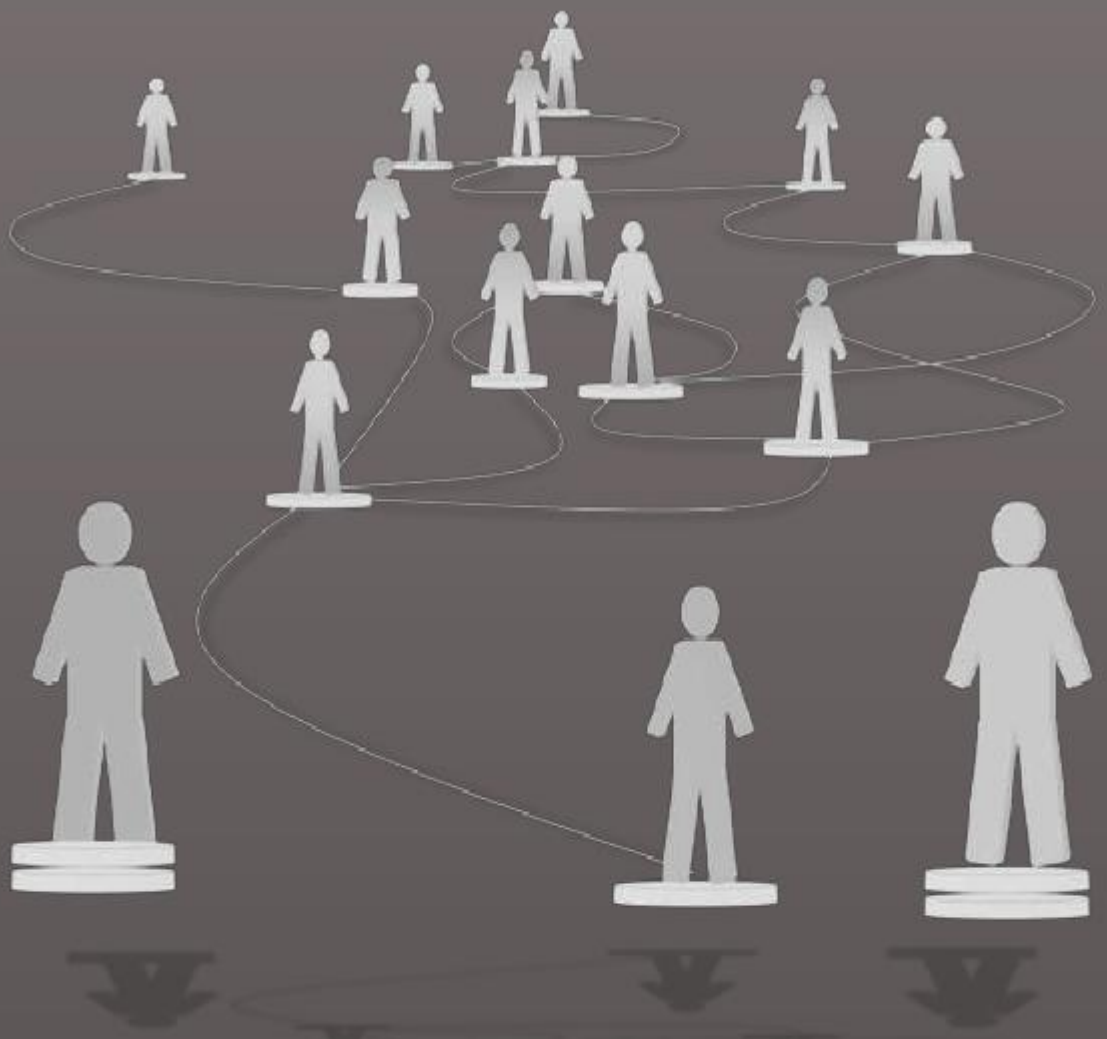

SUBIFLEX (PTY) LTD

The Duel Coal Project

FINAL REPORT: MACRO AND MICRO-ECONOMIC IMPACT ASSESSMENT

April 2016

THE DUEL COAL PROJECT

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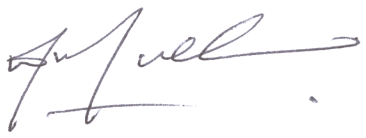
Name of Project: The Duel Coal Project.

Report Title: Macro and Micro-Economic Assessment.

I, William Mullins, declare that I am the Project Manager and co-author of this Socio and Macro-Economic Impact Analysis. I further declare that I am employed by Mosaka Economic Consultants cc, trading as Conningarth Economic Consultants, an independent Macro-Economic Analysis, Regional and Sectorial Analysis and Cost-Benefit Analysis company with 26 years of experience in conducting Macro-Economic and Cost Benefit Analyses.

Mosaka Economic Consultants cc did the Socio and Macro-Economic Impact Analysis of the proposed The Duel Coal Project based on independent research and data provided by the mining company. I hereby confirm that neither I nor the co-authors nor any employee of Mosaka Economists have any business, financial, personal or other interest in the activity or application other than fair remuneration for work performed and that there are no circumstances that may compromise the objectivity of these persons in performing the work as defined under the term "independent" in Chapter 1 of the Environmental Impact Assessment Regulations (2010).



William Mullins – Project Manager
Date: 22 April 2016

EXECUTIVE SUMMARY

OVERVIEW CURRENT LAND USE AND DEVELOPMENT ALTERNATIVES

CURRENT LAND USE

The aim of the proposed The Duel Coal Project is to mine on the farm The Duel 186 MS (RE) situated in an area containing privately owned game farms with a number of hunting lodges and game viewing facilities for local and overseas hunters. The game farms generally have game fencing and are stocked with a large variety of trophy and other game species.

The objective of this study is to determine the current economic activities and compare the current land use to the proposed mining of coal. In the process the possible impact of the proposed mine on the farm The Duel and surrounding properties will be determined and the economic feasibility of the proposed mine be established for inclusion in the Environmental Impact Assessment (EIA) study.

Outside and to the east of the proposed mining perimeter, are the village communities of Makushu and Mosholombe, further away to the south east the Pfumembe community (on the farm Telema 190 MT). Further to the south is Maangani in the Njelele Poort and to the south west, Mabvuka Jazz, Manyii and Matsa villages south of the foothills. The village Mudimeli/Fripp is situated to the west. Game farming is the main agricultural activity in the immediate vicinity of the mine with several game and hunting lodges.

With the exclusion of the Nzhelele Dam, surface water is very scarce in the area and underground water is the main source of water for farming purposes.

It is important to note that the proposed The Duel Coal Project site is virtually surrounded by the planned coal mining projects for which Mining Right Applications (MRA) have been submitted to the Department of Mineral Resources (DMR).

DEVELOPMENT ALTERNATIVES

The approach was to utilise the collected site specific data to determine the comparative feasibility of the project as an alternative land use and the possible impact on local activities. A micro- and macro-economic study is aimed at determining the economic and socio-economic indicators and assist in identifying the best alternative land use option in a resource economic re-evaluation.

The principle of efficiency raises the issue of whether alternative forms of a project would constitute a more efficient use of resources.

The equity principle requires the consideration of whether the project results in outcomes that can be considered “fair”. Investigating the distribution of impacts is required to clearly indicate what is impacted on, in what way and for what period.

Sustainability related issues include a consideration of whether the project is likely to be economically viable over the long term and whether it will be ecologically sustainable. Risks to the long-term success of the project, including factors such as changing interest and exchange rates, become important here.

ECONOMIC ASSESSMENT

The focus of the economic impact analysis is macro-economic, stressing linkages between the project and the remainder of the relevant economy. Environmental externalities may affect other

economic sectors and are included in the tools of the macro-economic impact assessment. Also, the local, regional and national socio-economic impact is assessed.

The approach is to establish the economic baseline of the current economic activities and weigh the possible change in land use of the mining proposal against the current economic baseline. This will include the possible negative impact on the current activities as well as the environment, physical and social.

In determining the economic impact of the proposed The Duel Coal Project, the economic impact on a wider scale, namely the Limpopo Province and the RSA, is considered together with the possible impact on the current economic activities in and surrounding the proposed mining area.

It is necessary to establish a baseline for the current economic activities in and adjacent to The Duel Coal Project area and do an estimation of the potential impact of the proposed development. Issues to be investigated and reported upon, include:

- Possible impacts on local population including the quality of life;
- Impacts on the natural environment and associated costs including the cost of possible mitigation measures;
- Potential impacts on the local municipality, the Limpopo Province and South Africa as an entity; and
- The economic sustainability of the project taking into consideration the associated economic risks.

The methodology for the study include two aspects, namely; data collection and the application of econometric models (local impacts, a Cost Benefit Analysis [CBA] and a Macro-economic Impact Analysis).

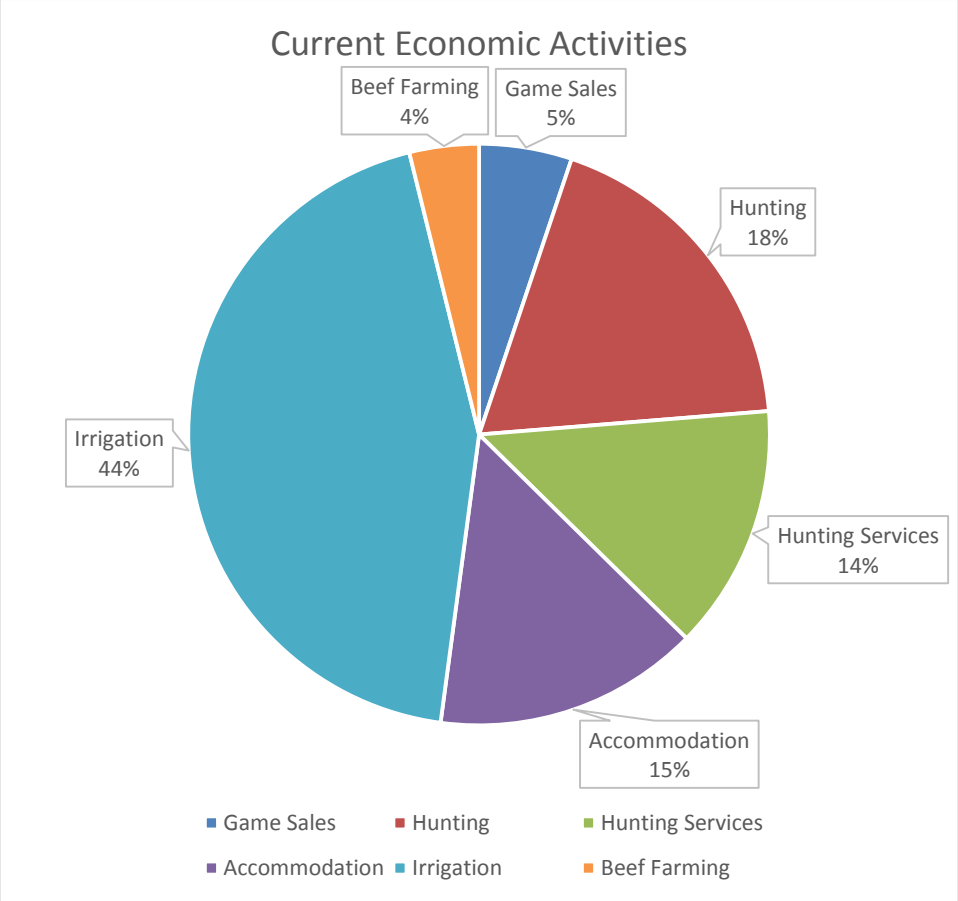
A macro-economic and micro-economic modelling approach was used in the calculation of the different parameters to test the impact of the mine and determine the economic sustainability.

CURRENT ECONOMIC ACTIVITIES

The magnitude of the current activities in the project area has been calculated according to the methods as explained. In the following sections the current economic activities are expressed in terms of the following economic and socio-economic parameters as provided by the Macro-Economic Model:

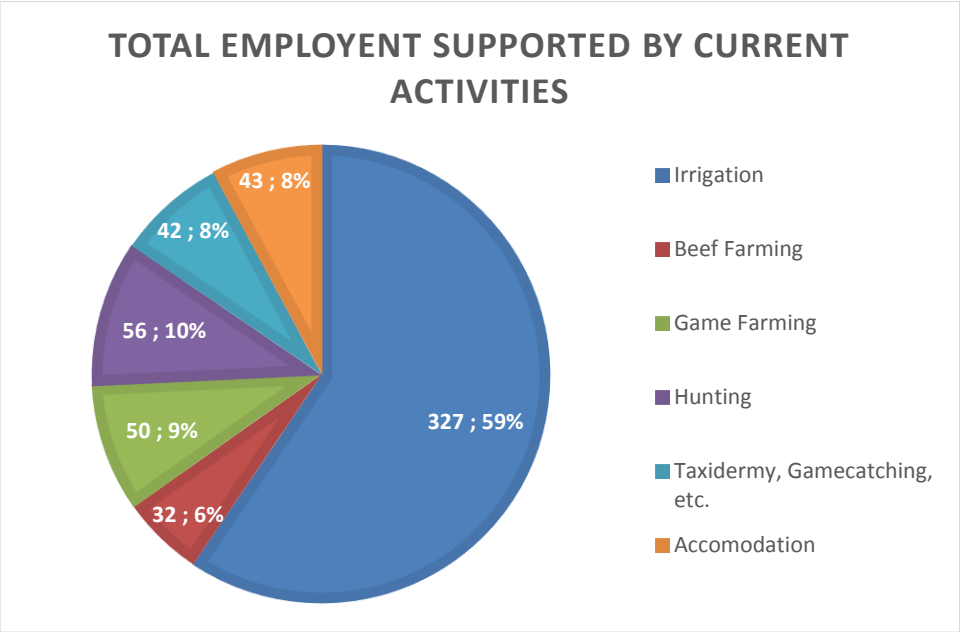
- Economic Parameters
  - Gross Domestic Product (GDP) – Direct and Indirect/Induced Impacts;
  - Capital Utilisation.
- Socio-economic parameters
  - Employment – Direct and Indirect/Induced Impacts;
  - Payments to Households – Low Income and Medium/High Income.

The chart below provides an indication of the distribution of the current economic activities in the wider project area.



The annual total value of the current activities are estimated at R59.45 million, with irrigation contributing around R26.28 million, 44%, with the hunting services and accommodation the second largest contributor at R16.80 million (29%), with the rest the hunting activities.

The following chart provides an indication of the contribution of each activity to employment in the project area.



The contribution of irrigation to direct employment opportunities are 266 out of 398 sustained by the current activities, with a total of 549 if the indirect and induced is added.

Economic Feasibility

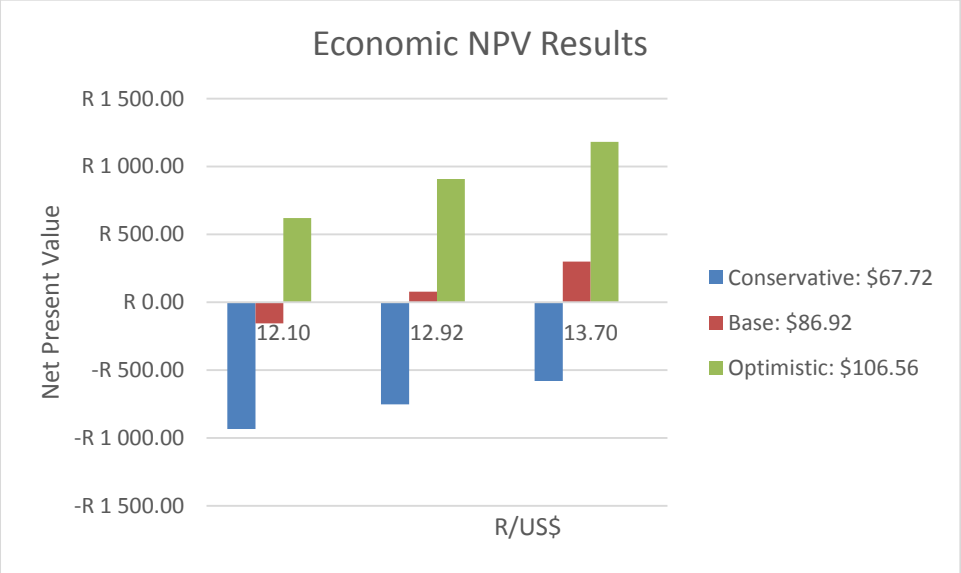
An economic Cost Benefit Analysis has been performed applying different coal prices with different exchange rates. The economic costs have been determined applying shadow prices and acceptable sources. In the following table the results of the different options are presented.

Coal Price US$/ton	Exchange Rate	Coal Price Rand/ton	NPV Rand million	IRR	BCR	Result
$67.62	12.10	R814.31	R-933.20	-1.50%	0.57	Negative
	12.92	R869.67	R-756.91	-2.95%	0.67	Negative
	13.70	R922.22	R-579.94	-4.21%	0.76	Negative
$86.94	12.10	R1 051.69	R-156.16	-7.04%	0.99	Negative
	12.92	R1 123.19	R77.92	8.47%	1.11	Positive
	13.70	R1 191.06	R300.08	9.76%	1.24	Positive
$106.56	12.10	R1 289.07	R620.88	11.6%	1.41	Positive
	12.92	R1 376.71	R907.79	13.1%	1.56	Positive
	13.70	R1 459.90	R1 180.11	14.5%	1.71	Positive

The results turns positive at the average export coal price for the last five years of $86.94 per ton with the accompanying exchange rate of R12.92/US$, the average exchange rate for the last 12 months.

The position was accepted that the export price will at least return to the average price and a R13/US$ exchange rate. With those assumptions in place it appears that the project will be economically feasible, although it must be kept in mind that a certain risk is associated with these assumptions.

The following graph highlights the results in terms of the NPV.



In South Africa the last producing hard coking coal mine is closing and in the process of rehabilitation. The Tshikondeni Mine produced in the order of 316 000 tonnes of hard coking coal

(HCC) and was the only HCC producer in the country since 1984. Its demise spells a total shortage of local HCC for the metals industry in South Africa. Tshikondeni sold coking coal to AcelorMittal, however, the mine was not very profitable because of the pricing arrangement, but had a captive market and only closed due to the depletion of its resources.

The demand for thermal coal in the future will largely depend on the extent of global reliance on coal for electricity production, while the demand for coking coal will depend on the growth in steel production. Coal demand is expected to increase significantly, especially on the back of increases in power and industrial production.

Risk Analysis

A detailed risk analysis was performed to estimate the possible impact of the proposed mining project on the current activities.

The following provides a picture of the projected impact on the current economic activities in the mining area. Area 1 represents the farm The Duel, Area 2 the farms in a 5 km radius from the mine and Area 3 the area in a 10 km radius.

Activity	Area 1	Area 2	Area 3
Beef & Livestock Farming	0.00%	-15.81%	-11.48%
Game Farming & Hunting	-29.76%	-11.87%	-5.23%
Professional and Taxidermist Services	-25.84%	-18.56%	-8.70%
Accommodation (Tourists & Hunting)	0.00%	-20.47%	-27.56%
Irrigation	0.00%	0.00%	-12.30%
Community	0.00%	-23.97%	0.00%
Environmental Impact	-32.06%	-22.67%	-20.77%
Average	**- 30.19%**	**-21.64%**	**-14.51%**

The table shows that the further from the mining operation the smaller the expected impact would be. The average impact varies from -30.19% for Area 1 to -14.51% for Area 3.

The mining project would on annual average production year create 503 direct employment opportunities during the operational phase in the Limpopo Province with a total, if the indirect and induced employment opportunities are added, 1 096 in the total economy.

The total GDP generated in the province is estimated at R306 million per average production year.

The total wages and salaries for an average year is estimated at R161.78 million with R58.62 million for the low-income households, 36% of the total.

The following table presents the estimated impact of the proposed The Duel Coal Project in the Vhembe district

Macro –Economic Parameter	Created and Supported by the Mining Activity	Created and Supported by the Current Activities	Estimated losses due to Mining Activities	Net Additional Benefit
Total GDP (Rand million)	R146	R77	R-8.4	R137.6
Direct Employment	503	399	-48	455
Total Employment	611	550	-70	541
Payments to Low-income HH	R58	R6.47	R-0.81	R57.19
Total Payments to HH	R161	R29.43	R-3.62	R158.61

A net direct additional employment of 455 is envisaged in the Vhembe district and an additional R57.19 million paid to low-income households as salaries and wages. It is there for foreseen that the mine will make a very positive contribution to poverty alleviation, not only in the Vhembe district but also in the Limpopo Province.

The overall picture is positive but it must be kept in mind that it is utilising a resource that will eventually not be renewable and certain risks are associated with the economic feasibility. The exchange rate and the export price of coal are the two big uncertainties. The following serves as an indication of the impact of a changing exchange rate.

Coal Price	**Exchange Rate**		
US $ - $55/ton	Dec 2015 – R12.92	Jan 2016 – R16.40	Feb 2016 – R15.94
Rand	Rand 710.60	R902	R876.7
Month on month change		27.2%	-2.8%

The table indicate the impact of the volatility of the exchange rate on a price, ignoring the possible price changes expressed in US dollars.

Although current activities will bear the negative brunt of the mining project, the overall conclusion is that from a macro-economic point of view The Duel Coal Project will be beneficial to the region, province and national economy.

