SECTION 3. INTRODUCTION

Urban-Econ was requested by the MSA Group on behalf of Veremo Minerals (Pty) Ltd to perform a Socio-Economic Impact assessment for proposed iron ore mining activity in the Stoffberg area in Limpopo. A baseline study for the mine was carried out in 2007 by Urban-Econ; the study provided a thorough socio-economic profile of the location in which the mining site is located as well as surrounding areas which are likely to be affected.

1.6 PROJECT DETAILS

Veremo Minerals Ltd. has submitted an application with the Department of Mineral Resources (DMR) to operate a open pit mine for the mining of iron ore, titanium, and vanadium ore. The mining site is situated between the towns of Stoffberg (16km north thereof) and Roossenekal (12km west thereof.) on a sequence of farms, namely;

- Farm Paardekloof 176 JS (approx. 1 160 ha) - Portion 2
- Farm The Wedge 175 JS (approx. 200 ha) - the remaining extent thereof
- Farm Duikerkrans 173 JS (approx. 1 600 ha) - Portions 1 to 5

The mining towns in which the site is located are in the southern section of the Steelpoort River Valley in the Elias Motsoaledi Local Municipality (LM) which forms part of the Greater Sekhukhune District Municipality (DM), Limpopo. This area is mainly characterised by its rural and agricultural nature, the main uses of land at present are cultivation, grazing, and a few residential dwellings.

Presently, the mining activity is expected to take place for a 30 year period split into five year phases. The mining process will commence in the Southern mining area by Farm Paardekloof and gradually proceed towards the northern mining ground on the Duikerkrans Farm.

1.7 SCOPE OF STUDY

The socio-economic impact assessment forms part of an Environmental Impact Assessment (EIA) process. The purpose of this report in the EIA is to provide the interested and affected parties (I&AP) with a clear indication of the socio-economic benefits and disbenefits of the proposed development. Any present or foreseen imbalances as well as possible mitigation measures will be brought to attention via this report.

The economic impact assessment needs to identify and evaluate issues pertaining to the proposed mining activity such that a basis of recommendation is formed. In addition to identifying these relevant issues it is necessary to quantify the impact on the economy of the study areas during the construction and operational phase of the project. Given the impact on the economy it is possible to determine whether or not the project is more beneficial for the affected people than the current activities taking place on the site.

1.8 Delineation of the Study Area

The purpose of the study area delineation is to identify the areas surrounding the selected sight which would be most affected by the proposed development. Geographical areas were selected in three tiers, namely primary, secondary and tertiary market area. The study areas have been defined as follows:

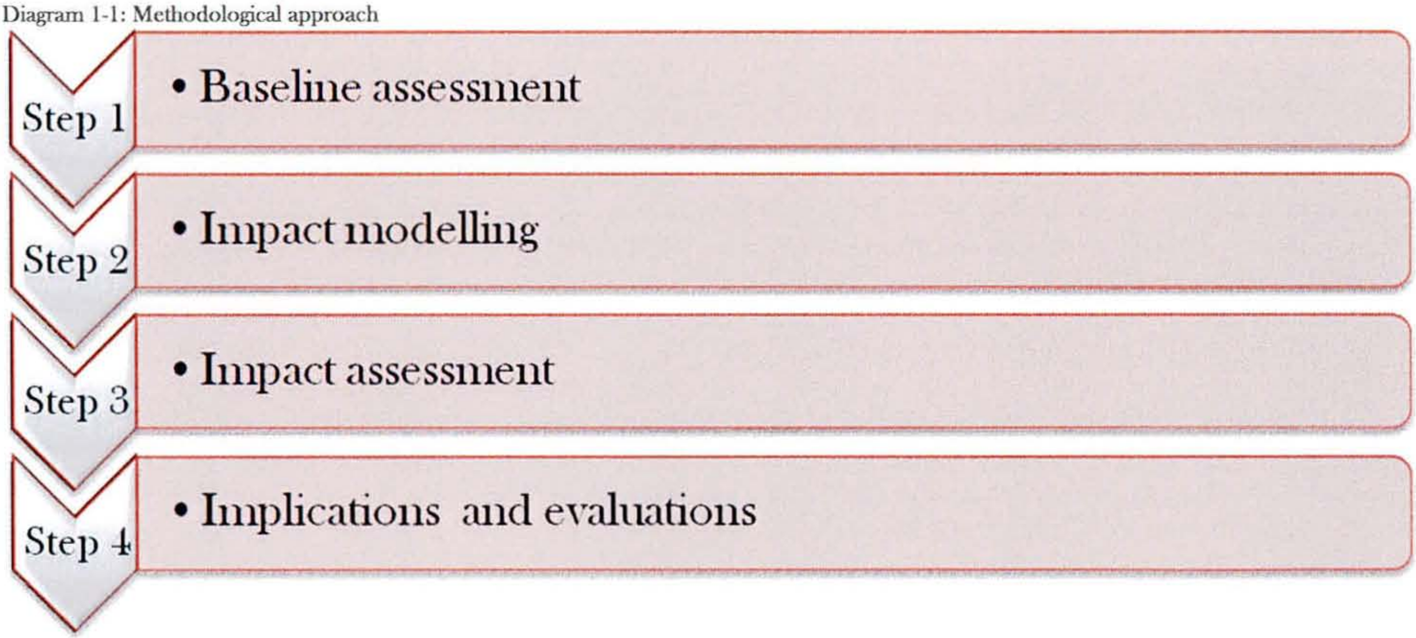
- **Primary study area: Elias Motsoaledi Local Municipality (LM) and Makhuduthamaga Local Municipality (LM).** The primary study area has been identified as the local municipality in which the mining site resides as well as the neighbouring (Makhuduthamaga) local municipality. The direct effects of the mining project during the construction phase will be most felt in these local municipalities. A considerable share of the labour force during the construction and operation phase will likely come from within the selected primary area.
- **Secondary study area: Limpopo Province.** The secondary study area has been selected as the province in which the primary study area falls. It represents a much larger area with a more diversified economy and can also be used as a measure of comparison for the primary study area.
- **Tertiary study area: South Africa.** The tertiary study area has been identified as the country in its entirety because it is understood that all impacts derived from the project expenditure will be realised throughout the country. Expenditure on capital goods as well as the indirect effects of the project are not restricted to a local municipality or province; it is highly likely that expenditure and effects will be distributed throughout the country.

Map 1-1 provides a spatial overview of the study areas under discussion in the document. The map shows the nested location of the primary study area within the secondary area as well as the secondary study area as part of the tertiary area.

1.9 Methodology

The diagram below illustrates the methodology that was employed for the study.

Diagram 1-1: Methodological approach



The following paragraphs give insight on each of the steps shown in Diagram 1-1.

Step 1: Baseline assessment

This step comprises of an overview of the study area with regard to socio-economic measures. Urban-Econ was appointed by Prime Resources in 2007 to conduct the socio-economic baseline assessment for the area in which the proposed mining activity is located, namely the Stoffberg area. The socio-economic profile of the study area included in this report is an update of the relevant indicators as well as the status quo at present.

The status quo profiling was done through a desk-top study using secondary information provided by Quantec Research and StatsSA. Due to insufficient data on a sub-place level, the profiling is limited to the local municipality in which the mining site is located. The essential indicators that were reviewed to compile the profile are as follows: population and household figures, income levels, access to services, employment, Gross Domestic Product per Region (GDP-R), and economic production.

Step 2: Impact modelling

A preparatory step for impact modelling is to gather specific information on the proposed mining activity. The information that was requested for modelling purposes is as follows:

- The capital expenditure (CAPEX) and the estimated number of employees required during the construction phase
- The operational expenditure (OPEX) per annum as well as the estimated number of employees during the operational phase

This information was sourced from Veremo Minerals (Pty) Ltd and represents the most accurate estimates on the expenditure of the project at the time of request. The CAPEX and OPEX represent a new investment in the economy which can be interpreted as a shock into the economy. Given the shock experienced in the economy, the purpose of the impact modelling is to establish a reaction within the economy which reflects reality as precise as possible. The effects were measured in terms of change in value-added, GDP-R and employment.

Once the requested information was sourced, a Social Accounting Matrix (SAM) relevant to the Limpopo province using 2010 prices was utilised to quantify the socio-economic impact of the project. By making use of the SAM it was possible to identify the direct, indirect, and induced effects of the construction phase and the operational phase.

Step 3: Impact assessment

The impact assessment involves the interpretation of the results obtained from the impact modelling (step 2). The assessment is reviewed for the duration of the construction process and the operational phase. The primary objective of this step is to determine whether the affected economies and communities experience a positive or negative impact overall as a result of the mining activity.

Step 4: Implications and evaluations

The implications of the iron ore mine on the local communities and regional economy are brought forth in this step. Interpretations are based on the outcomes of the impact assessment exercise (step 3). The evaluation of the impact in the study area focuses on the significance of the impact which is measured using pre-specified assessment criteria based on best accepted international best practice guidelines.

In conclusion, mitigation measures to maximise the positive impact and minimise any adverse effects are presented and recommendations are made based on the implications of the project and the mitigation measures.

1.10 REPORT OUTLINE

Aside from the introductory section, the report is structured as follows:

- Section 2 - Socio-economic profile: This section outlines the socio-economic profile of the primary, secondary and tertiary study area
- Section 3 - Project Overview: This section outlines the nature and extent of the economic activities involved in the construction and operation of the new iron ore mine
- Section 4 - Implications and evaluations of impact: This section presents the results of the impact modelling exercise as well as the interpretation of the impact with relevance to the local communities and regional economies
- Section 5 – Conclusion: This section provides recommendations applicable to the implications such that positive effects are maximised and negative impacts are minimised.

SECTION 4. BASELINE INFORMATION

The purpose of this section is to examine the socio-economic profile of the study area and benchmark it with the national standing. This is essential as it provides as it provides qualitative and quantitative data related to the economies under observation. The data will be used as a baseline to assess the economic impact of the proposed project.

The following socio-economic indicators are analysed in the following sub-sections:

- Population dynamics
- Household numbers and size
- Income and expenditure
- Access to services
- Labour market
- Economic production and GDP-R

2.8 POPULATION DYNAMICS

The population size and growth of any geographical area are crucial to the development course as economic growth is largely impacted by the population in terms of production output and provision of employment. To gain a fairly precise perspective of the masses to be affected by the proposed development, the population dynamics of the study areas stipulated in section area are assessed.

Table 2-1 presents the population count in each of the study areas as well as the national population for comparison sake. The historic growth rates of the population from 1995 to 2010 are also displayed in the table below.

Table 2-1: Population size and historical growth rates (1995- 2010)

Study area	2010	Historical growth rates			
		1995-2000	2000-2005	2005-2010	1995-2010
South Africa	49 991 472	1.7%	1.3%	1.1%	1.4%
Limpopo	5 439 552	1.5%	1.0%	1.0%	1.2%
Makhuduthamaga LM	271 748	0.0%	0.2%	0.3%	0.2%
Elias Motsoaledi LM	255 138	0.5%	1.0%	1.6%	1.0%

Source: Urban-Econ calculations based on Quantec (2011)

In 2010 the national population was slightly below 50 million, as seen in Table 2-1. Above five million people reside in Limpopo which represents approximately 11% of the national population. The Makhuduthamaga Local Municipality (LM) and the Elias Motsoaledi LM which both fall within the Greater Sekhukhune District Municipality (DM) each housed 5% of the provincial population. Approximately 271 748 and 255 188 people resided in the Makhuduthamaga LM and Elias Motsoaledi LM, respectively, in 2010.

The Compounded Annual Growth Rate (CAGR) of the country between 1995 and 2010 was 1.4% which is higher than that of Limpopo's and the study area's in the same period. Limpopo had a CAGR of 1.2% which may be less than the national growth but closely treads behind the national rate unlike in Makhuduthamaga LM and Elias Motsoaledi LM. Between 1995 and 2010 the population barely grew in the Makhuduthamaga LM – a CAGR of 0.2% was recorded for the 15 year timeframe. The Elias Motsoaledi LM population grew at a higher rate of 1.0% which is closely linked to the provincial CAGR in the same period.

It is important to note that the growth patterns in the Elias Motsoaledi LM and Makhuduthamaga LM are not similar to the national and provincial CAGR with have both decreased in the past 15 years despite the positive growth. In the primary study areas the population has continued to increase throughout the years. This may attributed to the lack of family planning facilities in and around the area as well as the net effect of migration.

The table below shows the projected population figures for the next 15 years. The projections were made based on the historical population dynamics discussed earlier. A 1.1% growth rate is expected in Limpopo between 2011 and 2025 with a population of approximately 6.5 million in 2025. The expected growth rate in the Makhuduthamaga LM is 0.8%, this is slightly less than the provincial rate and considerably less than the Elias Motsoaledi LM which will experience a 1.9% growth rate in the same time period. The population in both local municipalities will grow past 330 000 by 2025. On a national level, the population is expected to grow just below 55 million at a 0.9% growth rate.

Table 2-2: Projected population size (2011 - 2025)

Study area	Projected population numbers				CAGR (2010-2025)
	2011	2015	2020	2025	
South Africa	50 430 328	52 083 075	53 723 052	54 731 739	0.9%
Limpopo	5 492 834	5 727 890	6 060 014	6 419 516	1.1%
Makhuduthamaga LM	273 376	283 256	303 790	334 331	0.8%
Elias Motsoaledi LM	259 995	280 968	312 636	352 322	1.9%

Source: Urban-Econ calculations based on Quantec (2011)

The increase in population in the study areas will result in a greater labour force and higher demand for common production outputs. This expected increase will put pressure in the affected areas thus forcing job creation in the economies.

2.9 HOUSEHOLD NUMBERS AND SIZE

Analysing household dynamics of a geographical area provides further potential to assess the economic impact of a proposed development/project. The number of households and the rate at which they grow provides information on the future demand and subsequently potential economic growth. Knowledge of the household composition of the study areas also assists in estimating the extent to which the project will impact the economies.

From Table 2-3 it can be seen that South Africa had approximately 13.1 million households in 2010 with an average household size of 3.8. Ten in a hundred households were based in Limpopo with a larger average household size of 4.3. The primary study area of Makhuduthamaga LM had just above 56 100 households and a household average of 4.8 which is greater than the provincial and national average. Amongst all the study areas, Elias Motsoaledi LM had the lowest average household size of 3.7 and a household population of approximately 68 300 in 2010.

Table 2-3: Household numbers (2010), household size (2010), and historical growth rate (1995-2010)

Study area	HH number	Average HH size	Household number historical growth rates			
			1995-2000	2000-2005	2005-2010	1995-2010
South Africa	13 109 845	3.8	4.0%	2.1%	1.0%	2.3%
Limpopo	1 265 483	4.3	4.0%	1.7%	0.6%	2.1%
Makhuduthamaga LM	56 141	4.8	1.6%	0.6%	0.2%	0.8%
Elias Motsoaledi LM	68 337	3.7	4.3%	2.5%	2.1%	3.0%

Source: Urban-Econ calculations based on Quantec (2011)

The CAGR of households between 1995 and 2010 is higher than those of the population in all study areas with the exception of the Makhuduthamaga LM which has the population and household growth rate on par. The key factors that influence rapid household growth are an increase in population, a change in age structure and more people of a younger age group starting independent households.

From the historical pattern of household growth, the household numbers for 2011 to 2025 have been projected and are presented in Table 2-4 below. South Africa is expected to have just under 15 million households by 2025 with an average growth rate of 0.6% for the next fifteen years. The provincial growth rate (1.0%) is slightly higher than the national rate for the same period and approximately 1.5 million households will reside in Limpopo by 2025. The primary study areas have much higher growth rates than the province and country as a whole; Makhuduthamaga LM and Elias Motsoaledi LM households will grow at 1.6% and 3.4%, respectively, over the examined time period and approximately 70 000 and 110 600 households, respectively, will populate the local municipalities by 2025.

Table 2-4: Projected household figures (2011-2025)

Study area	Projected household numbers				CAGR (2010-2025)
	2011	2015	2020	2025	
South Africa	13 385 517	13 780 368	14 300 532	14 620 629	0.6%
Limpopo	1 292 732	1 330 201	1 400 274	1 471 698	1.0%
Makhuduthamaga LM	56 927	58 664	62 918	69 123	1.6%
Elias Motsoaledi LM	71 863	80 123	93 590	110 635	3.4%

Source: Urban-Econ calculations based on Quantec (2011)

2.10 INCOME AND EXPENDITURE

Income distribution is one of the most important social welfare indicators as people sustain their livelihoods by attending to primary needs such as food, shelter, health, clothing, etc. A change in income directly impacts the standard of living; an increase in income due to economic growth subsequently improves people's standard of living thus increasing expenditure capacity. This sub-section presents the income distribution of the study areas as well as the expenditure patterns thereof.

Table 2-5 illustrates the annual income distribution of households among various income levels.

Table 2-5: Income distribution (2007)

Income Categories (per annum)	South Africa		Limpopo		Makhuduthamaga LM		Elias Motsoaledi LM	
No Income	8.2%		6.5%		13.3%		10.3%	
R 1 - R 6 415	5.0%	41.1%	8.3%	55.1%	8.4%	59.2%	6.4%	51.8%
R 6 416 - R 12 830	9.0%		15.3%		13.5%		13.0%	
R 12 831 - R 25 660	18.9%		25.1%		23.9%		22.2%	
R 25 661 - R 51 320	19.1%		21.0%		21.9%		19.3%	
R 51 321 - R 102 641	11.4%		9.7%		5.8%		8.5%	
R 102 642 - R 205 282	7.6%		5.5%		5.4%		3.4%	
R 205 283 - R 410 564	5.3%		3.2%		1.8%		2.8%	
R 410 565 - R 821 128	2.8%		1.1%		0.4%		0.1%	
R 821 129 - R 1 642 256	0.9%		0.3%		0.1%		0.0%	
R 1 6 42 257 - R 3 284 512	0.3%		0.1%		0.2%		0.0%	
More than R 3 284 512	0.2%		0.1%		0.1%		0.0%	
No response	11.1%		4.1%		5.1%		14.0%	
TOTAL	100.0%		100.0%		100.0%		100.0%	
Weighted average (2010 prices)	**R8 087**		**R4 579**		**R3 705**		**R3 353**	

Source: Urban-Econ calculations based on Quantec (2011)

As indicated in the table above, the majority of the population in the province and primary study areas earn less than R2 200 per month (R25 660 per annum) which is more than on a national level (41.1%). The most common income bracket amongst the three study areas is R1 028 and R2 200 per month (R 12 831 - R 25 660 per annum). In the country as a whole, the average level of earnings is higher than the study areas; the most common income bracket is R25 661 - R51 320 per annum of which one out of five households earn within the bracket.

