated new values. However, this does not imply that the changes will immediately stop or reverse, but rather that coping mechanisms amongst the less vulnerable groups will be developed and engaged. To date, the local population have already adapted to such changes as related to other mining operations in the area.

Depending on the level of vulnerability of the stakeholders involved, these changes in social and cultural values could have a **negative** impact as people struggle to assimilate the rapid pace of change in the area. For others, such as the economically active, who are able to embrace this change and actively seek to escape their rural identity, the impact will be perceived as **positive.** The impact will commence prior to construction with the initial change from a rural and urban setting, and continuing beyond the life of the Project (**permanent**). This change will be constant and experienced as an **induced** impact by the majority of people (ie. traditional authorities, older people and people who value the current way of life). This will be experienced at the **local** level throughout the LM but in particular in the Project's direct area of influence. It is of **likely** probability that this impact will occur for most receptors in the community. The overall magnitude will be **medium** given the permanent duration and large number of receptors that will be negatively affected. The sensitivity of stakeholders will be **low** because the cultural

heritage is dynamic and is already in flux. The impact significance is rated as ***minor negative.***

Box 10.44 Summary of Construction, Operational and Decommissioning Impacts: Local Cultural and Social Values

Nature: Construction, operational and decommissioning activities would result in a **negative direct** impact on local cultural and social values.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent(ie irreversible).**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: This impact will **likely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-).

Degree of Confidence: The degree of confidence is **high.**

Mitigation Measures

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objective:
The objective of the mitigation measures is to assist affected stakeholders in developing coping mechanisms to help them cope with changing culture and social norms.

General: Mitigation Measures

- Implement the mitigation measures outlined in *Section 10.2.13* (change in sense of place) which related to:
    - monitor and mitigate the impacts associated with influx; and
    - develop and implement a grievance procedure such that the affected stakeholder concerns are addressed and resolved in a timely manner.

Construction and Operation: Mitigation Measures

- Management of workforce and accommodation by:
    - Developing and implementing a Code of Conduct to minimise the risk of conflict;

- Provide induction training to Project-related workers, particularly during the construction phase; and

- Appropriate catering and recreational facilities be provided to Project related staff to minimise the strain on public facilities.

- BMM will establish a heritage resource centre that will showcase Nama cultural heritage was well as heritage important other communities within the LM such the missionary history of the broader area. The objective of a heritage resource centre would be to preserve and educate people about the importance of cultural heritage.

Residual Impacts

The residual impact of change in culture will remain to be of ***minor negative*** significance. Over time, this change will cease to be an impact, as a new social and cultural values and sense of identity will become the 'norm'.

Table 10.54 Pre- and Post- Mitigation Significance: Local Cultural and Social Values

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction, Operation Decommissioning and Post Closure.	**MINOR (-ve)**	**MINOR (-ve)**

10.2.15 Increased Pressure on Infrastructure and Services (Indirect resulting from Influx)

Table 10.55 Impact characteristics: Increased pressure on infrastructure and services (Indirect from Influx)

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Increased pressure on public services resulting from influx.	Increased pressure on public services resulting from influx.	Increased pressure on public services resulting from influx.
Impact Type	Indirect.	Indirect.	Indirect.
Stakeholders/ Receptors Affected	Local municipal area.	Local municipal area.	Local municipal area.

The influx of people into the local area will increase pressure on public infrastructure and services. The 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 LM. Upgrades to public infrastructure and services are hampered by a number of challenges including a lack of funds and capacity by the LM.

Based on the current public infrastructure and service backlogs the additional pressure will further exacerbate the challenges faced by the LM. It is unlikely that the LM will be able to cope with the increased pressure and demand resulting from the indirect influx of people; they are already unable to meet their current obligations. More detail on each of the infrastructure impacts related to influx for the different phase of the project life cycle are provided below.

Box 10.45 Housing

The current housing backlog challenges faced by the LM will be exacerbated by the influx of job-seekers. The increase in demand for accommodation is likely to drive up rental prices which could lead to insecurity in housing tenure of local people who may not be able to afford the cost of accommodation. It is likely that any informal areas that are established during the construction phase will continue to grow.

Box 10.46 Health Care and Education

The influx of job-seekers will significantly increase the pressure on the already strained health care and education facilities. Chapter 6 provides further detail on the impact of health, which predicts an increase in the communicable diseases and other health disorders as well as an increase in social ills. These impacts will all lead to further pressure on an already limited health care system.

The education system will be impacted primarily during the operation phase by an increase in the learner-teacher ratio, affecting the quality of education of each learner. Linked to the increase in social ills, female learners are at an increased risk of early pregnancy thus exacerbating the already high drop-out rate.

The demands on the health and education systems is expected to decrease during decommissioning and post closure as people are expected to migrate elsewhere in search of economic opportunities. The services offered will likely to exceed the demands of the local community. Maintaining education and health infrastructure during the decommissioning and closure phase may demand resources that the LM is unable to provide as a result of reduced income resulting from the decrease in the number of ratepayers. The local community would have grown accustomed to a certain level of service which would have been attainable through the assistance of BMM, but it is likely that without such assistance the quality of education and health infrastructure would depreciate over time.

Box 10.47 Water and Sanitation Infrastructure and Supply

The Final Scoping Report notes that Pelladrift Water Board is planning to expand and upgrade the water infrastructure in response to growing demand from the settlements of Pofadder, Pella and Aggeneys as well to meet the water demands of the Project. Water and sanitation systems will come under increased pressure as a result of influx of job-seekers.

Box 10.48 Electricity

The increase in demand for electricity is set to grow as a result of the influx of job-seekers. The influx of job-seekers in the settlements of Pofadder and Pella, will likely increase the number of illegal electricity connections as the informal settlements in these areas grow. The proposed new substation and power line that will be constructed for the purposes of the mine activities will not be of benefit to the local communities or the LM. Urgent upgrade to the electricity system of the LM is required as the demand for electricity continues to grow.

Box 10.49 Refuse Removal

The influx of people expected during the construction phase will generate significantly more waste placing additional pressure on the landfill sites and waste management facilities. The expected increase in the volume of general waste, related to the influx of job-seekers, cannot be quantified; however significant influx is expected. Due to the high poverty levels, it is likely that people will scavenge on the waste disposal sites which pose a health risk to those individuals. The LM will struggle to cope with waste management as the increase in waste volumes will require more sophisticated waste management techniques as well as specialised equipment that the LM do not have (1).

Impact Assessment

Construction

The impact on public infrastructure during the construction phase will be **negative** and **indirect** as related to the influx of job-seekers. The magnitude of the impact to public infrastructure and services will be **large.**

The extent of the impacts will be local, confined to the LM, specifically in Pofadder and Pella where job-seekers are expected to settle. The duration will be short term for the construction phase. The scale of the impact will be large as the LM will likely struggle to cope with the increased demand for infrastructure and services. The scale of the impact would be highest on infrastructure such as housing, electricity, water and sanitation due to existing backlogs as well as health care. The scale of the impacts is therefore large and these impacts are likely to occur on a constant basis.

(1) Pers. Com., Dr David Baldwin, 5 February 2013.

The sensitivity of receptors will be **high** during the construction phase when the greatest influx is expected. The impact significance is rated as ***major negative***, specifically for Pofadder and Pella.

Box 10.50 ***Summary of Construction Impacts: Increased Pressure on Infrastructure and Services resulting from Influx***

Nature: Construction activities would result in a **negative indirect** impact on infrastructure and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – High.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – High.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **large changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Impact to services and infrastructure will **likely** be impacted.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR (-).

Degree of Confidence: The degree of confidence is **low.**

Operation

The impacts on public infrastructure during the operation phase will be **negative** and **indirect** as it relates to the influx of job-seekers. The rate of influx of job-seekers will decrease during the operation phase and some may migrate elsewhere if they have been unsuccessful in securing employment, especially given the absence of other large scale industries. There is still a likelihood that some job-seekers may remain as they are hopeful of securing permanent employment or other benefits. It is expected that impacts to infrastructure and services will remain strained, although it is expected to be less compared to the construction phase. The magnitude of the impact is expected to be **medium.** The extent of the impact is local, limited to the LM, specifically in Pofadder and Pella. The duration of the impact will be long term for the duration of the Project life and the scale of the impact will be small. The rate of influx is likely to slow down during the operational phase. The frequency of the impact will be constant and the impact is likely to occur.

The sensitivity of the receptors will be medium because the LM will continue to struggle to meet growing demands for infrastructure and services without assistance. Thus the impact significance is rated to be ***moderate negative***.

Box 10.51 Summary of Operational Impacts: Increased Pressure on Infrastructure and Services resulting from Influx

Nature: Operational activities would result in a **negative indirect** impact on infrastructure and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Impact to services and infrastructure will **likely** be impacted.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **high.**

Decommissioning and Closure

The impacts on infrastructure and services during the decommissioning and closure phase will be **indirect** and **negative**. With decommissioning, it is likely that people will migrate out of the area in search of employment opportunities elsewhere. The magnitude of the impact will be **small**. The extent of the impact will be local, limited to the LM and the impact will be permanent. The scale of the impact is likely to be small as the LM would have catered for a larger population size, but with out-migration the number of ratepayers would have decreased thus impacting the LM's ability to maintain the infrastructure and services. The LM's ability to maintain the infrastructure and services would also be limited without the support of BMM as it is likely that BMM would have provided considerable support to the LM throughout the Project life. The frequency of the impact would be short to long-term depending how long it takes for the LM to adjust to the change.

The sensitivity of stakeholders, most notably the communities of Pofadder and Pella will be **medium**. This as the communities of Pofadder and Pella would have grown accustomed to a good level of service provision from the LM as a result of the support of BMM. The impact significance is rated as ***minor negative*** for the decommissioning and closure.

Box 10.52 Summary of Decommissioning Impacts: Increased Pressure on Infrastructure and Services resulting from Influx

Nature: Decommissioning activities would result in a **negative indirect** impact on infrastructure and services.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Small.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: Impact to services and infrastructure will **likely** be impacted.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-).

Degree of Confidence: The degree of confidence is **low.**

Mitigation Measures

The mitigation measures and enhancement measures presented below indicate general measures that are applicable to all phases followed by specific measures for each phase of the project.

Objectives:
The key objectives of the mitigation measures are as follows:

- limit the extent of the impact on local infrastructure and services in the LM, specifically Pofadder and Pella;
- encourage and support government in improving the levels of infrastructure and services provided in the Project area.

General: Mitigation and Enhancement Measures

- Assist the LM with engineering and town planning services to improve services provided as the LM currently does not have a town planner and is heavily reliant on consulting services, thus limiting their ability to deliver services.

- Develop public-private partnerships to support the LM to address the indirect impacts on infrastructure and services.

- Assist the LM to monitor and manage the growth of informal settlements and associated pressure on other infrastructure and services. The aim should be to prevent the establishment of new informal settlements.

- BMM will assist government in developing the following documentation in order to better manage migration into the area:

- A Migration Situation Analysis Report: this report will show the migration trend of the Local and District municipalities as well as the Province over the past five years. This report is to be updated every five years.

- A Regional Migration Plan: this plan will outline strategies, programmes and measures to be implemented in order to better manage the levels of migration into the LM and NDM.

- A Migration Monitoring Programme: this program will outline steps needed to effectively monitor the migration trends.

Health and Education

- Provide assistance to the Provincial Department of Health to improve the quality of services and equipment and infrastructure in state facilities.

- Provide assistance to the Further Education and Training (FET) colleges to expand and offer more accredited courses to communities in the LM.

- Provide support and encourage learners to attend school, for example providing transport, career guidance and access to information.

- Extend the internship programme to learners outside of Aggeneys and provide learners with the necessary support to be able to participate in the internship programme.

- Provide bursaries to learners from Grade 10 onwards to attend FET colleges in study areas that are non-mining related but will support sustainable livelihoods locally.