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ACRONYMS

CBA	-	Cost Benefit Analysis
DMR	-	Department of Mineral Resources
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Programme
GDP	-	Gross Domestic Product
HCC	-	Hard Coking Coal
IWUL	-	Integrated Water Use Licence
MEIA	-	Macro-Economic Impact Analyses
MEIM	-	Macro-Economic Impact Model
MRA	-	Mining Right Application
NEMA	-	National Environmental Management Act
NOMR	-	New Order Mining Right
PR	-	Prospecting Right
Ptn	-	Portion
RE	-	Remaining Extent
SAM	-	Social Accounting Matrix

GLOSSARY OF TERMS

Gross Margin of an enterprise is the gross production value less directly allocatable variable cost. It is expressed on a per hectare or livestock unit basis and is a very useful tool for the financial planning of agricultural projects.

Animal Unit (AU): Is a technique to express different sizes of animals in similar equivalents. A live mass of 500 kg is normally accepted as one AU. It is used to calculate the amount of pasture space and animal feed necessary for a group of livestock. An AU is normally defined as one mature cow weighing about 1,000 pounds (450kg) with or without her unweaned calf.

Carrying Capacity: Refers to the grazing potential of pastures or for natural grazing. It is expressed as number of hectares required per AU.

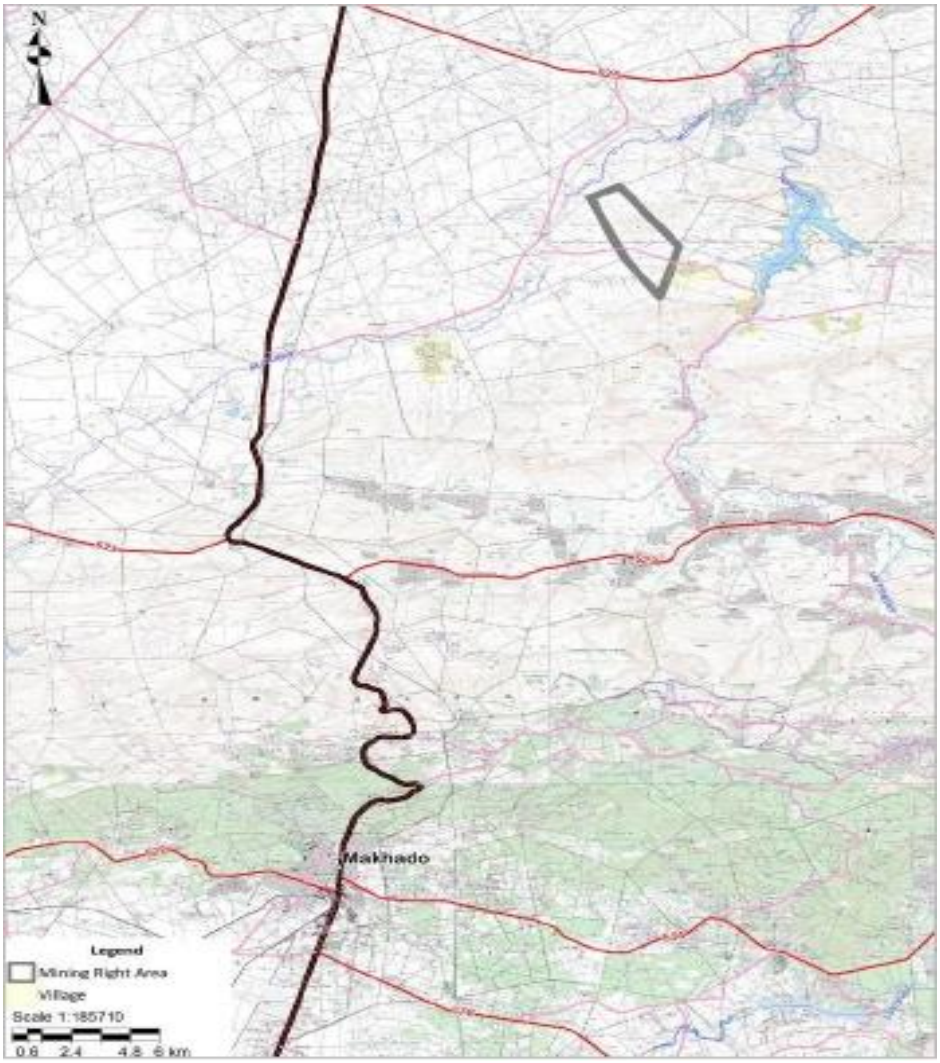
Enterprise Budgets: A system introduced by the Department of Agriculture to compile gross margins for agricultural enterprises.

1 OVERVIEW CURRENT LAND USE AND DEVELOPMENT ALTERNATIVES

1.1 CURRENT LAND USE

The aim of the proposed The Duel Coal Project is to mine coal on the farm The Duel 186 MS (RE) situated in an area containing privately owned game farms with a number of hunting lodges and game viewing facilities for local and overseas hunters. The game farms generally have game fencing and are stocked with a large variety of trophy and other game species.

Figure 1: Geographical Location of the Project



Source: The Duel Coal Project BID Document

The approach and contribution of this economic study to the Environmental Impact Assessment study is to determine the current economic activities and compare the current land use to the proposed mining of coal. In the process the possible impact of the proposed mine on the farm The Duel and surrounding properties will be determined and the economic feasibility of the proposed mine be established.

The N1 main highway to the north passes about 11.5 km to the west of the Mining Right Application (MRA) area. The main railroad from Gauteng to Zimbabwe passes further to the west of the area with a siding (Huntleigh) about 26 km from The Duel. This siding is earmarked by Coal of Africa for

the loading of coal produced by the planned Makhado and Generaal coal mining projects. The Nzhelele Dam and Nzhelele Nature Reserve are located immediately to the east of the MRA area. The Nzhelele River flows along the east and north-east of the MRA area, and there are several irrigated citrus orchards through to Tshipise below the Nzhelele Dam (which is situated roughly 4 km further to the east of the MRA area). The land coverage in the vicinity of The Duel Coal Project area itself is mixed between rural settlement, hunting and eco-tourism. Some of the properties are also focused on mixed farming, with a mixture of livestock, game and irrigated agriculture. Hunting, game trading and eco-tourism is an established socio-economic driver in the area. There are a number of properties utilised for trophy (for local and foreign tourists) and biltong hunting with eco-tourism spin-off activities.

The western border of the farm The Duel 186 MT shares a common border with CoAL's Makhado coal mining project.

Outside and to the east of the proposed mining perimeter, are the village communities of Makushu and Mosholombe and further away to the east the Pfumembe community (on the farm Telema 190 MT). Further to the south is Maangani in the Njelele Poort and to the south west, Mabvuka Jazz, Manyii and Matsa villages to the south of the foothills. The village Fripp is situated to the west. Game farming is the main agricultural activity in the immediate vicinity of the mine with several game and hunting lodges.

With the exclusion of the Nzhelele Dam, surface water is very scarce in the area and underground water is the main source of water for farming purposes. The only relevant water body is the ephemeral Mutamba River flowing west to east through the catchment area on the northern boundary of the proposed mining area and several ephemeral small streams flowing from east to west through the proposed mining site to the Mutamba River.

It is important to note that the proposed The Duel Coal Project site is virtually surrounded by coal mining projects for which Mining Right Applications (MRA) have been submitted to the Department of Mineral Resources (DMR).

In this respect the impact of The Duel Coal Project should be considered along with the total mining impact in the area. The Witbank Coal is nearing depletion and additional sources of coal supply must be identified as the Highveld Coalfield reserves are important to the long-term life of Sasol's Synthetic Fuels and Chemical Industries. The Waterberg Coalfield is a likely replacement of the Witbank Coalfield[1].

The farm The Duel 186 MT, covers an area of approximately 2 075.39 ha and has been subdivided into two portions of which the MRA area is located on the Remaining Extent (RE) of the existing farm and covers approximately 885.19 ha. The surrounding farms are privately owned and stocked with livestock and game, some with lodges for visiting hunters. These properties host, amongst others, Blesbuck, Eland, Oryx, Kudu and Impala. The farms Nakab 184 MT, Stayt 183 MT, Gray 189 MT and Riet 182 MT are included in the submitted NOMR application of Coal of Africa Limited.

Further to the north of the farm The Duel, the irrigation citrus farming area starts and continues along the banks of the Nzhelele River up to and beyond Tshipise. Presently the water from Nzhelele

[1] Jeffrey. L.S., The Characterization of the Coal Resources of South Africa. The Journal of the South African Institute of Mining and Metallurgy, February 2005.

Dam, for domestic and agricultural use, is severely stressed. At Tshipise there is a holiday resort which is dependent on the hot water mineral springs.

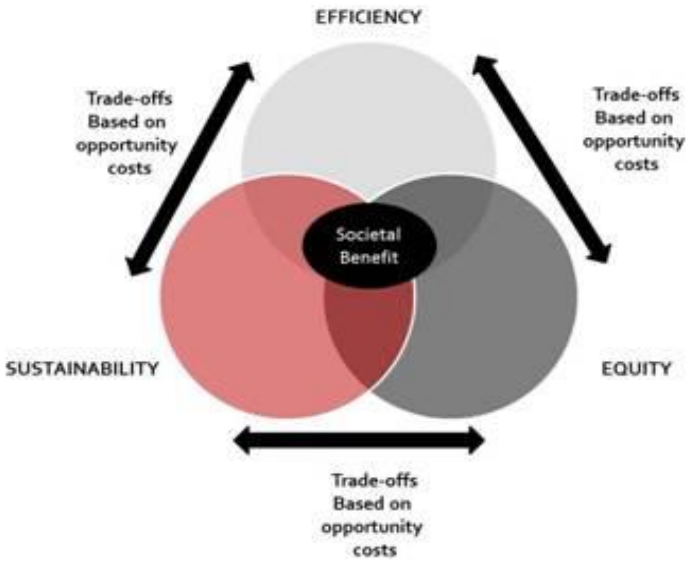
1.2 DEVELOPMENT ALTERNATIVES

The approach was to utilise the collected site specific data to determine the comparative feasibility of the project as an alternative land use and the possible impact on local activities. A micro and macro-economic study is aimed at determining the economic and socio-economic indicators and assist in identifying the best alternative land use option in a resource economic re-evaluation.

The basic function of this specialist study is to determine whether The Duel Coal Project will enhance net societal welfare as it is using a non-renewable resource to stimulate economic growth. At a broad level investigating impacts on overall welfare requires considering the efficiency, equity and sustainability of the project. Keeping these principles in mind, the core concept applied by the economist when considering trade-offs is "opportunity cost" - the net benefit that would have been yielded by the next best alternative. This is the net benefit that would have been yielded by the next best alternative (for example, if farming is the next best alternative for a piece of land, then the foregone benefit associated with it will be the opportunity cost of any other land use). It is vital information if decision makers are to understand the trade-offs involved in projects. A key part of considering opportunity costs is commonly to highlight the impacts of doing nothing i.e. the "no-go alternative" or also referred to as the "economic baseline".

The figure below illustrates how efficiency, equity and sustainability combine to impact on societal welfare and how trade-offs need to be made between these issues, taking cognizance of opportunity costs.

Figure 2: Efficiency, Equity and Sustainability Trade-offs Based on Opportunity Costs



The principle of efficiency raises the issue of whether alternative forms of a project would constitute a more efficient use of resources.

The equity principle requires the consideration of whether the project results in outcomes that can be considered "fair". Investigating the distribution of impacts is required to clearly indicate what is impacted on, in what way and for what period.

Sustainability related issues include a consideration of whether the project is likely to be economically viable over the long term and whether it will be ecologically sustainable. Risks to the long-term success of the project, including factors such as changing interest and exchange rates, become important here.

The economic study, for the Mining Right Application (MRA) area, considers the mining and the transport options together with other associated infrastructure, these include the:

- Evaluation of economic trade-offs between:
  - Agro-extractive (i.e. game/livestock and irrigation agriculture) land use activities;
  - Bio-experience (i.e. accommodation: hunters and eco-tourism accommodation; Conservation/Eco-tourism – Soutpansberg Conservancy) land use activities; and
  - Community use (i.e. rural settlements and communal land use if the land restitution process is successful).
- Assess the influence of the planned development (i.e. resource use restrictions, and especially rights to use and benefit from resources) on the magnitude and adaptability of land use activities and livelihood systems.
- Assess the vulnerability of land use activities to disease emergence.

The key issues that have been considered and addressed by the specialist can be summarized as follows:

- Environmental and social externalities that are not accounted for in financial costs and benefits, but must be addressed in terms of economic costs and benefits.
- The economic sustainability of the project over the medium term.
- Degree of compatibility with economic development planning in the area (i.e. does the project compliment economic and spatial plans).
- Linkage effects that allow a project to generate added benefits in the form or employment, incomes, increased production.
- Macro-economic risks (i.e. whether the project has the potential to impact on exchange rates, balance of payments, interest rates or local factor and product prices).

2 ECONOMIC ASSESSMENT

The focus of the economic impact analysis is micro and macro-economic, stressing linkages between the project and the remainder of the relevant economy. Environmental externalities may affect other economic sectors and are included in the tools of the macro-economic impact assessment. Also, the local, regional and national socio-economic impact is assessed.

2.1 APPROACH

The approach is to establish the economic baseline of the current economic activities and weigh the change in land use of the mining proposal against the current economic baseline. This will include a possible negative impact on the current activities as well as the environment, physical and social.

2.1.1 Current Activities

In determining the economic impact of the proposed The Duel Coal Project, the economic impact on a wider scale, namely; the Limpopo Province and the RSA, is considered together with the possible impact on the current economic activities in and surrounding the proposed mining area.

For some years now a certain land use pattern has developed in the project area, the area has changed from a predominantly beef producing (cattle farming) area in the past to the present game farming with the related activities. The village communities of Makushu, Mosholombe and Pfumembe on the farm Telema 190 MT are located within a 5 km radius of The Duel Coal Project. The village of Makushu borders the proposed mining area and will be affected by the mining activities.

A baseline for the current economic activities in and adjacent to The Duel Coal Project area was established and an estimation of the potential impact of the proposed development. Issues investigated and reported on, include:

- Possible impacts on local population including the quality of life;
- Impacts on the natural environment and associated costs including the cost of possible mitigation measures;
- Potential impacts on the local municipality, the Limpopo Province and South Africa as an entity; and
- The economic sustainability of the project taking into consideration the associated economic risks.

The Economic Impact Assessment was performed as follows:

- The possible impact on current economic activities, the population and the environment, by first establishing a baseline of current activities to eventually determine possible deviations from the baseline. This is performed in current monetary units and converted to economic parameters like Gross Domestic Product (GDP) and socio-economic parameters Employment and Payments to Households. The nature and magnitude of the possible economic impacts on the impacted agricultural sector (including game farming and the associated activities) emanating from the proposed The Duel Coal Project is determined. As such a comparison of the impacts (probably negative) that the project will have on the agricultural sector will be weighed against the positive economic development that the project will bring to the region, as is essential in projects of this nature.

- The determination of whether the project is economically viable. It is necessary to determine whether the benefits associated with the project actually outweigh the possible costs/negative impacts. This determination will include the impact on the environment as well as on the social quality of life.
- If the project is found to be economically viable, the positive macro-economic parameters are then estimated.

2.1.2 Proposed Mining Activities – The Due Coal Projectl[2]

Subiflex (Pty) Ltd holds a Prospecting Right on the farms Lotsieus 176 MT, Kranspoort 180 MT, Nairobi 181 MT and The Duel 186MT and is proposing to develop an underground and opencast coal mine on the Remaining Extent (RE) of The Duel 186 MT only. This mine development is located 54 km north of Louis Trichardt) in the Makhado Local Municipal area, Ward 21 in the Vhembe District.

The proposed The Duel Coal Project will be a combination of opencast and underground mining and has a potential Life-of-Mine (LOM) of 24 years. The envisaged mining method for the opencast area is a conventional drill and blast operation with truck and shovel, load and haul with drilling and blasting performed on 10 m and 15 m high benches. The underground development starts in year 9 and production the year thereafter in year 10, an average production rate of 1.2 Mtpa can be maintained for years 10 to 13 with a ramp down in year 14. Access will be from selected positions in the open pit and the coal will be mined through the long-wall methodology. After underground activities have been completed, the access to the underground areas will be closed followed by the final rehabilitation of the open pit.

Open Pit. At this stage of the project, a standard drill, blast, truck shovel operation is considered - the lowest operating risk mining method, in terms of both cost and productivity. As such, the diesel-powered heavy duty truck and shovel operation has been selected as the base case for this study. The loading conditions are expected to correspond closely to a large scale open pit site; a maximum pit depth of 270 m is envisaged.

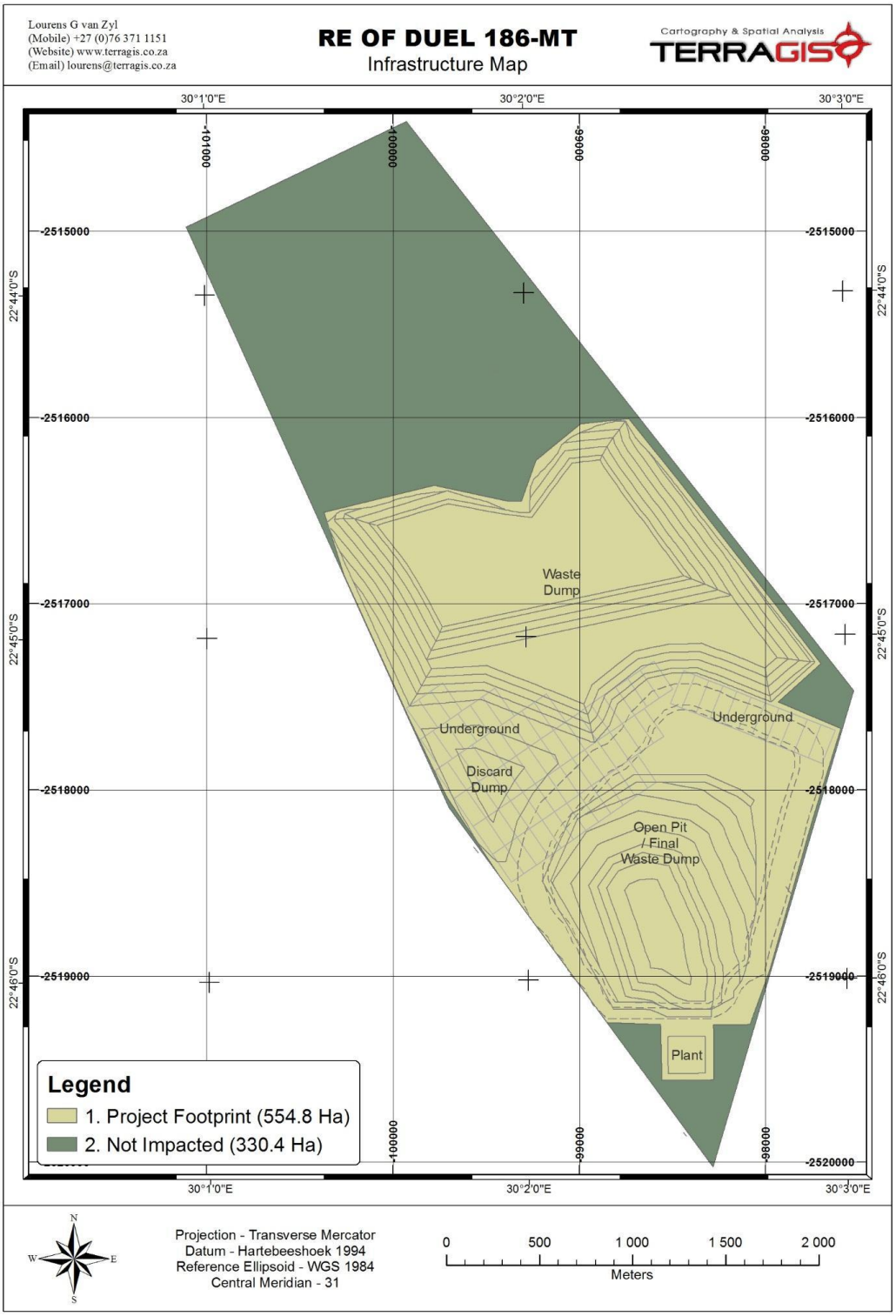
Underground. The inclusion of underground mining is a beneficial addition to the open pit operation. The transition from open pit to underground mining coupled with the motivation to extend the operational life of mine is most relevant. Two underground mining methods, the High wall mining and Longwall mining methods are considered.

The schedule runs over a period of approximately 24 years at a ROM production rate of 2.4 Mtpa for the first 14 years after which an increase of ROM to 3.6 Mtpa can be sustained by the remaining amount of waste stripping required.

The addition of the underground production during years 10 to 14 proves to be very beneficial to the project as a whole; the secondary product is almost doubled during the period of underground production. The timing of the underground inclusion is a synergistic approach in that at the addition of the 1.2 Mtpa from the underground in year 10 allows for the waste stripping to continue enabling the open pit to produce 3.6 Mtpa of ROM from year 15 onwards when the underground operation ramps down, and this without the need for additional waste stripping to sustain the production towards the end of LOM.

[2] Source: Signet Coking Coal (Pty) Ltd - Scoping Study: The Duel Project. April 2015.

Figure 3: Mining Right and Infrastructure Area



The proposed infrastructure to be developed includes:

- Coal Handling Processing Plant;
- Overburden Waste Dump;
- Temporary Discard Dump;
- Haul roads;

- Pollution Control Dams;
- Raw water storage facility and distribution systems;
- Access road; and
- Auxiliary infrastructure including a workshop and store, office and change house, electrical power supply and security fencing.