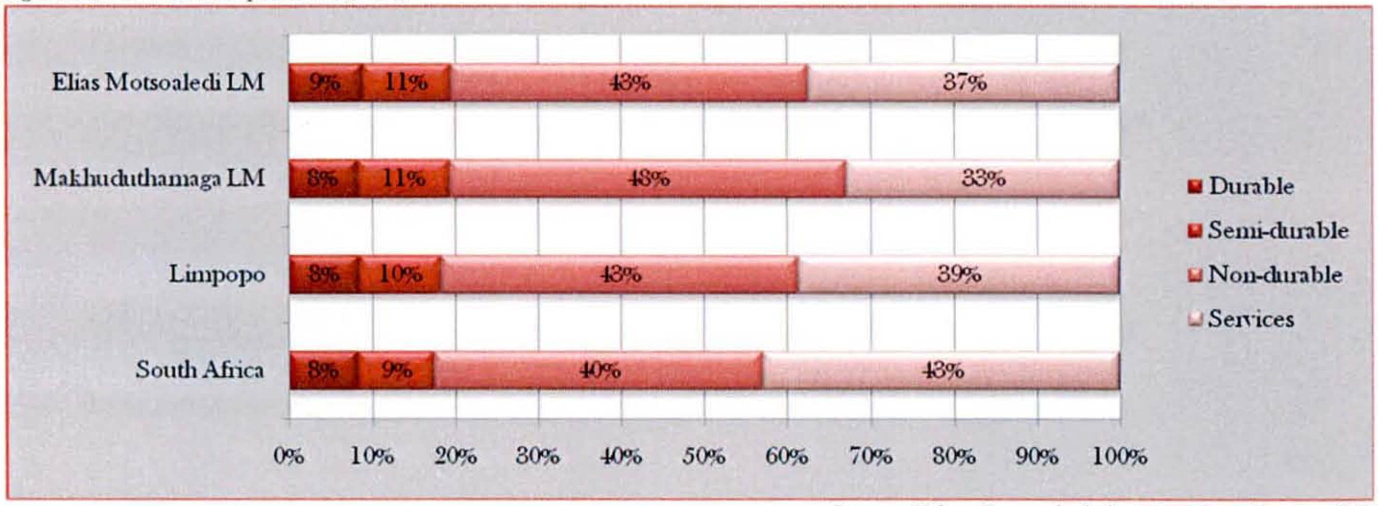
In the province about 6.5% of the households do not receive any form of income which is less than the national average of 8.2%. One in every four households earns between R1 028 and R2 200 per month followed by one in five households which earn slightly more than the majority of households in the province; approximately 21.0% of provincial households earn between R2 201 and R4 277 monthly (R25 661 - R51 320 per annum).

The incidence of extreme poverty in the Makhuduthamaga LM is the highest amongst all the study areas; 13 out of a hundred households do not receive any income. In the Elias Motsoaledi LM ten out of one hundred households do not earn any income which is above the national and provincial levels. Similar to the provincial distribution most households in Makhuduthamaga LM (24%) and the Elias Motsoaledi LM (22%) earn R1 580 on average (monthly) followed by households which earn R3 200 on average (monthly).

The weighted average household monthly income of the country is nearly double that of the province; on average a household in South Africa earns R8 087 whereas a average household in Limpopo earns R4 579 monthly. In the Makhuduthamaga LM a household earns R3 705; this is slightly more than the average household in the Elias Motsoaledi LM which earns R3 353 on average. This means that an average household in the primary study area was worse off than an average household in South Africa and the Province, clearly indicating the urgency for job creation in both municipalities.

Figure 2-1 illustrates the study area's household expenditure patterns per main groups; namely durable, semi-durable, non-durable goods and services. It can be seen that non-durable goods are the most sought after amongst all the study areas; 43% of households in each of the areas spend their income on non-durable goods followed by expenditure on services. The distribution of household expenditure is slightly different at a national level – household expenditure is primarily spent on services (43%) followed by non-durable goods (40%). No more than 20% of household expenditure is spent on durable and semi-durable goods (collectively) amongst the households in the study areas and South Africa. It is clear that the slight variance in household income does not have significant bearing on the expenditure patterns of the households.

Figure 2-1: Household expenditure (2008)



Source: Urban-Econ calculations based on Quantec (2011)

2.11 ACCESS TO SERVICES

This sub-section provides an overview of accessibility to services in the study areas. Poverty is a multi-tiered issue which is not limited to household income; it also encapsulates access to basic services such as water, electricity and sanitation facilities. This section assesses the level poverty in the study areas with regards to the accessibility of services within close proximity.

2.4.4 Access to water

Table 2-6 indicates the share of the household population which have access to an adequate supply of water. The adequate supply of water encapsulates water sourced from either a piped system within the dwelling or yard, as well as piped water from access points within close proximity (less than 200m from dwelling).

Table 2-6: Accessibility to water (2007)

	South Africa	Limpopo	Makhuduthamaga LM	Elias Motsoaledi LM
Water accessibility - numbers				
Adequate supply	9 698 284	754 041	20 102	23 045
Inadequate supply	2 802 325	461 894	33 552	23 795
Water accessibility - percentage				
Adequate supply	77.6%	62.0%	37.5%	49.2%
Inadequate supply	22.4%	38.0%	62.5%	50.8%

Source: Urban-Econ calculations based on Quantec (2011)

From Table 2-6 it is evident that over three quarters of all national households have access to an adequate supply of water. The provincial split between households with access to adequate supply of water and those which don't is less than the national level; almost two-thirds of the population have sufficient access. In the Makhuduthamaga LM the split is the exact opposite of that observed in province; two out of three households do not have access to an adequate supply of water in the area. The situation in the Elias Motsoaledi LM is such that half the households have access to an adequate supply of water meaning that the other half does not have access.

2.4.5 Access to electricity

The table below presents the accessibility of electricity by households in the study areas.

Table 2-7: Electricity supply (2007)

	South Africa	Limpopo	Makhuduthamaga LM	Elias Motsoaledi LM
Electricity accessibility - numbers				
Access	10 010 273	987 417	45 141	40 435
No access	2 490 336	228 518	8 513	6 405
Electricity accessibility - percentage				
Access	80.1%	81.2%	84.1%	86.3%
No access	19.9%	18.8%	15.9%	13.7%

Source: Urban-Econ calculations based on Quantec (2011)

Access to electricity does not differ largely amongst the study areas; on average, four out of five households in the study areas and the country have access to electricity. The largest share of households without electricity are at a national level (20%) followed by the province (19%), in the Makhuduthamaga LM and the Elias Motsoaledi LM approximately 16% and 14%, respectively, of households are without electricity.

2.4.6 Access to sanitation

Table 2-8 illustrates the accessibility of households to sanitation. Households which have access to adequate sanitation such as flush and pit toilets are perceived to have sufficient access to sanitation facilities. Households with limited or no access to sanitation facilities either make use of the bucket system or have no system in place.

Table 2-8: Sanitation supply (2007)

	South Africa	Limpopo	Makhuduthamaga LM	Elias Motsoaledi LM
Sanitation accessibility - numbers				
Have access	8 564 309	402 186	8 477	13 494
No/ limited access	3 936 300	813 749	45 177	33 347
Sanitation accessibility - percentage				
Have access	68.5%	33.1%	15.8%	28.8%
No/ limited access	31.5%	66.9%	84.2%	71.2%

Source: Urban-Econ calculations based on Quantec (2011)

In the country approximately two-thirds of households have sufficient access to sanitation facilities and one-third do not have access. At a provincial level only one-third of households have sufficient access to sanitation facilities and two-thirds have limited/no access to adequate sanitation. The situation in the Makhuduthamaga LM and the Elias Motsoaledi LM is far worse than the national and provincial stance; 85% of households in the Makhuduthamaga LM do not have access to a satisfactory sanitation system which is higher than in the Elias Motsoaledi LM (70%).

2.12 LABOUR MARKET

This sub-section focuses on the employment situation in the study area as employment is the main source of income. The employment status is a good indication of the level of disposable income which subsequently relates to the expenditure capacity of the market area.

The labour market comprises of persons who are either employed, unemployed or Not Economically Active (NEA). A clear distinction must be made between the employment status of persons therefore the official definition of unemployment, as stipulated by Statistics South Africa, has been used and the classification criteria is presented below:

d) The person did not work during the seven days prior to the survey interview, and does not have any job attachment.
e) The person wants to work and is available to start work in two weeks.
f) The person has taken active steps to seek work or taken initiative to start a business in the four weeks prior to the interview.

Table 2-9 illustrates the employment composition of the country, Limpopo, and the primary study areas. In 2010 just under 31.5 million people formed the working age population. Approximately 52% of this population were economically active and formed the labour force whilst 48% were non-economically active. Of the economically active population in the country, three-quarters were employed indicating a 25.1% unemployment rate. Limpopo's working age population represented a tenth of the national working age population however the split between persons who are NEA and in the labour force differs greatly. Nearly two-thirds of the provincial population are not economically active and only a third form the labour force revealing a 36% labour participation rate. The unemployment rate in the province (30%) suggests that just under 820 700 people are employed and under 344 500 are unemployed.

The employment situation in the Makhuduthamaga LM differs significantly from that of the nation and province. The working age population comprises of approximately 150 450 people which represents less than 5% of the provincial working age population. One out of four people of working age are active participants of the labour force whilst the remaining three people are not economically active. Approximately 20 400 people are employed in the municipality and just under 21 000 are unemployed which yields a unemployment rate of 51%; this is double that of the country and the Elias Motsoaledi LM. The employment composition in the Elias Motsoaledi LM is relatively similar to the provincial population although the unemployment (23%) and labour force participation (31%) are lower in the local municipality as opposed to the province. About 148 150 people are of working age which represents just under 5% of the provincial working age population. In the local municipality the NEA population (101 643) is slightly over double the labour force population (46 506). Three out of every four people in the Elias Motsoaledi LM labour force were employed in 2010 which yields the lowest unemployment rate (23%) of all the study areas. The employment situation in the Makhuduthamaga LM highlights the great need for job creation in and around the area to boost the local economy which subsequently increases employment opportunities whilst motivating more local people to participate in the labour force.

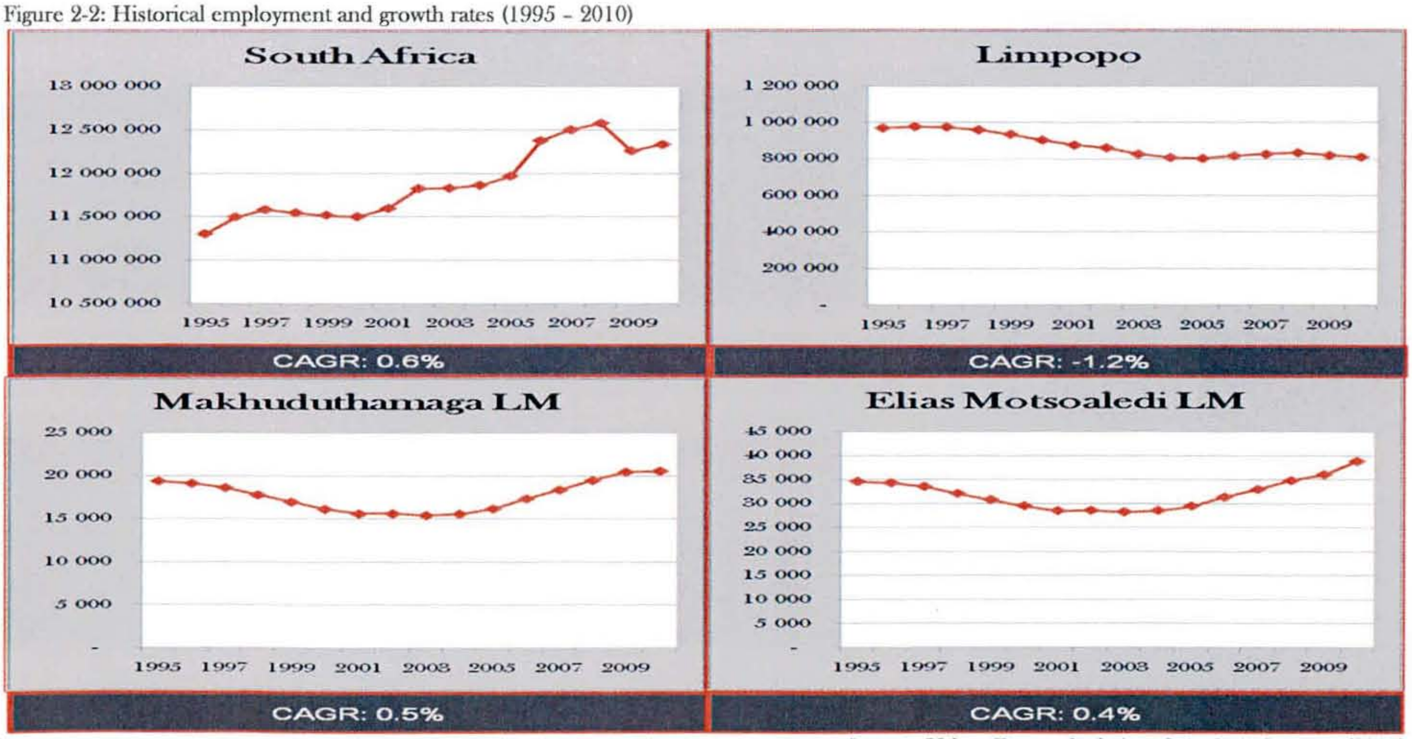
Table 2-9: Labour force statistics (2010)

Indicators	South Africa	Limpopo	Makhuduthamaga LM	Elias Motsoaledi LM
Working age population	31 496 936	3 215 569	150 438	148 149
➢ Non-economically active	15 131 133	2 050 434	109 056	101 643
➢ Labour force	16 365 803	1 165 135	41 382	46 506
▪ Employed	12 260 902	820 668	20 402	36 004
▪ Unemployed	4 104 901	344 467	20 980	10 502
Unemployment rate	25.1%	29.6%	50.7%	22.6%
Labour force participation rate	52.0%	36.2%	27.5%	31.4%

Source: Urban-Econ calculations based on Quantec (2011)

Figure 2-2 illustrates the historical employment levels and growth rates in each of the study areas.

Figure 2-2: Historical employment and growth rates (1995 - 2010)



Source: Urban-Econ calculations based on Quantec (2011)

The historical growth rates of employment for a 15 year period (1995 to 2010) assisted in projecting future employment levels however given the employment targets set by government the CAGR rate will most likely exceed the anticipated rate. Government is currently aiming to reduce unemployment from 25% (current level in South Africa-2010) to 15% by 2020. Assuming that the national target is met, approximately 19.7 million people will be employed in the country by 2025 with an average growth rate of 3.0% in the next fifteen years (2010-2025). In Limpopo the employed population may reach 2.6 million given that the CAGR is 7.6%. It is expected that just below 70 000 people would be employed in the Makhuduthamaga LM and over 184 300 in the Elias Motsoaledi LM, whereby the anticipated CAGR of the local municipalities is 7.6% and 5.7% respectively.

Table 2-10: Projected employment figures (2011-2025)

Study area	Projected employment figures				CAGR (2010-2025)
	2011	2015	2020	2025	
South Africa	12 768 389	14 586 973	17 228 663	19 697 891	3.0%
Limpopo	879 834	1 140 166	1 683 237	2 605 854	7.6%
Makhuduthamaga LM	25 734	36 589	52 050	69 524	7.6%
Elias Motsoaledi LM	56 297	96 130	143 527	184 382	5.7%

Source: Urban-Econ calculations based on Quantec (2011)

2.13 ECONOMIC PRODUCTION AND GDP-R

In order to assess the impact of a development or project it is crucial to know the economy of the area in which the development will be located. There are several indicators that measure the economic performance of an area; for the purpose of this report the production and the Gross Domestic Product per Region (GDP-R) are analysed. The production represents the total value of sales of goods and services whereas the GDP-R refers to the sum of value added by residents within a certain period of time (usually a year). The growth pattern of the GDP-R is closely followed and referred to as a economic growth indicator which can be used to measure the strength and performance of an area as well as the standard of living of citizens.

The current production and GDP-R values in the country and the study areas are tabulated below. The national economy was valued at R5 135 billion with regard to production which translates to R2 351 billion in value added (GDP-R). The provincial economy contributes approximately R304 742 million towards the national economy which represents 6% of the national economy. The primary study areas economy's each represent slightly less than 2% of the provincial economy and the production level is valued at 5 114 million in the Makhuduthamaga LM and 3 874 million in the Elias Motsoaledi LM.

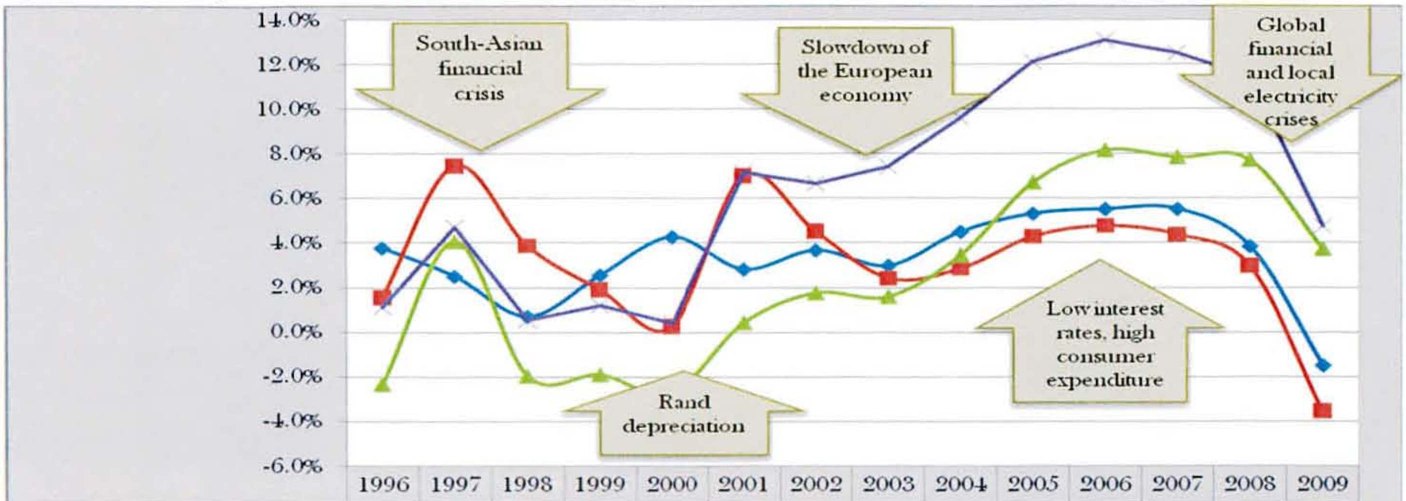
Table 2-11: Production and GDP-R (2010)

	Production (R'ml)		GDP-R (R'ml)	
	Current prices	CAGR (1995-2010)	Current prices	CAGR (1995-2010)
South Africa	5 135 243	4.6%	2 350 864	5.1%
Limpopo	304 742	4.2%	167 836	11.2%
Makhuduthamaga LM	5 114	4.6%	2 435	10.1%
Elias Motsoaledi LM	3 874	8.0%	5 515	14.3%

Source: Urban-Econ calculations based on Quantec (2011)

Figure 2-3 illustrates the growth rates of the analysed economies between 1996 and 2009.