Water

- BMM will monitor and report on Project water usage and associated effects on the surrounding communities/ farmers. If communities and farmers are negatively affected as a direct result of the Project, immediate and appropriate action will be taken (in collaboration with the relevant authorities).

- Raise awareness of the scarcity of water resources in order to encourage people to save water as far as possible as a measure to manage demand.

Refuse Removal

- Hazardous waste will be collected and disposed of in a registered hazardous waste facility.

- Appropriate waste management facilities will be provided by the Project to minimise the strain on public facilities.

<u>Construction: Mitigation and Enhancement Measures</u>

Health

- BMM will ensure that no additional strain will be placed on the local clinic/ facilities by the Project workers.

- BMM to make medical personnel available to assist medical practitioners in the LM in the case of emergencies

Water

- All water and sanitation needs of the Project and workers will be taken care of by BMM and BMM will not exceed their legal water allocation. In doing so BMM will ensure that no additional strain is put on public infrastructure.

Electricity

- BMM will investigate the feasibility of reducing their power demand through renewable energy off-sets.

Operation: Mitigation Measures

Education

- Build new or expand educational facilities in Aggeneys and Pofadder to accommodate the children of Project-related workers to ensure that no additional strain is placed on public infrastructure.

Decommissioning and Closure: Mitigation and Enhancement Measures

- Provide capacity building and training to the LM staff. This capacity building should start early in the operations phase so that there is a clear understanding of the mandate of the LM and their responsibilities post closure.

- Investigate training options from institutions such as the Centre for Sustainability at the University of Stellenbosch and the Development Bank of South Africa, who are currently providing such training.

- Provide additional training with to the LM to ensure that there is a clear understanding of the mandate of the LM and their responsibilities post closure.

Residual Impact

The residual impacts related to influx of job-seekers on the communities of Pofadder and Pella will be reduced from ***Major*** to ***moderate negative*** for the construction phase, from ***moderate*** to ***minor negative*** for the operation, and from ***minor*** to ***negligible negative*** for the decommissioning and closure phases. This is on the assumption that the mitigation measures are implemented effectively.

Table 10.56 Pre- and Post- Mitigation Significance: Increase Pressure on Infrastructure and Services

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	MAJOR (-ve)	MODERATE (-ve)
Operation	MODERATE (-ve)	MINOR (-ve)
Decommissioning and Post Closure	MINOR (-ve)	NEGLIGIBLE (-ve)

10.2.16 Communicable Diseases (Indirect resulting from Influx)

Table 10.57 Impact Characteristics: Communicable Diseases

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	In-migrants would result in an increase in health impacts	In-migrants would result in an increase in health impacts	In-migrants would result in an increase in health impacts
Impact Type	Indirect	Indirect	Indirect
Stakeholders/ Receptors Affected	Mine workers, in-migrants and surrounding towns.	Mine workers, in-migrants and surrounding towns.	Mine workers, in-migrants and surrounding towns.

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 make people pre-disposed to the spread of communicable diseases. The influx of people is the key driver to 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 LM. The rate of infection in the local communities is uncertain and inferred from the known rates of the NDM. What is certain is that the influx of people will increase the rate of infection and prevalence of HIV/AIDS, other sexually transmitted diseases and TB in the local communities of Pofadder and Pella. Other diseases that are likely to increase include diarrhoea, dysentery and flu as related to poor living conditions and increased pressure on public infrastructure such as housing, water, sanitation and waste management.

Impact Assessment

Construction

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. In addition, given the current lack of capacity of local government, it is likely that the LM will be ill-equipped to cope with the increased pressure on public infrastructure and services. A key contributor to the spread of communicable diseases in particular relate to housing and living conditions. During the construction phase job-seekers who migrate to the area are likely to settle in Pofadder and Pella adding

significant pressure to housing. The communities of Pofadder and Pella are thus at a greater risk to the increase in the spread of communicable diseases.

The impact of increased spread of communicable diseases is **negative** and **indirect** as it relates to the influx of job-seekers. The magnitude will be **large**. The extent of the impact is local as it relates to the impact on communities of Pofadder and Pella. The duration of the impact is short-term for the duration of the construction phase. The scale of the impact will be large because the local community is vulnerable due to the existing prevalence of communicable diseases, poor education levels, access to healthcare and poor living conditions. The frequency of the impact will be constant.

The sensitivity of the local communities will be **high**. The significance of the impact is rated as ***major negative*** for the local communities.

Box 10.53 Summary of construction impacts: Communicable diseases

Nature: Construction activities would result in a **negative direct** and **indirect** impact with regard to an increase in communicable diseases.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Large.
- Extent: The extent of the impact is **local – regional.**
- Duration: The expected impact will be **short term.**
- Scale: The impact will result in **large changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The spread of communicable diseases will **likely** increase.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR (-).

Degree of Confidence: The degree of confidence is **low.**

Operation

During the operation phase some of the job-seekers are likely to migrate out of the area in search of opportunities elsewhere if they have not been successful in finding employment, however some will stay regardless.

The impact of increased spread of communicable diseases is **negative** and **indirect** as it relates to the influx of job-seekers. The magnitude will be **medium**. The extent of the impact is local as it relates to the impact on communities of Pofadder and Pella. The duration of the impact is long term as the spread of diseases are likely to be on-going for the duration of the operations. The scale of the impact will be medium because the standard of living and the levels of education of the local community would likely have improved to some extent, although certain sectors of the community will continue to disproportionately vulnerable such as women and the youth. The frequency of the impact will be constant.

The sensitivity of the local communities will be **medium** because women and youth make up a large proportion of the communities. The significance of the impact is rated as ***moderate negative***.

Box 10.54 Summary of Operation Impacts: Communicable Diseases

Nature: Construction activities would result in a **negative direct** and **indirect** impact with regard to an increase in communicable diseases.

Sensitivity/Vulnerability/Importance of Resource/Receptor –Medium.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Large.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **long term.**
- Scale: The impact will result in **medium changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **constant.**
- Likelihood: The spread of communicable diseases will **likely** increase.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR - MODERATE (-).

Degree of Confidence: The degree of confidence is **low.**

Decommissioning and Closure

The spread of communicable diseases is expected to diminish substantially during the decommissioning and closure phases due to the likely out-migration as people look for economic opportunities elsewhere. It is possible that during the construction phase several initiatives would have been implemented to improve the standards of living, the quality of infrastructure and services as well as awareness raising campaigns associated to certain diseases and health risks.

The impact during the decommissioning and closure phase will be **negative** and **indirect** as it relates to local communities affected. The magnitude will be **small**. The extent of the impact will be local. The duration is expected to be temporary related to a small influx expected as a result of decommissioning activities. The scale of the impact will be small in comparison to that of the construction and operation phase. The frequency of the impact will be occasional. The sensitivity of receptors will be **low** at this late stage in the Project. The impact significance is rated as ***negligible negative*** impact.

Box 10.55 Summary of Decommissioning Impacts: Communicable Diseases

Nature: Construction activities would result in a **negative direct** and **indirect** impact with regard to an increase in communicable diseases.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Low.
Irreplaceability: The activity will **not** result in the loss of **irreplaceable** resources.

Impact Magnitude – Small.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **temporary.**
- Scale: The impact will result in **small changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **occasional.**
- Likelihood: The spread of communicable diseases will **likely** increase.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – NEGLIGIBLE (-).

Degree of Confidence: The degree of confidence is **low.**

Mitigation Measures

The mitigation measures presented below indicate general mitigation measures that are applicable to all phases followed by specific measures for each phase of the project.

Objectives
The objective is to minimise the transmission of diseases, through effective control measures and to reduce the impact of the diseases on the health of Project-related workers and affected local communities to the lowest possible degree.

General: Mitigation Measures

- Support the Provincial Department of Health in their awareness raising campaigns related to communicable diseases.

Construction: Mitigation Measures

- BMM will develop an HIV/AIDS Prevention Programme that covers the following key areas:

  Prevention
  - raise awareness (address the facts and fiction of HIV transmission);
  - get the message out (make use of local languages or non-written forms of communication);
  - go beyond the workplace;
  - de-stigmatise the disease;
  - peer education (train and support peer educators);
  - review occupational health and safety procedures;
  - distribute male and female condoms;
  - promote circumcision;

- establish voluntary HIV testing and counselling centres;
- institute a post exposure prophylaxis programme for all employees with potential exposure to blood or body fluids;
- establish a prevention programme to prevent Mother-to-Child Transmission;
- train managers and supervisors - to improve programme success; and
- work with and support the Provincial Department of Health to establish similar programmes in the local communities.

Treatment/ Management and Care

- dispense Anti-Retroviral Treatment (ARV) to workers;
- establish an ARV programme for family members;
- monitor and promote adherence to treatment regime;
- ensure dispensing of medication is controlled;
- provide nutritional programme in addition to treatment regime; and
- provide terminal and home-based care.

- BMM will establish a TB treatment programme similar to that of the HIV/AIDS programme. Specific measures include:

  - dispense TB Treatment to workers;
  - establish a TB programme for family members;
  - monitor and promote adherence to treatment regime;
  - ensure dispensing of medication is controlled;
  - provide nutritional programme in addition to treatment regime; and
  - provide terminal and home-based care.

<u>Operation: Mitigation Measures</u>

- BMM will continue to roll out the HIV/AIDS and TB programmes initiated in the construction phase.

Further to the HIV/AIDS and TB prevention and treatment programme, the following measures will be undertaken:

- All initiatives shall address the symptoms as well as behaviour change issues around the transmission and infection of HIV/AIDS as well as other sexually transmitted infections. The programs will need to be developed and carried out in partnership with health services (at various levels) and will not be the sole responsibility of BMM, but of the local government and NGOs operating in the area.

Residual Impact

The residual impact will be reduced from ***major*** to ***moderate*** negative for the construction phase, ***moderate*** to ***minor*** for the operation phase and to ***negligible*** for the decommissioning and closure phases of the Project, based on the assumption that the mitigation measures will be implemented.

10.3 VISUAL IMPACT

10.3.1 Impact on the Aesthetic Value of the Landscape

Newtown Landscape Architects (NLA) was commissioned by ERM to carry out a Visual Impact Assessment (VIA) to assess the severity of the visual impacts associated with the Project. As part of this process a baseline for the VIA was established (refer to Chapter 6), whereby the visual resource and 'sense of place' for the area was defined, as well as sensitive receptors being identified.

Assessing the likely effects of this Project on a landscape and on visual amenity is determined through a combination of quantitative and qualitative evaluations (Landscape Institute & the Institute of Environmental Management and Assessment, 2002). The landscape, its examination and the assessment of impacts on the landscape all contributed to the baseline for the VIA study. With respect to this, while the assessment of the potential impact on the landscape is carried out as an impact on an environmental resource (ie the physical landscape), visual impacts, on the other hand, are assessed as one of the interrelated effects on people (ie the viewers and the impact of an introduced object into a particular view or scene).

As such, visual impacts are a subset of landscape impacts, which relate to the changes that arise in the composition of available views as a result of changes to the landscape, people's responses to the changes and to the overall effect with respect to visual amenity. The overall visual impact is therefore measured as the change to the existing visual environment (ie views) caused by the intervention and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains (status quo) the visual quality of the scene as perceived by people visiting, working or living in the area.

This section describes the potential visual impacts that the Project may have on the surrounding landscape, its characteristic features and on the people who view it.

Table 10.58 Impact Characteristics: Impact on the Aesthetic Value (1) of the Landscape

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Loss of sense of place and aesthetic value of the landscape. Light and dust pollution. Light glow at night.	Loss of sense of place and aesthetic value of the landscape. Light and dust pollution. Light glow at night.	Loss of sense of place and aesthetic value of the landscape.

(1) Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes (NLA, 2013).