The washed coal will be transported via road to a nearby siding. The final discard material from the plant will be disposed of in the mined-out open pit. In the event that the pit is unavailable due to existing mining activities, the discard material will be placed on an interim surface discard dump, from where it will be reclaimed and dumped into the mined-out open pit towards the end of the mine life as part of the rehabilitation of the mining site.

The demand for thermal coal in the future will largely depend on the extent of global reliance on coal for electricity production, while the demand for coking coal will depend on the growth in steel production. Coal demand is expected to increase significantly, especially on the back of increases in power and industrial production.

2.1.3 Bulk Water Provision

The water requirement estimate for The Duel Coal Project indicates that a maximum of 1 182 m^3/day of water is required at the mining peak estimated using 120 l/ROM tonnes.

Fire, wash-down and dust suppression reticulation systems will be provided around the CHPP. The source of water for this system will come from the site CHPP raw water dam.

2.1.4 Electricity Supply

The Duel Coal Project will draw electricity from the local electricity supply grid. The project requires an estimated electrical supply capability of 5 MVA. An Eskom connection can only be established once the Nzhelele/Bokmakirie 400/132 kV Main transmission station has been commissioned - this is planned for 2017/18.

2.1.5 Closure Planning and Rehabilitation

After underground activities have been completed, the access to the underground areas will be closed followed by the final rehabilitation of the open pit. The objective is to rehabilitate the open pit, the remaining surface stockpiles and other disturbed areas to a post-mining grazing capability class. Mechanisms to ameliorate the social and economic impact on individuals, regions and economies, where retrenchment or closure of the operation is certain, are set out in the Rehabilitation Plan and Social and Labour Plan dated March 2015 of Subiflex (Pty) Ltd.

The rehabilitation cost estimate is R 0.235 per tonne mined.

2.2 SOCIAL AND LABOUR PLAN

Subiflex is committed to optimize opportunities in the local communities through the implementation of the Social and Labour Plan (SLP). The SLP implementation will commence once a decision has been made by the Department of Mineral Resources on the granting of the Mining Right.

2.2.1 Employment Creation

The Duel Coal Coal Project will create 346 permanent employment opportunities at commencement, ramping up to 503 employment opportunities in year 6 when underground mining will commence. Subiflex has set a target to ensure that at least half of these opportunities are allocated to the local communities.

2.2.2 Workforce Development

As part of the SLP, Subiflex plans to implement a comprehensive workforce development plan through adult basic education and training, core business training, artisan training, learnerships, bursaries and internship programmes. These will be supported by career-path planning and mentorship. Subiflex has committed these programmes over the first 5 years of mining with a total value of R 8.675 million:

- Core business and Artisan Training – creating an opportunity for candidates to complete various training courses in Machine Operation, Truck Driving, Health and Safety, Human Resources, Mechanics, Electricians, Fitting and Turning.
- To make available learnership opportunities in Engineering, Artisans, Machine Operation.
- To establish career-path plans for those candidates showing promise to fast track their development and facilitate promotions.
- To make available bursaries in Mining, Mechanical & Electrical Engineering, Financial, Human Resources and Geology study areas.
- To make available internship opportunities in Mechanical & Electrical Technicians, Health and Safety and Financial positions.

2.2.3 Community Development

To further support local communities, Subiflex is proposing Community Development Projects focused on Education and Small business development. Subiflex proposes the implementation of the following projects over the first 5 years of mining with a total value of R 2.93 million:

- Infrastructure Project(s), as identified by the directly affected communities.
- School Needs Project in the schools located in the directly affected communities. The project will focus on key needs in each school, which will be identified in consultation with the school management.
- Enterprise Development Project amongst local business people focusing on the establishment, training and mentoring of local companies in personnel transport, security and catering.

2.3 METHODOLOGY

The methodology for the study includes two actions, namely; data collection and the application of econometric models (local impacts, a Cost Benefit Analysis [CBA] and a Macro-economic Impact Analysis [MEIA]).

A macro-economic and micro-economic modelling approach will be used in the calculation of the different parameters to test the impact of the mine and determine the economic sustainability.

In the calculation of the baseline of the current economic activities in the area, use was made of multipliers synthesized from the Limpopo Provincial Social Accounting Matrices (SAM).

The economic sustainability was determined by the construction of a detailed economic CBA.

The macro-economic impact of the project on the Limpopo Province and South Africa was calculated using an econometric model based on the Limpopo SAM.

Three economic evaluation methodologies have been applied to contribute to the final decision on the mining application.

- Possible impact on local economic activities. A macro-economic approach was used to determine the magnitude of the present economic activities and the possible impact of the planned mining activities.
- Economic Viability. A CBA approach to determine medium to long term economic viability compared to current land use.
- A SAM based econometric model approach to estimate the macro-economic impact on the National Economy and the Limpopo Provincial Economy.

2.3.1 Data Collection

The area subjected to and immediately adjacent to the mining development in The Duel Coal Project area that might be directly impacted upon was visited, some of the land owners contacted and the information obtained channelled back by the different specialist teams.

Current data was sourced from the internet and contact made with a game enterprise in the area. The following sources were tapped:

- Game Sales Auction Prices 2015: Vleissentraal Game.
- Biltong Hunting Prices: Garamtata Safaris - Makhado, Vhembe Region.
- Trophy Hunting for Foreign Hunters Prices 2015: Greater Kuduland Safaris.
- Trophy Hunting for Local Hunters Prices 2015: Kudu Adventure Safaris.
- Taxidermy Costs for Trophies 2015: Taxidermy Africa.

Additional information gathering of any other areas and/or activities impacted upon by The Duel Coal Project was collected by means of secondary collection methods. The interaction with Subiflex (Pty) Limited was maintained and the necessary capital and operational income and expenditure (business plan) data for the mining operation on a time-line, together with the Social and Labour Plan, was received. The data from the mining authorities was required for the economic study.

An analysis was done of some of the several studies made in the recent past on development projects that are anticipated in the area. An analysis was done of published and unpublished secondary information in the possession of Mosaka Economic Consultants cc or other organizations.

2.3.2 Situational Analysis

A standard economic analysis, which consists of a local, provincial and national macro-economic impact analysis and an economic cost benefit analysis, was done. The macro-economic impact of the project on the area adjacent to the proposed project, the Local Municipality and the Limpopo Province as well as the national economy was determined. Various stakeholders in the Makhado and Musina Local Municipalities have raised concerns regarding the sustainability of mining project

developments *versus* agricultural and other developments in the area. It is therefore required that the long-term sustainable impact be measured in terms of two alternative land use options:

- The Duel Coal Project is not developed – the "no-go" option. Therefore current activities continue over the next number of years without optimization or expansion.
- The project is developed, the life of the project for a number of years, closure of the mine and land rehabilitated with land which cannot necessarily be utilized at the same level for agricultural purposes. The impact pre-, during and post-mining on the economy *versus* the other alternatives.

The impact on the economy, before, during and after the mine's establishment, is calculated *versus* the non-mining alternative. Focus is primarily on the properties directly affected, but also to a decreasing degree on neighbouring properties, due to possible negative environmental impacts, such as air and ground water pollution, noise and visual impacts. The impact of the project on the agricultural sector was calculated to determine whether it might decrease agricultural production.

The analysis was done in three demarcated areas, namely:

- Area 1: The farm The Duel 186 MT itself;
- Area 2: The farms located within a radius of 5 km surrounding The Duel, excluding Area 1;
- Area 3: The farms located within a radius of 10 km surrounding The Duel and excluding the Areas 1 and 2.

The cumulative impact of the mining activities in the immediate surrounding area where coal mining rights have been applied for and submitted to the Department of Mineral Resources, will also be reported on.

The present level of economic activities in the area was determined to serve as a baseline from where the possible deviations of the different impacts was calculated using a detailed Risk Model. The detail of the Risk Assessment Methodology is discussed in paragraph 2.2.5. The values allocated by the specialist reports have been converted in the Risk Model to monetary values, which are then expressed in terms of impacts on the Gross Domestic Product (GDP), employment and payments to households.

It is furthermore important to note that not all the impacts on the surrounding area can be attributed to The Duel Coal Project as there are other similar developments in the area. It will, therefore, be necessary to make an apportionment of certain of the impacts on the agriculture to get a clear picture, as The Duel Coal Project developments in the study area cannot be held responsible for all the cumulative impacts of the other developments in the region. However, the cumulative effects of existing developments have been taken into consideration in the formulation of the final conclusion.

2.3.3 Economic Viability (Micro Analysis)

A Cost-Benefit Analysis (CBA) forms part of the macro-economic impact analysis and focuses on the positive and negative economic impacts in order to put all direct and secondary impacts of the project into perspective for effective decision making purposes.

The theoretical foundations of a CBA are; benefits are defined as increases in human wellbeing (utility) and costs are defined as reduction in human wellbeing. For a project or policy to qualify on cost-benefit grounds, its social benefits must exceed its social costs. "Society" is simply the sum of

individuals. The geographical boundary for a CBA is usually the nation, but can be readily extended to wider limits. See Section 8 Appendix A for more detail about the theoretical context of a CBA.

To determine the economic viability of the proposed project an economic CBA was done in accordance with the Water Research Commission's publication "A Manual for Cost Benefit Analysis in South Africa with specific Reference to Water Resource Development" Third Edition. In short, the CBA can be described as a system whereby the costs and benefits of a specific development project are compared in order to evaluate the financial and economic viability of the project. The CBA method provides a logical framework by means of which development programmes can be evaluated and serves as an aid in the decision-making process.

The CBA will accommodate all the possible negative impacts on local economic activities, impacts on the environment and, if applicable, rehabilitation[3].

2.3.4 Macro-Economic Impact Analysis

The objective of this part of the study is to determine the economic and socio-economic impacts of both the construction and operation of the coal mining processes to be conducted. The study reflects the total direct and indirect macro-economic impacts in quantified terms for the investment that will be generated through the inputs from all of the economic entities that are required to supply goods and services to the construction and operational segments of the project. In addition, quantification is made of the induced effects that the infrastructural investments will have on economic entities such as households, in terms of their income and expenditure activities.

According to the general economic equilibrium analysis, the impacts of the project's developments can only be evaluated meaningfully if such impacts are assessed against the background of its total effect (direct and indirect) on certain economic objectives. The updated and benchmarked 2006 Limpopo Provincial SAM tables were used as a modelling input to quantify the relevant economic impacts. Thus, both the investment and operational activities of the project were analysed in terms of its impacts.

The macro-economic impact analysis can be regarded as an extension of the more narrowly defined financial cost-benefit analysis, at the macro level and not at the project level, demonstrating the efficiency of utilising scarce capital and other economic resources. The macro-economic analysis is therefore used in conjunction with the micro project CBA to provide an indication of the project's use of scarce resources relative to the main economic objectives contained in the economic development plan.

The economic and socio-economic aggregates covered in the study are the following:

- Employment levels (jobs).
- Value added to the economy (or gross Limpopo Province product).
- Aggregate wages and salaries.
- Fiscal impacts.

Each of these measures reflects a particular dimension of improvement or impact in the economic well-being of the area's households.

[3] See Appendix A for more detail on the theoretical context of a CBA.

There are different types of impacts that occur over time. In the initial construction phase, labour and materials will be used. After completion, on-going employment and other long-term impacts will result, as set out below.

- Total Employment Levels, reflecting the number of additional employment opportunities created by economic growth. This is the most popular measure of economic impact because it is easy to comprehend. However, employment opportunity counts do not necessarily reflect the quality/nature of the employment opportunities, nor salary levels. Therefore levels of employment, i.e. skilled/unskilled are also assessed where necessary.
- Value Added, which is normally equivalent to Gross Domestic Product or Gross Regional Product, and a broader measure of the full income effect.
- Aggregate Wages and Salaries in the area increase as pay levels rise and/or additional employees are hired. Either or both of these conditions can occur as a result of growth in business revenues. As long as nearly all of those affected employees live in the study area, this is a reasonable measure of the personal income benefit impact of a project.

It is also important to note that economic impacts also lead to financial impacts, which are changes in government revenues and expenditures. Economic impacts on total business sales, wealth creation or personal income, can affect municipal and other government revenues by expanding or contracting the tax base. Impacts on employment and associated population levels can affect municipal and other government expenditures by changing demand for public services.

This on-going process of macro-economic impact analysis focuses on aspects stressing linkages between the project and the surrounding economy. Environmental externalities may affect other economic sectors and are, therefore, included in the techniques of macro-economic impact assessment. This is necessary to assist in determining whether the project will enhance net societal welfare.

This necessitates the analysis of impacts on different sectors or groups that make up society. At a broad level, investigating impacts on overall economic welfare requires considering the efficiency, equity and sustainability of the project. It is important that all three of these aspects are considered in order to provide adequate information to decision makers:

- The principle of efficiency raises the issue of whether the nature and form of the project would constitute the efficient use of resources.
- The equity principle requires the consideration of whether the project results in outcomes that can be considered fair/equitable in socio-economic terms. Investigating the distribution of impacts is required to clearly indicate who is impacted upon, in what way and for what period.
- Sustainability relates to the consideration of whether the project is likely to be economically viable over the medium to long term and whether it will be economically sustainable. Risks to the long-term success of the project, including factors such as changing interest and exchange rates, therefore, become important aspects for assessment.

A partial general macro-economic equilibrium model based on the Social Accounting Matrix (SAM) of the Limpopo Province is used to determine the nature and magnitude of the macro-economic impacts that emanate from the project in terms of its impacts on larger macro-economic aggregates such as:

- Impact on Gross Domestic Product (GDP).
- Capital utilization.
- Employment impact.
- Impact on all households.
- Fiscal Impacts from tax revenues and royalties. Balance of Payment Impacts as a result of imports and exports.
- Infrastructure development.
- Efficiency Criteria for Capital and Labour.
- Income generation for sub-contractors in Limpopo.

The economic impacts associated with the project consist of a construction and a production (operational) phase. For purposes of this assessment, both phases have been measured and it is envisaged that the macro-economic; direct, indirect and induced emanating from the primary project as well as all the externalities will be addressed.

The construction and application of a SAM is discussed in Appendix B.

2.3.5 Risk Assessment Methodology

Risk is a combination of the probability or the frequency of an occurrence or of a hazard and the magnitude of the consequence of the occurrence (Nel 2002). Risk estimation is concerned with the outcome, or consequences of an intention, taking account of the probability of occurrence and can be expressed as P (probability) x S (severity) = RE (Risk Evaluation). Risk evaluation is concerned with determining significance of the estimated risks and also includes the element of risk perception. Risk assessment combines risk estimation and risk evaluation (Nel 2002).

In developing a possible impact scenario for the construction and operation on the local economic activities, it was necessary to differentiate the activities and to again estimate it within the three identified sub-areas as the possible impacts differ for the three areas.

A risk profile was developed for each of the areas making provision for a weight allocated to a specific intrusion caused by the mining activity. A percentage impact is then allocated to each economic activity, which is then multiplied with the weight; the answer is converted to a percentage impact. The percentage impact is then applied to the estimated annual turnover to arrive at the negative impact to be caused by the mining activity.

Mathematically the process can be explained as follows:

[Mining weights] x [Estimated Percentage Impact] = [Impact] ►converted to monetary values.

The weights allocated to the different identified infringements in respect of The Duel Coal Project farming areas are shown in the table below. For each of the three areas a separate model was developed.

The risk assessment methodology that was used during the EIA Phase to estimate the risk and determine the impact significance is tabled below.

Table 1: Risk Assessment Detail as Applied in the Macro-Economic Impact Analysis

DURATION		
Short term	12 months	1
Construction	12 months	2
Life of project	24 years	3
Post rehabilitation	Time for re-establishment of natural systems	4
Residual	Beyond the project life	5
EXTENT		
Site specific	Site of the proposed development	1
Local	Farm and surrounding farms	2
District	Makushu, Mosholombe and surrounding townships	3
Regional	Musina and Makhado Local Municipalities	4
Provincial	Limpopo Province	5
National	Republic of South Africa	6
International	Beyond RSA borders	7
PROBABILITY		
Almost Certain	100% probability of occurrence – is expected to occur	5
Likely	99% - 60% probability of occurrence – will probably occur in most circumstances	4
Possible	59% - 16% chance of occurrence – might occur at some time	3
Unlikely	15% - 6% probability of occurrence – could occur at some time	2
Rare	<5% probability of occurrence – may occur in exceptional circumstances	1
SEVERITY		
Catastrophic (critical)	Total change in area of direct impact, relocation not an option, death, toxic release off-site with detrimental effects, huge financial loss	5
Major (High)	> 50% change in area of direct impact, relocation required and possible, extensive injuries, long term loss in capabilities, off-site release with no detrimental effects, major financial implications	4
Moderate (medium)	20 – 49% change, medium term loss in capabilities, rehabilitation / restoration / treatment required, on-site release with outside assistance, high financial impact	3
Minor	10 – 19% change, short term impact that can be absorbed, on-site release, immediate contained, medium financial implications	2
Insignificant (low)	< 10 % change in the area of impact, low financial implications, localised impact, a small percentage of population	1

RISK ESTIMATION (Nel 2002)

	SEVERITY				
PROBABILITY	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Critical (5)
Almost certain (5)	H	H	**E**	**E**	**E**
Likely (4)	M	H	H	**E**	**E**
Possible (3)	L	M	H	**E**	**E**
Unlikely (2)	L	L	M	H	**E**
Rare (1)	L	L	M	H	H

E	Extreme risk – immediate action required, detail considerations required in planning by specialists – alternatives to be considered	4
H	High risk – specific management plans required by specialists in planning process to determine if risk can be reduced by design and management and auditing plans in	3

	planning process, taking into consideration capacity, capabilities and desirability – if cannot, alternatives to be considered, senior management responsibility	
M	Moderate risk – management and monitoring plans required with responsibilities outlined for implementation, middle management responsibility	2
L	Low risk – management as part of routine requirements	1

IMPACT SIGNIFICANCE	
Negligible	The impact is non-existent or insubstantial, is of no or little importance to any stakeholder and can be ignored.
Low	The impact is limited in extent, even if the intensity is major; whatever its probability of occurrence, the impact will not have a significant impact considered in relation to the bigger picture; no major material effect on decisions and is unlikely to require management intervention bearing significant costs.
Moderate	The impact is significant to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
High	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in project decision-making.
Very high	Usually applies to potential benefits arising from projects.

3 CURRENT ECONOMIC ACTIVITIES

In the following sections the approach and methodology is explained as well as the basic data used in the calculations.

In this section the baseline activities are identified and converted to macro-economic parameters, in a later section a risk profile is established for all three the identified areas, the risk is then converted to macro-economic parameters and presented as such.

3.1 APPROACH

A MEIM is used, based on the Limpopo SAM which has been converted to an econometric model to be used in the project area. The MEIM was adapted to accommodate each of the identified project areas and was then populated with the baseline data.

The magnitude of the current activities in the project area has been calculated according to the methods as explained. In the following sections the current economic activities are expressed in terms of the following economic and socio-economic parameters as provided by the Macro-Economic Model:

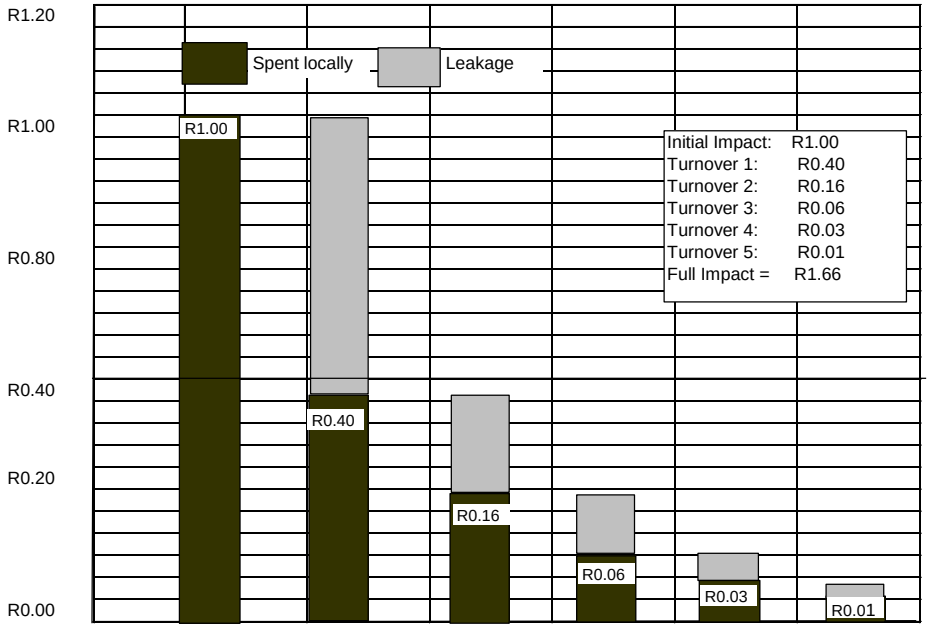
- Economic Parameters
  - Gross Domestic Product (GDP) – Direct and Indirect/Induced Impacts;
  - Capital Utilisation;
- Socio-economic parameters
  - Employment – Direct and Indirect/Induced Impacts;
  - Payments to Households – Low Income and Medium/High Income.

The possible impacts of the proposed coal mine on the current economic activities was estimated and converted to the macro-economic parameters to show the impacts.