Figure 2-3: Economic growth rates (1996-2009)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
South Africa	3.8%	2.5%	0.7%	2.6%	4.3%	2.8%	3.7%	3.0%	4.5%	5.3%	5.5%	5.5%	3.8%	-1.5%
Limpopo	1.6%	7.5%	3.9%	1.9%	0.3%	7.0%	4.5%	2.4%	2.9%	4.3%	4.8%	4.4%	3.0%	-3.5%
Makhuduthamaga LM	-2.3%	4.1%	-2.0%	-1.9%	-2.7%	0.4%	1.8%	1.6%	3.5%	6.7%	8.2%	7.8%	7.7%	3.7%
Elias Motsoaledi LM	1.1%	4.7%	0.5%	1.2%	0.4%	7.1%	6.7%	7.4%	9.6%	12.1%	13.1%	12.5%	11.5%	4.7%

Source: Urban-Econ calculations based on Quantec (2011)

From Figure 2-3 it that the highest peak in the national economy was experienced in 2006 and 2007 when the interest rates were low which resulted in high consumer expenditure thus boosting the economy. The highest growth in the Makhuduthamaga LM (8.2%) and the Elias Motsoaledi LM (13.1%) was observed in 2006 whilst the province realised its highest growth rate in 1997. The global economic and electric crisis drastically impacted the national, provincial and local economy; negative growth was observed at a national and provincial level whilst the local economies growth rates fell below half of the preceding growth rate. The global economic crisis was accelerated further by high interest rates and strict credit policy (in an attempt to curb extreme debt in national households) which resulted in low consumer expenditure.

The global and national economies are slowly recovering from the past economic crises; the national economy is expected to grow at 6.5% CAGR over the next 15 years and has an estimated value of R13 224 by 2025. The provincial economy is expected to grow at a 12.7% growth rate and contribute R1 339 billion towards the national economy. The growth in the Makhuduthamaga LM is estimated at 11.6% which is significantly lower than the Elias Motsoaledi LM which is estimated to grow at 15.8%.

Table 2-12: Projected production volume (2011-2025, 2010 prices)

Study area	Projected production figures (R'ml)				CAGR (2010-2025)
	2 011	2 015	2 020	2 025	
South Africa	5 479 081	7 236 079	10 378 891	13 224 388	6.5%
Limpopo	319 748	550 742	1 065 794	1 839 547	12.7%
Makhuduthamaga LM	5 732	11 858	19 623	26 512	11.6%
Elias Motsoaledi LM	4 485	13 977	27 605	35 026	15.8%
Study area	Projected GDP-R figures (R'ml)				CAGR (2010-2025)
	2011	2015	2020	2025	
South Africa	2 474 484	3 095 441	4 148 804	4 939 697	5.1%
Limpopo	173 729	283 436	512 545	826 652	11.2%
Makhuduthamaga LM	2 692	5 275	8 157	10 299	10.1%
Elias Motsoaledi LM	6 299	8 676	11 620	14 992	14.3%

Source: Urban-Econ calculations based on Quantec (2011)

2.14 STRUCTURE OF THE ECONOMY AND EMPLOYMENT COMPOSITION

It is imperative to know the structure of the economy and the employment composition per sector in order to determine the degree of impact per sector given an injection to the economy in the form of a new development or project. This sub-section provides a thorough analysis of the structure of the economy in terms of a sector's contribution to the overall GDP-R and employment.

Table 2-13 presents the economic structure of the study areas' in 2010 reflected in 2005 (basic) and 2010 (nominal) prices. It is worthy to note that the difference basic and current prices is mainly linked to the fact that prices do not change proportionally over years; prices in one sector can increase than another sector. For comparison purposes basic prices can be used whereas nominal prices reflect the economy at current market prices which take into account effects of market behaviour and income.

Table 2-13: Economic structure of study areas

	South Africa		Limpopo		Makhuduthamaga LM		Elias Motsoaledi LM	
	2005 prices	Nominal	2005 prices	Nominal	2005 prices	Nominal	2005 prices	Nominal
Primary sector	8.6%	13%	25.7%	35%	2.3%	5%	6.3%	9%
Agriculture, forestry and fishing	2.4%	3%	2.8%	3%	3.7%	5%	3.5%	4%
Mining and quarrying	6.2%	10%	22.9%	32%	-1.5%	0%	2.7%	5%
Secondary sector	23.3%	22%	8.8%	8%	15.7%	16%	9.9%	10%
Manufacturing	17.9%	16%	3.8%	3%	3.6%	3%	3.8%	4%
Electricity, gas and water	2.2%	2%	3.0%	3%	5.9%	6%	3.6%	4%
Construction	3.2%	3%	2.1%	2%	6.2%	6%	2.5%	3%
Tertiary sector	68.1%	65%	65.5%	57%	82.0%	79%	83.9%	81%
Trade	13.9%	14%	12.7%	11%	25.7%	25%	16.8%	16%
Transport, storage and communication	10.5%	10%	10.6%	9%	13.6%	14%	19.9%	20%
Finance, insurance and business services	23.4%	21%	18.0%	15%	3.8%	3%	26.9%	24%
Community and Government services	20.3%	20%	24.2%	21%	39.0%	37%	20.3%	20%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: Urban-Econ calculations based on Quantec (2011)

From the above table it can be seen that the tertiary sector is the most dominant in the country and the study areas. Over two-thirds of the national GDP come from the tertiary sector which is predominantly a service orientated; the finance and business services sector followed by the community and government sectors are the largest amongst the tertiary sector. Slightly below a quarter of the national economy is dependent on the secondary sector in which manufacturing is the leading sector.

The provincial economy is primarily a service economy (66%) of which community and government services lead followed by the finance and business sector. Unlike the national economy, the primary sector follows the tertiary sector and accounts for a quarter of the provincial GDP-R. Mining is the second strongest sector in the province – 23% of the provincial economy is reliant on the mining sector. The province is rich in mineral resources such as platinum group metals, diamonds, coal, chrome, iron ore and copper hence the relatively high economic activity in mining. The secondary sector contributes less than 10% to the provincial economy.

In the Makhuduthamaga LM over 80% of the GDP-R comes from within the tertiary sector. Community and government services contribute 39% towards the municipal economy followed by the trade sector (25%). The composition of the economy is not similar to that of the province with regard to the primary and secondary sector. The primary sector only represents 2.3% of the economy and it is evident that the mining sector (-1.5%) is ailing when compared to its previous capacity.

Of the study areas it appears that the Elias Motsoaledi LM is the most dependent on the tertiary sector - 84% of the municipal economy is sourced from this sector. Similar to the national economy the finance and business sector (27%) followed by the community and government services sector (20%) are the strongest sectors. Although the mining sector (2.7%) is not as stationary as in the Makhuduthamaga LM it does not compare favourably to that of the province. The secondary sector accounts for 10% of the municipal economy followed by the primary sector which represents 6%.

The figure below presents the employment composition of the study area per main sector.

Figure 2-4 corresponds with the economic activity presented in Table 2-13; the most dominant sectors in the economy's employ the largest percentage share of people. The biggest employment sectors are the services, trade, finance (which are all in the tertiary sector); three in four people in all the study areas work in one of these sectors. The construction and manufacturing sectors, which fall within the secondary sector, trail the employment capacity of the tertiary sector, more especially in the Elias Motsoaledi LM and the country as a whole. The agriculture sector contributed a considerable deal to employment relative to its contribution to the GDP-R in all the study areas whereas employment opportunities in the mining industry were few in the study areas with the exception of in Limpopo.

2.15 MINING SITE AT PRESENT

The mining site is situated across three farms in ward 15 of the Elias Motsoaledi LM. The ward is fairly widespread and mainly comprises of rural land on which agriculture and mining are the main activities. Cultivation and farming of livestock, specifically cattle, are the primary agricultural activities in the surrounding areas. According to Census 2001 approximately 46 people lived on and around the farms at the time. The population on the site can be estimated at 50 people given the population in the area grew at a similar rate to that of the local municipality. About three or four farmhouses are located directly on the site. The people residing in this area are mainly the farm owners and farm workers with their families. The actual population may be slightly higher than estimated due to mining activities nearby; the Mapochs iron ore mine is located approximately 11km from the planned site thus in-migration may have influenced the population size of the area.

2.16 SYNTHESIS

The Elias Motsoaledi LM has an approximate population of 255 138 people (2010 estimates) which represents 5% of the provincial population. About 68 337 households are located in the area with an average household size of 3.7 people. The Makhuduthamaga LM, which together with the Elias Motsoaledi LM form the primary study area, has a population size of about 271 748 and 56 141 households of which the average household size is 4.8 people. Over the last 15 years the population in the primary study areas grew at a slower rate than the Province and country; a population growth rate of about 1.0% and 0.2% were observed in the Elias Motsoaledi LM and the Makhuduthamaga LM, respectively.

The average household in the country earns more than double what households in the primary study area earn on a monthly basis. One in ten households do not earn any monthly income and more than half earn less than R4 277 over the same period. On average, a household living in the Elias Motsoaledi LM earns R3 353 a month which is slightly less than households residing in the Makhuduthamaga LM who on average earn R3 705 per month.

With regard to poverty levels defined by living standards, the primary area reflects relatively high poverty levels amongst households. Over half the local households do not have access to an adequate supply of water and approximately three-quarters have limited or no access to sufficient sanitation. Access to electricity is relatively high in the area and follows a similar pattern of the national and provincial accessibility whereby four in every five households has access to electricity.

According to Urban-Econ estimates based on StatsSA LFS data, there were 20 402 and 36 004 employed persons in the Elias Motsoaledi LM and Makhuduthamaga LM in 2010, respectively. The official definition of unemployment yields an unemployment rate of 23% and 51% whilst the labour force participation rate is 31% and 28% in the Elias Motsoaledi LM and Makhuduthamaga LM, respectively.

The production value of the Elias Motsoaledi LM and Makhuduthamaga LM is estimated at R5.1 million and R3.9 million (2010 prices) and have experienced growth rates of 4.6% and 8.0% in the past fifteen years, respectively. The growth in the rate the Elias Motsoaledi LM is nearly double that of the province and country. The most dominant economic sectors in the primary study area are the finance, insurance and business services, community and government services, as well as trade which all form part of the tertiary sector. The aforementioned sectors also employ the largest share of the population followed by the construction, manufacturing and agriculture sectors.

SECTION 5. PROJECT OVERVIEW

The purpose of this section is to present the results of the economic impact modelling exercise as well as to provide an overview of the mining sector in the country and primary study area. This section only presents the results; interpretation of the impact modelling results can be found in Section 4.

3.1. INDUSTRY OUTLOOK

The mining industry in South Arica is one of the most lucrative in the world and is known for its abundance of mineral resources varying from platinum group metals (PGMs), manganese, chrome, vanadium and gold amongst others. According to the SA Yearbook (2009/10) the mining industry contributes immensely to economic growth via its contribution to the tax base and national exports (of which half are from mineral resources). The table below indicates the national reserves and production of the most prominent minerals in 2007 as well as the country's world ranking with respect to the mineral production. It can be seen from Table 5-1 that the country holds a significant position with regard to the global mineral resource base.

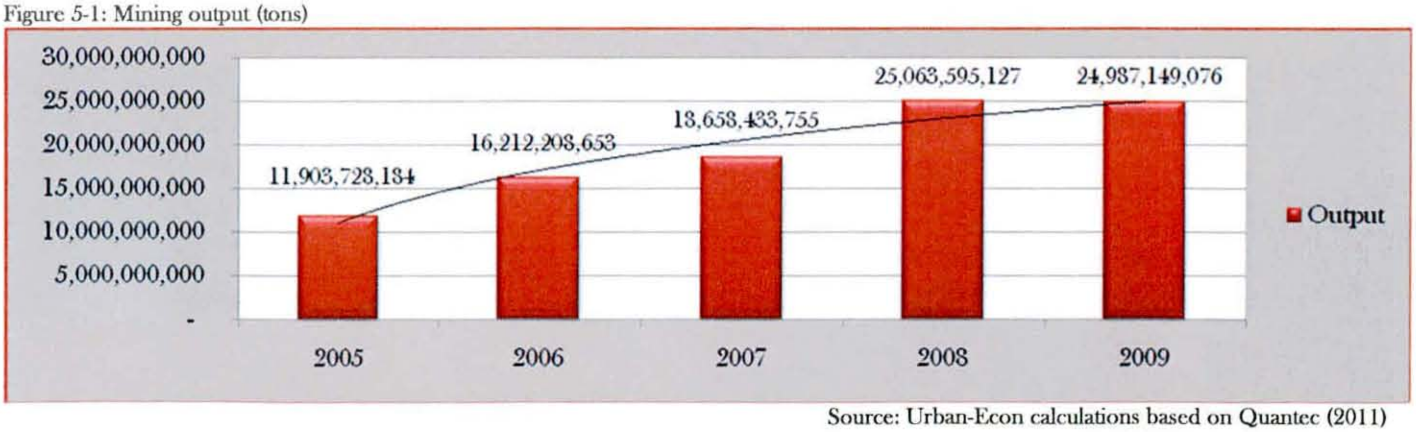
Table 5-1: National reserve and production of mineral reserves

Commodity	Unit	Reserve	Production	World ranking	
				Reserve	Production
Chrome ore	Mt	5 500	9 683	1	n/a
Fluorspar	Mt	80	285	2	4
Gold	t	36 000	253	1	2
Iron ore	Mt	1 50	41,3	9	7
Manganese ore	Mt	4 000	5 589	1	2
Platinum-group metals	Kg	70 000	304 031	1	1
Titanium	Mt	244	1 181	2	2
Vanadium	Kt	12 000	23,5	1	1
Zirconium	Kt	14 000	405	2	2

Source: SA Yearbook 2009/10

The mining output of the country between 2005 and 2010 is illustrated in Figure 5-1. In 2005, the demand for minerals was slightly less than 12 billion tons which grew by approximately 20% in a five year period to 25 billion tons in 2009. The demand for minerals dropped slightly between 2008 and 2009 by about 76 million tons; this can be accredited to the economic meltdown experienced in that period which lead to decreased demand for most goods and services globally.

Figure 5-1: Mining output (tons)



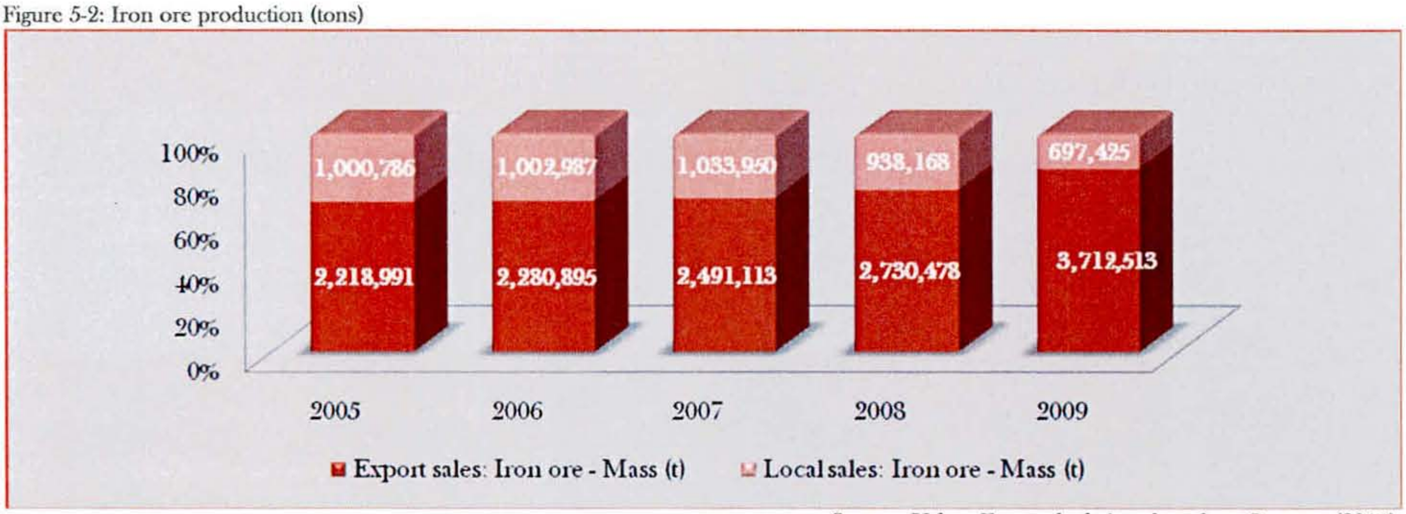
Source: Urban-Econ calculations based on Quantec (2011)

On a provincial level, large mining operations contribute to slightly over 20% of the economy which classifies mining as the main contributor to the GDP-R aside from community and general government services. According to SA reporter (2010), the country's largest PGM reserves in the country are based within the province alongside other precious metals such as vanadium, chrome, and titanium.

As iron ore is the main constituent of steel, it is valuable to possess background knowledge on the domestic and global steel industry. Iron ore is the world's most commonly used metal whereby steel represents approximately 95% of total iron ore used annually. Although South Africa has fairly large reserves of iron ore, the production levels of steel in the country are relatively low; the country is ranked 21st largest steel producer in the world. To date, China, the European Union and Japan are the world's top steel producers jointly producing a third of the total crude steel production. On a continental level, the country produces approximately half of the total crude steel thus making it the largest steel producer in Africa (World Steel Association 2008).