Summary	Construction	Operation	Decommissioning/ Post Closure
Impact Type	Direct.	Direct.	Direct.
Stakeholders/ Receptors Affected	Tourists, neighbouring residents and commuters using the N12 highway and local roads.	Tourists, neighbouring residents and commuters using the N12 highway and local roads.	Tourists, neighbouring residents and commuters using the N12 highway and local roads.
	Residents from the study area (ie from the Achab and Kykgate farmsteads and from the town of Aggeneys).	Residents from the study area (ie from the Achab and Kykgate farmsteads and from the town of Aggeneys).	Residents from the study area (ie from the Achab and Kykgate farmsteads and from the town of Aggeneys).
	Users of the Aggeneys recreational facility /golf course.	Users of the Aggeneys recreational facility /golf course.	Users of the Aggeneys recreational facility /golf course.

Construction Phase Impacts

During construction, direct and indirect visual impacts will arise as a result of the physical presence and visibility of construction activities associated with the Project. These include:

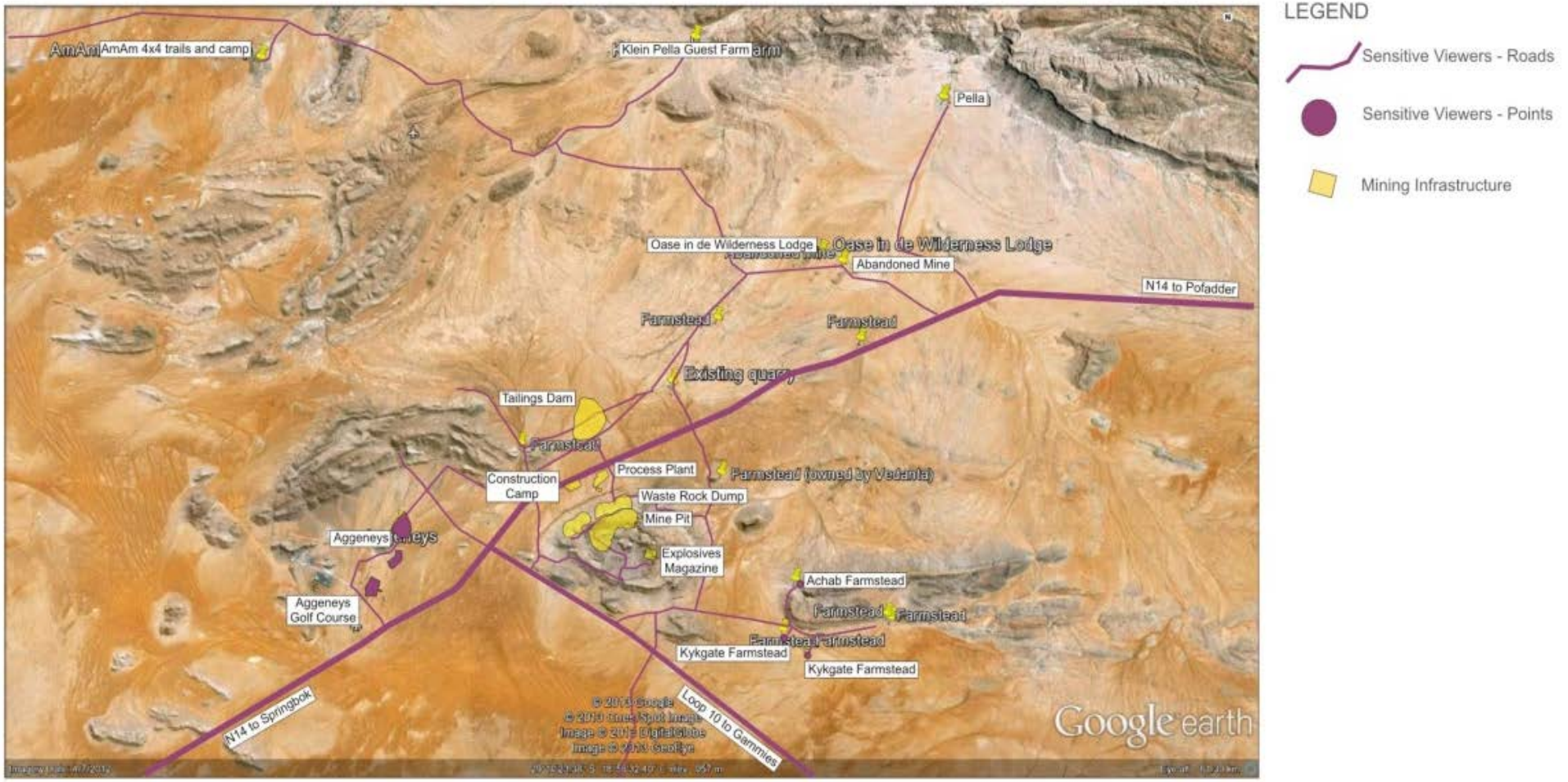
- Site clearance/vegetation removal (which could result in the scarring of the landscape) and topsoil/waste rock stockpiling. The loss of vegetation over this area will be perceived as a change to local landscape character and will be experienced by viewers located near to the project boundary.
- Construction of mining infrastructure.
- Presence and visibility of site boundary fencing and access roads.
- Earth-moving activities (eg digging of trenches, excavations etc.).
- Presence and visibility of construction vehicles and vehicles used for earth-moving activities.
- Lighting that will be used to spread light on the construction sites during the night time, will illuminate the dark rural night sky and the glow is expected to be seen from far beyond the 'zone of potential influence' (note that the 'zone of potential influence' is defined in the *Operational Phase Impacts* Section below).
- Dust generated from construction activities is likely to result in a negative visual impact during the daytime and reduce visibility.

The above construction activities will result in direct visual impacts on the sensitive viewers in the vicinity of the Project area.

The scale and size of the operation, and the fact that much of it is situated in a vast open landscape, will result in a dramatic contrast with the existing landscape patterns of the area. The consequence being that the Project would dominate most views in the immediate area (refer to *Figure 10.1*). In this regard, the Project will be highly visible from the N14, the area from where most people would view the development. This artery is also a relatively popular tourist route and thus determined to be a sensitive viewing area in relation to the Project. Other sensitive receptors include landowners and personnel living/working at the Achab farmstead (east of the Project site), recreational users (ie hikers, cyclists and bird-watchers) and residents/commuters from nearby communities (ie Pella, Pofadder and Springbok). Views from the town of Aggeneys would not be regarded as being sensitive since it is a mining town and most residents are employed by a mining company.

Temporary aesthetic visual impacts associated with construction activities include the presence of excavators, other construction vehicles, earth moving activities (ie site clearance and site preparation activities), as well as associated disturbances including dust and noise. More permanent changes to the landscape will be associated with the development of the necessary mining stockpiles and infrastructure, including the open-pit, the concentrator plant, temporary staff accommodation facilities, the wastewater treatment plant, the tailings dam and the waste rock dump (WRD).

Figure 10.1 Aerial Photograph Showing Proposed Mining Infrastructure in Relation to Sensitive Viewers/Receptors



Impact Description and Assessment

Construction activities would result in a **direct negative** impact on the aesthetic value of the landscape, as it would degrade the character of the existing natural and rural landscape. Although, construction activities will cease after completion of the infrastructure (less than 5 years), the expected impact will be **long-term** as the established infrastructure and support structures will remain in place throughout the operational phase. The scale and size of the operation and the fact that it is situated in a vast open landscape will result in a dramatic contrast with the existing landscape patterns, **severely** altering views in the area. Despite this, the impact would be experienced only at a **local** level as it would extend beyond the boundaries of the site but within the 'zone of potential influence' (approximately 15 km from the site). It is **certain** that the impacts would occur during normal operating conditions. The resulting magnitude is **large** and the resulting Sensitivity / Vulnerability / Irreplaceability of Resource / Receptor would be **high**. In light of this assessment the significance of this impact would be **major**.

Box 10.56 ***Summary of Construction Impact: Impact on the Aesthetic Value of the Landscape***

Nature: The above impacts would result in a **direct negative** impact on the aesthetic value of the landscape, as the existing character of the landscape would undergo dramatic changes during the construction phase.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **High.**
Irreplaceability: The activity will result in the loss of **irreplaceable** resources.

Impact Magnitude – **Large.**
Extent: Impacts would be experienced on a **regional level** beyond the boundaries of adjacent land.
Duration: Although construction activities will cease after completion of the infrastructure (less than 5 years), the expected impact will be **long-term** as the established infrastructure and support structures will remain after this phase.
Scale: Views would be **severely** be altered.
Frequency: The frequency of the impact will be **continuous**.
Likelihood: It is **certain** that the impacts would occur during normal operating conditions.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MAJOR (-).**

Degree of Confidence: The degree of confidence is **high**.

Construction Phase Mitigation

Construction of plant and associated infrastructure

- It is proposed that as little vegetation as possible be removed from building and infrastructure areas.

- Ensure, wherever possible, all existing natural vegetation is retained and incorporated into the mine site rehabilitation.

- Paint buildings and structures with colours that reflect and compliment the natural colours of the surrounding landscape. To further reduce the potential of glare, the external surfaces of buildings and structures should be articulated or textured to create an interplay of light and shade.

- The absolute minimum amount of vegetation and topsoil should be removed from the Project area.

- Ensure that conveyor belts are designed to follow the natural contours of the land to avoid extensive cut or fill areas.

Lighting

The negative effect of night lighting, glare and spotlight effects can be mitigated using the following methods:

- Install light fixtures that provide precisely directed illumination to reduce light 'spillage' beyond the immediate surrounds of the project structures and activities.

- Avoid high pole top flood and security lighting around the support infrastructure and areas of activity eg roads.

- To reduce the amount of glare, external surfaces of buildings and other structures should be articulated or textured to increase the interplay of light and shade.

Waste Rock Dumps

- Harsh steep engineered slopes should be avoided as these could impose an additional impact on the landscape by contrasting with the form of the existing topography.

- Final shaping and dumping should be implemented in such a way that the final horizon of the dumps simulates the existing profile of the inselberg and that the sides of the dumps are articulated in a fashion which resembles the existing topography.

- With aging the colour contrast of the exposed waste rock would begin to resemble the colours natural landscape. However, an environmentally safe product that simulates natural weathering can be applied to speed up the 'process of aging'. These applied coatings will have the added benefit of supplying plants with nutrition in the form of vital micronutrients and water-soluble nitrogen.

Landscaping

- Natural vegetation should be retained as far as possible, keeping clearing of vegetation as close as possible to the footprint of structures and activities.

- An ecological approach to landscaping is recommended. Should plants be introduced into the project site, plant selection should be guided by ecological rather than horticultural principles (ie ecological communities of plants provide more bio-diversity and habitat opportunities and would blend with the natural vegetation).

Access and Haul Roads

- Access and haul roads will require an effective dust suppression management programme, such as the application of non-polluting dust suppressing agents.

- Where paved surfaces are required, paving materials with a colour that would complement the natural colours and textures of the area shall be used.

Operational Phase Impacts

The introduction of the Project comprising of large scale buildings, structures and stockpiles (waste rock and zinc ore/concentrate) will add man-made elements, some of which are of considerable scale, to the receiving landscape establishing a new landmark feature and a point of reference for views associated with the proposed Project area.

The direct effects in terms of landscape losses or changes in the Project area are outlined as follows:

- Loss of areas of the landscape that are considered to hold high visual resource value, with its relatively unspoilt, vast, arid pains and rugged, rocky koppies that contrast dramatically with the characteristic blue skies.

- Alteration to the character of existing landscape patterns in the area. The consequence being that the proposed Project would dominate most views in the immediate area.

- Dust and light pollution from operational activities would add to the visual disturbance on the receiving environment.