The Limpopo SAM was used to synthesise appropriate multipliers to be used in the MEIM to calculate the macro-economic impact of the different activities.

All economic models incorporate a number of “multipliers” which form the nucleus of the modelling system. The nature and extent of the impact of a change in a specific economic quantity, e.g. exports, on that of another economic quantity or quantities, e.g. production output or employment, is determined by a “multiplier”. A multiplier summarises the total impact that can be expected from a change in a given economic activity. For illustrative purposes the figure below shows the multiplier concept used in assessing the change in economic activity.

Table 2: Multipliers and Turnover



In this example, R1 is received into the local economy of the area from sales beyond the local borders. Of this, 40 cents is spent for goods and services within the region. The economic sectors and individuals who receive the 40 cents spend 16 cents within the local area. Of the 16 cents, only six cents is spent locally, and so on. The total amount of money received by local firms and residents as a result of the initial R1 in added exported earnings is R1.66. Therefore, the multiplier is R1.66.

The change in economic activity resulting from the change in one factor of production, such as water resources, is measured by different multipliers. Four multipliers are commonly used to assess the impacts of an initial increase in production resulting from an increase in sales, usually called final demand in multiplier analysis. The four multipliers are: (1) output, (2) employment; (3) income; and (4) value added.

Sectorial multipliers are calculated using information contained in the applicable Provincial SAM and the National SAM as well as data obtained from the South African Reserve Bank and Statistics South Africa. These inverse matrices capture all the direct and indirect relationships among the inputs and outputs of the various entities included in the applicable provincial SAM.

Direct GDP, labour and capital multipliers for each sector are calculated using the following formula:

$$\text{GDP multiplier} = \frac{\text{Value Added}}{\text{Production}}$$

$$\text{Labour multiplier} = \frac{\text{Employment}}{\text{Production}}$$

$$\text{Capital multiplier} = \frac{\text{Capital stock}}{\text{Production}}$$

These multipliers were incorporated into the MEIM and used to calculate the macro-economic impacts. By using a SAM for the applicable region, the above multipliers can be calculated. The multipliers that were used in this study to determine the economic impacts are as follows:

- Economic growth, i.e. the impact on GDP.
- Employment creation, i.e. the impact on labour requirements.
- Income distribution, i.e. the impact on low income, poor households and total households.

A breakdown of the different effects of the agricultural sector multipliers used in this study is as follows:

- Direct Impacts: the effects occurring directly in the agriculture sector:
- Indirect Impacts: those effects occurring in the different economic sectors that link backwards to agriculture due to the supply of intermediate inputs, e.g., fertilisers, seeds, hunting professional services, transport, etc.
- Induced Impacts: the chain reaction triggered by the salaries and profits (less retained earnings) that are ploughed back into the economy in the form of private consumption expenditure.
- Total Impacts: Represents the direct, indirect and induced summed effect.

3.2 DATA

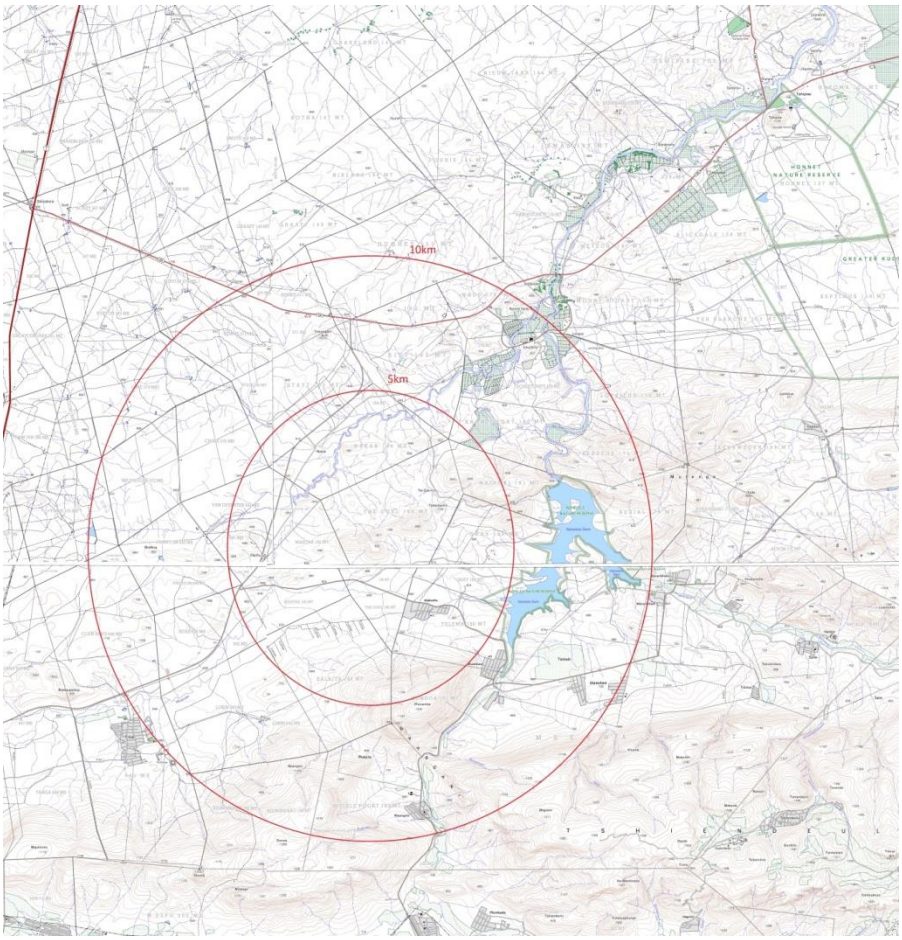
3.2.1 Area Sub-Division

The study area was divided in three sub-areas (see map below) to be used in the calculations, namely:

- Area 1: The area covered by the farm The Duel includes the proposed The Duel Coal Project development that may be impacted upon by the mining activities. This area includes the so-called "Resource Area and Infrastructure Footprint". The land is privately owned and stocked with game and hunting is reserved for invited guests. The farm The Duel comprises approximately 2 076 ha with the Remaining Portion (RE) approximately 888.5 ha; however, the actual mining footprint area is restricted to 554.8 ha.
- Area 2: The area within a 5 km radius of Area 1 in which the farms Nakab 184 MT, Nairobi 181 MT, Gray 189 MT, Telema 190 MT (with the village communities of Makushu, Mosholombe and Pfumembe), Kondoa 191 MT, Salaita 188 MT, Martha 185 MT and Van Deventer 641 MS are either fully or partially located. These farms may be impacted upon to a lesser extent than the so-called "Resource Area and Infrastructure Footprint" area. The main agricultural activities are game farming; the farms are stocked with game used either for visiting hunters or concession hunting. This area comprises approximately 8 386 ha. Use was made of secondary data to calculate the economic impact of the proposed project.
- Area 3: The area within a 10 km radius of The Duel Coal Project development which excludes Areas 1 and 2. The farms Stayt 183 MT, Bennie 571 MT, Riet 182 MT, Hughes 151 MT, Naus 178 MT, Schuitdrift 179 MT, Kranspoort 180 MT, Lotieus 176 MT, Persues 175 MT, Aerial 174 MT, Tribal Land, Tshitadi (with the village of Musekwa), Njelele Poort 193 MT (with the village of Maangani), Boas 642 MS, Lukin 643 MS, Kilimanjaro 192 MT, Coen Britz 646 MS, Phantom 640 MS, Fanie 578 MS, Wildgoose 577 MS and Chase 576 MS are either fully or

partially located in this area. The area comprises of approximately 28 064 ha. Also these farms are stocked with game for visiting hunters or concession hunting. Accommodation for hunters is available on some of the farms. Citrus farming is practised on the farms Kranspoort 180 MT, Lotieus 176 MT, Schuitdrift 179 MT, Perseus 175 MT and Mount Stuart 153 MT. Although a small area of citrus orchards on the farm Kranspoort falls within Area 2, these orchards have been included as part of Area 3. The citrus and vegetable cultivation in Area 3 also extends outside and to the north of the 10 km radius area to include the orchards on the farms Lotieus, Persues and Mount Stuart. The vegetable farming at Mount Stuart is also included. The rationale being that any impact on citrus or vegetables will extend beyond the artificial 10 km radius boundary.

Figure 4: Division of Study Area



The accumulated impact on the wider Soutpansberg area, due to other mining right applications already submitted for coal mining in the area, is also included in the study.

The motivation for the different areas are to determine different risk profiles, in terms of the distance from the mining activities in terms of noise, dust, crime and sense of place, for the current economic activities taking place.

The economic activities taking place in each area were identified and quantified applying accepted methodologies and then converted to economic and socio-economic parameters.

A risk profile per area was developed and a possible impact on current economic activities developed should the mine be developed.

3.2.2 Current Activities

The Duel Coal Project and surrounding area is known to be water scarce therefore livelihoods in the project area largely rely on water sources to be able to sustain their socio-economic activities. Surface and groundwater is captured in dams for utilization on the various properties. In collaboration with the surface and groundwater specialists the water resources utilized and the purpose have been determined to evaluate the secondary socio-economic dependencies on water use in and adjacent to the area.

Land use within The Duel Coal Project and surrounding area is predominantly hunting and game farming. Game farms within this area offer activities such as trophy and biltong hunting. Natural grazing within this area is used for game ranching. Irrigation farming is concentrated in the northern part of the area along the banks of the Nhzelele and Mutamba Rivers. A number of rural villages are present within the study area.

3.2.2.1 *Game Farming*

The land use in the area is predominantly game ranching. Some of the game farms accommodate game lodges. Beef farming has over time been overtaken by game as the major land use activity and is presently less than 10%. Game farming supports the value added components of eco-tourism and also stimulates the hunting industry.

3.2.2.2 *Irrigation*

Irrigation agriculture (mainly citrus) is practiced along the banks of the Nhzelele and Mutamba Rivers. The farms Schuitdrift 179 MT and Mount Stuart 153 MT have intensive irrigated agricultural activities focused along the river. On the Mount Stuart farms vegetables are also cultivated. Most of the irrigation water is supplied by means of water canals from the Nhzelele Dam. The irrigation agricultural area is utilised for predominantly export citrus production. A number of packing houses for citrus are present in the Mount Stuart section area.

The fear amongst citrus farmers is the possible loss of their Phytosanitary “Phyto” Registration and Good Agriculture Practise (GAP) accreditation due to mining dust, water contamination and possible re-allocation of water from the Nzhelele Dam. The citrus industry is in a very problematic situation as the European Union, from time to time, considers stopping the importation of citrus from South Africa because of the so-called “black spot” disease.

3.2.2.3 *Communities*

Traditional communities with modern and traditional structures are in place with some cattle and goat farming activities practiced with free range chickens. Because of the very low rainfall and a shortage of water very little garden and crop production takes place. The unemployment rate in the Makhado Ward 37, which includes the Makushu communities, is high.

In the communities crop farming is limited to small vegetable gardens within residential yards, this is mostly due to soil conditions in the area. Livestock farming is limited to grazing land on the property

Telema 190 MT which is utilised as communal grazing. All three the communities (Makushu, Mosholombe and Pfumembe) utilise portions of this property for grazing[4].

3.2.2.4 *Water*

Water within the surrounding area of The Duel Coal Project is scarce due to the dry climate. Water scarcity impacts greatly on agriculture and therefore the type of land use. On farms where cultivation of crops occurs, farmers rely on water from the Nzhelele Government Water Scheme and the abstraction of groundwater, therefore a number of boreholes are found throughout the study area. Groundwater for crop cultivation is mainly used for a back-up in emergency situations. A dominant form of land use within the area is game farming where farmers also rely on groundwater for their animals. Farms situated in close proximity to the confluence of the Nzhelele and Mutamba Rivers utilise this surface water supply for irrigation of their crops. Greater evidence of cultivated land is therefore present around the Nzhelele and Mutamba Rivers than on other portions of the study area.

3.3 MACRO-ECONOMIC IMPACT ANALYSIS (MEIA) MODELLING

3.3.1 Overview

In consideration of the specialist studies, specifically noise and blasting that have the most potential to affect households, a determination was made for this study that households within a 500 m radius would need to be resettled[5].

For analytical purposes, as mentioned, the farming activities in the project area were divided into three areas namely; the farm The Duel (which includes the MRA area) referred to as Area 1, the land in a 5 km radius around the farm The Duel referred to as Area 2 and the land in a 10 km radius of The Duel referred to as Area 3. The activities were grouped as follows:

- Area 1: The following farming practices were included in this group:
  - Game; and
  - Game lodges.
- Area 2: The following farming practices were included in this group:
  - Game; and
  - Game lodges.
  - Livestock – mostly cattle.
- Area 3: The following farming practices were included in this group:
  - Game;
  - Irrigation farming (predominantly citrus);
  - Game lodges.
  - Liver stock – mostly cattle

[4] The Duel Mining Right Application: Social Impact Assessment Report – January 2016.
[5] The Duel Mining Right Application: Social Impact Assessment Report – January 2016.

Table 3: Estimated Present Land Use in the Project Area[6]

Land Use	Area 1		Area 2		Area 3		Total	
	Percentage	Hectares	Percentage	Hectares	Percentage	Hectares	Percentage	Hectares
Irrigation	0.00%	0	0%	0	0.78%	214	0.51%	214
Game	100%	889	85.00%	8 137	74.22%	20 376	86.19%	29 402
Cattle	0%		15.00%	1 436	25.00%	6 864	13.30%	8 300
Total	**100.00%**	**889**	**100.00%**	**9 573**	**100.00%**	**27 454**	**100.00%**	**37 916**

The dominating land use activity in the areas is game farming representing approximately 86.2% of the total area, with the balance representing cattle and irrigation farming. A number of years ago beef farming was dominant but has now been replaced by game farming.

3.3.2 Game Numbers and Species per Farming Unit

As both the cattle and game numbers, together with the game species for every farm in the study area could not be determined, the cattle and game numbers together with the species present were projected in accordance with the neighbouring farms of which the data and also the land size was available.

The accepted grazing norm for the area together with the "Animal Unit" (AU) namely 12 ha/AU were used to estimate cattle and game numbers, which were then converted to animal numbers.

3.3.3 Allocation of Game Sold to Trophy Hunters and Biltong Hunters or Caught for Auction

The assumption was made that all game farms are fully stocked to carrying capacity. In order to determine the percentage of game sold to trophy hunters and biltong hunters or caught to be sold at auctions or to direct buyers, some of the landowners were requested to give an estimate for their specific businesses and the average of these allocations was applied to the area. The allocation used in the analysis is:

- Male animals 31.6% trophy hunting, 52.2% biltong hunting and 16.2% live game sales;
- Female animals 29.8% trophy hunting, 50.2% biltong hunting and 20.0% live game sales.

The percentages differ per animal group; the numbers reflected above are the average of all the game off take.

3.3.4 Site Visits

Representatives of Mosaka Economic Consultants cc did not physically visit the farms within the MRA area, the data obtained from the farm visits and the contact made with the property owners during 2011, 2013 and 2015 was used, this data was revised with the data received from the various specialist studies done in the area together with updated information obtained from Naledi Development Restructured (Pty) Ltd. studies done in the area[7].

[6] Mosaka Economists Research.
[7] The Duel Mining Right Application: Social Impact Assessment Report – January 2016.

3.3.5 Game Farming

The majority of farms stock game and allow hunting on own accord or by means of concessions made to professional hunters. Some farms, classified as game farms also have small herds of cattle.

The following sub-divisions of commercial farming enterprises in the study area were applied:

- Game farming.
  - Live game sales.
  - Trophy hunting.
  - Biltong hunting.
- Hunting supporting services.
  - Professional hunter.
  - Skinner and tracker.
  - Transport.
  - Taxidermist
  - Game Catching
  - Other.
- Accommodation.
- Hunting.
- Irrigation.
- Livestock – Beef.

A game farm as an independent enterprise can present a "one stop" hunting venture by providing the hunting supporting services, the game and the accommodation for both hunters and non-hunters. Such an enterprise may also have acquired hunting concessions from game farms in the area for specific game species not stocked or available on the farm where the supporting services and accommodation infrastructure is located. Also, a game farm (or cattle farm) may have no supporting services or accommodation infrastructure available and only sell game by allowing hunting concessions. In some cases no hunting takes place on the farm as the game is caught and sold at auctions or to private individuals.

For purposes of this study the breeding of game and the eventual marketing of the animals are divided in to three groups:

- Sale of live animals at either game auctions or through private transactions (the supporting service of game catching is included);
- Trophy hunting, predominantly foreign tourists; and
- Biltong hunting, predominantly South African groups.

As the numbers per sale activity varies from game specie to specie the price also differs for the different outlet activities. It was therefore necessary to use a number of assumptions, which not necessarily applies to all the farms or game producers. We also accept that this approach is open to criticism, but with the available data collected this approach gives acceptable results.

The different AU to game number conversion rates are presented in the following table.

Table 4: Estimated Game Representation Used in the Project Area plus the Sex Ratio and Annual Growth Rate

Specie	Conversion Rate[8]	Animal Representation[9]	Number of Females per Male[10]	Annual Growth Rate[11]
	Number/AU	Percentage	Numbers	Percentage
Blesbuck	4.50	2.73%	10	30%
Bushbuck	7.50	0.71%	6	20%
Blou Wildebeest	2.40	11.03%	10	25%
Buffalo	1.00	1.20%	15	20%
Eland	1.00	5.92%	15	20%
Gemsbok	2.20	9.11%	10	25%
Giraffe	0.70	1.75%	13	15%
Impala	7.00	39.38%	10	35%
Kudu	2.20	16.56%	7	20%
Nyala	3.30	1.31%	10	20%
Hartebeest (Red)	2.00	2.19%	10	20%
Sable Antelope	1.67	1.15%	12	20%
Roan Antelope	1.56	0.95%	10	20%
Tsessebe	2.63	0.57%	10	20%
Reedbuck, Klipspringer, Duiker, Steenbuck	7.70	2.08%	4	20%
Warthog	5.00	1.86%	10	20%
Waterbuck	2.40	0.63%	10	20%
Zebra	1.60	0.87%	6	25%
Average	3.29	100.00%		

The presence of rhinoceros and other game of the big five animals, except buffalos, have been ignored. The selection of specific animal species and percentage representation is the interpretation of Mosaka based on the survey results.

Applying the above to the number of Animal Units (AUs) and then converting it to animal numbers the following numbers are available for trading or hunting purposes.

Table 5: Number of AU and Game Available for Sale or Hunting purposes

	Area 1	Area 2	Area 3	Total
Number of AU	173	698	2 288	3 159
Number of Animals	742	2 990	10 091	13 823
Annual Animal Increase	210	829	2 800	3 839

A decision was then made on the numbers of animals sold live, the number hunted as trophy animals and the number hunted for biltong. It was firstly decided that some of the species are too

[8] Department of Agriculture.
[9] Mosaka Research and Interpretation.
[10] The SA Financial Sector Forum – HB Falkena: Profit and Honour in Game Ranching (2003).
[11] The SA Financial Sector Forum – HB Falkena: Profit and Honour in Game Ranching (2003).

expensive for the "biltong" market and was allocated to the live sales and trophy hunting section, the animals treated this way are:

- Buffalo;
- Giraffe; and
- Sable Antelope.

Of the male animals of the above group, 45% were mostly allocated to trophy hunting, 27% were allocated to live sales and 28% to biltong hunting; in the case of the females 34% to trophy, 30% were allocated to live sales and 36% to biltong hunting.

For the rest of the animals an analysis was performed in terms of the number of animals per specie that was sold and feedback on the preferences of biltong hunters and information received from professional hunters on the preferences of trophy hunters.

The prices of trophy game were sourced from Greater Kuduland Safaris - Rifle Hunters Price List 2015 (Trophy), the pricelist presents the prices in US$ which was converted by Mosaka to Rand using an exchange rate of ZAR12.5 = 1US$, eliminating decimals.

Table 6: Different Outlet Prices for Game as Used in the Calculations (2015 prices)

Specie	Male Offtake - Average Prices			Female Offtake - Average Prices		
	Game Sales	Trophy	Biltong	Game Sales	Trophy	Biltong
Blesbuck	R 2 300	R 7 475	R 1 500	R 3 600	R 7 475	R 1 500
Bushbuck	R 16 000	R 13 800	R 4 457	R 22 000	R 13 800	R 5 342
Blou Wildebeest	R 5 200	R 12 650	R 3 500	R 9 000	R 12 650	R 3 350
Buffalo	R 450 000	R 92 000	R 29 710	R 600 000	R 92 000	R 35 616
Eland	R 12 000	R 21 850	R 9 300	R 60 000	R 21 850	R 7 200
Gemsbok	R 5 500	R 13 800	R 5 900	R 7 000	R 13 800	R 5 500
Giraffe	R 15 500	R 27 600	R 14 000	R 18 000	R 27 600	R 12 000
Impala	R 3 000	R 4 888	R 1 250	R 5 500	R 1 150	R 1 000
Kudu	R 2 000	R 23 000	R 5 400	R 16 000	R 4 025	R 3 500
Nyala	R 35 000	R 25 300	R 10 900	R 28 000	R 25 300	R 8 300
Hartebeest (Red)	R 5 000	R 16 100	R 4 000	R 5 000	R 16 100	R 3 500
Sable Antelope	R 180 000	R 92 000	R 29 710	R 180 000	R 92 000	R 35 616
Roan Antelope	R 450 000	R 115 000	R 37 138	R 450 000	R 115 000	R 44 521
Tsessebe	R 14 000	R 32 200	R 15 000	R 26 000	R 32 200	R 15 000
Reedbuck, Klipspringer, Duiker, Steenbuck	R 8 000	R 7 855	R 1 500	R 8 000	R 7 855	R 1 250
Warthog	R 1 000	R 6 038	R 1 200	R 1 000	R 6 038	R 950
Waterbuck	R 14 000	R 23 000	R 4 300	R 4 300	R 23 000	R 3 500
Zebra	R 4 500	R 13 800	R 6 500	R 4 500	R 13 800	R 7 900

Using the above approach the estimated game farming annual turnover is presented in the following table.