Figure 5-2 shows the export and local sales of iron ore in tons between 2005 and 2009. The demand for iron ore has been increasing over the past decade by approximately 8.8% per annum. The local sales of iron ore represent approximately third of national iron ore production and the remaining two-thirds are exported to across the continent and globe. The high levels of exports reflect the contributor nature of the mineral resource base to national exports and income thus revealing the importance of the sector and its viability. In monetary terms, the total value of the iron ore production in the country was R627 million in 2005 and grew to R3.5 billion in 2009. Of the national sales of primary minerals, Limpopo is the country's third largest contributor and approximately 9% of national income from minerals is from the Province.

Figure 5-2: Iron ore production (tons)

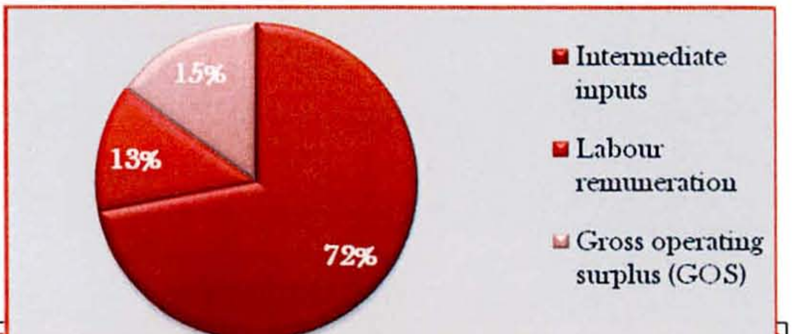


Source: Urban-Econ calculations based on Quantec (2011)

3.2. ESTIMATED CAPITAL EXPENDITURE

The capital expenditure for the contractor and beneficiation plant is estimated at R165 million in 2010 prices. The allocation of the suggested expenditure is illustrated in the diagram below.

Figure 5-3: Capital expenditure split



From Figure 5-3 it is evident that the largest share of the expenditure will go to intermediate outputs; approximately 72% of total capital expenditure will be spent on intermediate inputs. Of the intermediate inputs the greatest amount will be invested in the crushing plant followed by the necessary mechanical equipment. The gross operating surplus (GOS) accounts for approximately 15% of the expenditure followed by labour remuneration which represents the smallest share of approximately 13%.

3.3. ESTIMATED JOB CREATION DURING CONSTRUCTION PHASE

It is estimated that 130 employment opportunities will be created during the construction phase of the mine. The employees will vary between people who are classified as unskilled, semi-skilled, or skilled and highly skilled. The mandatory level of labour necessary to complete the construction phase is presented in Table 5-2.

Table 5-2: Workforce distribution-construction phase

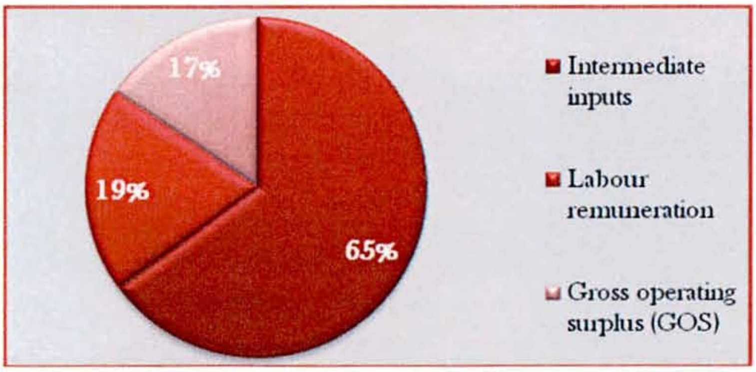
Workforce distribution	Distribution	Number
Skilled	38.4%	50
Semi-skilled	52.8%	69
Unskilled	8.8%	11
Total	100.0%	130

Source: Veremo, 2010

It appears that the slightly over half the workforce will comprise of people who are semi-skilled. In Table 5-2 it can be seen that semi-skilled persons will represent approximately 53% of the workforce followed by persons who are either skilled or highly skilled (39%). Unskilled personnel are the least sought after and will only account for 9% of the labour force.

3.4. ESTIMATED OPERATIONAL EXPENDITURE (OPEX)

Figure 5-4: Operational expenditure split



Source: Veremo, 2010

The operational expenditure of the mine is estimated slightly below R219 million per annum and is inclusive of operation and maintenance costs. Similar to the capital expenditure, the OPEX will be divided between intermediate inputs, labour remuneration and gross operating surplus (GOS). The division between the aforementioned agents is illustrated in Figure 5-4.

Intermediate inputs represent 65% of the annual OPEX which is relatively less than in the CAPEX instance. Approximately a fifth of the OPEX will be paid out in the form of labour remuneration which is a higher percentage share than that of the CAPEX. The gross operating surplus (GOS) is anticipated to account for 16% of annual expenditure.

3.5. ESTIMATED JOB CREATION DURING OPERATION PHASE

During the operation phase of the mine, an estimated 270 jobs will be created. Of the employment opportunities created over a third, 99, will be occupied by skilled persons and slightly over half, 144, will be occupied by semi-skilled persons. Similar to the CAPEX labour force, unskilled personnel form a relatively small part of the workforce; approximately 10% of the workforce will be unskilled persons.

Table 5-3: Workforce distribution-operational phase

Work force	Distribution	Number
Skilled	36.5%	99
Semi-skilled	53.4%	144
Unskilled	10.1%	27
Total	**100.0%**	**270**

Source: Veremo, 2010

The estimated wages on a yearly basis amount to R22.5 million of which R8.2 million will be paid out to the skilled employees. The semi-skilled wage bill is estimated at R12 million whilst the unskilled personnel wages amount to approximately R2.3 million per annum.

3.6. SYNTHESIS

The construction phase of the iron mine in Stoffberg will require an investment of R165 million in 2010 prices. During the construction period of the mine, approximately 130 people will be employed of which half will be skilled, over a third skilled/ highly skilled and nearly a tenth unskilled.

The operational phase will employ 270 people of which 53% will be semi-skilled, 37% skilled/ highly skilled and 10% unskilled. The cost per annum is estimated at R219 million to operate and maintain the mine.

SECTION 6. IMPLICATIONS AND EVALUATION OF ECONOMIC IMPACTS

The purpose of this section in the report is to estimate and quantify the potential effects, positive or negative, on the economy and society of the iron mine development in the Stoffberg area. The potential impact is measured using the potential change in production output, Gross Value Added, and employment during the construction and operational phases of the project.

4.1 BACKGROUND TO IMPACT ASSESSMENTS

A economic impact assessment deals with the evaluation of potential impacts of a proposed project on the economic environment. Economic impacts refer to the effects of an external intervention in the economy of a pre-specified area on the level of economic activity. The intervention may be in the form of new investment in infrastructure, new development, or adoption of a new policy or services.

When assessing the economic impact of a project, not only the direct effects of the project are considered; the broader influences on the local and regional economy are also taken into consideration. These economic impacts are defined as effects on additional jobs, generation of business sales, and increase in disposable income which happen as a result of the development. In order to quantify the most likely economic impact of a new development or expansion of an existing project, three types of economic impacts can be identified and measured. These types of economic impacts are, namely:

- Direct economic effects are generated when new developments create new jobs and purchase goods and services to operate the new facility. The result of such effects are an increase in job creation, production, business sales, as well as household income.
- Indirect economic effects occur when the suppliers of goods and services to the new business experience larger markets and potential to expand. The result of such effects are an increase in job creation, GGP and household income.
- Induced economic effects represent further shifts in spending on goods such as food, clothing, and shelter amongst other consumer goods and services as a consequence of the increase in workers and change in payroll of directly and indirectly affected businesses. The result of such effects is further business growth/decline throughout the local economy.

Economic impacts can also be viewed in terms of their duration, or the stage of the project's lifecycle that is being analysed. Generally two phases are subjected to the economic impact assessment - construction phase and operational phase. The construction phase economic impacts are of a temporary nature, they have, therefore, a temporary effect. On the other hand, the operational phase of the project usually takes place over a long-term; hence, the impacts during this stage are of a sustainable nature.

The economic impacts during the construction and operational phases can be viewed in terms of a change in the following indicators: job creation, GGP, personal income, business output (or sales volume), and impact on the balance of payments. Any of the aforementioned indicators suggest an improvement in the standard of well-being of residents, which is the overall intent of any investment project. The net economic impact is usually viewed as the expansion or contraction of an area's economy, resulting from the induced changes.

In order to quantify the economic impact of a project of such magnitude the Social Accounting Matrix (SAM) has been used. A SAM is a comprehensive, economy-wide database that contains information about the flow of resources that takes place between the different economic agents existing within the economy (Conningarth, 2007). The database has been specified to generate outcome based on the economy of the Limpopo Province and reflects 2010 prices.

In order to project the socio-economic impact of the proposed iron ore open pit mine, the following assumption has been made: The financial inputs, both CAPEX and OPEX, and the anticipated employment figures provided by Veremo are as precise as possible at this point in time. The modelling process also assumes a state of ceteris paribus in the economy. A few additional assumptions that were made with regard to the model are as follows:

- The impact assessment assumes that the proposed development concept is financially viable
- Production activities in the economy are grouped in homogenous sectors
- The mutual interdependence of sectors is expressed in meaningful input factors
- Each sector's inputs are a function of the specific sector's production, comparative advantage and location
- The production by different sectors is equal to the sum of the production of separate sector's
- The technical coefficients of the SAM model remain constant for the period over which forecast projection is made

Although the SAM is widely considered a reputable measurement of economic impact, it too reflects limitations, such as:

- Assumptions, which in themselves are a limitation to any model yet are crucial in the estimation process
- Unpredictable events that may occur in future are not accounted for
- Data availability and quality thereof

The degree of the impact on the economy is measured using predefined criteria in accordance with accepted international best practice guidelines. The assessment criteria components are namely;

- Extent or spatial influence of impact: Large, Medium or Small
- Magnitude of impact: High, Medium, Low, Very low, or Zero
- Duration of impact: short term, medium term, or long term
- Intensity of impact: Low, Medium, or High
- Probability of impact: Improbable, Probable, or Definite
- Significance of impact : High, Medium, or Low

The significance of the impact is a function of the extent, magnitude and the duration of the impact as follows:

Significance of impact = Extent + Magnitude + Duration

4.2 QUANTITATIVE CONSTRUCTION PHASE IMPACTS

The construction and preparation of the site is expected to last for a relatively short period of time (less than three years) after which the operational phase can commence. Note that the capital expenditure indicated in this section refers to the expenditure required in order to establish the contractor and beneficiation plant thus excludes continual construction on site during operational phase and the continual rehabilitation phase.

4.1.1 Construction Phase Production Impact

An estimated R165 million is required to construct and sufficiently equip the mine. The construction phase of the iron ore mine is expected to have a positive impact on economic development in all the study areas, more especially in the local economy. The impact will vary between the primary, secondary and tertiary areas and will be observed via direct, indirect and induced impacts.

Table 6-1: Construction phase impact on production (R'mil)

Sector	Impact on Production				
	Direct	Indirect	Induced	Total	Percentage
Agriculture	R -	R 6.44	R 2.27	R 8.71	2.9%
Mining	R -	R 10.61	R 0.70	R 11.31	3.8%
Manufacturing	R -	R 12.21	R 4.62	R 16.83	5.7%
Utilities	R -	R 20.82	R 1.21	R 22.03	7.4%
Construction	R 165.01	R 29.87	R 0.55	R 195.44	65.7%
Trade	R -	R 5.25	R 3.76	R 9.01	3.0%
Transport	R -	R 4.38	R 3.09	R 7.47	2.5%
Finance and business services	R -	R 16.32	R 6.70	R 23.02	7.7%
Government	R -	R 1.45	R 1.14	R 2.59	0.9%
Other	R -	R 0.40	R 0.88	R 1.29	0.4%
Total	R 165.01	R 107.76	R 24.92	R 297.70	100.0%

Source: Urban-Econ calculations based on SAM for Limpopo Province, 2010

The capital expenditure will generate R297.7 million in value-added terms. The dispersion of the generated returns is discussed in depth below.

- The ***direct impact*** of the project will generate approximately R165 million into the local economy. The value-added of local production will experience an increase of about 4.3% as a result of the direct impact of mining within the area. Approximately 55% of the total value-added comes in the form of direct impacts in which construction industries will benefit absolutely.
- About 36% of value added, R107.8 million, is expected to arise as a result of the ***indirect impact*** of the mining activity. This value comes as a result of the increased demand for services, construction materials, and other project related necessities. The greatest demand will be created in the construction, finance and business services as well as the utilities industries.

- The expected ***induced impact*** on production is valued at R25 million which represents 8% of the total value-added by the capital expenditure. The induced impact will come as a result of higher disposable income available to people and households in the study area due to increased levels of employment. Higher disposable income will subsequently lead to increased demand for goods and services. The tertiary sector will absorb approximately two-thirds of the induced value-added of which the business service industry, followed by the trade and insurance industries will benefit the greatest. Amongst the secondary sector, the food industry, specifically meat, fish, fruit, vegetables, oils and fat industries, will reflect high demand thus high production of such goods is in order.

In total, the construction industry will generate the highest value-added (65.7%) followed by the business services (7.7%) and the utilities sector (7.4%). These three sectors jointly account for 80% of total value added whilst agriculture, manufacturing, mining, trade and transport industries collectively generate just under a fifth of the total value-added (18%).

4.1.2 Construction Phase GGP Impact

The impact of the construction phase on the GDP-R is tabulated and discussed below.

Table 6-2: Construction phase impact on the GDP-R (R'mil)

Sector	Impact on GDP-R				
	Direct	Indirect	Induced	Total	Percentage
Agriculture	R -	R 3.00	R 1.06	R 4.06	3.7%
Mining	R -	R 4.95	R 0.33	R 5.28	4.8%
Manufacturing	R -	R 5.69	R 2.15	R 7.85	7.2%
Utilities	R -	R 9.71	R 0.56	R 10.27	9.4%
Construction	R 47.28	R 13.93	R 0.26	R 61.47	56.3%
Trade	R -	R 2.45	R 1.75	R 4.20	3.8%
Transport	R -	R 2.04	R 1.44	R 3.48	3.2%
Finance and business services	R -	R 7.61	R 3.12	R 10.73	9.8%
Government	R -	R 0.68	R 0.53	R 1.21	1.1%
Other	R -	R 0.19	R 0.41	R 0.60	0.5%
Total	**R 47.28**	**R 50.25**	**R 11.62**	**R 109.16**	**100.0%**

Source: Urban-Econ calculations based on SAM for Limpopo Province, 2010

From Table 6-2 it is clear that a positive impact is exerted on all three levels and distributed in a similar manner to that observed on the production. The total GDP-R is valued at approximately R109 million in 2010 prices. Of the overall GDP-R, indirect impacts are the highest in value followed by direct then induced impacts. A brief analysis of each impact is provided below.

- About 43% of the total GDP-R impact value which is estimated at R47.3 million arises as a result of direct impact. The impact will mainly be realised in the construction industry.
- The indirect impact is valued at R50.3 million during the construction phase and represents the greatest effect on the GDP-R. The location in which the mine is situated is not surrounded by high economic activity as the area mainly comprises of farms. The lack of sufficient facilities and services nearby compels businesses and/or people based in the area to travel further out to places with such facilities in order to meet their needs. As a result, a considerable share of expenditure is spent outside the local economy hence the value of the indirect impact is higher than that of the direct impact. The construction, utilities, and business services industries are the main industries benefitting from the indirect impacts of the project.

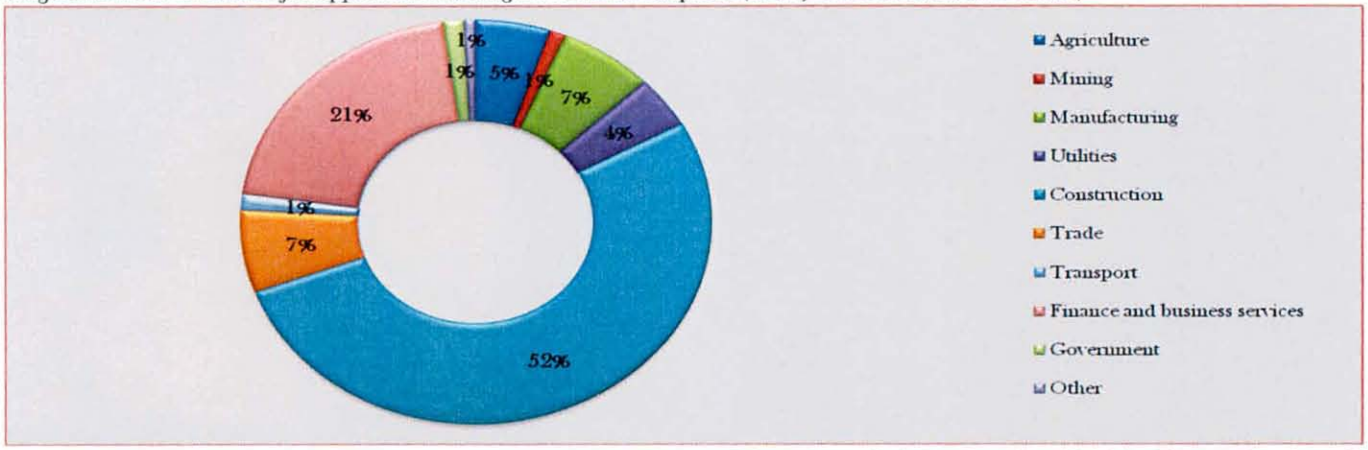
- The induced effects of the increased household income is valued at R11.6 million. The sectors benefitting most from the increase in expenditure are business services, insurance and trade industries, which all form part of the tertiary sector.

4.1.3 Construction Phase Employment Impact

The construction phase of the iron ore mine will create 619 employment opportunities overall. Of the total opportunities created, 130 will be directly employed by Veremo, therefore the remaining 489 job opportunities will come in the form of indirect labour (385) and induced (104) labour.

From the total labour and level of skills required, it is assumed that the unskilled and semi-skilled labour (or the majority thereof) of approximately 80 persons will come from within the local area. The skilled persons who form part of the required labour force represent 38% of the total staff and will most likely be sourced from outside the boundaries of the primary area contributing minimally to the local economic development with regard to employment. The construction phase is of a temporary nature therefore resulting in the loss of jobs upon completion however a considerable positive difference will be realised by households in the local area who are employed during this assembly period.

Diagram 6-1: Distribution of job opportunities during the construction phase (direct, indirect and induced labour)



Source: Urban-Econ calculations based on SAM for Limpopo Province, 2010

Diagram 6-1 shows that just above half the employment opportunities to be created fall within the construction sector; 130 jobs of a direct nature will be created in the construction industry whilst 191 and 104 job opportunities will come as a indirect and induced result of the proposed mining activity. The finance and business services industry will account for a fifth of all jobs created of which 77 will come from indirect labour demands and 18 from induced labour demands. The trade and manufacturing sectors (7%) followed by the agriculture (5%) and utilities (4%) sectors will also realise a need for job creation as a result of the activity from the Veremo mine.