The same sensitive viewers are expected as per the construction phase. These include motorists and tourists using the N14 highway and the local ancillary road network. In addition to recreational users (eg hikers, cyclists and bird watchers), residents of nearby communities (ie Pella, Pofadder, Aggeneys and Springbok), and adjacent farm landowners, whom are likely to have views

that will be compromised as a direct result of the proposed intervention (refer to *Figure 10.1* above).

Long-term impacts will be associated with the operation of the following key Project infrastructure and stockpiles/dumps:

- the open pit zinc mine;
- the crusher;
- the concentrator plant;
- the tailings dam;
- the waste rock dumps;
- contractor camp;
- waste and sewage infrastructure;
- the salvage yard; and
- other support and ancillary infrastructures

These are all expected to result in noticeable visible changes to the landscape.

The waste rock dumps will appear as 'engineered' extensions attached to the side of the inselberg, facing the N14 highway (refer to *Figure 10.2*). The plant and associated infrastructure would also be visible when driving along the N14. The size and scale of the plant and waste rock dumps is expected to draw viewers' attention as they move closer to these features, especially in the earlier years of the mine, when the dumps would still be relatively small. Viewers' attention would also be drawn towards the horizon of the inselberg, which would be animated (during certain intervals) by large trucks dumping waste rock over the edge of the inselberg.

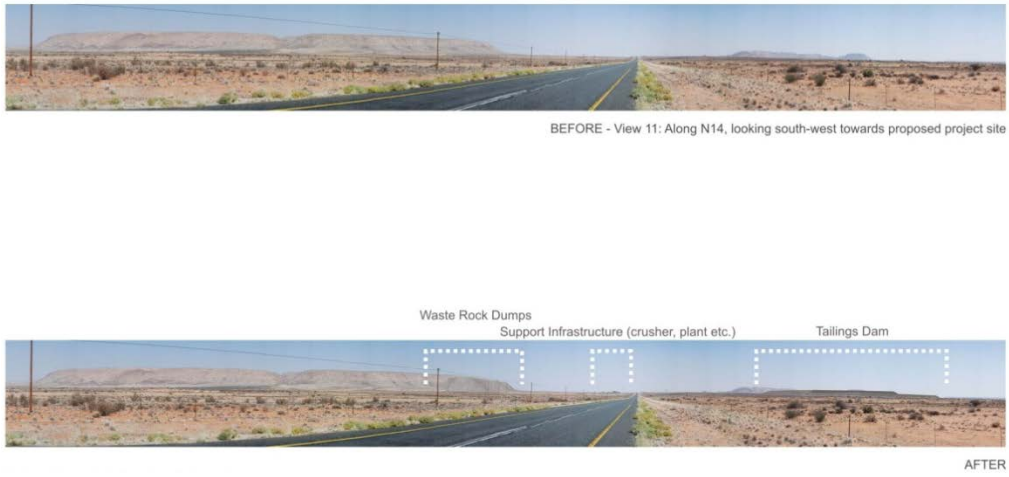
Figure 10.2 Simulation Showing Predicted Effect of the Proposed Waste Rock Dump and Plant

BEFORE - View 10B: Along N14, looking south-west towards proposed project site

AFTER

The tailings dam, being located on the other side of the road, would spread the negative effect on the visual environment beyond the perceived 'boundary' created by the N14 road. As such, the negative visual elements would not only be limited to the one side of the road, leaving the other side 'untouched', but also visually 'contaminate' the area north of the N14 (refer to *Figure 10.3*).

Figure 10.3 Simulation Showing Potential Mining Infrastructure on Either Side of the N14



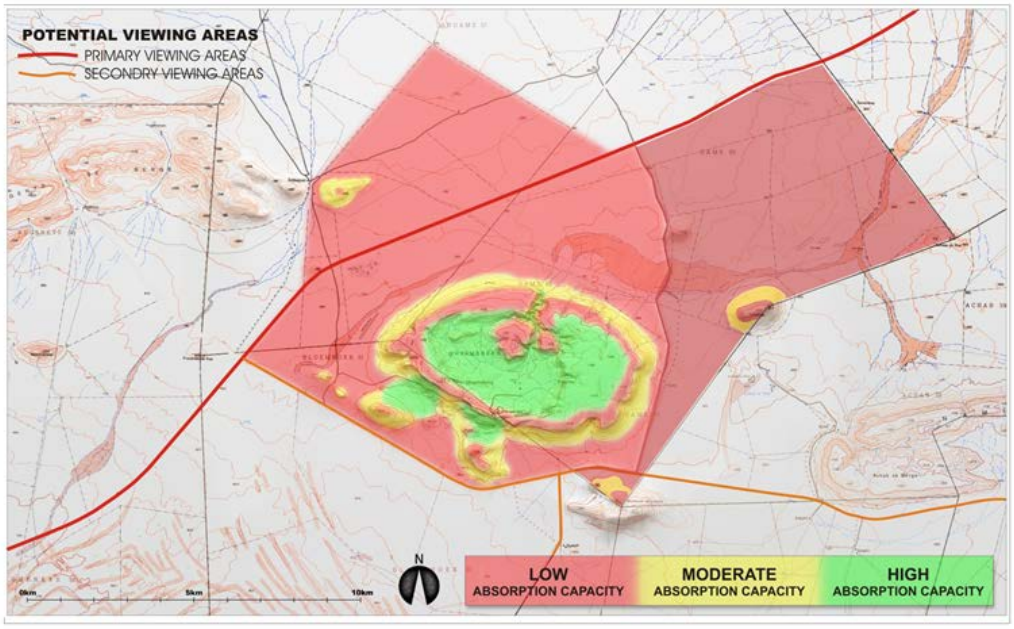
The above simulations clearly illustrate the visually intrusive nature of the Project. It is also clear from the simulations that the tailings dam and the waste rock dumps would have the most dramatic negative effect in the long term as they would remain after closure. Despite this, the plant, associated infrastructure and activities would have the most contrast with the existing natural landscape. The plant and associated infrastructure would also dominate the night time scene, as they would be illuminated for safety and security reasons.

In addition to the simulations shown above, the visual absorption capacity (VAC) of the Project site was mapped as part of the VIA study (*Figure 10.4*). VAC is the measure of the landscape's ability to visually accept the development into it (Cave Klapwijk and Associates, 1994). Areas which have a high VAC are more easily able to 'accept' objects into it so their impact is less noticeable. On the other hand areas with low VAC will suffer a higher visual impact from objects or structures imposed on them. *Figure 10.4* illustrates the three zones of VAC, including:

- low (ie flat plain areas and the crests of koppies and the inselberg);
- moderate (ie side slopes of koppies and the inselberg); and
- high (ie valleys and 'bowl' of the inselberg).

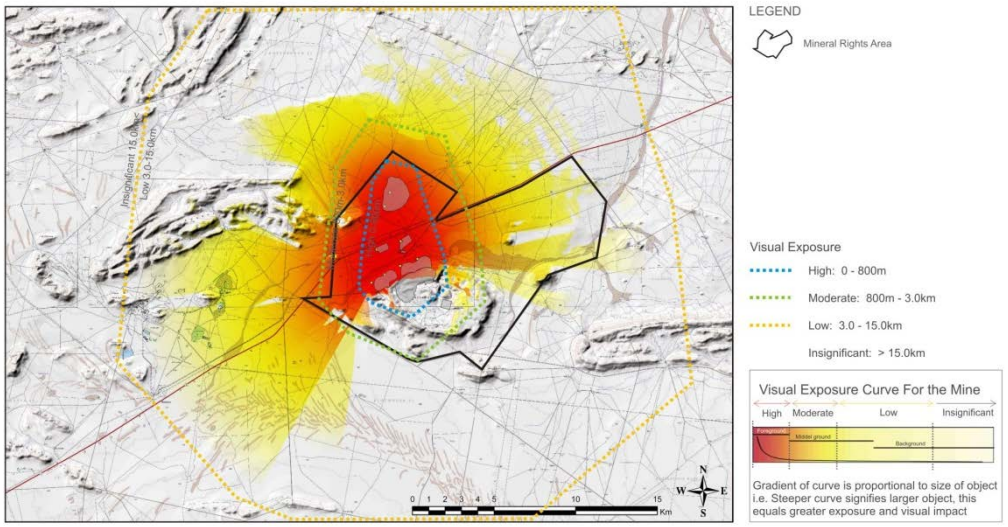
This illustration indicates that the majority of the proposed mining structures and buildings will be located in a zone rated with a low VAC. The waste rock dumps would be partially located in a moderate zone as it would be dumped over the rim of the inselberg, thus covering the whole gradient of the slope.

Figure 10.4 Illustration Showing the Visual Absorption Capacity of the Project Site



In addition to this, the VIA study determined the 'zone of potential influence' associated with the Project. This is the area from which the proposed site is supposedly visible. In terms of the Project, the or the 'zone of potential influence' was established and is regarded to be approximately 15 km (refer to *Figure 10.5*). This means that at a distance of 15 km from the site the visual impact of the proposed activities is expected to be diminished due to the diminishing effect of distance (the project recedes into the background) and atmospheric conditions (haze) on visibility. Also, at this distance the features would appear in the background of a view and thus begin to be 'absorbed' into the landscape setting.

Figure 10.5 Diagram Showing the Proposed 'Zone of Potential Influence' for the Project



Impact Description and Assessment

Operational activities would result in a **direct negative** impact on the aesthetic value of the landscape, as it would degrade the character of the existing natural and rural landscape. The impact would be of a **permanent** nature since waste rock dumps and the tailings dam would remain after decommissioning phase. The plant and other support structures would however be decommissioned during decommissioning phase. Impacts would be experienced on a **local** level beyond the boundaries of the Project site, even after decommissioning phase. Views would be **severely** be altered. It is **certain** that the impacts would occur during normal operating conditions. The resulting Magnitude is **large** and the resulting Sensitivity / Vulnerability / Irreplaceability of Resource / Receptor would be **high**. In the light of these findings the resulting Significance would be rated as being **major**.

Box 10.57 Summary of Operational Impact: Visual

Nature: Operational activities would result in a **direct negative** impact on the aesthetic value of the landscape, as it would degrade the character of the existing natural and rural landscape.

Sensitivity/Vulnerability/Importance of Resource/Receptor **– High.**
Irreplaceability: The activity will result in the loss of **irreplaceable** resources.

Impact Magnitude **– Large.**
Extent: The impact would be experienced only at a **local** level as it would extend beyond the boundaries of the site but within the 'zone of potential influence' (approximately 15 km from the site).
Duration: The impact would be of a **permanent** nature since waste rock dumps and the tailings dam would remain after decommissioning phase.
Scale: The impact will result in **severe changes** to the resource/receptor.
Frequency: The frequency of the impact will be **continuous.**
Likelihood: It is **certain** that the impacts would occur during normal operating conditions.

IMPACT SIGNIFICANCE (PRE-MITIGATION) **– MAJOR (-).**

Degree of Confidence: The degree of confidence is **high**.

Operational Phase Mitigation

Lighting

The negative effect of night lighting, glare and spotlight effects can be mitigated using the following methods:

- Install light fixtures that provide precisely directed illumination to reduce light 'spillage' beyond the immediate surrounds of the project structures and activities.

- Avoid high pole top flood and security lighting around the support infrastructure and areas of activity eg roads.

Waste Rock Dumps

- Harsh steep engineered slopes should be avoided as these could impose an additional impact on the landscape by contrasting with the form of the existing topography.

- Final shaping and dumping should be implemented in such a way that the final horizon of the dumps simulates the existing profile of the Gamsberg and that the sides of the dumps are articulated in a fashion which resembles the existing topography. Would final shaping refer to the decommissioning/ closure phase?

- With aging the colour contrast of the exposed waste rock would begin to resemble the colours natural landscape. However, an environmentally safe product that simulates natural weathering can be applied to speed up

the 'process of aging'. These applied coatings will have the added benefit of supplying plants with nutrition in the form of vital micronutrients and water-soluble nitrogen."