Table 7: Annual Game Farming Turnover

	Area 1	Area 2	Area 3	Total
Annual Turnover (R.mil.)	1.03	3.19	14.04	18.26

With the game farming industry rapidly increasing in the area, investments have been made to establish new luxury accommodation or upgrading existing accommodation for the trophy hunting fraternity, simultaneously accommodating the eco-tourism segment.

The two types of hunters hunting in the area are divided into the so-called trophy hunters and biltong hunters.

The trophy hunters are mostly foreigners who are looking for specific game species for which they are prepared to pay a very high price. They are generally not interested in the meat of the hunted animals. They, however, support a number of supplementary activities grouped together and referred to as "Supporting Services".

Supporting services (usually included in the daily rates and package purchased) comprise the transport from the airport of arrival to the hunting camp and for the duration of the hunting expeditions, the services of a professional hunter, trackers and skinners, use of facilities such as cold room and salt, the field preparation of trophies, caping of trophies, laundry, accommodation and all refreshments.

Taxidermy, shipping of trophies and dipping and packing of trophies is for the account of the hunter and is not included in the daily rates and package quoted, although assistance is offered to deliver the trophy to the taxidermist.

3.3.5.1 *Accommodation*

There is a marked difference between the accommodation and catering facilities provided for the trophy hunter (with accompanying non-hunter) and the biltong hunter.

3.3.5.1.1 Trophy Hunter Accommodation

The hunting camps and lodges used for trophy hunters and non-hunters (observers) accompanying the hunters and tourists range from very comfortable to luxurious with all modern amenities always available.

3.3.5.1.2 Biltong Hunter Accommodation

The biltong hunters decide, according to their budget, what accommodation is preferred. The average biltong hunter requires only basic accommodation with limited personal amenities such as sleeping quarters (single or shared), shower and facilities to prepare meals/coffee/tea (braai) all self-catering.

3.3.5.1.3 Beds Available and Occupation

The number of available beds and tariffs was sourced from Naledi Development Restructured and the internet, and an estimation of the bed occupation was made. The trophy hunter group presented a special problem because included in their daily tariffs are not only the accommodation fee, but also the services of a professional hunter, skinners, trackers and vehicles. It is an all-

inclusive package which also includes the transfer from the OR Tambo airport and only excludes the price of the animal and the taxidermy services.

The following number of beds could be traced per area:

- Area 1 – None;
- Area 2 – 109; and
- Area 3 – 72.

A 22% bed occupation was used to calculate the number of bed nights per annum.

After analysing the data obtained the accommodation turnover in the area was estimated and is presented in the following table.

Table 8: Annual Accommodation Turn Over in the Project Area (2015 prices)

Area	Accommodation
	Rand mil.
Area 1	0
Area 2	4.63
Area 3	4.00
Total	**8.63**

The total accommodation turnover in the project area is R 8.63 million.

Table 9: Annual Accommodation Data

Area	Number of Beds	Occupation	Average Day Bed nights	Annual Bed nights
Area 1: The Duel - Impacted Area	0	0%	0	0
Area 2: 5 km radius	109	22%	23.98	8 753
Area 3: 10 km radius	72	22%	15.84	5 782

3.3.5.2 *Hunting Supporting Services*

The professional hunter operates independently and is contracted by the hunting organiser for a specific safari. The professional hunter often resides abroad and meets the hunting party at the airport on arrival. From arrival he/she will accompany the hunting party to the game farm with either his/her own transport or transport supplied by the hunting organiser or hired helicopter.

The trackers and skinners are the responsibility of the hunting organiser and are separately hired by the organiser for the specific safari. They do the field preparation of trophies and the caping of trophies. It could also be that the tracker(s) and skinners are in the full employment of the hunting organiser.

All transport and amenities on the game farm is the responsibility of the hunting organiser. Transport to visit local sights, souvenir hunting and entertainment is also supplied at additional cost.

The facilities such as cold room and salt, the field preparation of trophies, caping of trophies is provided by the hunting organiser. The arrangement and responsibility for taxidermy, the shipping

of the trophies and the dipping and packing of trophies is the hunter's, although advice is given and assistance is offered to deliver the trophy to the taxidermist.

A hunting trophy is an item prepared from the carcass of a game animal killed by a hunter and kept as a souvenir of the successful hunting expedition. Often the heads or entire bodies are processed by a taxidermist, although sometimes other body parts such as teeth, tusks or horns are used as the trophies.

The cost of hunting services was calculated separately from the money spent on taxidermist services. The taxidermy fees were obtained from the internet and the number of animals treated determined from discussions with individuals in the industry.

In the following table the support services and taxidermist costs are presented.

Table 10: Annual Value of Support Services and Taxidermy Costs (2015 prices)

Area	Support Services Rand mil.	Taxidermy Rand mil.	Total Rand mil.
Area 1	0.15	0.46	0.61
Area 2	1.10	1.53	2.63
Area 3	0.93	5.34	6.27
Total	**2.18**	**7.33**	**9.51**

The table shows that the value of the support services is R 2.18 per annum and the taxidermy costs are around R 7.33 million per annum for the project area.

3.3.6 Irrigation

As no detailed data on the exact crop varieties produced, other than citrus, was available, it was necessary that some assumptions be made to be used for the analysis:

- It appears as if the more accepted practice for the vegetable crops is three crops in a two year cycle period, although some farmers claim two crops per annum. A 67% double cropping factor for the vegetable crops (summer and winter crops) was used.
- The area is predominantly producing citrus and the hectare areas were sourced from Google Earth measurements of orchards.

In the next table a breakdown of the physical hectares and crop hectares used in the calculation is presented based on the available information and the formulated assumptions.

Table 11: Irrigation Areas and Crops

Irrigation Crops	Area 3	
	Physical Area hectares	Crop Area hectares
Vegetables	60	80
Citrus	134	134
Total	**194**	**214**

The total physical irrigated hectares are estimated at 214, all in Area 3. The estimated orchard crop hectares are 134 ha citrus and 60 ha vegetable crops. The total vegetable area is estimated at 60 hectares, but with a 67% double cropping assumption 80 ha are harvested per annum.

Enterprise budgets compiled for the Land Bank and Development Bank during 2012 were updated to 2015 values and applied to arrive at the total irrigation value per category.

Table 12: Enterprise Budgets (2015 Rand Values)

Current Situation (per hectare)	Brassicas (Winter)	Cucurbits (Summer)	Citrus
Gross Income	**128 000**	**56 100**	**122 439**
Variable Costs	**56 017**	**32 040**	**79 147**
-Marketing Costs	*7 047*	*7 013*	*805*
-Pre Harvest Cost			*0*
-Irrigation labour			
- Other – pre-harvest costs	*37 545*	*12 726*	*29 301*
-Harvest Cost	*11 425*	*12 302*	*49 040*
Interest on Working Capital	***1 690***	***704***	***3 304***
Gross Margin	**70 293**	**23 356**	**39 988**
Fixed Costs	**3 594**	**2 910**	**7 412**
-Depreciation			
- Irrigation equipment			
- Other	*2 041*	*1 758*	*2 660.60*
-Labour	*184*	*115*	*736.00*
-Insurance	*311*	*269*	*572.40*
-Repairs & Maintenance	*596*	*511*	*1 287.90*
-Administration Costs	*184*	*85*	*975.20*
-Fuel & Electricity	*223*	*117*	*743.40*
-Sundry	*55*	*55*	*436.72*
Net Farm Income	**66 700**	**20 446**	**32 575**

In the following table the estimated value of the irrigation activities per area is presented.

Table 13: Estimated Value of the Irrigation Activities (2015 prices)

Irrigation Crop	Annual Turnover Rand/ha	Number of Hectares	Annual Income Rand
-Brassicas (Winter)	128 000	40	5 062 499
-Cucurbits (Summer)	56 100	40	2 218 798
-Citrus(Oranges)	122 439	155	19 000 314
Total		234	26 281 611

The following table presents the total estimated value of the irrigation activities in Area 3.

Table 14: Estimated Value of the Irrigation Activities (2015 prices)

Farm Category	Value Rand million
Area 3	26.28
Total	**26.28**

The table shows that the annual estimated value of the irrigation activities in the total project area is around R26.28 million.

3.3.7 Communities

The three village communities of Makushu, Mosholombe and Pfumembe on the farm Telema 190 MT are located within a 5 km radius of The Duel Coal Project. . The village of Makushu borders the proposed mining area and will be directly affected by the mining activities. Pfumembe is approximately 3 km from The Duel Coal Project's eastern perimeter and should not be affected by the proposed mining activities in respect of air quality impact – dust, blasting vibration impact and noise increase to the same extent as would Makushu. The possible detour in the road from the N1 to Nzhelele Dam will, however, has an impact on all three villages.

The villages of Makushu and Mosholombe cover an area of approximately 111 ha, with currently approximately 291 households and a population of 1 509 residents[12] (of which 882, 58.4% are female and 627, 41.6% male). The employment profile in the larger area is shown in the table below.

Table 15: Employment Profile in the Wider and Project Area[13]

Area	Employed	Unemployed	DWS*	SUR%**	EUR%***
Makhado LM	78 768	45 705	24 383	36.70%	47.10%
Makhado Ward 21	10 636	821	269	7.20%	9.30%
Makhado Ward 37	714	633	678	31.30%	65%

* DWS: Discouraged Work Seeker
** SUR: Strict Unemployment Rate
*** EUR: Expanded Unemployment Rate

Several structures for accommodation are in the process of being erected on existing occupied stands and on open stands. The existing structures are both modern and traditional. The western perimeter of the Makushu village borders the MRA area of The Duel Coal Project.

The development will have an impact on households that would need to be resettled. The zone of displacement has been determined utilising Geographical Information Systems where baseline Social Sensitive Receptors were identified overlain by impact assessment and level of risks to the communities. The displacement zone was determined as an area where impacts could not be

[12] Statistics South Africa, Census 2011 as well as Household Survey, 2015.
[13] Statistics South Africa, Census 2011.

satisfactorily mitigated, and therefore households within the 500 m from the MRA boundary will need to be resettled. See table below for types of stands[14].

Table 16: Stands Potentially Affected

TYPE OF STAND	NUMBER
Business Stands	6
Large Residential Stands	64
Medium Residential Stands	67
Small Residential Stands	72
Vacant Stands	2
Total Stands	**211**

There are 211 stands and households within this radius that will potentially be affected.

3.3.8 Total Current Activities

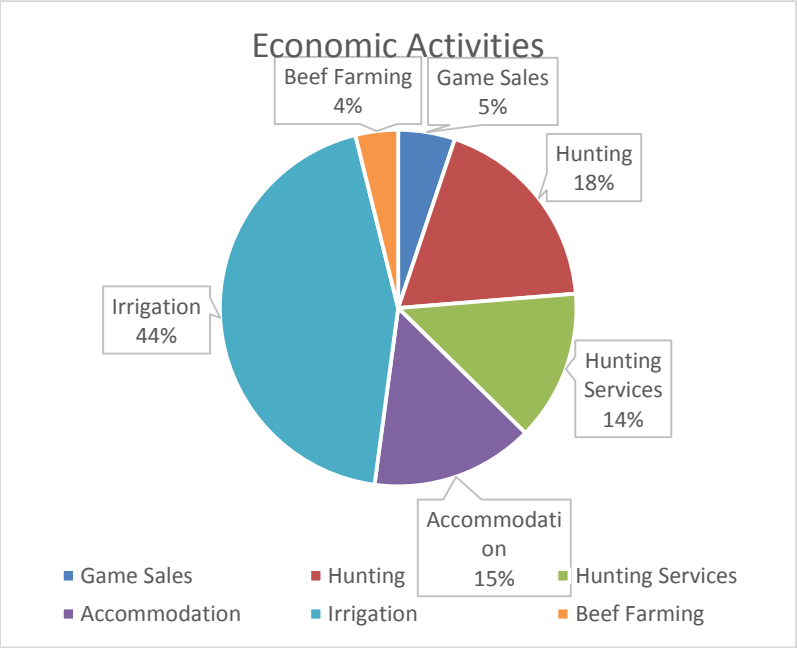
In the next table the total estimated annual value of the current activities in the project area is presented.

Table 17: Annual Turn Over of the Activities in the Project Area (2015 prices)

Farming Activity	Annual Income Area 1 Rand mil.	Annual Income Area 2 Rand mil.	Annual Income Area 3 Rand mil.	Annual Income Total Rand mil.
Game Farming - Animals(Turn Over)	**R 0.50**	**R 3.10**	**R 10.46**	**R 14.06**
- *Game Sales*	R 0.29	R 0.64	R 2.14	R 3.07
- *Trophy Hunting*	R 0.08	R 1.31	R 4.93	R 6.32
- *Biltong Hunting*	R 0.13	R 1.15	R 3.39	R 4.67
Beef and other livestock	0	**R 0.24**	**R 2.07**	**R 2.31**
Hunting				
- Professional Hunting Services (including	R 0.15	R 1.10	R 0.91	R 2.16
- *Taxidermy*	R 0.13	R 1.39	R 4.31	R 5.83
- *Accommodation*	R 0.00	R 4.63	R 4.18	R 8.81
Total	**R 0.28**	**R 7.12**	**R 9.40**	**R 16.80**
Eco-Tourism	**R 0.00**	**R 0.00**	**R 0.00**	R 0.00
Irrigation	**R 0.00**	**R 0.00**	**R 26.28**	**R 26.28**
Grand Total	**R 0.78**	**R 10.46**	**R 48.21**	**R 59.45**

[14] The Duel Mining Right Application: Social Impact Assessment Report – January 2016.

Figure 5: Monetary Value Contribution of Current Activities



Current Activities

The figure shows that irrigation represents 44% of the monetary value of the current activities in the total impacted area, hunting 18%, the hunting services 14%, accommodation 15% and game sales 5% and livestock farming 4%.

The annual total value of the current activities are estimated at R59.45 million, with irrigation contributing around R26.28 million, 44%, with the hunting services and accommodation the second largest contributor at R16.80 million (29%), with the rest the hunting activities.

3.3.9 Baseline Results

In the following paragraphs the current activities per area is presented in economic and socio-economic parameters.

3.3.9.1 *Area 1 – The Duel*

The following table presents the current economic and socio-economic parameters for The Duel.

Table 18: Current Economic and Socio-Economic Parameters for The Duel Area 1

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-	-	-	-	-	-	-	-	-
Beef Farming	-	-	-	-	-	-	-	-	-
Game Farming	0.19	0.32	0.51	1	3	4	0.22	0.15	0.08
Hunting	0.12	0.11	0.23	0	0	0	0.11	0.07	0.04
Taxidermy, Game catching, etc.	0.08	0.08	0.16	1	0	1	0.05	0.04	0.01
Accommodation	-	-	-	0	0	0	-	-	-
Total	**0.38**	**0.52**	**0.90**	**2**	**3**	**5**	**0.38**	**0.26**	**0.13**

The total GDP generated is estimated at a total of R0.90 million per annum and the direct at R0.38 per annum.

Only two direct employment opportunities are sustained by the farming activities on The Duel, with a total of 5 when the indirect and induced are added.

The total payments to households are R0.38 million with R0.13 million, 34% to the low-income households.

3.3.9.2 *Area 2 - 5 km Radius*

The following table presents the current economic and socio-economic parameters for the area included in Area 2 (the 5 km radius area).

Table 19: Current Economic and Socio-Economic Parameters for Area 2

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-	-	-	-	-	-	-	-	-
Beef Farming	0.40	0.16	0.56	1	0	1	0.08	0.06	0.02
Game Farming	0.77	1.11	1.88	7	8	15	1.25	1.23	0.02
Hunting	1.74	1.71	3.45	9	7	16	1.62	1.10	0.52
Taxidermy, Game catching, etc.	1.43	1.44	2.87	8	5	13	0.90	0.67	0.23
Accommodation	2.10	2.45	4.56	14	10	24	2.38	1.61	0.77
Total	**6.44**	**6.87**	**13.32**	**39**	**30**	**69**	**6.23**	**4.67**	**1.56**

The total GDP generated is estimated at a total of R13.32 million per annum and the direct at R6.44 per annum.

Only 39 direct employment opportunities are sustained by the farming activities, with a total of 69 when the indirect and induced are added.

The total payments to households are R6.23 million with R1.56 million, 23.1%, to the low-income households.

3.3.9.3 *Area 3 – 10 km Radius*

The following table presents the current economic and socio-economic parameters of the area included in Area 3 (the 10 km radius area).

Table 20: Current Economic and Socio-Economic Parameters for Area 3

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	15.18	12.80	27.98	266	61	327	13.03	10.96	2.07
Beef Farming	1.97	0.71	2.68	27	3	30	0.36	0.27	0.09
Game Farming	10.49	2.79	13.28	17	14	31	1.86	1.46	0.40
Hunting	4.73	4.62	9.35	20	20	40	4.38	2.97	1.41
Taxidermy, Game catching, etc.	2.91	2.93	5.84	18	11	29	1.85	1.37	0.48
Accommodation	1.90	2.21	4.11	10	9	19	1.34	1.00	0.34
Total	**37.18**	**26.06**	**63.24**	**358**	**118**	**476**	**22.82**	**18.03**	**4.79**

The total GDP generated is estimated at a total of R63.24 million per annum and the direct at R37.18 per annum. The two largest contributors to the direct GDP is irrigation with R15.18 million and game farming R10.49 million.

The contribution of irrigation to direct employment opportunities is 266 out of 358 sustained by the farming activities, with a total of 476 when the indirect and induced are added.

The total payments to households are R22.82 million with R4.79 million, 21.4%, to the low-income households.

3.3.9.4 *Total All Areas*

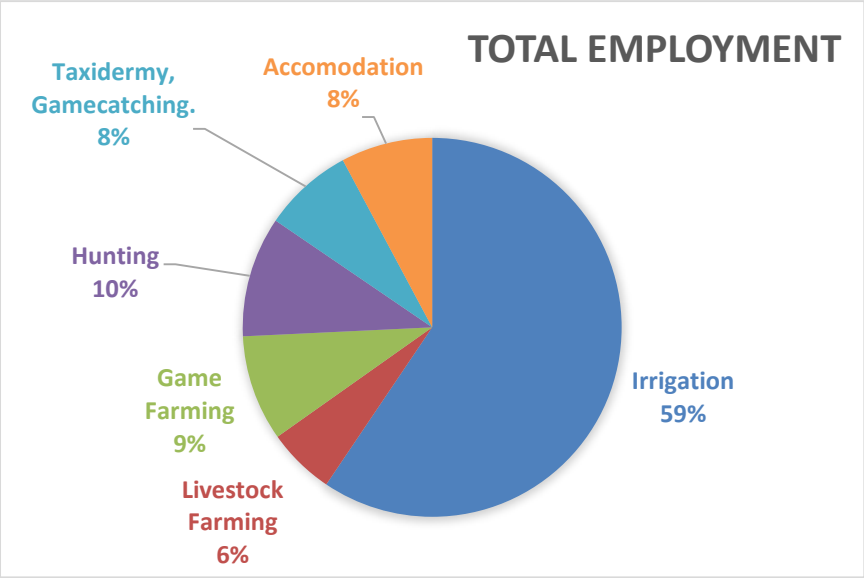
The following table presents the total parameters for all three the areas.

Table 21: Current Economic and Socio-Economic Parameters All Areas

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	15.18	12.80	27.98	266	61	327	13.03	10.96	2.07
Beef Farming	2.37	0.87	3.24	29	3	32	0.44	0.33	0.11
Game Farming	11.45	4.23	15.68	25	25	50	3.34	2.85	0.49
Hunting	6.59	6.44	13.03	29	27	56	6.11	4.14	1.97
Taxidermy, Game catching, etc.	4.42	4.45	8.87	26	16	42	2.80	2.08	0.72
Accommodation	4.00	4.67	8.67	24	19	43	3.71	2.60	1.11
Total	**44.01**	**33.46**	**77.47**	**399**	**151**	**550**	**29.43**	**22.96**	**6.47**

The total GDP generated is estimated at a total of R77.47 million per annum and the direct at R44.01 per annum. The two largest contributors to the direct GDP is irrigation with a R15.18 million contribution, followed by game farming with R11.45 million.

Figure 6: Employment per Current Activity



Total Employment

Irrigation represents 59% of the total employment, hunting 10%, game farming 9%, taxidermy and game catching 8% and accommodation 8%. The total contribution of the game activity is 37%.

Livestock farming contributes 6%.

The contribution of irrigation to direct employment opportunities is 266 out of 399 sustained by the farming activities, with a total of 550 if the indirect and induced is added.

The total payments to households are R29.43 million with R6.47 million, 22.0% to the low-income households.

3.3.10 Summary of Current Activities

The Current Economic and Socio-Economic Parameters for the total area show that irrigation farming is the main economic activity. The irrigation system is part of Nzhelele Government Water Scheme sourcing the water from the Nzhelele Dam by means of a canal system and the farmers supplement it from ground water supplies. Game farming, together with the related hunting activities, covers the largest land surface area.