4.1.4 Assessment of the construction phase

The impact of the construction phase as a whole is summarised in Table 6-3.

Table 6-3: Overall impact of the construction phase

Impact	Production	GDP-R	Employment
Extent	Large	Large	Large

+ Magnitude	Low	Low	Low
+ Duration	Short	Short	Short
Significance	Low	Low	Low
Intensity	Low	Low	Medium
Probability	Definite	Definite	Probable
Confidence	Sure	Sure	Sure

Source: Urban-Econ impact assessment model, 2010

From Table 6-3 it is clear that the significance and intensity of the impact on production and the GDP-R under the construction phase is ranked as low accompanied by a high degree of certainty and probability that the economy will be affected as estimated. The employment situation reflects a similar effect with regard to significance and confidence, however the intensity of the impact is higher than for production and GDP-R.

4.3 Operational Phase Impacts

The operational phase of the new iron ore mine will commence after the initial construction period and is expected to last for 30 years. This phase brings about more sustainability in the impacts unlike those observed during the construction phase and are therefore more significant in the assessment of the project.

4.2.1 Operational Phase Production Impact

The operational phase is expected to continue for a period of up to 30 years in which the estimated value added per annum is R365.7 million. The value-added is tabulated below and can be distributed between direct, indirect and induced impacts which are further discussed below.

Table 6-4: Operational phase impact on production per annum (R'mil)

Sector	Impact on Production				
	Direct	Indirect	Induced	Total	Percentage
Agriculture	R -	R 1.54	R 2.66	R 4.19	1.1%
Mining	R 218.72	R 11.86	R 1.70	R 232.28	63.5%
Manufacturing	R -	R 9.99	R 6.75	R 16.74	4.6%
Utilities	R -	R 9.11	R 1.80	R 10.91	3.0%
Construction	R -	R 1.62	R 0.82	R 2.44	0.7%
Trade	R -	R 11.55	R 5.57	R 17.11	4.7%
Transport	R -	R 22.17	R 4.54	R 26.71	7.3%
Finance and business services	R -	R 16.54	R 10.10	R 26.65	7.3%
Government	R -	R 24.96	R 1.69	R 26.65	7.3%
Other	R -	R 0.69	R 1.33	R 2.02	0.6%
Total	**R 218.72**	**R 110.02**	**R 36.96**	**R 365.69**	**100.0%**

Source: Urban-Econ calculations based on SAM for Limpopo Province, 2010

The direct impact accounts for 60% of total value-added, followed by indirect impacts which represent just under a third and induced impacts which represent a tenth of total value-added.

- The ***direct impact*** of the operational expenditure converts to R218.7 million per annum value-added. The direct impact is of a local nature thus it will directly contribute to the local mining sector which is currently ailing. The impact on the local economy is equivalent to an additional 6% on value-added per annum.

- The indirect effects of the mining operation will be realised in the district municipality of which several people exercise buying power as well as regionally, namely Limpopo and a few surrounding provinces such as Gauteng and Mpumalanga. The value-added from ***indirect impacts*** amounts to R110 million per annum. The main industries to benefit from the operational expenditure indirectly are the health and social work industry (R25 mil.) and transport service industry (R19.5 mil.) followed by the business services industries (R9.2 mil.), trade (R8.9 mil.) and electricity (R7.3 mil.) industries. It evident that tertiary sector is the most dominant with regards to the indirect impacts implying that the local economy is in shortage of sufficient business related services to cater for day to day needs.

- The ***induced effects*** of the increased household income converts to R37 million value-added annually. The sectors largely benefitting from the increase in household income are the business services, trade, insurance, transport, health and social work, as well as the communication industries.

4.2.2 Operational Phase GDP-R Impact

The value of the operational expenditure in terms of the GDP-R is valued at R146 million per annum. Table 6-5 indicates the GDP-R per sector relative to the type of impact.

Table 6-5: Operational phase impact on GDP-R per annum (R'mil)

Sector	Impact on GGP				
	Direct	Indirect	Induced	Total	Percentage
Agriculture	R -	R 0.72	R 1.24	R 1.96	1.3%
Mining	R 77.53	R 5.53	R 0.79	R 83.85	57.4%
Manufacturing	R -	R 4.66	R 3.15	R 7.80	5.3%
Utilities	R -	R 4.25	R 0.84	R 5.09	3.5%
Construction	R -	R 0.75	R 0.38	R 1.14	0.8%
Trade	R -	R 5.38	R 2.60	R 7.98	5.5%
Transport	R -	R 10.34	R 2.12	R 12.45	8.5%
Finance and business services	R -	R 7.71	R 4.71	R 12.43	8.5%
Government	R -	R 11.64	R 0.79	R 12.43	8.5%
Other	R -	R 0.32	R 0.62	R 0.94	0.6%
Total	R 77.53	R 51.30	R 17.23	R 146.07	100.0%

Source: Urban-Econ calculations based on SAM for Limpopo Province, 2010

The value of the direct impact on the local GDP-R is estimated at R77.6 million per annum. Of the total GGP created as a result of the mining project, the direct impact represents half of the expenditure and indicates that the increased expenditure in the local economy is mainly spent within the primary study area. The coal and lignite industry is the main benefactor of the direct impact in the local economy.

The indirect effects of the mining activity will mainly be observed on a regional level however these spill-out effects are also realised in the national economy. The indirect impacts will contribute approximately R51 million to the GGP per annum. The sectors most likely to benefit from the proposed development are the health and social work, transport services, business services and transport industries. A similar industry distribution is observed for the induced impact on the GGP with the inclusion of insurance related industries amongst the main beneficiaries. The value of the induced impacts per annum is R17.2 million.

4.2.3 Operational Phase Employment Impact

The operational phase of the project will create about 757 work opportunities. Of the anticipated jobs to be created, 270 will come directly under Veremo whilst 333 will arise from the indirect need for additional labour and 154 from the induced impact on employment.

Diagram 6-2: Distribution of job opportunities during the construction phase (direct, indirect and induced labour)

Source: Urban-Econ calculations based on SAM for Limpopo Province, 2010

From Diagram 6-2 it can be seen that the most dominant sectors with regard to creating employment opportunities are the mining, finance and business services, general government, and trade sectors. Above a third of jobs created fall within the mining sector which is succeeded by the finance and business services industry which will provide a fifth of the estimated employment opportunities. The general government and sector and trade industries jointly represent another fifth of all employment created by the proposed project.

The tertiary sector, which comprises of trade, transport, finance and business services, general government services, and other services, will provide nearly half (47%) of the new employment opportunities on the market. The following industries within the tertiary sector will contribute a great deal to the creation of employment:

- Health and social work (approx. 85 jobs - indirectly, 6 - induced)
- Business services (approx. 51 jobs - indirectly, 26 - induced)
- Trade (approx. 41 jobs - indirectly, 19 - induced)
- Insurance (11 jobs - indirectly, 22 - induced)

Following the tertiary sector is the primary sector which will mainly create jobs in mining however the agricultural industry will also create a substantial number of jobs (approx. 56). The jobs in the mining sector are primarily a result of the direct impact of the project whereas the agriculture sector will require additional labour mainly due to induced effects in vegetable farming and other agriculture sectors.

Although the direct employment of Veremo is estimated at 270, it is highly likely that the contractors would utilise their highly skilled or skilled expertise which would not come from within the local area. This implies that the local labour force would be limited to the semi-skilled and unskilled personnel required for the project. Given these conditions it is assumed that the local population can be provided with up to 171 jobs.

4.2.4 Assessment of the operational phase

The impact of the operational phase on production, GGP and employment has been summarised and is indicated in Table 6-6.

Table 6-6: Overall impact of the operational phase

Impact	Production	GDP-R	Employment
Extent	Large	Large	Large
+ Magnitude	Medium	Medium	Medium
+ Duration	Medium	Medium	Medium
Significance	Medium	Medium	Medium
Intensity	Medium	Medium	Medium
Probability	Definite	Definite	Definite
Confidence	Sure	Sure	Sure

Source: Urban-Econ impact assessment model, 2010

The information presented in Table 6-6 implies that the operational phase has a fairly significant impact on the local economy and the suggested outcome is highly probable. The impact and probability is to a similar degree on production, GDP-R and employment.

4.4 MITIGATION MEASURES

This sub-section presents the mitigation measures that need to be put in place to ensure the impacts are as positive as possible. The socio-economic effects off the proposed open-cast mine in the Stoffberg area are primarily of a positive nature however a few mitigation measures should be taken into consideration to maximise the positive effects of the proposed mining activity.

4.4.1 Mitigation measures to stimulate the positive impact on the economy - Production and GDP-R

The mining site is located in Stoffberg, in the Elias Motsoaledi LM which does not have an extensively diversified economy. During the construction and operational phases of the open cast mine several goods and services (i.e. petrol, food, clothing, medical services etc.) will be required to satisfy the business needs and/or personal needs from the employees. In order to stimulate the local economy as much as possible, it is recommended that *great emphasis be put on economic development of the local economy* by ensuring that (where possible) the *goods and services are sourced from within the primary study area.* It is also suggested that the iron ore be beneficiated as far as possible on site in order to enhance the skills and knowledge base of the workforce, more especially the local population, as well as to increase the benefits reaped from the mining development.

The Table 6-7 indicates the change in the overall socio-economic impact of the mine on the projected levels of production and GDP-R for the construction and operational phases.

Table 6-7: Impact on production and GDP-R during the construction and operational phase with mitigation in place

Impact	Construction Phase		Operational Phase	
	Production	GDP-R	Production	GDP-R
Extent	Large	Large	Large	Large
+ Magnitude	Medium	Medium	Medium	Medium
+ Duration	Short	Short	Medium	Medium
Significance	Medium	Medium	Medium	Medium
Intensity	Medium	Medium	Medium	Medium
Probability	Definite	Definite	Definite	Definite
Confidence	Sure	Sure	Sure	Sure

Source: Urban-Econ impact assessment model, 2010

Table 6-7 shows that if local development is a key focus during the construction period, the overall significance of the impact on production and GDP-R, will heighten from relatively low levels to medium significance. During the operational phase, the level of significance remains constant even if the mitigation measures for socio-economic impacts are implemented.

4.4.2 Mitigation measures to stimulate the positive impact on the economy - Employment

In 2010, the unemployment rate in the Elias Motsoaledi LM was estimated at 22.6% and the labour force participation rate was 31%. From the participation rate it is clear that a large number of people are not discouraged and still seek employment opportunities in the area. To stimulate the economy with regard to employment the required labour, more especially *unskilled and semi-skilled persons, should be sourced from the local labour-force*. The *use of local contractors should be enforced (where viable)* similarly *local sub-contractors and suppliers* should be used as much as possible. Additionally, a *skills transferral programme should be put in place* in order to enhance the skills levels of the local population which subsequently improves the employment profile of the population. For the construction of the mining site and infrastructure (i.e. roads, buildings etc.) *labour-intensive methods should be employed* as an supplementary approach to increase the employment levels.

Table 6-8 shows that a change in the significance of the impact on employment (from low to medium) may occur during the construction phase if the mitigation measures are implemented. During the construction phase the impact is estimated to have a medium significance regardless of the implementation mitigation measures.

Table 6-8: Impact on employment during the construction and operational phase with mitigation in place

Impact	Construction Phase	Operational Phase
Extent	Large	Large
+ Magnitude	Medium	Medium
+ Duration	Short	Medium
Significance	Medium	Medium
Intensity	Medium	Medium
Probability	Probable	Definite
Confidence	Sure	Sure

Source: Urban-Econ impact assessment model, 2010

The development of the open pit mine will increase the number of households with income or increase the level of disposable income for households which already have some form of income on a regular basis; about 1 376 households nationwide of which 250 are in the primary study area. The increase in disposable income will bring about a increase in the standard of living for these households which is vital for the poverty alleviation process.

4.5 SYNTHESIS

The construction of the open pit iron mine and the operational period will have a positive socio-economic impact on the local and regional economies.

The capital expenditure of R165 million (in 2010 prices) is projected to generate R132.7 million in value-added terms and R61.9 million in GDP-R. The growth in value-added during the construction phase is equivalent to a 4.3% increase of the local production which is presently valued at R3 874 million. Indirect and induced effects of the mining activity will also create several employment opportunities in and around the local area as well as on a regional level. About 489 jobs will be created aside from the 130 work opportunities that Veremo will provide in order to run the mine as planned. Approximately 60% of the required labour-force is semi-skilled or unskilled persons of which the majority should be sourced locally.

The operational expenditure per annum is estimated at R218.7 million (in 2010 prices) and will indirectly add R147 million in value-added terms to the economy (inclusive of induced effects). The GDP-R is expected to increase by R77.5 million locally and by R68.5 million locally and regionally per annum during the 30 year operational period. In total, 757 employment opportunities will be created of which 270 are direct effects of the mine, i.e. Veremo will hire 270 people to operate the mine. Similar to the construction phase, approximately two-thirds of the staff will be semi-skilled or unskilled of which the majority would idealistically come from the local work force. The jobs created during this phase are sustainable given the projected life span of the mine thus the standard of living for several households will be improved.

Regional and national economies will experience an increase in the demand for products and input materials, mainly in the construction sector. The tertiary sector is expected to expand considerably, whereby business and finance services, insurance, general government and community services, health and social work, transport, communication, and trade will be the main benefactors within the sector. Vegetable farming, manufacturing and mining activities are amongst the more beneficial industries that fall under the primary and secondary sectors. The increased demand for such goods and services comes as a result of the increased buying power brought to households due to higher levels of employment in the area.

SECTION 7. CONCLUSION

The purpose of this report is to outline the socio-economic impacts that will be observed during the construction and operation phases of the new development in Stoffberg. The impact has been assessed with respect to production, GDP-R and employment in the study areas and it follows that the affected economies and persons will benefit from the project.

The capital expenditure of R165 million (in 2010 prices) is anticipated to generate R132.7 million in value-added terms and R61.9 million in GDP-R. The growth in value-added during the construction phase is equivalent to a 4.3% increase of the local production which is presently valued at R3 874 million. Indirect and induced effects of the mining activity will also create several employment opportunities in and around the local area as well as on a regional level. About 489 jobs will be created aside from the 130 work opportunities that Veremo will provide in order to run the mine as planned. Approximately 60% of the required labour-force is semi-skilled or unskilled persons of which the majority should be sourced locally.

The operational expenditure per annum is estimated at R218.7 million (in 2010 prices) and will indirectly add R147 million in value-added terms to the economy (inclusive of induced effects). The GDP-R is expected to increase by R77.5 million locally and by R68.5 million locally and regionally per annum during the 30 year operational period. In total, 757 employment opportunities will be created of which 270 are direct effects of the mine, i.e. Veremo will hire 270 people to operate the mine. Similar to the construction phase, approximately two-thirds of the staff will be semi-skilled or unskilled of which the majority would idealistically come from the local work force. The jobs created during this phase are sustainable given the projected life span of the mine thus the standard of living for several households will be improved.

In order to ensure maximisation and longevity of the positive impacts, it is essential to implement the suggested mitigation measures (where viable). The mitigation measures are as follows:

<u>Production and GDP-R</u>

- great emphasis be put on economic development of the local economy
- goods and services should be sourced from within the primary study area
- the iron ore be beneficiated as far as possible on site

<u>Employment</u>

Employment:

- the required labour, more especially unskilled and semi-skilled persons, should be sourced from the local labour-force.
- use of local contractors should be enforced (where viable), similarly local sub-contractors and suppliers should be used as much as possible.
- labour-intensive methods should be employed as much as possible throughout the construction and operational phases

APPENDIX 9:

VISUAL IMPACTS SPECIALIST REPORT

Visual Impact Report

Proposed Veremo Iron Ore Mine

Mitha Theron PrLArch
Newtown Landscape Architects

PROPOSED VEREMO IRON ORE MINE, LIMPOPO PROVINCE

Specialist Study Report
VISUAL IMPACT ASSESSMENT

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Report Revision No:	DRAFT
Date Issued:	28 March 2011
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Reviewed By:	Yonanda Martin
Reference:	Veremo Iron Ore Mine

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GLOSSARY OF TERMS

Aesthetic Value

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay, 1993). Thus aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper, 1993). Aesthetic value is always discussed within the context of the region.

Aesthetically significant place

A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands of people visit Table Mountain on an annual basis. They come from around the country and even from around the world. By these measurements, one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the region probably has regional significance. A place visited primarily by people whose place of origin is local is generally of local significance. Unvisited places either have no significance or are "no trespass" places. (after New York, Department of Environment 2000).

Aesthetic impact

Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a project proposal, should not be a threshold for decision making. Instead a project, by virtue of its visibility, must clearly interfere with or reduce (i.e. visual impact) the public's enjoyment and/or appreciation of the appearance of a valued resource e.g. cooling tower blocks a view from a National Park overlook (after New York, Department of Environment 2000).

Cumulative Effects

The summation of effects that result from changes caused by a development in conjunction with the other past, present or reasonably foreseeable actions.

Landscape Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings and roads. They are generally quantifiable and can be easily described.

Landscape Impact

Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The Landscape Institute, 1996).

Sense of Place *(genius loci)*

Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. *Genius loci* literally means 'spirit of the place'.

Sensitive Receptors

Sensitivity of visual receptors (viewers) to a proposed development.

Viewshed analysis

The two dimensional spatial pattern created by an analysis that defines areas, which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1,8m above ground level.

Visibility

The area from which project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance.

Visual Exposure

Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weather and light conditions.

Visual Impact

Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity.

Visual Intrusion

The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.

Worst-case Scenario

Principle applied where the environmental effects may vary, for example, seasonally to ensure the most severe potential effect is assessed.

Zone of Potential Visual Influence

By determining the zone of potential visual influence it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

***

1 INTRODUCTION

1.1 Project Overview

Veremo Minerals (Pty) Ltd applied for mining rights for the mining of Iron Ore, Heavy Minerals (particularly Titanium) and Vanadium Ore. MSA Geoservices (Pty) Ltd was appointed by Veremo Minerals as the Environmental Consultant for this project. As part of the Environmental Impact Assessment process, the visual impact of the proposed Iron Ore Mine needs to be addressed. Newtown Landscape Architects (NLA) had been appointed by MSA to undertake a specialist study on the impact of the proposed project on the visual environment.