Tailings Dam

- Treatment would be similar to that prescribed for the waste rock dumps both in terms of shaping and 'colouration'.

Landscaping

- Natural vegetation should be retained as far as possible, keeping clearing of vegetation as close as possible to the footprint of structures and activities.

- An ecological approach to landscaping is recommended. Should plants be introduced into the project site, plant selection should be guided by ecological rather than horticultural principles. (ie ecological communities of plants provide more bio-diversity and habitat opportunities and would blend with the natural vegetation).

Access and Haul Roads

- Access roads and haul roads will require an effective dust suppression management programme, such as the application of non-polluting dust suppressing agents.

- Where paved surfaces are required, use paving materials with a colour that would complement the natural colours and textures of the area.

Decommissioning and Post Closure Phase Impacts

The decommissioning phase of the Project would result in the removal of all operational facilities such as the plant, crusher, concentrator etc. The process of removal will result in continued levels of visual disturbance. After decommissioning the waste rock dumps and tailings dam will remain. These as well as the scarring of the landscape brought on by the removal of the ancillary infrastructure can be slightly reduced as the veld will be shaped and seeded with indigenous plants.

If the tailings dam and waste rock dumps remain on site and are not rehabilitated successfully the visibility will remain high especially for people travelling along the N14 local road. The visibility can however be reduced if successfully rehabilitated as per the mitigation measures given below.

Impact Description and Assessment

Decommissioning activities would result in a **direct negative** impact on the aesthetic value of the landscape, as the character of the existing natural and

rural landscape will continue to be degraded. Although, most of the decommissioning activities will cease after the removal of the operational facilities, the expected impact will be **permanent** as the established tailings dam and waste rock dumps will remain in place after the decommissioning phase and into closure. The scale and size of the tailings dam and the waste rock dumps and the fact that they are situated in a vast open landscape will result in a dramatic contrast with the existing landscape patterns, severely altering views in the area. Despite this, the impact would be experienced only at a **local** level as it would extend beyond the boundaries of the site but within the 'zone of potential influence' (approximately 15 km from the site). It is **certain** that the impacts would occur during normal operating conditions. The resulting magnitude is large and the resulting Sensitivity / Vulnerability / Irreplaceability of Resource / Receptor would be **high**. In light of this assessment the significance of this impact would be **major**.

Box 10.58 Summary of Decommissioning Impact: Visual

Nature: Decommissioning activities would result in a **direct negative** impact on the aesthetic value of the landscape, as the character of the existing natural and rural landscape will continue to be degraded.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **High.**
Irreplaceability: The activity will result in the loss of **irreplaceable** resources.

Impact Magnitude – **Large.**
Extent: The impact would be experienced only at a **local** level as it would extend beyond the boundaries of the site but within the 'zone of potential influence' (approximately 15 km from the site).
Duration: The expected impact will be **permanent (ie irreversible).**
Scale: The impact will result in **notable changes** to the resource/receptor.
Frequency: The frequency of the impact will be **continuous.**
Likelihood: It is **certain** that the impacts would occur during normal operating conditions.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MAJOR.**

Degree of Confidence: The degree of confidence is **high**.

Decommissioning and Post Closure Phase Mitigation

- Incorporate all existing natural vegetation into the mine site rehabilitation process.

Lighting

The negative effect of night lighting, glare and spotlight effects, can be mitigated using the following methods:

- Install light fixtures that provide precisely directed illumination to reduce light 'spillage' beyond the immediate surrounds of the project structures and activities.

- Avoid high pole top flood and security lighting around the support infrastructure and areas of activity eg roads.

Landscaping

- An ecological approach to landscaping is recommended. Should plants be introduced into the project site, plant selection should be guided by ecological rather than horticultural principles. (ie ecological communities of plants provide more bio-diversity and habitat opportunities and would blend with the natural vegetation).

Residual Impact

Due to the immense scale of the Project and its resultant residual features (waste rock dumps and tailings dam), it is not possible to reduce the long term negative impact significantly to result in a lower rating. Impact ratings would thus remain similar for before and after implementation of mitigation measures.

Table 10.59 Pre- and Post- Mitigation Significance: Visual

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MAJOR (-ve)**	**MAJOR (-ve)**
Operation	**MAJOR (-ve)**	**MAJOR (-ve)**
Decommissioning and Post Closure	**MAJOR (-ve)**	**MAJOR (-ve)**

10.4 IMPACT ON TRAFFIC AND TRANSPORT NETWORKS

10.4.1 Impact on Traffic and Transport Networks

Traffic modelling was undertaken in order to calculate the amount of traffic that will be generated as a result of the Project. A qualitative measure called 'Level of Service' (LOS) was used to assess changes to existing traffic conditions. In determining the LOS for a specific transport network, several different operating conditions are assessed, including speed, travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort and convenience. Six LOS were defined for capacity analysis. These were given letter designations from LOS A to LOS F, with LOS A representing the best range of operating conditions and LOS F the worst.

In addition to this, expected delays that may occur as a direct result of the Project were assessed. These were measured in seconds.

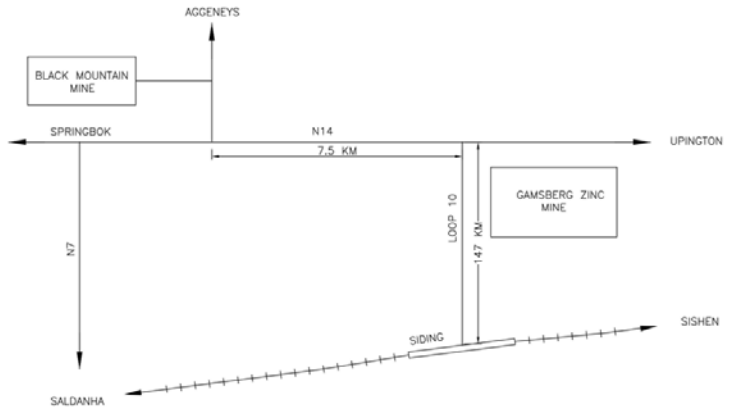
Finally, the projected LOS and expected delays were measured at key intersections that will be affected (see paragraph below) using Highway

Capacity Manual (HCM) software. HCM is an internationally recognised programme for analysing traffic impacts.

Figure 10.6 illustrates the key traffic and transport routes that were assessed as part of this Study. These included:

- the N14 highway (owned by SANRAL);
- Loop 10 (a gravel road that leads from the mine to the Loop 10 rail-siding on the TRANSNET Sishen-Saldanha Ore Line); and
- the N7 highway (owned by SANRAL).

Figure 10.6 Schematic of the Key Traffic and Transport Routes



The following section provides the key findings and recommendations derived from the traffic and transport assessment study conducted.

Table 10.60 Impact Characteristics: Traffic and Transport Network

Summary	**Construction**	**Operation**	**Decommissioning/ Post Closure**
Project Aspect/activity	Increase in traffic (associated with construction vehicles) on-site and at the site access road/N14 intersection.	Transfer of Zinc Concentrate to the Port of Saldanha via the N14 & N7 and via Loop 10 and the Sishen-Saldanha Railway Line.	Increase in traffic associated with the decommissioning of the mine.
Impact Type	Direct.	Direct.	Direct.

Summary	Construction	Operation	Decommissioning/ Post Closure
Stakeholders/Receptors Affected	SANRAL (N14). Local commuters. Local residents. Tourists.	SANRAL (N14 & N7). Provincial and Local Road Authorities (R399 and Loop 10). Transnet (Sishen-Saldanha Railway Line. N14 and N7 road users. Local residents Tourists.	SANRAL (N14). Local commuters. Local residents. Tourists.

Construction Phase Impacts

The Project will generate traffic and transportation impacts throughout the construction phase. Potential traffic impacts associated with the establishment of the Project will be associated with the delivery of construction materials, mining plant and processing components, bulk services infrastructure (eg pipework and transmission lines) and other equipment/infrastructure (eg bulk storage tanks) during the construction phase.

The construction of Project access roadways is also likely to impact upon the local transport network during the construction phase. With respect to this, all surface materials for the roads will be sourced from suitable overburden material and/or existing burrow pits at Lemoenplaas (located north of the existing BMM Township). Material to be brought in from outside will include cement, plant and equipment.

It is also estimated that the construction phase of the Project will require a labour force in the order of 3,200 people, which will include highly skilled engineers and technicians, semi-skilled labourers and unskilled labourers. These employment opportunities will be taken up and result in an increase in traffic between the town of Aggeneys and the Project site, which is 10 km east of the town. *Table 10.63* below shows the predicted person trip generation for the construction phase (60 month period) of the Project. It is estimated that construction activities will result in approximately 507 person trips per day. This relates to the use of approximately 155 vehicles per day, including 3 buses, 25 minibus taxis and 127 cars. It should be noted that there will be two shifts per day during the construction phase. As such, if it is assumed that trips are to be distributed evenly throughout the day, this means that there will be approximately 155 vehicle trips per shift change.

Table 10.61 Forecast of the Person Trip Traffic Generation during the Construction Phase

Assumptions	**Value**			
Total Number of Contractors	3,200			
Contract Period (months)	60			
Average Duration on Site (months)	19			
Contractors on Site Simultaneously	1,013			
Temporary Housing at Gamsberg Mine	500			
Persons / unit	2			
Person trips / day	0.5			
No Shifts	2			
Trip Generation	**Modes**			
Modal Split	Bus	Taxi	Car	NMT
Percentage split	10%	40%	50%	1%
Person trips	51	203	253	12
Persons / mode	20	8	2	
Motorized trips	3	25	127	
Total No. Vehicle Trips / Day	**155 vehicles / day**			

Traffic volumes of 155 trips per hour are considered not to be significant in the context of the background traffic on the N14, which is fairly low. There may, however, be some localised short-lived congestion at the intersection of the N14 and the Aggeneys access road and at the intersection of the N14 and Loop 10, with minor delays of more than 60 seconds per vehicle for a brief period, during the shift changes.

Impact Assessment

Construction activities will result in a **direct negative** impact on the traffic and transport network, particularly to those people using the N14 highway. The activity will **not result in the loss of irreplaceable** resources as the N14 will be able to accommodate the additional traffic associated with the construction phase, especially with the contractors accommodated on site in temporary housing. The extent of the impact is likely to be **localised** and within the sphere of influence of key intersections along the N14 highway. Construction phase impacts will be of a **temporary** nature and will abate on completion of this phase. The impact will result in **notably altered traffic conditions** along the N14 and in the vicinity of the site entrance. Although there is a **definite** likelihood of increased traffic, it is likely that disruption to traffic on the N14 would be **periodic.** In light of this assessment the significance of this impact would be **minor**.

Box 10.59 Summary of Construction Impact: Traffic and Transport Network

Nature: Construction activities will result in a **direct negative** impact on the traffic and transport network, particularly to those people using the N14 highway.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Medium.**
Irreplaceability: The activity will **not result in the loss of irreplaceable** resources as the N14 will be able to accommodate the additional traffic associated with the construction phase, especially with the contractors accommodated on site in temporary housing.

Impact Magnitude – **Low.**
Extent: The extent of the impact is likely to be **localised** and within the sphere of influence of key intersections along the N14 highway.
Duration: Construction phase impacts will be of a **temporary** nature and will abate on completion of this phase.
Scale: The impact will result in **notably altered traffic conditions** along the N14 and in the vicinity of the site entrance.
Frequency: It is likely that disruption to traffic on the N14 would be **periodic.**
Likelihood: There is a **definite** likelihood of increased traffic.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MINOR (-).**

Degree of Confidence: The degree of confidence is **high.**

Construction Phase Mitigation

- Establish appropriate construction warning signs and road markings at the site entrance.
- Prepare the carriageway crossing at the Loop 10/N14 intersection with a concrete edge beam or construct an asphalt bell-mouth.
- Restrict all construction activities to designated working areas with all work areas and access areas clearly marked and signposted.
- Ensure lorry/trucks carrying abnormal loads have necessary permits in terms of the National Roads Act.
- Ensure that a traffic and transportation management plan is in place for the construction phase of the Project.