The Nzhelele Irrigation Scheme supplies water to all the citrus and vegetable farms along the Nzhelele River up to Tshipise and beyond. It is necessary to also take notice of the citrus situation and possible risks, such as the possible loss of citrus farmers' loss of their Phytosanitary "Phyto" Registration and Good Agriculture Practise (GAP) accreditation due to mining activities, not only of the proposed The Duel Coal Project, but also the envisaged mining activities in the area north of the Soutpansberg.

The Tshipise Holiday Resort is located next to the R525 approximately 20 km north east of the proposed The Duel Coal Project. The resort is a well-established hot spring based holiday resort with chalet and camping facilities and owes its existence to a natural thermal spring.

The future of the village of Makushu, which is situated on the border of the proposed mining and infrastructure area of The Duel Coal Project, might require special attention. The partial resettlement of the Makushu village residents bordering the MRA area (possibly a buffer area of 500 m from the mining area perimeter) is included in the economic CBA analysis.

4 ECONOMIC FEASIBILITY – COST BENEFIT APPROACH

The economic tools used for these assessments are the Cost-Benefit Analysis (CBA) and the Partial General Equilibrium Analysis, based on the Limpopo Provincial SAM.

In short, the CBA can be described as a system whereby the costs and benefits of a specific development project are compared to evaluate the financial and economic viability of the project. The Partial General Equilibrium Analysis is used to determine the nature and magnitude of the macro-economic impacts that emanate from the project as an alternative land use option in terms of its impact on larger macro-economic aggregates such as Gross Domestic Product (GDP), employment opportunities, investment, the impact on poor households, etc.

A CBA forms part of the micro-economic impact analysis and focuses on the positive and negative economic impacts in order to put all direct and secondary impacts of the project into perspective, for effective decision making purposes.

4.1 OBJECTIVE OF THE COST BENEFIT ANALYSIS

The principles underlying the Standard CBA are applied to evaluate the financial and economic viability of The Duel Coal Project, taking into consideration all negative and positive costs (impacts) of the mining activities.

The CBA approach provides a logical framework by means of which development projects can be objectively evaluated and, as such, serves as an aid in the decision-making process. (A more detailed explanation of the CBA can be found in Section 8, Appendix A).

4.2 COST BENEFIT ANALYSIS METHODOLOGY

Although a CBA comprises of two distinct portions, a financial CBA component and an economic CBA component, it was only required to construct an economic CBA as part of the EIA. The financial CBA component is based on market and nominal prices, whilst the economic CBA component is based on shadow/economic and constant prices. The use of shadow/economic prices is necessary in order to reflect more realistic values of scarce economic resources. Market prices often do not give a true representation of the scarcity values of resources, owing to interference in market price setting such as government tax regulation and artificial adjustments to, for example, fossil fuels prices, electricity tariffs and minimum wage levels.

Within the CBA framework, various impacts have been calculated for each year of the project period.

The impacts for each year of the project are discounted to present values, using an appropriate discount rate. The financial CBA is conducted in current prices (with the assumption that the SA inflation rate over the longer period will be less than 6%) and a real yield on capital of 5% giving a discount rate of 11% per annum, reflecting the cost of capital. The economic CBA is done in constant prices and discounted by a social discount rate of 8% per annum.

The CBA methodology has been chosen to indicate whether the project in question is economically feasible or not. Within the framework, the estimated economic cost of the project is compared by means of a ratio (Benefit Cost Ratio) to the estimated economic benefits of the project. In order for a project to be considered economically viable, this ratio must have a value greater than 1 in order to indicate that benefits outweigh costs.

Additional viability indicators provided are Net Present Value (NPV) and Internal Rate of Return (IRR). A more detailed discussion on the interpretation of each indicator is included in the results section of the CBA component.

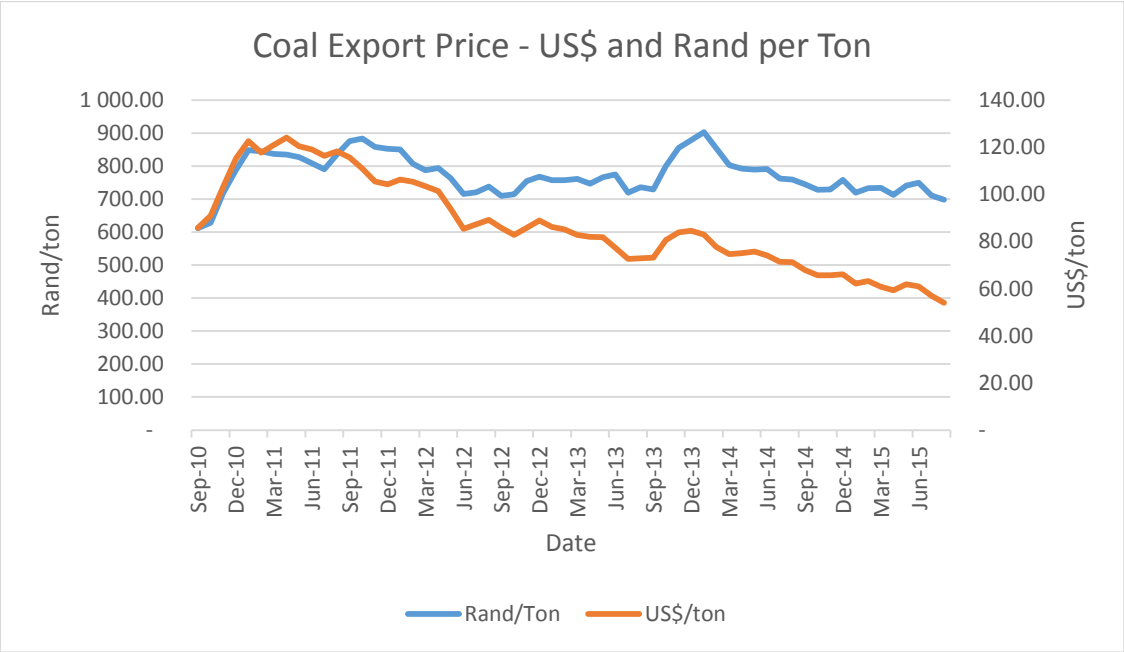
4.3 ASSUMPTIONS UNDERLYING THE COST BENEFIT ANALYSIS

The assumptions that were used in relation to the benefits and costs for the economic CBA are briefly discussed below.

4.3.1 Benefits Relating to the Project (Coal Price)

In determining the benefits/revenue applicable in the CBA model it was necessary that the movements on the international coal market and the Rand exchange rate be taken into account as the coal export price was accepted as being the economic price. In the following graph the respective movements of the coal price over the last five year period is presented.

Figure 7: Comparative Coal Price



Source: *www.indexmundi.com*

The graph shows that the coal price in US dollars has declined from September 2010 at $90 per ton to $54 in August 2015. The position of the Rand was more stable because of the dramatic weakening of the Rand, from R7.13 to the US$ to R12.92 in August 2015. It is currently trading (November 2015) at R13.40 to the US$.

It therefore appears as if the exchange rate provides some shelter for coal producers in South Africa. The above necessitates that a position be taken for the CBA models, in the next paragraphs a number of options for the economic CBA model is developed.

4.3.1.1 *Economic CBA Model – Coal Prices*

The economic price of the thermal coal is accepted to be the export price minus transport cost to the port. In this specific case it is assumed that Maputo would be the export harbour.

However the price is quoted in US$ and in South Africa the Rand/$ exchange rate is very volatile and is it necessary that a position on possible variations be taken.

The exchange for the last five years were analysed and a standard deviation was calculated around the average Rand/US$ price for the period providing three figures called:

- Conservative Exchange Rate – R12.1 to the US$ – rate after the standard deviation was subtracted;
- Base Exchange Rate – R12.92 to the US$ - average exchange rate;
- Coal Producer Optimistic Exchange Rate – R13.70 to the US$ - rate after the standard deviation was added.

The coal prices for the last five years were analysed and a standard deviation was calculated in US$ around the average dollar price for the period providing three figures called:

- Pessimistic Price - $67.62 – price after subtracting of standard deviation;
- Realistic Price – $86.94 – average price over the five year period;
- Optimistic Price - $106.56 – average price after adding the standard deviation.

This provides a wide variation of exchange rates and coal prices.

4.3.2 Costs Relating to the Project

The cost applied in the CBA is provided in the "Signet Coking Coal (Pty) Ltd – Scoping Study: The Duel Coal Project – April 2015".

Table 22: Capital Cost Estimates for The Duel Coal Project CHPP[15]

Contract Description	ZAR
Raw Coal Handling	71 952 263
Coal Processing Plant	204 993 908
Materials Handling	60 294 189
Plant Services	14 953 218
Infrastructure	11 900 944
EPC Allowances	7 488 886
Allowances (Taxes & Duties)	7 544 952
Commercial Allowances	88 905 600
Total Cost (Design & Construct)	**468 033 962**

4.3.1.2 *Shadow Prices*

Shadow prices (economic prices) are regarded as the opportunity costs of products and services when the market price, for whatever reasons, does not reflect these costs in full. Examples are the shadow wages of labour, where minimum wages are fixed at levels higher than market prices; shadow price for fuel, where taxes and subsidies are excluded; and shadow exchange rates are pegged and/or some kind of exchange control is still in place. The shadow price is therefore nominal

[15] Signet Coking Coal - The Duel Scoping Study - Final Report dated 14 May 2015.

(market) price, adjusted for the effect of interventions or other factors that are causing the market not to perform its natural role.

In practice, shadow prices should only be use when the market price of products and services do not reflect their scarcity value or economic contributions. In cases where market prices give an indication of the scarcity of products and services, market prices are used not only for financial analysis, but also for economic analysis.

The full table of the shadow price factors are presented in Appendix F.

4.3.1.3 *Capital Expenditure (Capex)*

All capital expenditure is assumed to occur over and 18 month period commencing at the beginning of 2016 and ending mid-2017. Initially, construction was to commence in 2014, but due to unforeseen delays, it is now scheduled to start at the earliest in 2016, with a one and a half year construction and development period. The life of mine (LOM) period runs 24 years from mid-2017 to the end of 2040, during which period the coal resources at the project location should be exhausted.

Capital expenditure comprises three components as outlined below:

- Total mine:
  - Capital expenditure on the mine amounts to approximately R468 million and the open pit mining equipment to R249.3 in constant 2014 prices.
  - The underground equipment to be utilised from year 10 onwards is estimated at R584 million also expressed in 2014 constant prices.
  - Railway Construction: No provision made as it is accepted that they will use an existing siding.
- Water Supply:
  - The scoping report makes no provision for capital expenditure on water provision.

4.3.1.4 *Operational Expenditure (Opex)*

In the case of the Economic CBA model cost prices were sourced and developed from the: Technical Report:- South African Coal Road Map – Outlook for the Coal Value Chain: Scenarios to 2040 – July 2013, was used.

This was necessary to eventually determine the economic viability of the project using independent cost data and an evaluation of the coal price.

4.3.1.4.1 Rehabilitation, General and Administration Costs

Provision is for General and Administration and Rehabilitation costs in the Signet Scoping Report and applied as such in the economic CBA model. The table below provides a picture for the first five years; the full table is presented in Appendix C - Rehabilitation, General and Administrative Costs.

Table 23: Rehabilitation, General and Administration Costs Expressed in 2014 Constant Prices

Rehabilitation, General and Administration Cost	Y1	Y2	Y3	Y4	Y5
Total	**12 301 746**	**16 167 709**	**16 859 063**	**17 726 585**	**17 662 077**
G & A Cost	5 791 937	7 331 371	8 022 757	8 890 550	8 825 602
Rehabilitation	6 509 809	8 836 339	8 836 306	8 836 035	8 836 474

4.3.1.4.2 Social and Labour Plan[16]

Subiflex (Pty) Ltd. has an extensive Social and Labour Plan for The Duel Coal Project. The labour plan is estimated for 550 permanent employees in the Operational Phase (commencing Year 3, ramping up to steady state at Year 6). The Human Resource Development Plan has been based on this estimated labour plan and therefore may change once the actual labour force has been recruited and a skills assessment has been completed. The results will be reported on in the annual SLP report to DMR and in the Workplace Skills Plan to the Mine Qualifications Authority.

The SLP sets out the envisaged Human Resource Development Programme, the Mine Community Economic Development Plan and the Processes Pertaining to Management of Downscaling and Retrenchment.

- The Human Resource Development Programme includes:
  - Adult Basic Education and Training (ABET) will be planned according to the availability of skills in and around the local area. Should there be skills shortages in the area initially; the company will consider importing certain skills sets, while local skills are being developed.
  - Core Business Training. The Company will implement core business training that is aligned to the company's Human resources Department (HRD) strategy and practices.
  - Artisans Training. Foundational Learning Competence (FLC) in Communication Literacy and Mathematics Literacy will form the basis for artisan development.
  - Learnerships. Trade related learnership qualifications will be addressed as part of the artisan development programme.
    - Internal learnerships will be offered to employees that form part of the identified talent pool.
    - External learnerships will be offered to the broader public. School support and post matric programmes are included.
  - Individual Development Plans. Once recruitment for the permanent operational staff commences, an individual development plan for each employee participating in the Skills Development Programme will be compiled.
- Mine Community Economic Development. The following Local Economic Development and Infrastructure Projects have been identified:
  - Infrastructure Projects - Project 1: Household Solar Project.
  - Educational and Poverty Alleviation Projects - Project 2: School needs project.
  - Income Generating Projects -Project 3: Enterprise Development Project linked to Solar Project.

- Processes Pertaining to Management of Downscaling and Retrenchment. The Company will develop strategies to introduce measures that could prevent job loss in the event of circumstances threatening guaranteed employment. Certain processes will be followed when prevailing economic conditions cause the profit-to-revenue ratio of the company to drop below 6% on average for a continuous period of 12 months.

Table 24: Financial Provision

Item	Financial provision for a 5 year period					Total
	2018	2019	2020	2021	2022	
Human Resource Development	R 735 000	R 1 350 000	R 1 990 000	R 2 190 000	R 2 410 000	R 8 675 000
Local Economic Development	R 230 000	R 837 500	R 687 500	R 637 500	R 537 500	R 2 930 000
Management of Downscaling	R 100 000	R 150 000	R 200 000	R 250 000	R 250 000	R 950 000
Total	**R 1 065 000**	**R 2 337 500**	**R 2 877 500**	**R 3 077 500**	**R 3 197 500**	**R 12 555 000**

Table 25: Local Economic Development and Infrastructure Projects

Project	Budget
Household Solar Project	R 1 330 000
School Needs Project	R 900 000
Enterprise Development Project	R 700 000
Total	**R 2 930 000**

4.3.1.4.3 Economic Cost Prices

As previously stated the following data was constructed from: Technical Report: - South African Coal Road Map – Outlook for the Coal Value Chain: Scenarios to 2040 – July 2013.

The report provides a general guideline in terms of production and transport costs in terms of Rand/ton as presented in the following table.

Table 26: Production, Transport and Port Costs[17]

	2013 Prices		2014 Prices	
	Waterberg Rand/tonne	Central Basin Rand/tonne	Waterberg Rand/tonne	Central Basin Rand/tonne
Production Costs	R156	R225	R175	R253
Transport to RBCT	R258	R126	R290	R214
To Vereeniging	R132		R149	
Port Costs	R15	R15	R17	R17

The 2013 price is as published and the 2014 prices have been adjusted by Conningarth Economists applying the official inflation rate.

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[16] The Duel Coal Project - Social and Labour Plan – March 2015.
[17] South African Coal Road Map – 2013.

As there is no direct reference to the proposed Soutpansberg mines, the following costs where deduced and applied in the model:

- Production Costs – R175 + 10% additional costs per tonne;
- Transport to Maputo – Calculations based on the distance difference between Waterberg and Richards Bay – over 900 km and Makhado and Maputo over 600 km – 65% of R290 = R188 was used.
- Port Costs – R23/tonne.

4.3.1.4.4 Resettlement Costs

According the "Social Impact Report – November 2015" the following numbers are identified which will probably be ammended.

Table 27: Number of Stands Potentially Affected

Stands Potentially Affected	Numbers
Business Stands	6
Large Residential Stands	64
Medium Residential Stands	67
Small Residential Stands	72
Vacant Stands	2
Total	**211**

Certain assumptions of the actual size of the different stands were applied after intensive google earth measurements. The actual replacement cost was sourced from the "Aecom Blue Book" which presents general construction costs. A "solatium[18]" value was added as a compensation [19]value for having to move.

Table 28: Stands Potentially Affected

Stands Potentially Affected	**Numbers**	**Relative Size m²**	**Building Costs m²**	**Sub Total Rand Million**	**"Solatium"**		**Total Rand Million**
Business Stands	6	300	R 8 193	R 14.75	10%	R 1.47	R 16.22
Large Residential Stands	64	240	R 7 007	R 107.63	10%	R 10.76	R 118.39
Medium Residential Stands	67	50	R 4 204	R 14.08	10%	R 1.41	R 15.49
Small Residential Stands	72	25	R 1 940	R 3.49	10%	R 0.35	R 3.84
Vacant Stands	2	0	R 7 546	R 0.02	10%	R 0.00	R 0.02
Total	**211**			**R 139.95**		**R 14.00**	**R 153.96**

[18] Solatium -a thing given to someone as a compensation or consolation. "a suitable solatium in the form of an apology was offered to him".
[19] Solatium (plural solatia) is a form of compensation for emotional rather than physical or financial harm.

The total financial cost is estimated at R153.96 million, the economic cost is calculated by multiplying with the shadow factor of 0.977 providing the economic cost of R150.42 million for inclusion in the economic CBA.

It must be emphasised that this value has no legal standing and is an estimation of the cost of resettlement. The correct professional individuals will eventually calculate the correct amount.

4.3.2 Externalities and Risk Analysis

Under this heading is included the possible negative impact on current land use activities, possible impact on the society and projected impact on the environment. As already discussed, it was necessary to establish a so-called baseline and then determine the estimated negative impact from this baseline represented by the deviation. It is therefore necessary that the Risk Analysis that was used be discussed.

4.3.2.1 *Risk Analysis*

The risk analysis is based on the following infringements with different weights per area. The three areas being:

- The farm The Duel;
- The farms included in the 5 km radius; and
- Farms included in the 10 km radius.

The following table presents the different infringements with the weight allocated to each item in the specific group. The weights are specific per area as the impact per infringement can change.

Table 29: Identified Infringements per Farm Grouped and Allocated Weights

Infringement		Area 1	Area 2	Area 3
Mining and Transport Operations	***Noise***	8.00	7.00	5.00
	Dust	25.00	25.00	10.00
	Blasting	8.00	7.00	5.00
Impact on community and environment	***Social, Crime and Other***	4.00	18.00	20.00
	Sense of Place - Visual	20.00	18.00	16.00
Impact on water resources	***Ground Water***	12.00	10.00	18.00
	Surface Water	23.00	15.00	26.00
	Total	**100**	**100**	**100**

In the following table the categories per infringement and impact for one of the main infringements is explained.

Table 30: Infringements, Activities

Infringe-ment	Activity	Sub -Activity	Extent	Duration	Magnitude	Probability	Significance
Noise	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	0	0
		Community	*0*	*0*	*0*	0	0
	Game Farming	*Game (breeding)*	*0*	*0*	*0*	0	0
		Live Sales	*0*	*0*	*0*	0	0
		Trophy Hunting	*0*	*0*	*0*	0	0
		Biltong Hunting	*0*	*0*	*0*	0	0
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	0	0
		Hunters	*0*	*0*	*0*	0	0
	Irrigation	*Citrus*	*0*	*0*	*0*	0	0
		Other Crops	*0*	*0*	*0*	0	0
	Community	*Life Style/Health/etc.*	*0*	*0*	*0*	0	0
	Environment (birds & plants)		*0*	*0*	*0*	0	0
	Sub-total		*0*	*0*	*0*	0	0

For each infringement the table is populated for the three farm groups and is then converted to a mathematical impact. In the following table the negative impacts per economic activity are presented.

The detailed tables are presented in Appendix E.

Table 31: Estimated Negative Impact per Activity

Activity	Area 1	Area 2	Area 3
Beef & Livestock Farming	0.0%	-15.8%	-11.5%
Game Farming & Hunting	-29.8%	-11.9%	-5.2%
Professional and Taxidermist Services	-25.8%	-18.6%	-8.7%
Accommodation (Tourists & Hunting)	0.0%	-20.5%	-27.6%
Irrigation	0.0%	0.0%	-12.3%
Community	0.0%	-24.0%	0.0%
Environmental Impact	-32.1%	-22.7%	-20.8%
Average	-30.2%	-21.6%	-14.5%

4.3.2.1.1 Agriculture Externality Impact

In the table below the projected income on the beef and other livestock as well as the irrigation activity is presented.

Table 32: Estimated Impacts on the Livestock and Irrigation Activities

Activity	Area	Monetary Baseline Rand million	Estimated Impact	Monetary Impact Rand million
Beef and other livestock	**1**	0	0%	0
	2	0.24	-15.8%	- 0.04
	3	2.07	-12.3%	- 0.24
Irrigation	**1**	0	0	0
	2	0	0	0
	3	26.28	-12.3%	- 3.23
Total		**28.59**		**-4.51**

From the above it appears that the negative impact on the livestock and irrigation farming could be around R4.51 million in the worst case scenario.