1.2 Project Location

The study area is located in the southern section of the Steelpoort River Valley in the Limpopo Province. The project is located on a series of farms (Remaining Portion of Portion 2 of the Farm Paardekloof 176-JS, Remaining Extent of the Farm The Wedge 175-JS and Portion 1, 2, 3, 4 and 5 of the farm Duikerskrans 173-JS) approximately 12km west of the town of Roossenekal and approximately 16km north of the town of Stofberg. Refer to Figure 1 'Locality'.

1.3 Project Description

The project will consist of a series of three open pits to extract the iron ore from the five ore bodies over a period of 30 years. Waste from the process would be non hazardous and could be used for rehabilitation purposes. Ore will be crushed and processed on site and the final product will be processed off site. A channel system will be implemented to take the water around the mine to the river. Should the project prove to be feasible a smelter plant may be constructed in a future phase. This will be dealt with in a separate EIA process in future. The total area of the proposed site is approximately $9km^2$ of which the footprint would consume $2km^2$.

1.4 Aim of the Study

The aim of the Visual Impact Report (VIA) is to determine the aesthetic value of the visual resource (receiving environment) and to rate the visual impact associated with the proposed intervention on the receiving environment from a visual impact point of view.

1.5 Terms and Reference / Scope of Work

A specialist study is required to assess the visual impacts arising from the proposed Veremo Iron Ore Mine project. Based on the general requirements for a comprehensive Visual Impact Assessment (VIA), the following scope of work had been established:

- Conduct a field survey to study the area to the extent that a professional opinion can be given of the potential impact on the visual environment and the sense of place of the proposed solar park project;
- Describe the visual resource (i.e. receiving environment);
- Describe and map the landscape character of the study area. The description of the landscape will focus on the nature and character of the landscape rather than the response of a viewer;
- Describe the quality of the landscape. Aesthetic appeal is described using recognized contemporary research in perceptual psychology as the basis;
- Describe the sense of place of the study area as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations associated with the historic / current use of the land;
- Illustrate the proposed intrusion of the project by overlaying the project onto panoramas of the landscape, as seen from nearby sensitive viewing points to give the reviewer an idea of the scale and location of the proposed project within its landscape context;
- Rate the impact on the visual environment and sense of place of the proposed Veremo Iron Ore Mine project based on accepted international criteria the method described below and in Appendix C; and
- Recommend mitigation measures.

Refer to Item 2 'Approach & Methodology' for a detailed description of the above mentioned process.

1.6 Assumptions / Limitations

There is to date not adequate data on the process plant and data on similar projects were used to construct the simulations and viewshed. For the purpose of this report the worst case scenario was assumed and a height of 20m was used for the plant and a height of 19m for the waste dumps.

2 APPROACH & METHODOLOGY

2.1 Approach

The assessment of likely effects on a landscape resource and on visual amenity is complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002)). When assessing visual impact the worst-case scenario is considered. Landscape and visual assessments are separate, although linked, procedures.

The landscape, its analysis and the assessment of impacts on the landscape all contribute to the baseline for visual impact assessment studies. The assessment of the potential impact on the landscape is carried out as an impact on an environmental resource, i.e. the physical landscape. Visual impacts, on the other hand, are assessed as one of the interrelated effects on people (i.e. the viewers and the impact of an introduced object into a particular view or scene). The focus of this report is on the latter.

2.1.1 The Visual Resource

Landscape character, landscape quality (Warnock, S. & Brown, N. 1998) and "sense of place" (Lynch, K. 1992) are used to evaluate the visual resource, i.e. the receiving environment. A qualitative evaluation of the landscape is essentially a subjective matter. In this study the aesthetic evaluation of the study area is determined by the professional opinion of the author based on site observations and the results of contemporary research in perceptual psychology. The criteria given in Appendix B are used to assess landscape quality, sense of place and ultimately to determine the aesthetic value of the study area.

2.1.2 Landscape Impact

The landscape impact of a proposed intervention is measured as the change to the fabric, character and quality of the landscape caused by the physical presence of the new development. Identifying and describing the nature and intensity of change in the landscape brought about by the proposed new development is based on the professional opinion of the author supported by photographic simulations. It is imperative to depict the change to the landscape in as realistic a manner as possible (Van Dortmont in Lange 1994). To do this, photographic panoramas were taken from key viewpoints and altered using computer simulation techniques to illustrate the physical nature of the proposed intervention in its final form within the context of the landscape setting. The resultant change to the landscape can then be observed and an assessment of visual intrusion made i.e. impact on views.

2.1.3 Visual Impact

Visual impacts are a subset of landscape impacts. Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effect with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (i.e. views) caused by the intervention and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the scene as perceived by people visiting, working or living in the area. This approach reflects the layman's concerns, which normally are:

- Will I be able to see the new development?
- What will it look like?
- Will the development affect views in the area and if so how?

Landscape and visual impacts do not necessarily coincide. Landscape impacts can occur in the absence of visual impacts, for instance where a development is wholly screened from available public views, but nonetheless results in a loss of landscape elements and landscape character within a localized area (the site and its immediate surrounds).

2.1.4 *Intensity* of Visual Impact

The *intensity* of visual impact is determined using visual intrusion, visibility and visual exposure criteria qualified by the sensitivity of viewers (visual receptors) towards the proposed development. The *intensity* of visual impact is therefore concerned with:

- The overall impact on the visual amenity, which can range from degradation through to enhancement;
- The direct impacts of the development upon views of the landscape through intrusion or obstruction;
- The reactions of viewers who may be affected.

For a detailed description of the methodology used in this study, refer to Appendices B and C. The diagram, Visual Impact Process, below graphically illustrates the assessment process.

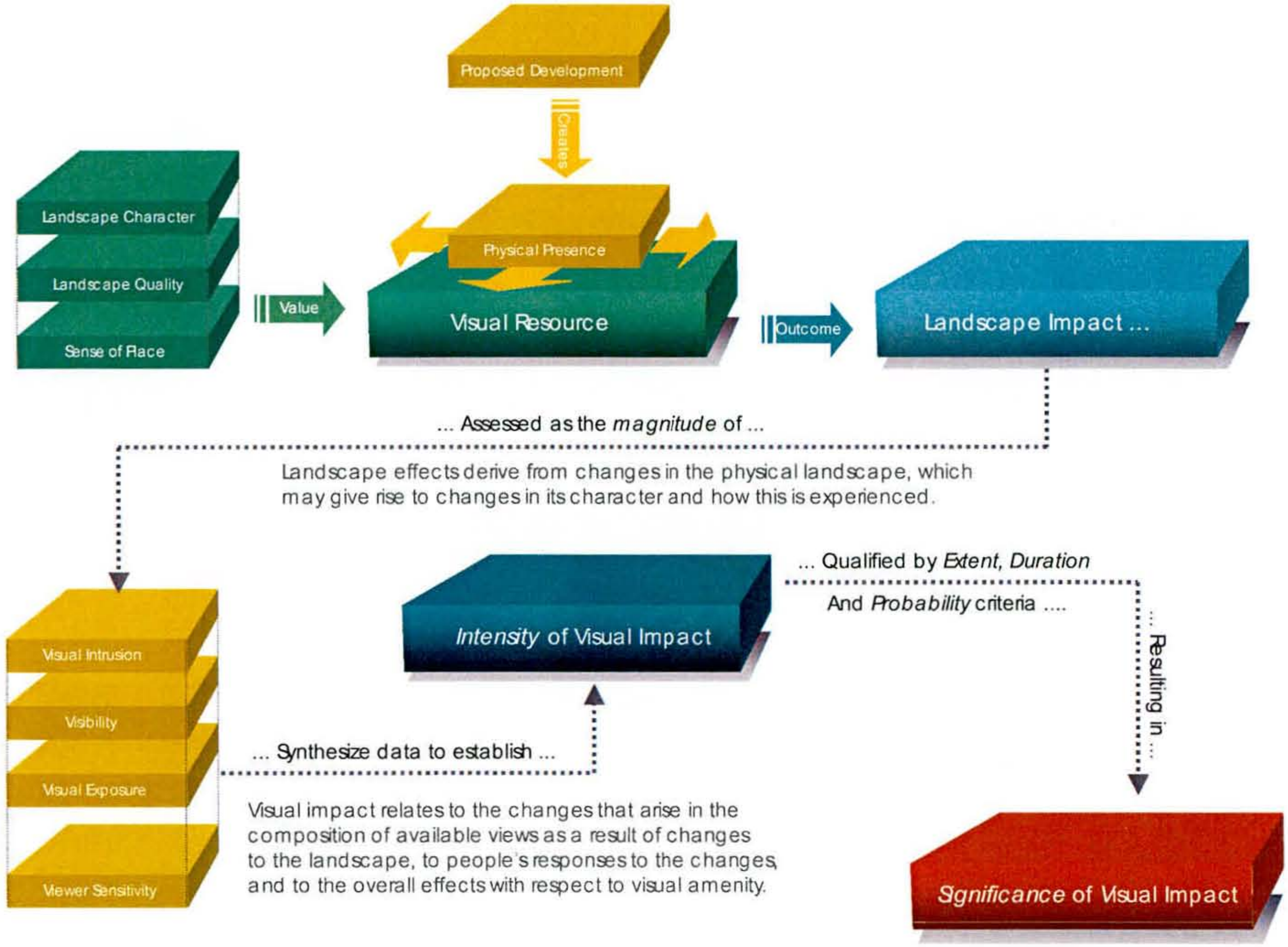

Diagram 1: Visual Impact Process

2.1.5 Significance of Visual Impact

The significance of impact was determined using a ranking scale, based on terminology from the Department of Environmental Affairs and Tourism's (DEAT) guideline document on EIA Regulations, April 1998 and the methodology referred to Appendix D.

2.2 Methodology

To evaluate the impacts of the proposed Iron Ore Mine, the inherent scenic value of the landscape (visual resource) first needs to be determined. Data collected during the site visit allowed for a comprehensive description and valuation of the receiving environment. The following method was used for the project:

- Site visit – a field survey was undertaken on 21 March 2011 and the study area scrutinized to the extent that the receiving environment could be documented and adequately described;
- Project components - the physical characteristics of the project components were described;

- General landscape characterization – Visual Resource (i.e. receiving environment) - was mapped using field survey data and observations of aerial photographs and other available data.
- Describe the quality of the landscape. Aesthetic appeal is described using recognized contemporary research in perceptual psychology as the basis;
- Describe the sense of place of the study area as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations associated with the historic / current use of the land;
- Illustrate, with basic simulations, the proposed project overlaid onto panoramas of the landscape, as seen from nearby sensitive viewing points to give the reviewer an idea of the scale and location of the proposed project within their landscape context;
- Determine visual intrusion (contrast) of the proposed project using the simulations;
- Determine the visibility of the proposed project by conducting a detailed viewshed analyses;
- Rate the impact on the visual environment of the proposed Solar Park project based on accepted international criteria the methods described in Appendices B and C; and
- Suggest management measures that could mitigate the negative impacts of the proposed Iron Ore Mine project.

3 VISUAL RESOURCE DESCRIPTION

3.1 Landscape Character

Landscape character types are landscape units refined from the regional physiographic and cultural data derived from 1:50 000 maps, aerial photographs and information gathered on the site visit. Dominant landform / and use features (e.g., hills, rolling plains, valleys and urban areas) of similar physiographic and visual characteristics, typically define landscape character types. Refer to the views 1 to 14 on Figure 4 to 10 (location of viewpoints indicated on Figure 3).

The proposed mining site lies at the foot (i.e. east) of the escarpment between the Highveld and the middleveld. The proposed site includes numerous well-defined drainage courses down the face of the escarpment; these in turn have created spurs that reach down towards the Steelpoort River. The general terrain just to the east of the site is flat to undulating up to the Steenkampsberg Mountains that from the eastern boundary of the Steelpoort River valley some 15km to the east of the proposed mining site. The footprint area is situated mainly in Sekhukhune Montane Grassland. Vegetation types on site include several grassland, Acacia and Aloe communities. Aquatic ecosystems present in the study area comprise: the perennial Steelpoort River, the seasonal Uitkyk Stream, several ephemeral streams, alluvial wetlands and farm dams. The present Ecological state of the aquatic ecosystems within the study area varies between 'moderately modified' to 'largely natural'. Refer to Figure 11 'Visual Resource'.

3.1.1 Surrounding Land Use

3.1.1.1 Residential

Several farmhouses and farm labourer residence occur on the project site and in the immediate vicinity. These are scattered through the study area with the main concentration being on the farms to the east and south-east of the project site. Slovo Township and Sehlakwane Village lies at the top of the escarpment approximately 2.5km and 6km respectively north-west of the north-western corner of the site. The town of Roossenekal lies approximately 12km east of the site and Laersdrif Town adjacent to Stofberg, lies approximately 12.5km to the south of the site.

3.1.1.2 Schools / Educational Institutions

There is a school in Laersdrif.

3.1.1.3 Business / industry

Most businesses and industries are located in Stofberg, Laersdrif and Roossenekal. The Mapochs Iron Ore Mine is located approximately 11km east of the proposed project site.

3.1.1.4 Agriculture / farming

Currently the land identified for the mining operations is being used for cattle grazing. Adjacent land is being used for crop production purposes.

3.1.1.5 Conservation Status

According to the Mpumalanga Biodiversity Conservation Plan (MBCP) the footprint of the mine and surrounding area is situated in an area of High conservation significance within a designated ecological corridor. It is deemed to have 'high biodiversity status and should be maintained as natural vegetation cover.'

3.1.1.5 Transportation and other infrastructure

Infrastructure includes the roads described as follows. The R33 between Stofberg and Groblersdal is aligned in a south-east to north-west direction approximately 9km to the south of the proposed project site. From the R33 the R569 to Polokwane runs through Sehlakwane village approximately 2km south and west of the site. The R555 between Stofberg and Steelpoortis aligned in a north to south direction approximately 10km to the east of the site and links to the R33 at Stofberg. The D353 links from the R569 to Road D366. It is aligned in a south to north direction through the study area and at its closest point, approximately 2km from the south-eastern corner of the site. The D366 is aligned in a south north direction from a point on the R555 (approximately 10km of Roossenekal) and curving back to the R555 at an intersection approximately 9km north of the Mapochs mine, at its closest it is aligned approximately 5.8km from the eastern boundary of the proposed site. The D1888 links from the D353 to the R555. It is aligned in a north-west to south-east direction and at its closest it is approximately 2.3km from the south-eastern corner of the proposed project site.

The only railway through the study area is the rail line from the Mapochs Iron Ore Mine to Stofberg and then on to Middleburg. It is aligned in a north to south direction through the eastern section of the study area and at its closest, approximately 7.5km east of the eastern boundary of the site. There are existing sidings along the section of track between the Mapochs Mine and Stoberg.

Two ESKOM transmission lines, aligned east to west, bisects the site, one in the northern section and another in the southern section.

3.2 Sense of Place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. According to Lynch (1992), sense of place, "is the extent to which a person can recognize or recall a place as being distinct from other places – as having a vivid, unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases the values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognized and therefore, strong sense of place.

Because the sense of place of the study area is derived from the emotional, aesthetic and visual response to the environment, it cannot be experienced in isolation. The landscape context must also be considered. With this in mind, escarpment and flat to undulating topography to the east, infrastructural elements such as the roads, railway line, power and telecommunication infrastructure as well as land use activities all contribute to the sense of place for the study area. It is these predominant land-uses, which define the sense of place of the area and establish its identity. The combination of the natural elements (escarpment, flat to undulating plains, water bodies, rivers and streams as well as agricultural fields) with the man-made elements (farmsteads and infrastructural elements) creates a rural and pastoral environment which evokes a strong sense of place.

3.3 Landscape Quality / Visual Resource Value

In determining the quality of the visual resource, both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high.

The landscape as described in Section 3.1 can be divided into basic landscape character types, each with its own set of physical, visual and aesthetic characteristics. The spatial distribution of these landscape types is illustrated in Figure 11 'Visual Resource', and is a graphic illustration of the various elements contributing to the value of the visual resource. The diagram on Figure 11 indicates the aesthetic quality and resultant landscape resource sensitivity.

Scenic quality ratings (using the scenic quality rating criteria described in Appendix B) were assigned to each of the landscape units defined in Figure 11. The *highest* value is assigned to the mountain / escarpment, water bodies, rivers and streams and grassed plains. The combination of these natural features, which is characteristic of the study and surrounding area, as well as the agricultural activities and farmsteads create a rural and pastoral environment.

The landscape types with the lowest scenic quality rating were the following: erosion sites, infrastructure such as the power lines, regional and local farm roads and railway line.

Based on the discussion in this section, the specialist experience of the author and the criteria in Appendix C, the scenic quality value for the various landscape types within the study area is rated as ***moderate*** to ***high***. This is due to the fact that landscape types with a high scenic quality (small mountain, farm dams, nature reserve and grassed plains) are mixed with those with a lower quality (regional and local farm roads, telecommunication and power infrastructure) around the proposed intervention and within the study area as well as the fact that the landscape character is common in terms of the sub-region. This is tabulated in Table 1 below.

Table 1: Value of the Visual Resource - Scenic Quality

(after The Landscape Institute with the Institute of Environmental Management and Assessment (2002))

High	**Moderate**	**Low**
Mountain / Escarpment, water bodies, rivers & streams, grassed plains	Agricultural activities and farmsteads	Erosion / sand, power lines, regional and local farm roads and railway line
This landscape type is considered to have a *high* value because it is a: Distinct landscape that **exhibits a very positive character with valued features** that combine to give the experience of unity, richness and harmony. **It is a landscape that may be considered to be of particular importance to conserve and which has a strong sense of place. It may be sensitive to change in general and may be detrimentally affected if change is inappropriately dealt with.**	This landscape type is considered to have a *moderate* value because it is a: **Common landscape that exhibits some positive character but which has evidence of alteration / degradation / erosion of features** resulting in areas of more mixed character. It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with but change may not require special or particular attention to detail.	This landscape type is considered to have a *low* value because it is a: Minimal landscape generally negative in character with few, if any, valued features. Scope for positive enhancement could occur.

3.4 Sensitivity of Visual Resource

The sensitivity of a landscape or visual resource is the degree to which a particular landscape type or area can accommodate change arising from a particular development, without detrimental effects on its character. Its determination is based upon an evaluation of each key element or characteristic of the landscape likely to be affected. The evaluation will reflect factors such as its quality, value, contribution to landscape character, and the degree to which the particular element or characteristic can be replaced or substituted (Institute of Environmental Assessment & The Landscape Institute, 1996:87). Landscape types with a high value present the highest sensitivity to change, mostly because these are 'greenfields' sites.