Operational Phase Impacts

One of the major operational activities that will impact on the associated traffic and transport network will be the bulk transportation of zinc concentrate from the Project site to the Port of Saldanha. In this regard, it is proposed that the Project will be implemented in three phases with a ramp up during the operation phase (over a 17 year period) to meet the maximum production target of 1,0 Mtpa. During the first phase of operation (Year 1 and 2) it is anticipated that 0,335 Mtpa of zinc concentrate will be transported by road (N14, N7 and R399) to Saldanha Bay for export. During the second phase

transportation of the zinc concentrate will be split between road and rail, with 0,335 Mtpa being transported via road (N14, N7 & R399) and another 0,335 Mtpa being transported via rail on the Sishen – Saldanha railway line. This second phase will involve the road transportation of concentrate from the Project site to the Loop 10 rail-siding (located approximately 147 km to the south-east of the Project site) via the existing Loop 10 gravel road. Similarly, the third phase will involve a split between road and rail with 0,500 Mtpa being transported via road (N14, N7 & R399) and another 0,500 Mtpa being transported via rail on the Sishen – Saldanha railway line. Again the proportion of concentrate being transported via rail will need to be transported via road to the Loop 10 rail siding. In light of the expected ramp-up in operations, the estimated additional trip generation, for road tankers and rail wagons, for each of the three phases mentioned above is indicated in *Table 10.64* below.

Table 10.62 Road Traffic Generation Based on the Proposed Ramp-up

	Transport Requirements	Phase 1 (Year 1 and 2)	Phase 2 (Year 3 and 4)	Phase 3 (Year 5 – 17)
Road based transport to Saldahna via N14, N7 and R399.	**Volume of concentrate transported**	335,000 tons per annum	335,000 tons per annum.	500,000 tons per annum.
	Trucks required.	27 trucks per day (35t trucks operating 350 days per year)	27 trucks per day (35t trucks operating 350 days per year).	41 trucks per day (35t trucks operating 350 days per year).
	Wagons required.	N/A	N/A	N/A
Road and rail based transport to Saldanha via Loop 10 gravel road and Sishen – Saldanha railway line.	**Volume of concentrate transported.**	N/A	335,000 tons per annum.	500,000 tons per annum.
	Trucks required.	N/A	27 trucks per day (35t trucks operating 350 days per year).	41 trucks per day (35t trucks operating 350 days per year).
	Wagons required.	N/A	143 wagons per week (52t wagons operating 45 weeks of the year).	214 wagons per week (52t wagons operating 45 weeks of the year).

As shown above, the three phases of operation are likely to generate significant volumes of heavy vehicular traffic on the road network as zinc concentrate is transferred from the Project site to the Port of Saldanha. Despite this, the additional traffic loading on the N14 and N7 was analysed with HICAP software and the results are found to be satisfactory in relation to the background traffic associated with these transport routes. In this regard, the prevailing 'Level of Service' was found to be LOS A (refer to *Table 10.65* below), with average delays of less than 10 seconds per vehicle.

Table 10.63 HiCap 2000 Analysis: N14 (Springbok to Pofadder) and the N7 (Garies to Springbok)

Measures of Effectiveness	Phase 1	Phase 2	Phase 3
N14 (Springbok to Pofadder)			
Two way hourly volume (vph)	228	228	242
Levels of Service (LOS)	A	A	A
Average Travel Speed (km/h)	105.5	105.5	105.3
V/C Ratio	0.079	0.079	0.084
N7 (Garies to Springbok)			
Two way hourly volume (vph)	245	245	259
Levels of Service (LOS)	A	A	A
Average Travel Speed (km/h)	99.5	99.5	99.3
V/C Ratio	0.095	0.095	0.100

It is anticipated that during the first year of production that approximately 630 jobs will be created. This relates to an estimated 630 person trips per day (refer to *Table 10.66* below), resulting in an additional trip generation of 40 vehicles per day (11 buses, 8 minbus-taxis and 21 cars). It should be noted that during operations of the Project, there will be three shifts per day. If it is assumed that the trips will be distributed evenly throughout the day, it is expected that there will be approximately 27 trips per shift change.

Table 10.64 Forecast of Person Trip Generation DURING Operation (Year 1)

Assumptions	**Value**			
Number of jobs	630			
Number of contractors	128			
Permanent at Aggeneys	502			
Persons / unit	1			
Person trips	630			
No Shifts	3			
Trip Generation	**Modes**			
Modal Split	Bus	Taxi	Car	NMT
Percentage split	70%	20%	10%	1%
Person trips	441	126	63	6.3
Persons / mode	40	15	3	
Motorized trips	11	8	21	
Total No. Vehicle Trips / Day	**40 Vehicles per day**			

When full production is reached in the 5th year of operation it is expected that approximately 1,230 jobs will be created. This relates to approximately 1,230

person trips per day, resulting in an additional trip generation of approximately 79 vehicles per day (22 buses, 16 minbus-taxis and 41 cars). If it is assumed again that there are three shifts per day and that trips are distributed evenly throughout the day, this relates to approximately 53 trips per shift change.

Table 10.65 Forecast of Person trip Generation during Operation (Year 5)

Assumptions	**Value**			
Number of jobs	1230			
Number of contractors	380			
Permanent at Aggeneys	850			
Persons / unit	1			
Person trips	1230			
No Shifts	3			
Trip Generation	**Modes**			
Modal Split	Bus	Taxi	Car	NMT
Percentage split	70%	20%	10%	1%
Person trips	861	246	123	12.3
Persons / mode	40	15	3	
Motorized trips	22	16	41	
Total No. Vehicle Trips / Day	**79 Vehicles / Day**			

Traffic volumes of 53 trips per hour are not considered significant in the context of the background traffic on the N14, which is fairly low. There may however, be some localised short-lived congestion at the intersection of the N14 and the Aggeneys access road and at the intersection of the N14 and the Project site entrance, with minor delays of more than 20 seconds per vehicle for a brief period, particularly during shift changes.

The N14 has no indication of any public transportation services in close proximity to the Project site. In addition to this, there are not existing sidewalks to the site to serve the needs of cyclists and pedestrians alike.

Impact Assessment

Operational activities that increase traffic would result in a **negative direct** impact on people who use the roads along the final transport route. The activity will **not result in the loss of irreplaceable resources**. The extent of the impact is **regional** as the potential impact will extend along the selected key transport routes (ie N7, N14 & R399). The duration will be **long-term** as the impact is associated with the operational phase which is proposed to last for a minimum of 17 years. There is a definite likelihood of the impact occurring, which will result in **notable** changes to the resource/receptor. In light of this assessment the significance of this impact would be **moderate**.

Box 10.60 Summary of Operational Impact: Traffic and Transport Network

Nature: Operational activities that increase traffic would result in a **negative direct** impact on people who use the roads along the final transport route.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Medium.**
Irreplaceability: The activity will **not result in the loss of irreplaceable resources**.

Impact Magnitude – **Medium.**
Extent: The extent of the impact is **Regional** as the potential impact will extend along the selected transport route.
Duration: The duration will be **long-term** as the impact is associated with the operational phase which is proposed to last for a minimum of 17 years.
Scale: The impact will result in **notable** changes to the resource/receptor.
Frequency: The frequency of the impact will be **constant.**
Likelihood: There is a **definite** likelihood of increased traffic.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MODERATE (-).**

Degree of Confidence: The degree of confidence is **high.**

Operational Phase Mitigation

- Balance the transport of Zinc concentrate between the two transportation modes (ie road and rail).
- Ensure that a traffic and transportation management plan is in place for the operational phase of the Project.
- As the specialist report indicates that the N14 and the N7 will be operating at an acceptable LOS for existing and future traffic volume scenarios, no geometric improvements will need to be made to these roads to accommodate anticipate the increased traffic volumes.
- The transport of fuels on public roads is governed by the National Road Traffic Act and as such vehicles and drivers must meet stringent safety controls.
- Bulk road tankers must undergo regular maintenance/servicing inspections to ensure that they remain in good working condition.
- Adequate road signage and warning lights indicating working and turning areas should be provided at and near the site.
- Bus stops and mini-bus taxi stops should be established on the N14, to promote public transport use, particularly for the transport of semi-skilled and unskilled labourers during the operation phase.
- Sidewalks to the site should be provided and made wide enough to safely accommodate cyclists and pedestrians. Furthermore, the use of non-

motorised modes of transport (ie bicycles and walking) should be promoted. In this regard, employees living in close proximity to the site should be encouraged to use non-motorised transport instead of using private vehicles.

Decommissioning and Post Closure Phase Impacts

The decommissioning phase of the activity would result in the removal of all operational equipment. This will result in further impacts to the surrounding road network as the mining equipment is removed from site. The actual details of the decommissioning phase are not available and cannot be assessed comprehensively. Despite this, the receiving environment of the N14 is considered to be sufficiently robust to accommodate the decommissioning phase of the Project, which is expected to have very similar impacts to that of the construction phase.

Impact Assessment

Decommissioning activities will result in a **direct negative** impact on the traffic and transport network, particularly to those people using the N14 highway. The activity will **not result in the loss of irreplaceable** resources as the N14 will be able to accommodate the additional traffic associated with the decommissioning phase, especially with the contractors accommodated on site in temporary housing. The extent of the impact is likely to be **localised** and within the sphere of influence of key intersections along the N14 highway. Decommissioning phase impacts will be of a **temporary** nature and will abate on completion of this phase. The impact will result in **notably altered traffic conditions** along the N14 and in the vicinity of the site entrance. In light of this assessment the significance of this impact would be **minor**.

Box 10.61 Summary of Decommissioning Impact: Traffic and Transport Network

Nature: Decommissioning activities will result in a **direct negative** impact on the traffic and transport network, particularly to those people using the N14 highway.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Medium.**
Irreplaceability: The activity will **not result in the loss of irreplaceable** resources as the N14 will be able to accommodate the additional traffic associated with the decommissioning phase, especially with the contractors accommodated on site in temporary housing.

Impact Magnitude – **Low.**
Extent: The extent of the impact is likely to be **localised** and within the sphere of influence of key intersections along the N14 highway.
Duration: Decommissioning phase impacts will be of a **temporary** nature and will abate on completion of this phase.
Scale: The impact will result in **notably altered traffic conditions** along the N14 and in the vicinity of the site entrance.
Frequency: It is likely that disruption to traffic on the N14 would be **periodic.**
Likelihood: There is a **definite** likelihood of increased traffic.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **MINOR (-).**

Degree of Confidence: The degree of confidence is **high.**

Decommissioning and Post Closure Phase Mitigation

- Ensure that a traffic and transportation management plan is in place for the decommissioning phase of the Project.
- Establish appropriate decommissioning warning signs and road markings at the site entrance.
- Restrict all decommissioning activities to designated working areas with all work areas and access areas clearly marked and signposted.
- Ensure lorry/trucks carrying abnormal loads have necessary permits in terms of the National Roads Act.

Residual Impact

The implementation of the above mitigation measures would reduce the construction impacts from Minor to Negligible significance, while the operation impacts will remain Minor. The implementation of the decommissioning phase mitigation measures would reduce the associated significance rating from Minor to Negligible. The pre- and post-mitigation impacts are compared in *Table 10.68* below.