4.3.2.1.2 Game Farming and Hunting Externality Impact

In the table below the projected income of the game farming and hunting activities are presented.

Table 33: Estimated Impacts on the Game Farming and Related Activities

Activity	Area	Monetary Baseline Rand million	Estimated Impact	Monetary Impact Rand million
Game Farming and Hunting	**1**	R 0.50	-29.8%	R -0.15
	2	R 3.10	-11.9%	R -0.37
	3	R 10.56	-5.23%	R -0.55
Professional and Taxidermist Services	**1**	R 0. 29	-25.8%	R -0.07
	2	R 2.59	-18.6%	R -0.48
	3	R 5.27	-8.70%	R -0.46
Accommodation: Tourists and Hunters	**1**	0	0	0
	2	R 4.63	-20.5%	R -0.95
	3	R 4.18	-27.56%	R -1.15
Total		R31.12	-13.43%	R-4.18

From the above table it appears that the estimated negative impact on the game farming and related activities could be R4.18 million per annum in the worst case scenario.

4.3.2.1.3 Community Externality Impact

To estimate a monetary value of the impact of the proposed mining activity on the lives of the community in Makushu it is necessary to identify the impacts. On the positive side is the possibility of employment opportunities which must be weighed against the negative impact on "their way of life" and the impact on their livestock.

This value is economic concept that is currently widely accepted in academic circles; however, it is difficult to always put a value to the change in lifestyle brought about by the planned mining activity.

The projected impact on the livestock is accommodated in the agricultural section and the value of job creation is estimated in the macro-economic analysis. This left us with the quality of life issue and the possibility of the community being resettled and accompanying cost.

Estimating the impact on quality of life a base line was first established. The publication "A Manual for Cost Benefit Analysis in South Africa with Specific Reference to Water Resource Development (Third Edition - Updated and Revised)" set the value of time for rural people in the Limpopo Province at R8 698 per person in 2012 prices. This was updated to 2014 prices, R9 699 per annum. This was calculated with the number of inhabitants as established in the 2011 census, at 1 508 and the total value was established at R14.62 million. It must be kept in mind that this not only refers to the possible number that will be resettled but to the total community whose current lifestyle will effected.

A negative impact was estimated using the discussed methodology established at -24% and the monetary impact calculated by R14.62 x -24% = -R3.51 million.

It must be stated again that this value is not part of a financial CBA, but only used in an economic CBA.

4.3.2.1.4 Environmental Externality Impact

Establishing a monetary baseline for the environment and then to measure the estimated deviation is problematic as no general accepted methodology exists. Therefore, it was decided to use the current "production" from the involved areas as a baseline. This included:

- Livestock farming.
- Game Farming and Related Activities;
- Tourism and Accommodation.

Irrigation was not used as the surface water is mostly from outside the project area.

The following table presents the estimated baseline and the projected negative impacts.

Table 34: Estimated Externality Environmental Impact

Area	Estimated Baseline Rand million	Percentage Negative Impact	Estimated Negative Impact Rand Million
1	R 0.78	-32.1%	R -0.25
2	R 10.56	-22.7%	R -2.39
3	R 22.08	-20.8%	R -4.59
Total	**R33.43**	**-21.6%**	**R-7.23**

The value of –R7.23 million is applied in economic CBA analysis. It must be emphasized that this value is not applicable in the financial CBA and is only used in the economic CBA.

4.3.2.1.5 Total Externality Impacts

The following table presents the application of the different externality cost items.

Table 35: Allocation of Externality Impacts to Respective CBAs

Activity	Financial CBA Rand million	Economic CBA Rand million
Agriculture	R-4.51	R-4.51
Game Farming and Related Activities	R-4.18	R-4.18
Community		R-3.51
Resettlement	R-153.96	R150.42
Environment		R-7.23
Total	R-162.65	R-169.85

4.3.3 Results

4.3.3.1 *CBA Results Interpretations*

The CBA parameters calculated is interpreted as follows:

- The Net Present Value (NPV) of an investment compares the present value of the benefits from an investment with the present value of all costs. In order for a project to be considered viable, a positive NPV is required as this indicates that the overall benefits outweigh the overall costs of the project over time.
- The Benefit Cost Ratio (BCR) is a ratio of the present value of benefits relative to the present value of costs. A project should only be considered viable if the BCR is greater than 1. A BCR of 2.13 indicates that for each Rand invested in the project there is an expected return of R2.13.
- The Internal Rate of Return (IRR) is the discount rate at which present values of both benefits and costs are equal. Projects should have and IRR greater than the discount rate to be considered viable.
- The NPV, BCR and IRR all confirm the financial viability of the project.

4.3.3.2 *Economic CBA*

The table below reflects the summarised results of the Economic CBA. As previously discussed, the analysis has been done in constant prices, and using an economic discount rate of 8% per annum.

The results for a number of options are presented in the following table.

Table 36: Results of the Different Coking Coal Price and Exchange Rate Options

Coal Price US$/ton	Exchange Rate	Coal Price Rand/ton	NPV Rand million	IRR	BCR	Result
$67.62	12.10	R814.31	R-933.20	-1.50%	0.57	Negative
	12.92	R869.67	R-756.91	-2.95%	0.67	Negative
	13.70	R922.22	R-579.94	-4.21%	0.76	Negative
$86.94	12.10	R1 051.69	R-156.16	-7.04%	0.99	Negative
	12.92	R1 123.19	R77.92	8.47%	1.11	Positive
	13.70	R1 191.06	R300.08	9.76%	1.24	Positive
$106.56	12.10	R1 289.07	R620.88	11.6%	1.41	Positive
	12.92	R1 376.71	R907.79	13.1%	1.56	Positive
	13.70	R1 459.90	R1 180.11	14.5%	1.71	Positive

Figure 8: The Economic NPV Values for Different Coal Prices and Exchange Rates

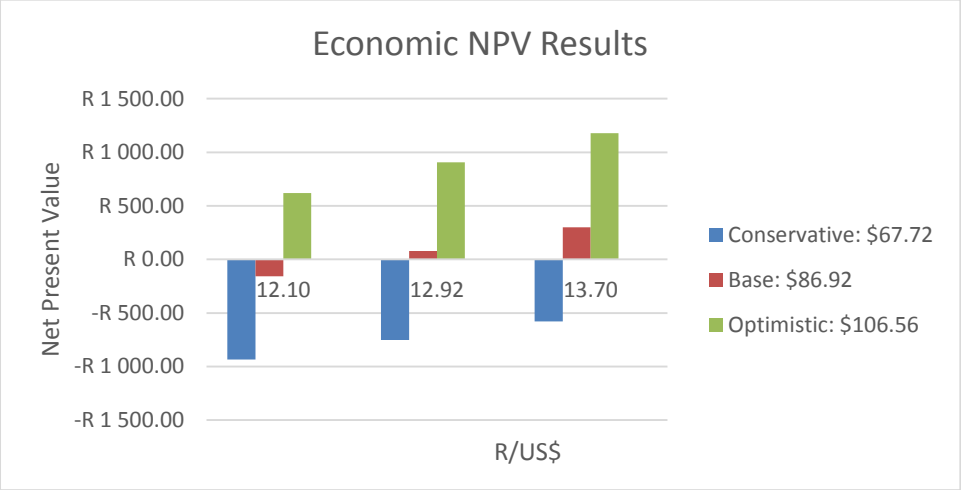


Figure 9: The Economic BCR Values for Different Coal Prices and Exchange Rates

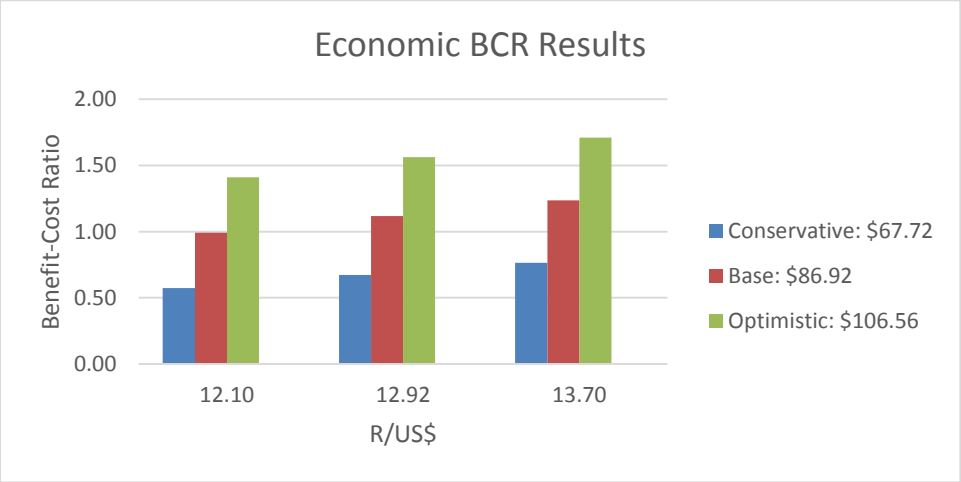
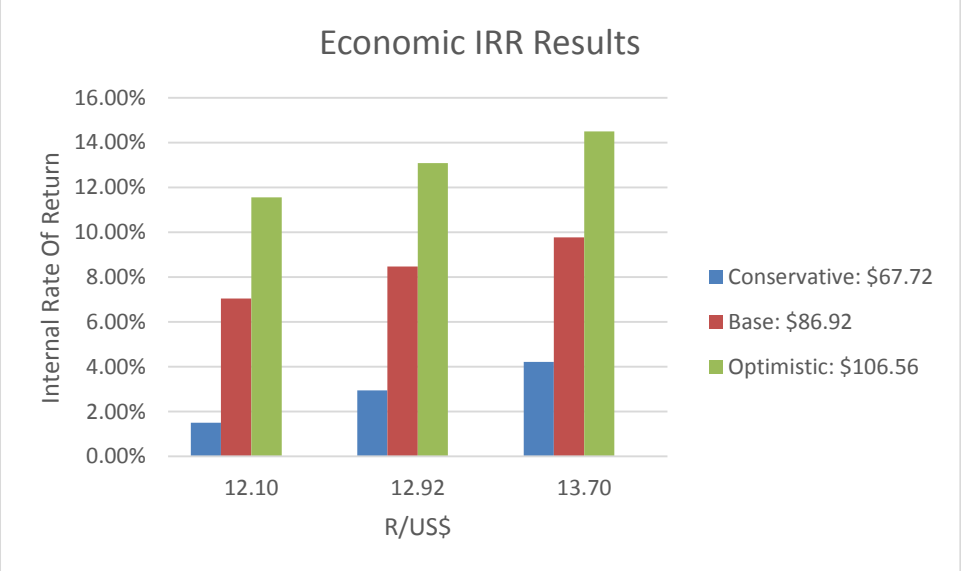


Figure 10: The Economic IRR Percentages for Different Coal Prices and Exchange Rates



The above set of results show very clearly that, at current export prices for thermal, coal will be very difficult to get a profitable and viable project. However, any return to pre 2010 prices show very positive results.

The determining factor will therefore be the future movement of export coal prices. On the short term it appears that export coal prices will remain low, but on the medium to longer term the general feeling is that moderate recovery is possible.

4.3.3.3 *Macro-Economic Impact Results*

Once the risk analysis has been performed the impact is also expressed in terms of macro-economic parameters indicating the projected negative impact of the mining project.

The following tables present the results of each area with the final table reflecting the total results.

Table 37: Projected Negative Impact of the Mining Project Expressed in Macro-Economic Parameters in the Project Area (Area 1)

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-	-	-	-	-	-	-	-	-
Beef Farming	-	-	-	-	-	-	-	-	-
Game Farming	-0.06	-0.10	-0.16	-1	-2	-3	-0.07	-0.04	-0.02
Hunting	-0.03	-0.03	-0.06	0	-1	-1	-0.03	-0.02	-0.01
Taxidermy, Game catching, etc.	-0.02	-0.02	-0.04	0	-1	-1	-0.01	-0.01	-0.00
Accommodation	-	-	-	0	0	0	-	-	-
Total	**-0.11**	**-0.15**	**-0.26**	**-1**	**-4**	**-5**	**-0.11**	**-0.07**	**-0.04**

The table shows that the impact will be very small and very few jobs lost.

Table 38: Projected Negative Impact of the Mining Project Expressed in Macro-Economic Parameter in the 5 km Area (Area 2)

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-	-	-	0	0	0	-	-	-
Beef Farming	-0.06	-0.03	-0.09	0	0	0	-0.01	-0.01	-0.00
Game Farming	-0.09	-0.13	-0.22	-1	-1	-2	-0.15	-0.15	-0.00
Hunting	-0.32	-0.32	-0.64	-2	-2	-4	-0.30	-0.20	-0.10
Taxidermy, Game catching, etc.	-0.27	-0.27	-0.53	-1	-1	-2	-0.17	-0.13	-0.04
Accommodation	-0.43	-0.50	-0.93	-3	-2	-5	-0.49	-0.33	-0.16
Total	**-1.17**	**-1.25**	**-2.42**	**-7**	**-6**	**-13**	**-1.12**	**-0.81**	**-0.30**

The impact will be more noticeable with a total of 13 jobs lost and R1.12 payments to households also lost.

Table 39: Projected Negative Impact of the Mining Project Expressed in Macro-Economic Parameters in the 10 km Area (Area 3)

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-1.87	-1.57	-3.44	-33	-9	-42	-1.60	-1.35	-0.25
Beef Farming	-0.23	-0.08	-0.31	-2	-1	-3	-0.04	-0.03	-0.01
Game Farming	-0.02	-0.05	-0.07	-1	0	-1	-0.06	-0.05	-0.01
Hunting	-0.25	-0.24	-0.49	-1	-2	-3	-0.23	-0.16	-0.07
Taxidermy, Game catching, etc.	-0.15	-0.15	-0.30	-1	-1	-2	-0.10	-0.07	-0.02
Accommodation	-0.52	-0.61	-1.13	-3	-3	-6	-0.37	-0.27	-0.09
Total	**-3.04**	**-2.70**	**-5.74**	**-41**	**-16**	**-57**	**-2.39**	**-1.93**	**-0.47**

The negative impact will probably only occur in the worst possible scenario and be more severe in the irrigation activity should any surface or underground water be contaminated with 42 of the estimated 57 jobs lost in this sector.

Table 40: The Total Projected Negative Impact of the Mining Project Expressed in Macro-economic Parameters

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-1.87	-1.57	-3.44	-33	-9	-42	-1.60	-1.35	-0.25
Beef Farming	-0.29	-0.11	-0.40	-3	-1	-4	-0.05	-0.04	-0.01
Game Farming	-0.17	-0.28	-0.45	-2	-3	-5	-0.27	-0.23	-0.04
Hunting	-0.60	-0.59	-1.19	-3	-3	-6	-0.56	-0.38	-0.18
Taxidermy, Game catching, etc.	-0.44	-0.44	-0.88	-2	-1	-3	-0.28	-0.21	-0.07
Accommodation	-0.95	-1.11	-2.07	-6	-5	-11	-0.85	-0.60	-0.25
Total	**-4.32**	**-4.10**	**-8.42**	**-48**	**-22**	**-70**	**-3.62**	**-2.81**	**-0.81**

In total it is estimated that the mining project could cause a loss of about R8.42 million in GDP, 48 direct employment opportunities, a total of 70 jobs lost and a household income loss of R3.62 million of which R0.81 is million from the low income households.

5 MACRO-ECONOMIC IMPACT ANALYSIS

5.1 OBJECTIVE

The objective of this chapter is to present the macro and socio-economic impacts that emanate from both the construction and operational phases of the capital investment project under consideration. The CBA preceded the macro-economic impact analysis and the information requirements for the CBA (See Paragraph 4.2.4) will serve as a major data source needed to initiate the macro-economic modelling system that quantifies the impacts.

The macro-economic impact analysis was conducted at a national, regional/provincial and local level. However, the main focus of the analysis is the Limpopo Province and the Vhembe District Municipality area, in particular. The impact analysis is based on the contribution that the project is expected to make towards the national, provincial and local economies in terms of the following macroeconomic aggregates:

- Gross Domestic Product (Economic Growth);
- Employment Creation:
  - Skilled Labourers;
  - Semi-Skilled Labourers; and
  - Unskilled Labourers.
- Capital Utilisation (Investment);
- Household Income (Poverty Alleviation in terms of Low Income Households);
- Fiscal Impacts; and
- Balance of Payments.

The macro-economic impact analysis was so structured to reflect the average annual production output over the project period of 24 years. Furthermore these macro-economic impacts also reflect the ultimate or total outcome, i.e. through the direct, indirect and induced linkages of the construction and operational parts of the project in question.

5.2 METHODOLOGY

5.2.1 Overview of the Macro-Economic Impact Analysis

As indicated previously in the report, the main purpose of this chapter of the study is to estimate the impact of the proposed The Duel Coal Project on the South African economy as well as to give an indication of the impact it will have on the provincial economy of Limpopo and the local economy of Vhembe District Municipality. It is important to note that the National, Provincial and local macro-economic impact results are shown in a separate format for the construction and operational phases. For purposes of the impact analysis Conningarth Economists has compiled and updated SAMs for the South African and Limpopo economies which formed the basis of the impact model – *viz* – a general equilibrium model. This model will quantify the direct, indirect and induced impacts over time.

The compilation of the updated South African and Limpopo SAMs was part of a major initiative by the Development Bank of Southern Africa (DBSA), Department of Provincial and Local Government (DPLG), StatsSA and the South African Reserve Bank (SARB) to compile nine comparable provincial SAMs that have all been updated to 2006 prices and have been benchmarked with the new South

African SAM of 2006. The Limpopo SAM was finalized in October 2009, and was overseen by an expert group of people from the Limpopo Province, chaired by the Limpopo Economic Development Department.

The benchmarking exercise was necessary to ensure that all control totals add up to the National Account figures as reflected in the SARB Quarterly Bulletin – June 2008 and the relevant figures reflected in the StatsSA publications, especially P0144 that reflects the 2006 Supply and Use Matrix.

The provincial SAMs compiled by Conningarth Economists were converted into user-friendly macro-economic impact models which can be used by each province to calculate the economic impact of "interventions" by way of programmes and projects on the economy of the relevant province.

The model makes use of Excel spreadsheets and is driven by a set of "Macros" which are used to eliminate the need to repeat the steps in a simple task over and over. For a specific project or say a policy intervention, the model provides the size of the macro-economic impacts, the values of which are then also used to calculate key economic performance or efficiency indicators at national, provincial and local government level. Such key macro-economic performance indicators can be produced for both the construction and operational phases of a specific project.

It is also important to highlight the fact that the macro-economic impact model is robust enough to cater for varying degrees of input data qualities and availability. For instance, if the impacts are required at local government level, the model lends itself well to adjusting relevant provincial coefficients to realistically portray the situation at lower levels.

5.2.2 Current Activities

In layman's terms a SAM also represents a mathematical matrix depicting the linkages that exist in financial terms between all the major role players in the economy, i.e. business sectors, households and government. It is very similar to the input/output table in the sense that it also reflects the inter-sectoral linkages that are present in an economy. The development of the SAM also provides a logical framework within the context of the National Accounts in which the activities of especially households are accentuated and distinguished prominently. The households are indeed the basic economic unit where significant decisions are taken affecting economic variables, such as consumption expenditure and personal saving. By combining households into homogenic groups in the SAM, makes it possible to study how the economic welfare of these groups is affected by changes in the economy.

To summarise, the SAM serves a dual purpose. Firstly, it is a reflection of the magnitude of financial linkages that exist between the major stakeholders in an economy, and secondly, it becomes a powerful econometric tool that can be used to conduct various economic analyses such as calculating the impact of investment projects on the economy. A more detailed technical description of the SAM and its analytical attributes are provided in Section 9, Appendix B.

By applying the general tenets of the general equilibrium economic model to the SAM structure, the so-called direct, indirect and induced effects emanating from the various levels of value adding at all levels i.e. primary (including mining), manufacturing, commercial services etc. are quantified.

The direct impact that occurs, for example, in the mining industry, is measured through changes in production/turnover, payment of remuneration to employees and profit generation. The indirect impacts refer to impacts on industries that provide raw material inputs to the mining industry and other backward linkages. The induced effect or income effect refers to a further round of economic

activity that takes place in the economy because of additional consumer spending as a result of the additional salaries and wages that occur throughout the economy. The impact analysis was based on the standard economic aggregates. A brief overview of the definition of each of these aggregates is given in Section 9, Appendix B.

5.3 DATA SOURCES AND ASSUMPTIONS

Modelling the macro-economic impact of the construction and operational phases of The Duel Coal Project requires certain detailed information regarding these two phases of the project.

When evaluating the construction and operational phases the model requires information on the new mine such as costs of buildings, machinery and equipment, etc. This type of data as well as the planned outputs of the mine, etc. are discussed in detail in the appropriate section. There are, however, also externalities linked to the operation of the mine, such as the negative impact on agriculture, tourism and positive impacts on government spending and the rail transport of the domestic coal. The possible magnitude of these externalities is discussed in detail in the previous chapters.

Examples of the type of inputs the model requires are given in Section 10, Appendix C.

5.4 RESULTS

It is important to keep in mind that the provincial results are a subset of the national results.

5.4.1 National Results

The macro-economic impact assessments contained in this study covered the totals of the construction phase over the construction phase period and the average annual operational phase totals for the period construction period as well as the projected 24 year production period. The entire results section is reflected in a construction phase and/or in an operational phase, respectively. The results that follow reflect the impact arising from the main components involved with the construction and operation of the coal mine, the transportation and water supply.