The combination of an escarpment with flat to undulating topography, relatively uniform landscape character and the main vegetation type being grassland all reduce the ability of the visual resource to absorb a change in the visual environment resulting it to be relatively *low*. Thus the sensitivity of the visual resource can be rated as *moderate* to *high* in the opinion of the author.

4 LANDSCAPE IMPACT

The *landscape impact* (i.e. the change to the fabric and character of the landscape caused by the physical presence of the intervention) of the proposed Iron Ore Mine project would be ***high*** since the intervention proposes to clear existing vegetation, scar the landscape with open pits and waste dumps as well as introduce infrastructure including roads, bridges and a crusher plant. The main disturbance would be where the proposed structures would be protruding above the vegetation line and undulating topography as well as lights that would be switched on at night.

However, as stated in the approach, the physical change to the landscape at the proposed project site must be understood in terms of the visibility and aesthetic effect on the study area. The following sections discuss the effect that the proposed project will have on the visual and aesthetic environment.

5 VISUAL IMPACT

In the following section the intensity of the visual impact will be described. The intensity of visual impact is determined using visibility, visual intrusion, visual exposure and viewer sensitivity criteria. When the intensity of impact is qualified with spatial, duration and probability criteria the significance of the impact can be predicted (refer to Appendix C).

5.1 Sensitive Viewers

From the desktop study, the viewshed analysis and site investigation, sensitive viewers were identified and included farmsteads on adjacent properties as well as travellers through the study area. Refer to Table 2 below for rating of sensitivity of receptors.

Table 2: Sensitivity of Receptors

High	Moderate	Low
Visual Receptors For example **when viewed from residential properties, public rights of way,** tourist routes / attractions and or the majority of the I&AP's are opposed to the proposed project and take major issue with the visual aspects of the project.	*Visual Receptors* For example when viewed from sporting and recreational facilities and / or there is a split between I&AP's who either support or oppose the proposed project and take moderate issue with the visual aspects of the project.	*Visual Receptors* For example when viewed from, industrial or mining areas and / or most I&AP's are either supportive of the proposed project or do not take issue with the visual aspects of the project.

Given the criteria in Table 5, the sensitivity of the visual receptors to change in the visual environment brought on by the physical presence of the proposed intervention would be ***high***.

5.2 Visibility

In determining the visibility of the project, the worst-case scenario i.e. visibility of the project's features at a variety of heights and locations, was used. To do this, vantage points were assigned at offsets equivalent to the height above ground level of the proposed project. The height set for this project was established at 20 metres above ground level. The 'zone of potential influence' (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) was established at 10.0km for this project. Over 10.0km the impacts of the proposed components are insignificant due to the diminishing effect of distance and atmospheric conditions (haze / time of day / lighting conditions) on visibility. When determining the visibility of a project, its general visibility is determined as a percentage of the total area that the project could potentially be seen. This gives a general sense of its visibility and its potential impact on the totality of the study area.

A viewshed analysis was undertaken from various vantage points around the proposed intervention area. The spatial pattern generated by the viewshed analysis is illustrated in Figure 12 'Viewshed' and indicates areas from which the project can potentially be seen. As evident from the viewshed analysis the project would have a visibility of approximately 15% in the Zone of Potential Influence.

Form the site investigation it was clear that the proposed intervention would be visible to a couple of farmsteads within the Zone of Potential Influence located south-east of the proposed intervention as well as along section of the roads R569, D353, D366 and D1888. The viewshed does however not take existing vegetation into consideration thus visibility would reduce depending on the occurrence of existing vegetation. Refer to simulations on Figures 12 to 18.

Using the criteria in Table 3, visibility of the components of the proposed intervention from the surrounding areas will be ***low***. Refer to Table 3 below.

Table 3: Visibility of the Components of the Proposed Iron Ore Mine

High	Moderate	Low
If the proposed development is visible from over half the zone of potential influence, and/or views are mostly unobstructed. The proposed development is visible by most people travelling through the study area and views from sensitive viewing areas (public roads, residences and/or tourist facilities) are mostly open and unobstructed.	If the proposed development is visible from less than half the zone of potential influence within 1km, and/or views are partially obstructed. The proposed development is visible by people travelling through the study area and a reduced number of views from sensitive viewing areas (public roads, residences and/or tourist facilities) are open and unobstructed.	**If the proposed development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed.** The proposed development is visible from the least number of people and views from sensitive viewing areas are mostly obstructed due to distance and vegetation.

5.3 Visual Intrusion

Visual intrusion is measured as the magnitude of intrusion that the project will have on available views, specifically those from within sensitive or critical viewing areas. Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the cultural aesthetic of the landscape as a whole or contrast with it?

As discussed in Section 3.2, the study area is characterised by an escarpment to the west of the proposed project site and flat to undulating topography to the east. The built elements consist of infrastructural elements such as the roads, railway line, power and telecommunication infrastructure. The study area evokes a rural and pastoral environment which evokes a strong sense of place. The proposed mining project will add cumulatively to the negative visual impact of the existing manmade structures. It should be noted that the presence of the existing Mapochs Iron Ore Mine would neither influence the sense of place nor the visual character of the visual resource due to it being too far from the proposed intervention and not visible from sensitive viewpoints within the study area.

From the discussion above and the criteria in table 4 below it is clear that the proposed Iron Ore Mine project will have a ***high*** visual intrusion for the study area. Taking the *worst case scenario* into account Table 4 rates and summarises the visual intrusion for the study area.

Table 4: Visual Intrusion

High	Moderate	Low	Positive
Because the proposed development: - Has a **substantial negative effect on the visual quality of the landscape;** **- Contrasts dramatically with the patterns or elements that define the structure of the immediate landscape;** **- Contrasts with land use, settlement or enclosure patterns of the immediate environment;** **- Cannot be 'absorbed' into the landscape from key viewing areas**	Because the proposed development: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use (utilities) patterns of the general area. - Is partially 'absorbed' into the landscape from key viewing areas	Because the proposed development: - Contrasts minimally with the patterns or elements that define the structure of the landscape; - is mostly compatible with land use, (utility) patterns. - is 'absorbed' into the landscape from key viewing areas	The proposed development: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement or enclosure patterns.
Result: **Notable change in landscape characteristics over an extensive area** and/or intensive change over a localized area resulting in major changes in key views (surrounding farmsteads).	*Result* Moderate change in landscape characteristics over localized area, resulting in a moderate change to key views	*Result* Moderate change in landscape characteristics over localized area resulting in a minor change to a few key views.	*Result* Positive change in key views.

5.4 Visual Exposure

Visual exposure is rated using four increments of severity, each with their respective qualification and contribution to visual impact. The visual exposure curve in Figure 12 'Viewshed' graphically illustrates these increments.

As stated earlier the Zone of Potential Influence was established at a 10.0km radius around the components of the proposed intervention. In terms of visual exposure, when studying the viewshed analysis (Figure 12) and from the site investigation, it was apparent that only travellers along an approximate 500m section of the R569, would be exposed to the visual impact of the proposed mine in their foreground views and thus have *high* visual exposure. Possible views from the D353 would be blocked by existing vegetation from foreground views. Possible views from farmsteads to the east and south-east as well as views from the R569, D1888, D353 and D366 would range from being in the middle to background and would thus having a *moderate* to *low* visual exposure. It can be concluded that the visual exposure of the proposed intervention would be rated as ***moderate*** to ***low*** for the study area. Refer to Table 5 below for rating of visual exposure of the components of the proposed intervention.

Table 5: Visual Exposure Ratings for the Components of the Proposed Iron Ore Mine

	High Exposure (significant contribution to visual impact)	Moderate Exposure (moderate contribution to visual impact)	Low Exposure (minimal influence on visual impact)	Insignificant Exposure (negligible influence on visual impact)
Farmsteads	0 – 800m	**800m – 5.0 km**	**5.0 – 10.0 km**	Over 10.0 km
Travellers along R569	**0 – 800m**	**800m – 5.0 km**	5.0 – 10.0 km	Over 10.0 km
Travellers along D1888, D353, D366	0 – 800m	**800m – 5.0 km**	**5.0 – 10.0 km**	Over 10.0 km

5.5 *Intensity* of Visual Impact

In synthesising the criteria used to establish the *intensity* of visual impact, a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement (Institute of Environmental Assessment & The Landscape Institute (1996)).

According to the results tabulated below in Table 6 the *intensity* of visual impact (based on the worst case scenario) of the proposed project activities would be *high* due to the proposed intervention only causing a major alteration to key elements / features / characteristics of the baseline environment. However, due to the proposed project having a *low* visibility and *low to moderate* visual exposure the *intensity* of the visual impact can be rated as ***moderate to high***.

Table 6: Intensity of Impact for the Proposed Iron Ore Mine

High	Moderate	Low	Negligible
Total loss of or **major alteration to key elements / features / characteristics of the baseline**. I.e. Pre-development landscape or view and / or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape. High scenic quality impacts would result.	Partial loss of or alteration to key elements / features / characteristics of the baseline. I.e. Pre-development landscape or view and / or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic when set within the attributes of the receiving landscape. Moderate scenic quality impacts would result	Minor loss of or alteration to key elements / features / characteristics of the baseline. I.e. Pre-development landscape or view and / or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape. Low scenic quality impacts would result.	Very minor loss or alteration to key elements / features / characteristics of the baseline. I.e. Pre-development landscape or view and / or introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation. Negligible scenic quality impacts would result.

6 SIGNIFICANCE OF VISUAL IMPACT

The *intensity* of impact, rated in Table 6, is further qualified with *extent*, *duration* and *probability* criteria to determine the *significance* of the visual impact. The methodology used were provided by MSA and is described in Appendix D.

Table 7: Significance of the Proposed Veremo Iron Ore Mine Project

	Management	**Probability**	**Intensity**	**Duration**	**Severity**	**Significance**
Construction & Operational Phases	Without mitigation	4	2	4	(8 = very high severity) 3	12 (Medium Significance)
	With mitigation	3	1	4	(4 = medium severity) 2	6 (Low Significance)

Note: * This prediction assumes all mitigating measures implemented and are effectively managed at all times.

7 MITIGATING MEASURES

In considering mitigating measures there are three rules that were taken into account - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area). To address these, the following principles have been established:

- Mitigation measures should be designed to suite the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness.
- It should be recognized that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective.

Mitigation measures would be feasible and effective in reducing the visual impact on some sensitive views from surrounding farmsteads and tourist attractions. It is proposed that the following actions be implemented:

7.1 Site Development

- A Registered Professional Landscape Architect should be appointed to ensure that the proposed mitigation measures are implemented in the most optimal and environmentally enhancing way.
- With the construction of the proposed components the minimum amount of existing vegetation and topsoil should be removed. Ensure, wherever possible, all existing natural vegetation is to be retained and incorporated into the site rehabilitation especially in line of sight from sensitive viewers.

7.2 Earthworks

- Earth works should be executed in such a way that only the footprint and only a minimum 'construction buffer zone' around the proposed components are exposed. In all other areas, the natural occurring vegetation, more importantly the indigenous vegetation should be retained.
- Dust suppression techniques should be in place at all times during the construction phase.

7.3 Landscaping

- Indigenous, preferably endemic, vegetation could be introduced at sensitive viewpoints (i.e. farmsteads and foreground views) to screen views towards the proposed intervention. An ecological approach to rehabilitation and vegetative screening measures, as opposed to a horticultural approach to landscaping should be adopted. For example, communities of indigenous plans enhance bio-diversity and blend well with existing vegetation. This approach can significantly reduce long-term costs as less maintenance would be required over conventional landscaping methods as well as the introduced landscape being more sustainable.

7.4 Lighting

Light pollution should be seriously and carefully considered and kept to a minimum wherever possible as light at night travels great distances especially in undisturbed areas such as the study area.. Security lighting should only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas. Wherever possible, lights should be directed downwards so as to avoid illuminating the sky.

The negative impact 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 site – this is especially relevant where the there are open views from the nearby farmsteads and tourist attractions towards the proposed intervention.
- Minimise the amount of light fixtures to the bare minimum and connecting these lights to motion sensors can also considered in reducing light pollution.

8 CONCLUSION

It can be concluded that visual impacts would result from the proposed Veremo Iron Ore Mine Project. Specifically impacts would arise from the project being visible from farmsteads within the Zone of Potential Influence more specifically, within the viewshed. As evident from the viewshed analysis (Figure 12) these are mostly farmsteads located to the east and south-east of the proposed project. Further visual impacts would include foreground views from the R569 and middle ground views from the R569, D353, D366 and D1888. The proposed project would cause a major alteration to the key characteristics of the baseline environment. The introduction of the elements of the proposed development is considered to be totally uncharacteristic when set within the attributes of the receiving landscape / visual resource resulting in high scenic quality impacts. However, due to the proposed project having a *low* visibility and *low to moderate* visual exposure the *intensity* of the visual impact can be rated as ***moderate to high***.

Correctly implemented mitigation measures, as stated in Item 7, could however significantly reduce the negative visual impact that would result from the proposed project.

In summary, the ***significance*** of the visual impact that would arise from the proposed Veremo Iron Ore Mine Project **before** the implementation of mitigation measures would be rated as ***MEDIUM (NEGATIVE)*** and the ***significance*** after mitigation measures, could be rated as ***LOW*** due to the nature of the proposed project and the character of the receiving landscape. After the pits, waste dumps and roads have been rehabilitated and the structures removed, and all rehabilitation processes have been correctly implemented the significance of the visual impact could be reduced to an almost insignificant level.

NLA

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APPENDIX A: FIGURES

APPENDIX B: DETERMINING A LANDSCAPE AND THE VALUE OF THE VISUAL RESOURCE

In order to reach an understanding of the effect of development on a landscape resource, it is necessary to consider the different aspects of the landscape as follows:

Landscape Elements and Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, savannah, trees, water bodies, buildings and roads are generally quantifiable and can be easily described.

Landscape character is therefore the description of pattern, resulting from particular combinations of natural (physical and biological) and cultural (land use) factors and how people perceive these. The visual dimension of the landscape is a reflection of the way in which these factors create repetitive groupings and interact to create areas that have a specific visual identity. The process of landscape character assessment can increase appreciation of what makes the landscape distinctive and what is important about an area. The description of landscape character thus focuses on the *nature of the land*, rather than the response of a viewer.

Landscape Value – all encompassing (Aesthetic Value)

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993).

Aesthetic appeal (value) is considered high when the following are present (Ramsay 1993):

- *Abstract qualities*: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes;
- *Evocative responses*: the ability of the landscape to evoke particularly strong responses in community members or visitors;
- *Meanings*: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general;
- *Landmark quality*: a particular feature that stands out and is recognised by the broader community.

Sense of Place

Central to the concept of a sense of place is that the place requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations and traditions associated with historic use and habitation. According to Lynch (1992) sense of place "is the extent to which a person can recognize or recall a place as being distinct from other places - as having a vivid, or unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognized and therefore, strong sense of place.

Scenic Quality

Assigning values to visual resources is a subjective process. The phrase, "beauty is in the eye of the beholder," is often quoted to emphasize the subjectivity in determining scenic values. Yet, researchers have found consistent levels of agreement among individuals asked to evaluate visual quality.

Studies for perceptual psychology have shown human preference for landscapes with a higher visual complexity particularly in scenes with water, over homogeneous areas. On the basis of contemporary research landscape quality increases when:

- Topographic ruggedness and relative relief increase;
- Where water forms are present;
- Where diverse patterns of grasslands and trees occur;
- Where natural landscape increases and man-made landscape decreases;
- And where land use compatibility increases and land use edge diversity decreases (Crawford 1994).

Scenic Quality - Explanation of Rating Criteria:

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Landform: Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Fish River or Blyde River Canyon, the Drakensberg or other mountain ranges, or they may be exceedingly artistic and subtle as certain badlands, pinnacles, arches, and other extraordinary formations.

Vegetation: (Plant communities) Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular (wildflower displays in the Karoo regions). Consider also smaller scale vegetational features, which add striking and intriguing detail elements to the landscape (e.g., gnarled or wind beaten trees, and baobab trees).

Water: That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

Colour: Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.

Adjacent Scenery: Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units which would normally rate very low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.

Scarcity: This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.

Cultural Modifications: Cultural modifications in the landform/water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit.

Scenic Quality Inventory and Evaluation Chart
(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Key factors	Rating Criteria and Score	.	.
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers.	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional.	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features.
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present, but not noticeable.
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields.	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	Subtle colour variations, contrast, or interest; generally mute tones.
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
Scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. National and provincial parks and conservation areas	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony.	Modifications add little or no visual variety to the area, and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

Scenic Quality (i.e. value of the visual resource)
In determining the quality of the visual resource both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high.

When considering both objective and subjective factors associated with the landscape there is a balance between landscape character and individual landscape features and elements, which would result in the values as follows:

Criteria to value a visual Resource
Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response is usually to both visual and non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value is more than the combined factors of the seen view, visual quality or scenery. It

includes atmosphere, landscape character and sense of place (Schapper 1993). Refer also to Appendix A for further elaboration.

Studies for perceptual psychology have shown human preference for landscapes with higher visual complexity, for instance scenes with water or topographic interest. On the basis of contemporary research, landscape quality increases where:

- Topographic ruggedness and relative relief increase;
- Water forms are present;
- Diverse patterns of grassland and trees occur;
- Natural landscape increases and man-made landscape decreases;
- Where land use compatibility increases. (Crawford 1994)

Aesthetic appeal (value) is therefore considered **high** when the following are present (Ramsay 1993):

- Abstract qualities: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes;
- Evocative responses: the ability of the landscape to evoke particularly strong responses in community members or visitors;
- Meanings: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general;
- Landmark quality: a particular feature that stands out and is recognized by the broader community.

And conversely, it would be **low** where:

- Limited patterns of grasslands and trees occur;
- Natural landscape decreases and man-made landscape increases;
- And where land use compatibility decreases (after Crawford 1994).

Value of Visual Resource – expressed as Scenic Quality

(After The Landscape Institute with the Institute of Environmental Management and Assessment (2002))

High	Moderate	Low
Areas that exhibit a very positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.	Areas that exhibit positive character but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again change may be detrimental if inappropriately dealt with but it may not require special or particular attention to detail.	Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

APPENDIX C: METHOD FOR DETERMINING THE INTENSITY OF LANDSCAPE AND VISUAL IMPACT

A visual impact study analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the project.

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002).