Table 10.66 Pre- and Post- Mitigation Significance: Traffic and Transport Network

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**MINOR (-ve)**	**NEGLIGIBLE (-ve)**
Operation	**MINOR (-ve)**	**MINOR (-ve)**
Decommissioning and Post Closure	**MINOR (-ve)**	**NEGLIGIBLE (-ve)**

10.5 IMPACT ON ARCHAEOLOGY, HERITAGE AND PALAEONTOLOGY

10.5.1 Impact on Archaeology

Table 10.67 Impact Characteristics: Archaeological Resources

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Loss of archaeological resources through landscape/site disturbance.	Loss of archaeological resources through landscape/site disturbance. Management of archaeological resources relative to operation of the mine and associated infrastructure.	No archaeological impacts are anticipated during decommissioning phase.
Impact Type	Direct.	Direct.	
Stakeholders/ Receptors Affected	Archaeological resources.	Archaeological resources.	

Construction and Operational Phase Impacts

Construction phase activities will include land clearance and excavation of different parts of the site in preparation of infrastructural development. The primary construction activities will include the following:

- Pre-stripping of the open pit;
- Excavation of the waste rock dump and tailings dam area;
- Construction of a contractor's camp and concentrator plant (including some of associated infrastructure); and
- Construction of bulk service requirements (ie water, sewage and power infrastructure).

The following activities will be characteristic of the operational phase of the Project:

- Further expansion of open pit;
- Increase in the waste rock dump and tailings dam footprint;
- Construction of full internal road network; and
- Expansion of the concentrator plant and associated infrastructure.

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 construction and operational phase impacts can be seen as permanent and irreversible, and would likely be experienced at both phases of the Project. It is likely that the construction and operation of infrastructure would contribute to the loss of archaeological artefacts. In light of this, the construction and operational phase impacts associated with the Project are assessed in an integrated manner, as they are closely linked. Note however that mitigation measures are specific to the different phases and are presented accordingly.

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 (a detailed description of artefacts identified in these three regions are contained in above). *Figure 10.7* illustrates areas of archaeological importance in relation to the proposed layout of the Project.

Northern Slope

Artefact occurrence NG1 (mid-twentieth century drilling site) is likely to be impacted during the construction and subsequent expansion of the tailings dam, located on the northern border of the N14. However, this site has been allocated a low archaeological significance.

Artefact occurrence NG 2 is located along the northern border of the N14, in close proximity to the road. This artefact has been allocated a high archaeological significance, consisting of a series of dome-shaped bedrock outcrops around which are clustered an abundance of Ceramic Later Stone Age artefacts (stone artefacts, pottery, ostrich eggshell). Due to its location well clear of the proposed tailings dam (and other infrastructure), the site is unlikely to be impacted during the construction and operational phase.

Artefact occurrence NG3 will likely be impacted by the construction of powerlines and potentially activities related to the construction and operation of the contractor camp. This artefact has been allocated a low archaeological significance, as this is an individual instance of an isolated Earlier Stone Age cleaver that lacks context and hence is of limited archaeological importance.

18°55'0"E
19°0'30"E
19°6'0"E
29°13'30"S

KHÂI-MA RURAL
KHÂI-MA LOCAL MUNICIPALITY
AGGENEYS
KHÂI-MA RURAL
N14
NG1
Tailings Dam
AGGENEYS
Return Water Dam
NG2
Plant
Truck Workshop
Explosive Magazine
Camp
N14
Electrical Switching Yard
Conveyors
Primary Crusher
NG3
GI1
GI2
GI3
Waste Rock Dump 2
Open Pit
SG1
SG2
Waste Rock Dump 1
SG4
SG7
Loop 10 Gravel Road
AGGENEYS
KHÂI-MA RURAL
KHÂI-MA RURAL

Legend

- Archaeological Observation Points
- Non-Perennial River
- Dry Water Course Centre Line
- Dry Water Course Extent
- Dam
- Dry Pan
- National Route (N14)
- Main Road
- Secondary Road
- Other Road
- Track/Footpath
- Railway
- Electrical cables
- Haul Roads
- Town Boundary
- Cadastral_Boundaries
- Waste Rock Dump 1
- Waste Rock Dump 2
- Open Pit
- Contractors Camp
- Conveyor
- Electrical Switching Yard
- Explosive Magazine
- Plant
- Primary Crusher
- Return Water Dam
- Tailings Dam
- Truck Workshop
- Mineral Rights Area

SCALE:
0 1 2 3 4
Kilometres
N

TITLE:

Figure 10.7:
Areas of Archaeological Importance

CLIENT:
vedanta
BLACK MOUNTAIN MINING (PTY) LTD

DATE: Apr 2013	CHECKED: MP	PROJECT: 0164903
DRAWN: AB	APPROVED: SHC	SCALE: 1 : 70 000

DRAWING: Areas of Archaeological Importance.mxd
REV: 0

ERM
Great Westerford Building
240 Main Road
Rondebosch, 7725
Cape Town, SOUTH AFRICA
Tel: +27 21 681 5400
Fax +27 21 686 073

Projection: Transverse Mecator, CM19. Datum : WGS84
Source: Chief Directorate National Geo-Spatial Information. Black Mountain Mining (Pty) LTD. McGregor Museum
Inset Map: Esri Data & Maps

SIZE: A3

T:\Gis Projects\0164903_Gamsberg\Mapping\MXD\Report\Apri2013\Areas of Archaeological Importance.mxd

Southern Slope

The southern slopes of the inselberg contain a greater variety and richness of archaeological artefacts. A total of 8 artefact occurrences considered to be a high archaeological importance were identified.

Artefact occurrence SG 1, which is suspected as being a grave site, is located to the south west of the inselberg. Furthermore, artefact occurrence SG2, which is a surface scatter of Ceramic Later Stone Age material, is also located to the south west of the inselberg. Both artefacts occurrences have been allocated a high importance. Based on the power infrastructure proposed, these two sites (SG 1 and SG 2) may likely be impacted during the construction phases.

The site SG 7 has been identified as the Kloof in which the suspected history of San genocide occurred. The Namies inselberg is also considered to be a potential area, but the exact location of the genocide events could not be confirmed. In light of this, these locations have been identified to be a high heritage importance. Although upon inspection no particular evidence was found at the site itself of this historical event, written and oral history lends support to this speculation, and on this basis the site must be considered important. The existing access road to the inselberg will be widened by 15 m and utilised for the construction phase only. A new access road will be constructed along the northern slopes of the inselberg, at an operational level. The processes of widening the existing access road along the southern slopes of the inselberg will unlikely impact the site SG7.

It is unlikely that the remaining artefact occurrences identified on the southern slope will be impacted by project activities.

Basin of Inselberg

A total of seven artefact occurrences of archaeological value were identified within the basin (including the rim) of the inselberg. Of the seven artefacts identified, only three sites are expected to be impacted during the construction and operational phases.

Artefact occurrence GI 2, which contains indications of is ephemeral Later Stone Age occupation, was considered to be of low archaeological importance, partly on account of previous disturbance. Artefact occurrence GI3, which is a Middle Stone Age artefact site, has also been allocated an importance rating of low. Both sites have been subject to disturbances form previous mining activities and erosion from high energy surface run-off (ie heavy rains over millennia). Both these sites are likely to be impacted during the construction and operation of the primary crusher and conveyor system. Furthermore, artefact site GI3 will likely be impacted by the operational phase of the open pit.

The most significant artefact occurrence identified was found along the rim of the inselberg (artefact GI1). This site is characterised as a Middle Stone Age

workshop and is considered of regional importance. The site was originally quarried for material to construct a new landing strip. However, despite the past impacts, the site is still considered to be of a high heritage importance. Based on its location, it is likely that the operational phase (and to a lesser extent construction) of the waste rock dump will have a direct impact on this site.

Survey of the flat plains at the south western side of Aggeneys where the housing development is due to be situated, and alongside (south of) the existing Wastewater Treatment Works, as shown below, yielded no archaeological or cultural heritage resources. It is also considered unlikely that any significant artefact occurrences would be found below the surface in either instance. No mitigation is required.

18°49'30"E

29°13'30"S

KHÂI-MA LOCAL MUNICIPALITY

KHÂI-MA RURAL

AGGENEYS

AGGENEYS 56

AGGENEYS 56

AGGENEYS 56

AGGENEYS 56

AGGENEYS 56

AGGENEYS 56

AROAMS 57

ZUURWATER 62

ZUURWATER 62

ZUURWATER 62

BLOEMHOEK 61

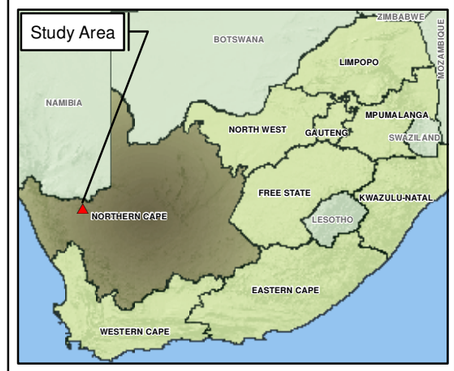
BLOEMHOEK 61

N14

N14

Legend

- Dry Water Course Center Line
- Non-Perennial Center Line
- Dam
- Dry Pan
- Dry Water Course Extent
- National Route
- Secondary Road
- Other Access
- Track/Footpath
- Town Boundary
- Farm Boundary
- Town Expansion Area
- Existing town
- Waste Water Treatment Works Expansion Area
- Existing Waste Water Treatment Works



SCALE:

0 1 2

Kilometres

N

TITLE:

Figure 10.8:
Expansion of Town and
Waste Water Treatment Works

CLIENT:

vedanta

BLACK MOUNTAIN MINING (PTY) LTD

DATE: Oct 2012	CHECKED: MP	PROJECT: 0164903
DRAWN: AB	APPROVED: SHC	SCALE: 1 : 40 000

DRAWING: Expansion of town & WWTW.mxd

REV: 0

ERM
Great Westerford Building
240 Main Road
Rondebosch, 7725
Cape Town, SOUTH AFRICA
Tel: +27 21 681 5400
Fax +27 21 686 073

ERM

Projection: Transverse Mecator, CM19. Datum : WGS84
Source: Chief Directorate National Geo-Spatial Information. Black Mountain Mining (Pty) LTD
Inset Map: Esri Data & Maps

SIZE: A3

T:\Gis Projects\0164903_Gamsberg\Mapping\MXD\Report\April2013\Expansion of housing & WWTW.mxd

Box 10.62 Summary of Construction and Operational Impact: Archaeological Resources

Nature: Construction and operational activities would result in a **direct negative** impact on archaeological resources.

Sensitivity/Vulnerability/Importance of Resource/Receptor – High.
Irreplaceability: The activity **will** result in the loss of **irreplaceable** resources.

Impact Magnitude – High.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent(ie irreversible).**
- Scale: The impact will result in **severely altered changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **once off.**
- Likelihood: Archaeological resources would **likely** be lost.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR (-).

Degree of Confidence: The degree of confidence is **high**.

Construction and Operational Phase Mitigation

- Minimise the development footprint to only what is actually needed.
- Restrict all construction activities to designated working areas with all work areas and access areas clearly marked and signposted.
- Immediately report any heritage trace that may come to light during the construction phase.
- In the case of sites NG1 and NG3 it is suggested that a sufficient record exists and/or the sites are of low significance so that no further mitigation is recommended.
- In the case of sites SG 1 and SG 2 it is noted that the sites lie close to proposed power infrastructure, but pending more specific detail on the nature and precise location of the power infrastructure, it appears that mitigation here may not be required.
- In the case of sites GI 1 to 5, it was previously recommended that mitigation by way of salvage be carried out. (SAHRA issued permits in Nov 2000 for this work but these have since lapsed). However, in terms of revised layout, only GI 1, 2 and 3 would be impacted and hence only these three sites would now require Phase 2 archaeological mitigation (salvage).
- Physical salvage of sites would need to take place before commencement of the construction and operational phases. Detailed recommendations and proposals for mitigation need to be made.

- Further investigation of the possible massacre site SG7 and possibly associated archaeological sites SG3 and SG4 (not expected to be impacted) on the south side of Gamsberg is recommended in order to ensure adequate protection of this sensitive zone within the Study Area. If further investigations reveal SG7 to be important, then the suggestion of its declaration as a provincial heritage site may be explored.