Landscape impact assessment includes a combination of objective and subjective judgements, and it is therefore important that a structured and consistent approach is used. It is necessary to differentiate between judgements that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of magnitude of change). Judgement should always be based on training and experience and be supported by clear evidence and reasoned argument. Accordingly, suitably qualified and experienced landscape professionals carry out landscape and visual impact assessments (The Landscape Institute with the Institute of Environmental Management and Assessment (2002),

Landscape and visual assessments are separate, although linked, procedures. The landscape baseline, its analysis and the assessment of landscape effects all contribute to the baseline for visual assessment studies. The assessment of the potential effect on the landscape is carried our as an effect on an environmental resource, i.e. the landscape. Visual effects are assessed as one of the interrelated effects on population.

Landscape Impact

Landscape impacts derive from changes in the physical landscape, which may give rise to changes in its character and from effects to the scenic values of the landscape. This may in turn affect the perceived value ascribed to the landscape. The description and analysis of effects on a landscape resource relies on the adoption of certain basic principles about the positive (or beneficial) and negative (or adverse) effects of change in the landscape. Due to the inherently dynamic nature of the landscape, change arising from a development may not necessarily be significant (Institute of Environmental Assessment & The Landscape Institute (2002)).

Visual Impact

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the magnitude of visual impact four main factors are considered.

Visual Intrusion: The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use.

Visibility: The area/points from which project components will be visible.

Visual exposure: Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.

Sensitivity: Sensitivity of visual receptors to the proposed development

Visual Intrusion/contrast

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the ecological and cultural aesthetic of the landscape as a whole? Or conversely what is its contrast with the receiving environment. Combining landform/vegetation contrast with structure contrast derives overall visual intrusion/contrast levels of high, moderate, and low.

Landform/vegetation contrast is the change in vegetation cover and patterns that would result from construction activities. Landform contrast is the change in landforms, exposure of soils, potential for erosion scars, slumping, and other physical disturbances that would be noticed as uncharacteristic in the natural landscape. Structure contrast examines the compatibility of the proposed development with other structures in the landscape and the existing natural landscape. Structure contrast is typically strongest where there are no other structures (e.g., buildings, existing utilities) in the landscape setting.

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change (contrast) to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama. The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

- Does the physical development concept have a negative, positive or neutral effect on the quality of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the project enhance and promote cultural continuity or does it disrupt it?

The consequence of the intrusion/contrast can then be measured in terms of the sensitivity of the affected landscape and visual resource given the criteria listed below. For instance, within an industrial area, a new sewage treatment works may have an insignificant landscape and visual impact; whereas in a *valued* landscape it might be considered to be an intrusive element. (Institute of Environmental Assessment & The landscape Institute (1996)).

Visual Intrusion

High	Moderate	Low	Positive
If the project: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts dramatically with the patterns or elements that define the structure of the landscape; - Contrasts dramatically with land use, settlement or enclosure patterns; - Is unable to be 'absorbed' into the landscape.	If the project: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts moderately with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use, settlement or enclosure patterns. - Is partially 'absorbed' into the landscape.	If the project: - Has a minimal effect on the visual quality of the landscape; - Contrasts minimally with the patterns or elements that define the structure of the landscape; - Is mostly compatible with land use, settlement or enclosure patterns. - Is 'absorbed' into the landscape.	If the project: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement or enclosure patterns.
Result Notable change in landscape characteristics over an extensive area and/or intensive change over a localized area resulting in major changes in key views.	*Result* Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	*Result* Imperceptible change resulting in a minor change to key views.	*Result* Positive change in key views.

Visual intrusion also diminishes with scenes of higher complexity, as distance increases, the object becomes less of a focal point (more visual distraction), and the observer's attention is diverted by the complexity of the scene (Hull and Bishop (1988)).

Visibility

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1.8m above ground level. Topographic data was captured for the site and its environs at 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. It should be noted that viewshed analyses are not absolute indicators of the level of significance (magnitude) of the impact in the view, but merely a statement of the fact of potential visibility. The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

Visibility

High	Moderate	Low
Visual Receptors If the development is visible from over half the zone of potential influence, and/or views are mostly unobstructed and/or the majority of viewers are affected.	*Visual Receptors* If the development is visible from less that half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed and/or few viewers are affected.

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object in the foreground (0 – 800m) is greater than the impact of that same object in the middle ground (800m – 5.0 km) which, in turn is greater than the impact of the object in the background (greater than 5.0 km) of a particular scene.

Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

Areas seen from 0 to 800m are considered foreground; foliage and fine textural details of vegetation are normally perceptible within this zone.

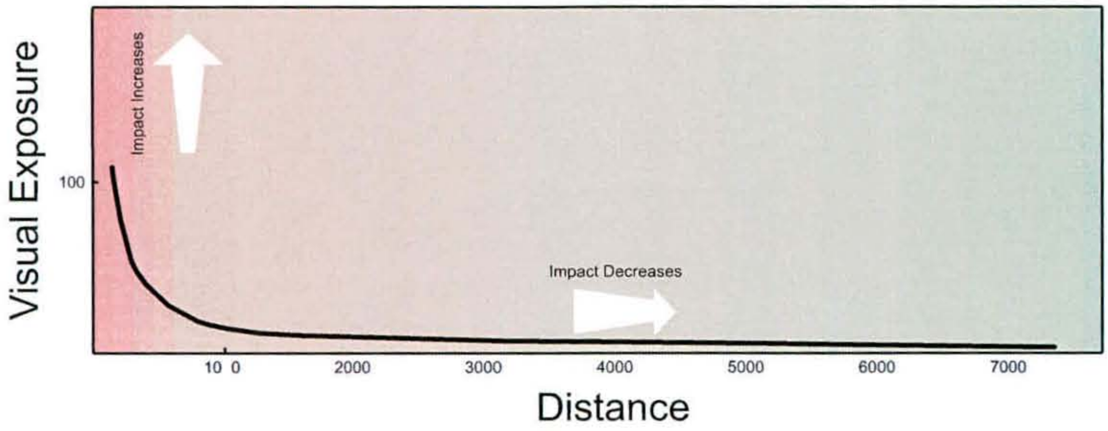
Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km.

Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

Seldom seen areas are those portions of the landscape that, due to topographic relief or vegetation, are screened from the viewpoint or are beyond 16km from the viewpoint. Landforms become the most dominant element at these distances.

The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the Figure below.

Effect of Distance on Visual Exposure



Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the magnitude of the impact of the development can be determined.

The sensitivity of visual receptors and views will be depended on:

- The location and context of the viewpoint;
- The expectations and occupation or activity of the receptor;
- The importance of the view (which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape;
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;
- Occupiers of residential properties with views affected by the development.
- These would all be high

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value);
- People travelling through or past the affected landscape in cars, on trains or other transport routes;

- People at their place of work.

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

In this process more weight is usually given to changes in the view or visual amenity which are greater in scale, and visible over a wide area. In assessing the effect on views, consideration should be given to the effectiveness of mitigation measures, particularly where planting is proposed for screening purposes (Institute of Environmental Assessment & The Landscape Institute (1996).

Sensitivity of Visual Receptors

High	Moderate	Low
Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape; Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; Occupiers of residential properties with views affected by the development.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value); People travelling through or past the affected landscape in cars, on trains or other transport routes;	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas). Roads going through urban and industrial areas

Magnitude (Intensity) of the Visual Impact

Potential visual impacts are determined by analysing how the physical change in the landscape, resulting from the introduction of a project, are viewed and perceived from sensitive viewpoints. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks, and conservation areas, highways and travel routes, and important cultural features and historic sites, especially in foreground views.

The magnitude of impact is assessed through a synthesis of visual intrusion, visibility, visual exposure and viewer sensitivity criteria. Once the magnitude of impact has been established this value is further qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact.

For instance, the fact that visual intrusion and exposure diminishes significantly with distance does not necessarily imply that the relatively small impact that exists at greater distances is unimportant. The level of impact that people consider acceptable may be dependent upon the purpose they have in viewing the landscape. A particular development may be unacceptable to a hiker seeking a natural experience, or a household whose view is impaired, but may be barely noticed by a golfer concentrating on his game or a commuter trying to get to work on time (Ittleson *et al.,* 1974).

In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment and The landscape Institute (1996)).

Magnitude (Intensity) of Visual Impact

High	Moderate	Low	Negligible
Total loss of or major alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape. High scenic quality impacts would result.	Partial loss of or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic when set within the attributes of the receiving landscape. Moderate scenic quality impacts would result	Minor loss of or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view an/or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape. Low scenic quality impacts would result.	Very minor loss or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation. Negligible scenic quality impacts would result.

Cumulative effects

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility (visibility) of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The landscape Institute (1996)).

APPENDIX D: IMPACT ASSESSMENT METHODOLOGY

REFER TO DOCUMENT 'J1746 VEREMO MRA SCOPING REPORT LK EDITED 6 (p 97 – 99)'

APPENDIX E: CRITERIA FOR PHOTO / COMPUTER SIMULATION

To characterize the nature and magnitude of visual intrusion of the proposed project, a photographic simulation technique was used. This method was used according to Sheppard (in Lange 1994), where a visual simulation is good quality when the following five criteria are met.

Representativeness: A simulation should represent important and typical views of a project.
Accuracy: The similarity between a simulation and the reality after the project has been realized.
Visual clarity: Detail, parts and overall contents have to be clearly recognizable.
Interest: A simulation should hold the attention of the viewer.
Legitimacy: A simulation is defensible if it can be shown how it was produced and to what degree it is accurate.

To comply with this standard it was decided to produce a stationary or static simulation (Van Dortmont in Lange 1994), which shows the proposed development from a typical static observation points (Critical View Points).

Photographs are taken on site during a site visit with a manual focus, 50mm focal depth digital camera. All camera settings are recorded and the position of each panoramic view is recorded by means of a GPS. These positions, coordinates are then placed on the virtual landscape (see below).

A scale model of the proposal is built in virtual space, scale 1:1, based on CAD (vector) information as supplied by the architect/designers. This model is then placed on a virtual landscape, scale 1:1, as produced by means of GIS software. The accuracy of this depends on the contour intervals.

The camera views are placed on the points as recorded on the virtual landscape. The respective photographs are overlaid onto the camera views, and the orientation of the cameras adjusted accordingly. The light source is adjusted to suit the view. Each view is then rendered as per the process above.

APPENDIX F: VIEWSHED ANALYSIS

A Digital Terrain Model (DTM) was created by capturing current and most up to date topographic and land use data in digital format. Using the DTM, the programme performs a viewshed analysis on the lattice surface (a fine grid of cells extending over the entire study area). Each cell has stored information relating to x, y (plan) and z (height) co-ordinates. It computes a line of sight analysis across the current lattice from a selected vantage point in a 360 degree arc to define the area from which a vantage point may be seen.

APPENDIX G: DECLARATION OF INDEPENDANCE

I, Mitha C Theron hereby declare that Newtown Landscape Architects cc, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

Consultant name: Mitha Theron

Signature:

Date: 2011 03 28

APPENDIX H: CURRICULUM VITAE OF AUTHORS

Since 1994

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Graham is a registered landscape architect with interest and experience in landscape architecture, urban design and environmental planning. He holds a degree in landscape architecture from the University of Toronto and has practiced in Canada and Africa, where he has spent most of his working life. During his 30 year career he has received numerous Institute of Landscape Architects of South Africa and other industry awards. He has published widely on landscape architectural issues and has had projects published both locally and internationally in design journals and books. In addition to being a founding member of Newtown Landscape Architects he is currently a senior lecturer, teaching landscape architecture and urban design at post and under graduate levels, at the University of Pretoria. He has been a visiting studio critic at the University of Witwatersrand and University of Cape Town. A 'niche' speciality of his is Visual Impact Assessments for which he was cited with an ILASA Merit Award in 1999.

EXPERIENCE: Current	**NEWTOWN LANDSCAPE ARCHITECTS cc.** ***Founding Member*** Responsible for project management, landscape design, urban design, and visual impact assessment. *Senior Lecturer*: Department of Architecture, University of Pretoria.
1991 - 1994 1988 - 1989	**GRAHAM A YOUNG LANDSCAPE ARCHITECT** - ***Sole proprietor*** Designed major transit and CBD based urban design schemes; designed commercial and recreational landscapes and a regional urban park; participated in inter-disciplinary consulting teams that produced master plans for various beachfront areas in KwaZulu Natal and a mountain resort in the Drakensberg.
1989 - 1991	**CANADA** - ***Free Lance*** Designed golf courses and carried out golf course feasibility studies (Robert Heaslip and Associates); developed landscape site plans and an end-use plan for an abandoned mine (du Toit, Allsopp and Hillier); conducted a visual analysis of a proposed landfill site. .
1980 - 1988	**KDM (FORMERLY DAMES AND MOORE)** - *Started as a Senior Landscape Architect and was appointed Partner in charge of Landscape Architecture and Environmental Planning in 1984*. Designed commercial, corporate and urban landscapes; completed landscape site plans; developed end-use master plans for urban parks, college and technikon sites; carried out ecological planning studies for factories, motorways and a railway line.

1978 - 1980 **DAYSON & DE VILLIERS - *Staff Landscape Architect***

Designed various caravan parks; designed a recreation complex for a public resort; conducted a visual analysis for the recreation planning of Pilgrims Rest; and designed and supervised the installation of various private gardens.

EDUCATION:

Bachelor of Landscape Architecture, 1978, (BLArch), University of Toronto, Canada;
Senior Lecturer - Department of Architecture, University of Pretoria.

PROFESSIONAL:

Registered Landscape Architect – South African Council for Landscape Architectural Profession (2001);
Board of Control for Landscape Architects of South Africa (1987) – Vice Chairman 1988 to 1989;
Professional Member - Institute of Landscape Architects Southern Africa (1982) – President 1986 - 1988;
Member Planning Professions Board 1987 to 1989;
Member International Association of Impact Assessment;

AWARDS:

Intermediate Phase(S'kumbuto, Moshate and Uitspanplek), Freedom Park: ILASA Merit Award (2009)

Corniche Bay Resort, Mauritius: ILASA Merit Award (2009)

Torsanlorenzo International Prize, Landscape design and protection 2nd Prize Section B: Urban Green Spaces, for Intermediate Phase Freedom Park (2009)

Phase 1 and Intermediate Phase Freedom Park: Loerie Awards Gold Statue (2008)

Phase 1 and Intermediate Phase Freedom Park: Special Mention World Architecture Festival, Nature Category (2008)

Moroka Park Precinct, Soweto: ILASA Merit Award for Design (2005) and Gold Medal United Nations Liveable Communities (LivCom) Award (2007)

Isivivane, Freedom Park: ILASA Presidential Award of Excellence Design (2005)

Information Kiosk, Freedom Park: ILASA Merit Award for Design (2005)

Moroka – Mofola Open Space Framework, Soweto: ILASA Merit Award for Planning (2005)

Mpumalanga Provincial Government Complex: ILASA Presidential Award of Excellence (with KWP Landscape Architects for Design (2003)

Specialist Impact Report: Visual Environment, Sibaya Resort and Entertainment World: ILASA Merit Award for Environmental Planning (1999);

Gillooly's Farm, Bedfordview (with Dayson and DeVilliers): ILASA Merit Award for Design;

COMPETITIONS:

Johannesburg Inner City Park Design competition – with MMA architects (2009) Finalist and considered "the strongest concept" by the adjudication panel.

Pan African Parliament International Design competition – with MMA architects (2007) Finalist

Leeuwpan Regional Wetland Park for the Ekurhuleni Metro Municipality (2004) Landscape Architectural Consultant on Department of Trade and Industries Building (2002) – Finalist

Landscape Architecture Consultant on Project Phoenix Architectural Competition, Pretoria (1999): Winner;

Mpumalanga Legislature Buildings (1998): Commissioned;

Toyota Fountain (1985): First Prize - commissioned;

Bedfordview Bike/Walkway System - Van Buuren Road (1982): First Prize -commissioned;

Portland Cement Institute Display Park (1982): Second Prize

CONTRIBUTOR / AUTHOR:

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- Freedom Park Phase 1 and Intermediate Phase (NBGM), Pretoria, Gauteng

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- *Freedom Park Phase 1 and Intermediate Phase* (NBGM), Pretoria, Gauteng
- *Riverside Government Complex* (NLAKWP), Nelspruit, Mpumalanga;
- *Moroka Dam Parks* Precinct, Soweto, Gauteng.

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Malan, C. and McInerney, P (eds) ***The Making of an African Building. The Mpumalanga Provincial Government Complex***, Johannesburg MPTS Architectural Library, Johannesburg (2001)

- *Riverside Government Complex* (KWPNLA), Nelspruit, Mpumalanga;

Numerous publications in industry journals.

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Mitha is a landscape architect with seven years experience. She has worked as Landscape Architect in South Africa and Angola and has valuable expertise in the practice of landscape architecture and environmental planning. She currently focuses on gaining experience in Visual Impact Assessments subcontracting for NLA, she also subcontracts as Landscape Architect for other Landscape Architectural firms, as Landscape Designer for Landscape Contractors as well as undertaking private projects.

EXPERIENCE:

2008 to present: *Consultant:*

NEWTOWN Landscape Architects cc.
Visual Impact Assessments
KWP Landscape Architects & Environmental Consultants
Landscape Maintenance Auditing
Landscape Design and draughting
REAL Landscapes
Landscape Design

2005 – 2007 *Landscape Architect:*

KWP Landscape Architects & Environmental Consultants
Landscape design for various types of projects ranging from residential garden design to industrial landscaping, including the landscape upgrade of the SASOL plant in Secunda.
General project administration and documentation including Bill of Quantities, Tender Evaluation and site inspections.
Landscape Maintenance Auditing at the Nelspruit Riverside Government Offices
Preparation of Environmental Impact Assessment Reports for proposed housing developments.
Environmental Control Officer on various residential housing developments.

2003 – 2004 *Candidate Landscape Architect:*

Sigma Gibb – part of the GIBB Africa Group
Co-Landscape Architect on a residential housing estate in Luanda, Angola.
Design and draughting for various projects in Angola.

2003 *Candidate Landscape Architect:*

NEWTOWN Landscape Architects cc.

Design and draughting various projects ranging from private residential gardens to public parks.

Project administration including Bills of Quantities and Tender Evaluation and site inspections

PROFESSIONAL:

Registered Landscape Architect – South African Council for Landscape Architectural Profession (2007)

Committee Member – South African Council for Landscape Architectural Profession (2009 & 2011)

EDUCATION:

Bachelor of Landscape Architecture, 2001, (BLArch), University of Pretoria.

APPENDIX 10:

TRAFFIC ASSESSMENT SPECIALIST REPORT

TRAFFIC IMPACT ASSESSMENT
VEREMO MINE

31 March 2011

Report prepared by:

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TRAFFIC IMPACT ASSESSMENT
VEREMO MINE

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