- Restrict operational activities to designated working areas with all work areas and access areas clearly marked and signposted.

- Immediately report any heritage trace that may come to light during the operation phase.

- Consider creation of a resource centre/museum for Gamsberg as a means of enhancing tourism in the area while also addressing community needs in terms of local heritage (both for general awareness as well as formal educational uses).

Residual Impact
The implementation of the above mitigation measures would reduce the decommissioning phase impacts from **Major** to **Moderate** significance. The pre- and post-mitigation impacts are compared in *Table 10.70* below.

Table 10.68 Pre- and Post- Mitigation Significance: Impact on Archaeology

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction and Operational	**MAJOR (-ve)**	**MODERATE (-ve)**

Consideration was given to potential impacts experienced during the decommissioning phase. However, at decommissioning, activities will include the removal of existing infrastructure and will be limited to the existing disturbed footprint. In doing so, no decommissioning impact is anticipated on archaeological sites.

10.5.2 Impact on Cultural Heritage

Table 10.69 Impact Characteristics: Cultural Heritage

Summary	Construction	Operation	Decommissioning/ Post Closure
Project Aspect/ activity	Loss of cultural heritage resources through landscape/site disturbance.	Loss of cultural heritage resources through landscape/site disturbance.	The removal of operational infrastructure relative to cultural heritage resources.
Impact Type	Direct	Direct	Direct

Summary	Construction	Operation	Decommissioning/ Post Closure
Stakeholders/ Receptors Affected	Cultural Heritage resources	Cultural Heritage resources	Cultural Heritage resources

Construction and Operational Phase Impacts

Similarly to the impact on archaeology, the construction and operational phase impacts to cultural heritage and sense of place will overlap between the two phases. Since these impacts are closely linked, the construction and operational phase impacts will be jointly assessed.

The sense of place for the area derives from the combination of all landscape types and their impact on the senses. Most people who live near or pass through the Study Area approach it along the N14 national road. They travel through an open dry landscape that is frequently 'punctuated' by curious inselbergs. It is this vast, desolate landscape coloured directly by its geological substrate against a wide open blue sky that gives the area its distinctive character. Although the study area evokes a distinct sense of place, it is not unique to the district or region. Nevertheless, the sense of place (including landscape quality) of the Study Area is considered to be high. The Project will disturb the surrounding landscape through the construction of physical infrastructure (ie waste rock dump and tailings dam) and increased traffic volumes of heavy duty vehicles during the operation of the Project. Furthermore, increased ambient dust and noise levels associated with the Project may also contribute to further changes to the overall sense of place.

During the site inspection, tangible artefacts of cultural heritage value were not identified within the mining license area. However, as described above, the southern section of the inselberg may pertain to the local San people who may have been subject to local genocide in the later nineteenth century (the south western and south eastern corner of the inselberg might relate to a historically attested massacre). This makes a rather sensitive landscape that may in future become increasingly a focus of genocide consciousness. Should the massacre site be confirmed within the mining license area (implicating, primarily, site SG 7 and perhaps also SG 4 - refer to *Figure 10.7* above), cultural heritage importance of the site will certainly increase. Furthermore, if the suspected gravesite is confirmed, the cultural value of the area will become of further importance.

Box 10.63 Summary of Construction and Operational Impact: Cultural Heritage Resources

Nature: Construction and Operational activities would result in a **direct negative** impact on cultural heritage.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity **will** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent (ie irreversible).**
- Scale: The impact will result in **notable changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **once off.**
- Likelihood: Sense of place and cultural heritage resources would un**likely** be lost.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **low**.

Construction and Operational Phase Mitigation

- Minimise the development footprint to only what is actually needed.
- Restrict all construction activities to designated working areas with all work areas and access areas clearly marked and signposted.
- Immediately report any cultural heritage trace that may come to light during the construction phase.
- Physical salvage of sites would need to take place before commencement of the construction and operational phases.
- Further investigation of the possible massacre site SG7 and possibly associated archaeological sites SG3 and SG4 (not expected to be impacted) on the south side of Gamsberg is recommended in order to ensure adequate protection of this sensitive zone within the Study Area. If further investigations reveal SG7 to be important, then the suggestion of its declaration as a provincial heritage site may be explored.
- Restrict operational activities to designated working areas with all work areas and access areas clearly marked and signposted.
- Immediately report any cultural heritage trace that may come to light during the construction and operation phase.

Decommissioning Phase Impacts

During decommissioning, mining production will begin to decline and finally come to a halt. This would have the indirect result of reduced traffic volumes

of heavy duty vehicles as well as reduced dust and noise generation. This is likely to reduce the expected impacts to the sense of place. However, the key project infrastructure such as the tailings dam and waste rock dump will remain a permanent feature within the landscape. These large features would persist with impacts on the surrounding landscape, post mining. Despite the changes to traffic volumes and dust generation, the permanent nature of the mineralised waste facilities (ie waste rock dump and tailings dam) will continue to impact the sense of place permanently.

Box 10.64 Summary of Decommissioning Impact: Cultural Heritage Resources

Nature: Decommissioning activities would result in a **direct negative** impact on cultural heritage resources.

Sensitivity/Vulnerability/Importance of Resource/Receptor – Medium.
Irreplaceability: The activity **will** result in the loss of **irreplaceable** resources.

Impact Magnitude – Medium.
- Extent: The extent of the impact is **local.**
- Duration: The expected impact will be **permanent(ie irreversible).**
- Scale: The impact will result in **notable changes** to the resource/receptor.
- Frequency: The frequency of the impact will be **once off.**
- Likelihood: The sense of place would un**likely** be impacted.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-).

Degree of Confidence: The degree of confidence is **high**.

Decommissioning Phase Mitigation

- Limit all decommissioning activities to the existing disturbed areas.
- Remove as much as possible of the mine infrastructure from the site, during decommissioning.
- Rehabilitate all disturbed areas and attempt to reinstate the impacted areas as closely as possible to their original state.
- If, as recommended, a museum or resource centre is created for enhancing tourism and awareness of local heritage, then seek to ensure its sustainability as a resource during and beyond decommissioning.

Residual Impact

The implementation of the above mitigation measures would reduce the construction, operational and decommissioning phase impacts from **Moderate** to **Minor** significance. The pre- and post-mitigation impacts are compared below.

Table 10.70 Pre- and Post- Mitigation Significance: Impact on Cultural Heritage

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction and Operation	**MODERATE (-ve)**	**MINOR (-ve)**
Decommissioning	**MODERATE (-ve)**	**MINOR (-ve)**

10.5.3 Impact on Palaeontology

A Paleontological Impact Assessment (PIA) was undertaken by John Pether in (refer to *Annex G* for the report) to outline the nature of paleontological heritage resources (fossils) in the subsurface of the Project area, which may potentially be affected by construction and operation activities (eg bulk earth works) during the development of the mine. While important features of paleontological interest were not explicitly identified on site, the paleontological heritage and the potential for disturbing such resources was acknowledged, especially in the potentially more fossiliferous fluvial/stream deposits associated with ephemeral watercourses at the Project site.

The potential impacts of this development on paleontological resources are assessed and mitigation measures to reduce the impacts are outlined below.

Table 10.71 Impact Characteristics: Paleontological and Heritage Resources

Summary	Construction	Operation
Project Aspect/ activity	Disturbance of or damage to palaeontology heritage resources associated with site preparation and construction activities.	Negligible impacts associated with site expansions and services and maintenance activities.
Impact Type	Direct negative.	Direct negative.
Stakeholders/ Receptors Affected	Paleontological heritage resources within site clearance and excavation areas. On-site fossils.	Paleontological heritage resources within site clearance and excavation areas. On-site fossils.

Construction and Operational Phase Impacts

Project activities undertaken predominantly during the preparation and construction and operational phases of the Project will have the potential to interfere with or disturb paleontological heritage resources on site. These activities include:

- Pre-stripping and establishment of open pit;
- site and vegetation clearance;
- levelling, compacting and grading activities;

- trenching and excavations for infrastructure and pipelines; and
- the laying of foundations for buildings and structures.

The mining of the zinc ore in unfossiliferous Bushmanland Group bedrock strata is not expected to have an impact on fossil heritage in the area. However, a direct impact will be associated with bulk earth works that are excavated into the surficial Kalahari Group sediments that surround the Gamsberg amphitheatre, viz the red aeolian sands (Gordonia Fm/Q-s1), the Q-s2 coversands and colluvial deposits and the fluvial deposits in watercourses. The bulk earth works with a potential paleontological impact are those required for the installation of the mine infrastructure.

Although no areas of particular paleontological sensitivity have been identified in the Study, fossils are expected to occur sporadically in the subsurface of the sands. Provided that no further bulk earth works in the surficial deposits take place there should not be an impact during the operational phase. However, it is possible that with time further infrastructure may be required.

The decommissioning phase likewise should not involve additional installations requiring earth works. However, it is possible that earthmoving involved with rehabilitation and landscaping might entail excavation into undisturbed deposits.

Impact Assessment

Construction and operational activities such as earthworks have the potential to have a **direct negative** impact on paleontological heritage resources on site. The extent of the impact is **on site**, as the potential impact on paleontological resources would be limited to the site. The duration would be **permanent**, as paleontological resources are irreplaceable and any loss would be permanent. The intensity is **low** considering the generally unfossiliferous strata found below the site. Notwithstanding, when fossils are found in these formations, they are often very significant additions to the geologic understanding of the area. Due to the sparse, very patchy distribution of fossils in the subsurface, the probability of a significant fossil find is rated **unlikely**. Due to the low fossil content predictability of the surficial deposits, the degree of confidence is rated as **medium**.

Box 10.65 Construction and Operational Impact: Damage to or Destruction of Paleontological Heritage Resources

Nature: Construction activities such as earthworks have the potential to have a **direct negative** impact on paleontological heritage resources on site.

Sensitivity/Vulnerability/Importance of Resource/Receptor – **Low.**
Irreplaceability: The activity is **unlikely to result in the loss of irreplaceable** heritage resources.

Impact Magnitude – **Low.**
Extent: The extent of the impact is **on-site,** as the extent of their disturbance is limited to the site.
Duration: The duration would be **permanent,** as paleontological and heritage resources are irreplaceable and any loss would be permanent.
Scale: Considering the generally unfossiliferous strata found below the site, the Project is not expected to significantly alter any receptors. Notwithstanding, when fossils are found in these formations, they are often very significant additions to the geologic understanding of the area.
Frequency: The frequency of the impact would be **once-off.**
Likelihood: Due to the sparse, very patchy distribution of fossils in the subsurface, the probability of a significant fossil find is rated **unlikely.**

IMPACT SIGNIFICANCE (PRE-MITIGATION) – **NEGLIGIBLE (-).**

Degree of Confidence: The degree of confidence is **medium.**

Construction Phase Mitigation

Mitigation measure(s)

The ECO responsible for the development must remain aware that all sedimentary deposits have the potential to contain fossils and he/she should thus monitor all substantial excavations into sedimentary bedrock for fossil remains. If any fossils are found during construction, HWC and SAHRA should be notified immediately.

If significant fossils are found, an appropriately qualified palaeontologist will investigate, and if required, a permit will be obtained to recover and preserve the paleontological resources for scientific purposes before work can be commenced again.

Residual

If the above-mentioned mitigation is adhered to, the residual impact significance on any paleontological resources is considered to be *Negligible*.

Table 10.72 Pre- and Post- Mitigation Significance: Paleontological Heritage Resources

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Construction	**NEGLIGIBLE (-ve)**	**NEGLIGIBLE (-ve)**

Phase	Significance (Pre-mitigation)	Residual Significance (Post–mitigation)
Operation	**NEGLIGIBLE (-ve)**	**NEGLIGIBLE (-ve)**