Table 41: Macro-Economic Impact of the Construction Phase of The Duel Coal Project on the South African Economy (2014 prices and Rand million)

	Direct Impact	*Indirect Impact*	*Induced Impact*	*Total Impact*
Impact on GDP (R millions)	R 115	R 114	R 156	**R 385**
Impact on Capital Formation (R millions)	R 92	R 230	R 289	**R 611**
Impact on Employment [numbers]:	1 276	547	764	**2 587**
Skilled impact on employment [numbers]	142	117	208	**467**
Semi-skilled impact on employment [numbers]	877	312	394	**1 584**
Unskilled impact on employment [numbers]	257	118	161	**536**
Impact on Households: (R millions)				**R 513.24**
Low Income Households (R millions)				**R 43.83**
Medium Income Households (R millions)				**R 53.45**
High Income Households (R millions)				**R 159.33**
Fiscal Impact: (R millions)				**R 116.91**
National Government (R millions)				**R 107.85**
Provincial Government (R millions)				**R 1.24**
Local Government (R millions)				**R 7.82**
Impact on the Balance of Payments (R millions)				**-R 173.22**

Table 42: Macro-Economic Impact of the Operational Phase of The Duel Coal Project on the South African Economy (2014 prices)

	Direct Impact	*Indirect Impact*	*Induced Impact*	*Total Impact*
Impact on GDP (R millions)	R 204	R 122	R 212	**R 539**
Impact on Capital Formation (R millions)	R 717	R 285	R 393	**R 1 395**
Impact on Employment [numbers]:	503	575	1 045	**2 124**
Skilled impact on employment [numbers]	35	134	284	**453**
Semi-skilled impact on employment [numbers]	369	326	540	**1 234**
Unskilled impact on employment [numbers]	99	116	222	**437**
Impact on Households: (R millions)				**R 439.96**
Low Income Households (R millions)				R 75.41
Medium Income Households (R millions)				R 208.99
High Income Households (R millions)				R 155.56
Fiscal Impact: (R millions)				**R 155.56**
National Government (R millions)				R 143.35
Provincial Government (R millions)				R 1.80
Local Government (R millions)				R 10.41
Impact on the Balance of Payments (R millions)				**R 252.20**

5.4.1.1 *Impact on GDP*

GDP is a good indicator of economic growth and welfare as it represents, among other criteria, remuneration of employees and gross operating surplus (profits) as components of value added at all the levels of the economy.

According to Table 41, the construction phase impact on RSA's GDP, is estimated to amount to approximately R385 million per annum (in constant, 2014 prices) over the construction period, of which the direct impact is estimated at R115 million which is nearly a third when compared to the total GDP. It must be kept in mind that these positive results will only be for the initial 18 months construction period.

Similarly, Table 42 reflects the average annual operational phase impact on RSA's GDP, which is estimated to amount to approximately R539 million (in constant, 2014 prices), of which the direct impact is estimated at R204 million and accounting for nearly 38% when compared to the total. This emphasises the importance of the so-called multiplier effects which the mine will have on the South African economy.

From these figures, it can already be assumed, that the ultimate benefit of the bulk of salaries and wages paid out, directly and indirectly, in the course of constructing and operating the project will not accrue within the Limpopo Province, but will filter through to the other provinces in SA.

5.4.1.2 *Impact on Capital Investments*

Productive capital assets are required to support or generate any given amount of economic activity (i.e. GDP). These capital assets, together with labour and entrepreneurship, form the core productive factors needed for production. Obviously the effectiveness and efficiency with which these factors are combined will determine the overall level of productivity and profitability of such assets. The former will in turn depend on a whole array of factors, of which the appropriate technology and skills content of the labour force are important. The above Table 42 indicates the following: construction phase capital stock that needs to be employed (utilised) nationally to sustain this project amounts to R1 395 million, of which, R717 million is attributed directly to The Duel Coal Project.

5.4.1.3 *Impact on Employment Creation*

Labour input is a key element of the production process. It is one of the main production factors in any economy and employment levels are indicators of the extent that labour is effectively absorbed in the economy. This study determines the number of new employment opportunities that will be created through the impact of the construction and operation of the identified project on an average annual basis.

The construction phase impact on employment (Table 41) amounts to 2 587 employment opportunities nationally, which are mostly temporary job opportunities, lasting through the duration of the construction period.

The operational phase impact on employment (Table 42) amounts to 2 124 employment opportunities nationally, which are mostly permanent job opportunities, lasting through the lifespan of the mine.

5.4.1.4 *Impact on Households*

One of the crucial aspects of any macro-economic assessment is determining the personal income distribution characteristics thereof, especially with regard to how low income households will be impacted. In this section the extent to which low-income households will be positively affected by the spin offs created by the total development project is under scrutiny.

The impact on low-income households is presented in the two tables above. From Table 42 it is evident that the operational phase impact on low-income households will be R75.4 million per annum which translates to 17.1% of the total impact on households' income.

5.4.1.5 *Impact on Balance of Payments*

The impact on "Balance of Payments" refers to the net result between estimated export earnings and import costs. A positive balance indicates that the exports earnings per annum are more than the costs of imports.

It is estimated that the positive impact on the Balance of Payments will amount to approximately R252.2 million per annum for the operational phase (Table 42). The negative value during the construction phase shows the impact importation of mining implements.

5.4.1.6 *Fiscal Impact*

According to Table 42, total government revenue is expected to increase on an average annual basis of approximately R155 million during the operational phase. The main tax revenues are from direct tax and indirect tax, where direct tax consists mainly of personal income tax and company tax. Examples of indirect taxes are value added tax (VAT) and customs and excise tax. The increase in VAT is the result of additional household spending made possible by the increase in household incomes as a result of the project being implemented.

The increase in annual state revenue as a result of the construction and operation of the identified project could provide the means to increase government expenditure on social services.

5.4.1.7 *Economic Efficiency Criteria*

The macro-economic impacts discussed above provide an indication of the contribution that the coal mine will make to economic and socio-economic goals and objectives. However, it is also necessary to further interpret these impacts in order to determine whether or not the project represents an effective use of scarce economic resources. Since capital is a scarce resource in South Africa, the effectiveness criteria used in this study measure the use of capital in terms of GDP and job creation, relative to averages for South Africa.

In order to do these comparisons, two key multipliers/ratios have been calculated i.e. the GDP/Capital ratio, and the Labour/Capital ratio. Using these two ratios, it is possible to establish whether the capital employed in these projects and the contribution towards economic growth and job creation could in fact be regarded as effective and efficient. If continuous economic growth in the long-term is considered to be more important than job creation in the short-term, then the GDP/Capital ratio's performance is the more important of the two. However, if job creation is given priority, particularly in the short term, then the Labour/Capital ratio is the more important one to use in evaluating the project's efficiency.

The efficiency/effectiveness criteria measured for the project is provided in the table below. This table also reflects the averages for the South African economy and for the mining sector.

Table 43: Economic Effectiveness Criteria of The Duel Coal Project Compared to the South African Economy

	GDP/Capital	Labour/Capital	Low Income/Total Income
The Duel Coal Project	0.43	1.77	17.1%
Mining and quarrying	0.45	2.18	18.7%
Total National Economy	**0.45**	**2.94**	**16.2%**

A comparison of the coal mines GDP/Capital ratio with the average for the total South African economy indicates that for every R1 million of capital invested in the coal mine, it generates an overall GDP ratio of 0.43 compared to the average for the national economy of 0.45. This suggests that the coal mine utilises capital more effectively than other sectors in the national economy.

When a similar comparison of the Labour/Capital ratio is made, the coal mine will generate fewer employment opportunities, i.e. 1.77 jobs created for every R1 million invested in this project, in comparison with the national average of 2.94 jobs created, but in comparison with the mining sector average of 2.18 jobs created, the project is almost on par.

In terms of the income portion that is distributed to the low income households, it is well above the national average at 17.1%.

5.4.2 Provincial Results

The following macro-economic impact table reflects the total construction phase and the average annual totals for the operational phase for the 24 year period on the Province of Limpopo. The components measured incorporate the construction and operation of the mine, transport and water supply of the project.

Table 44: Macro-Economic Impact of the Construction Phase of The Duel Coal Project for the Province of Limpopo (2010 prices)

	Direct Impact	***Indirect Impact***	***Induced Impact***	***Total Impact***
Impact on GDP (R millions)	R 94	R 29	R 26	**R 149**
Impact on Capital Formation (R millions)	R 61	R 78	R 72	**R 210**
Impact on Employment [numbers]:	1 180	180	194	**1 554**
Skilled impact on employment [numbers]	117	25	25	**168**
Semi-skilled impact on employment [numbers]	821	115	88	**1 024**
Unskilled impact on employment [numbers]	242	40	80	**362**
Impact on Households: (R millions)				**R 78.92**
Low Income Households (R millions)				**R 26.50**
Medium Income Households (R millions)				**R 13.81**
High Income Households (R millions)				**R 38.61**

Table 45: Macro-Economic Impact of the Operational Phase of The Duel Coal Project for the Province of Limpopo (2010 prices)

	Direct Impact	***Indirect Impact***	***Induced Impact***	***Total Impact***
Impact on GDP (R millions)	R 204	R 53	R 49	**R 306**
Impact on Capital Formation (R millions)	R 717	R 176	R 131	**R 1 024**
Impact on Employment [numbers]:	503	290	303	**1 096**
Skilled impact on employment [numbers]	35	52	51	**137**
Semi-skilled impact on employment [numbers]	369	174	155	**698**
Unskilled impact on employment [numbers]	99	64	98	**261**
Impact on Households: (R millions)				**R 161.78**
Low Income Households (R millions)				**R 58.62**
Medium Income Households (R millions)				**R 31.46**
High Income Households (R millions)				**R 71.70**

5.4.2.1 *Impact on GDP*

According to Table 44, the construction phase impact on GDP for Limpopo Province, is approximately R149 million (in constant, 2015 prices), of which the direct impact on GDP is estimated at R94 million.

According to Table 45, the operational phase impact on GDP for Limpopo Province, is approximately R 306 million on an annualised basis (in constant, 2014 prices), of which the direct impact on GDP is estimated at R204 million.

5.4.2.2 *Impact on Employment Creation*

The construction phase impact on employment amounts to 1 554 employment opportunities that will be sustained over the construction period. Of this number, 1 180 employment opportunities are associated directly with the project. See Table 44.

The operational phase impact on employment amounts to 1 096 employment opportunities that will be sustained on an annualised basis over the lifespan of the mine. Of this number, 503 employment opportunities are associated directly with the project. See Table 45.

5.4.2.3 *Impact on Households*

The operational phase impact on low-income households is given in Table 45. From this table it is evident that the operational phase impact on low-income households will be R58.62 million per annum which translates to ±36 % of the total (direct, indirect and induced) operational phase impact on household income.

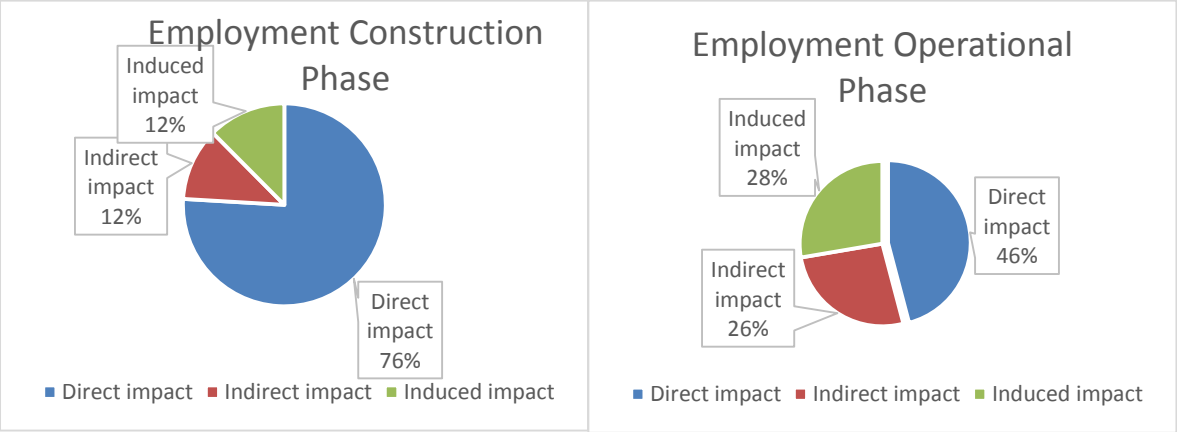
5.4.2.4 *Magnitude of Linkages (Direct, Indirect and Induced Effects)*

As indicated before, the SAM – based model measures the sum of the direct, indirect and induced effects that will emanate from the project under consideration. The direct effect of employment, for example, refers to the number of persons that will on an annual basis be directly linked to either the construction and/or the operation of the relevant project. In the same vain, the indirect effect on employment is measured as the number of employment opportunities that will be created in other sectors because of their supporting roles to sustain the increased investment and operational

activities emanating from the project. The induced effect of employment refers to the number of employment opportunities created due to the increase in spending power that is flowing from the remuneration of workers employed at all the levels described above.

Below are the charts representing the direct, indirect and induced impacts on employment in the Limpopo Province. The direct effect in terms of construction phase employment accounts for more than the indirect and induced effects combined. The operational phase employment is reflected differently to the construction phase employment due to this particular project under investigation being very labour intensive during the construction phase with less employment required on the direct effect level in the operational phase.

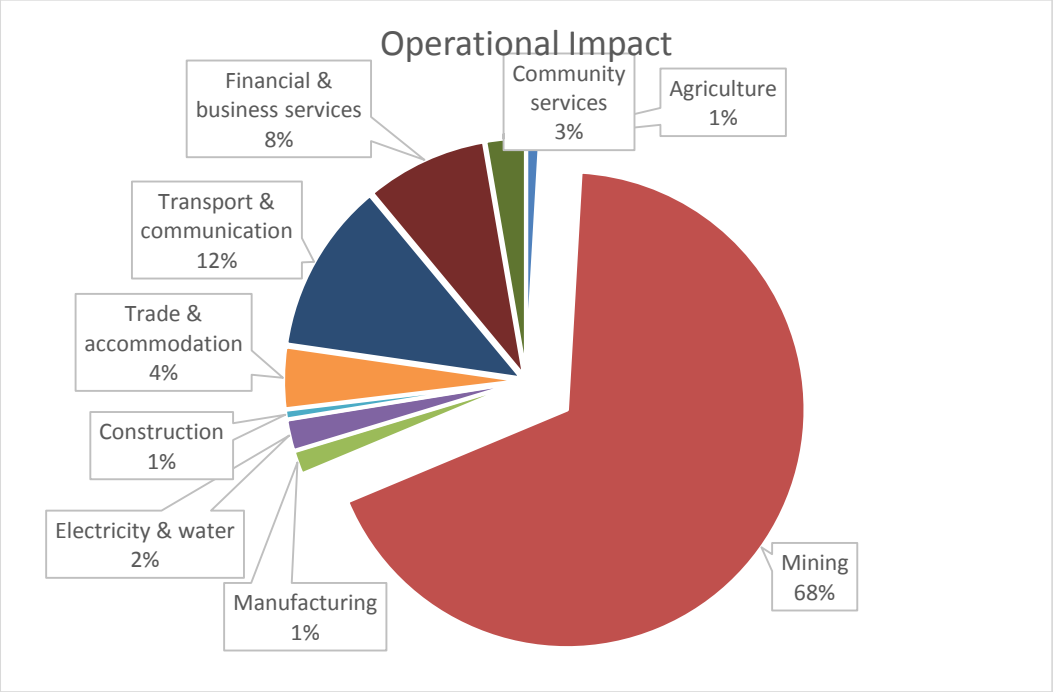
Figure 11: Macro-Economic Impact on Limpopo Province in Terms of Construction and Operational Phase Employment



5.4.2.5 *Sectoral Impact*

It is important to note that the total impact of the project concerned in Limpopo takes place across a wider spectrum of sectors than those in which the investments initially take place. In the chart below the GDP is divided according to the nine (9) main sectors of the Limpopo Provincial economy. From this it can be seen that the total effect is more profound in the mining sector which is quite understandable because the capital development project per se is classified to fall in the mining sector.

Figure 12: Sectoral GDP Impact on the Limpopo Province (percentages)



5.4.3 Local Results

5.4.3.1 *Macro-Economic Impact Results on the Vhembe District Municipality Economy*

The macro-economic impact also provides an insight into the contribution which the construction and operation phases of the relevant project will have on the economic and socio-economic situation in the Vhembe District Municipality.

5.4.3.2 *Summary of Results Referring to the Vhembe District Municipality Area*

In Table 46 and Table 47 a summary is provided of the macro-economic impact in the Vhembe District for the construction and operational phases respectively.

Table 46: Macro-Economic Impact of the Construction Phase of The Duel Coal Project on the Vhembe District Municipality (2010 prices)

	Direct Impact	***Indirect Impact***	***Induced Impact***	***Total Impact***
Impact on GDP (R millions)	63.7	5.2	4.7	**73.6**
Impact on Employment [numbers]:	1 180	21	29	**1 230**

Table 47: Macro-Economic Impact of the Operational Phase of The Duel Coal Project on the Vhembe District Municipality (2010 prices)

	Direct Impact	***Indirect Impact***	***Induced Impact***	***Total Impact***
Impact on GDP (R millions)	136	3.1	3.7	**146**
Impact on Employment [numbers]:	503	52	56	**611**

5.4.3.2.1 Impact on GDP

According to Table 46, the construction phase impact on GDP amounts to approximately R73.6 million over the construction period. The direct part of this impact on GDP is estimated at R63.7 million. In Table 47, the operational impact on an annualised basis, on the GDP of the Vhembe District Municipality is estimated to amount to approximately R146 million (in constant, 2014 prices) while the direct impact amounts to R136 million which illustrates the positive economic growth that will be created as a result of the construction of The Duel Coal Project.

5.4.3.2.2 Impact on Employment Creation

The construction phase of the coal mine will create and sustain 1 230 employment opportunities which will occur over the duration of the construction phase only. The annualised impact on employment in the operational phase amounts to 611 employment opportunities that will be created and sustained over the lifespan of The Duel Coal Project in the Vhembe District Municipality.

6 SUMMARY AND CONCLUSION

The proposed The Duel Coal Project in the end comes down to an issue of which is the better land use option between the two resource economic activities. Mining is the non-renewable resource user, while the current land-use activities, depending on the quality of environmental management, are a renewable resource activity.

Another point of view is that the employment opportunities are now needed and by limiting the possible negative impact of the mining activities the majority of the current activities can proceed, if proper rehabilitation programs are in place some of the mining land can eventually be brought back into production.

The Economic Cost Benefit Analysis (CBA) shows positive results for a number of price options and read together with results of the macro-economic impact analysis the economics of the project shows positive parameters for the local area, the Limpopo Province and South Africa.

However, as so often happens, the economic benefit will put a negative burden on the current local economic activities in the project area. For analytical purposes the project area was divided into three circular areas, the inner circle (Area 1), the so-called project area, comprising in total 888 hectares with all 888 hectares being part of the MRA area, the second circle (Area 2), representing roughly 9 573 hectares and the outer circle roughly 27 454 hectares. The majority of the land is utilised for game farming, with little commercial beef farming. In the analysis and interpreting the realities of the site of the proposed coal mine, it was concluded that about 30.2% of the present activities in the project area will be negatively impacted on, in Area 2 this figure will be around 21.6% with about 15.8% in the outer circle.

The following two issues have been identified as relevant issues:

- Hunting activities, specifically trophy hunting and the accompanying accommodation.
- Irrigation in the Area 3.

A third issue raised by land owners is the possible drawdown and contamination of ground water resources, where special care should be taken.

Most of the farms in Areas 2 and 3 would be able to maintain production with minor adjustments to their business plan and way of operation.

The results of the CBA are summarised in the table below.

Table 48: Summarised Results of the Economic CBA

Coal Price US$/ton	Exchange Rate	Coal Price Rand/ton	NPV Rand million	IRR	BCR	Result
$67.62	12.10	R814.31	R-933.20	-1.50%	0.57	Negative
	12.92	R869.67	R-756.91	-2.95%	0.67	Negative
	13.70	R922.22	R-579.94	-4.21%	0.76	Negative
$86.94	12.10	R1 051.69	R-156.16	-7.04%	0.99	Negative
	12.92	R1 123.19	R77.92	8.47%	1.11	Positive
	13.70	R1 191.06	R300.08	9.76%	1.24	Positive
$106.56	12.10	R1 289.07	R620.88	11.6%	1.41	Positive
	12.92	R1 376.71	R907.79	13.1%	1.56	Positive
	13.70	R1 459.90	R1 180.11	14.5%	1.71	Positive

CBA Results

- The economic Net Present Value (NPV) turns positive at a coal price of $86.94 and an exchange rate of R12.92 to the US dollar. It is only at an NPV of approximately R146.47 million that a significant excess of benefits over costs is shown.
- The Benefit Cost Ratios (BCR) of 1.15 in the economic CBA implies a return per Rand of R1.15, which confirms profitability of the project. The cut-off point for the BCR is 1.
- The Internal Rate of Return (IRR) of 8.47% indicates economic viability of the project at coal prices above the level of US$86.94 per ton product. A project needs an IRR greater than the discount rate to indicate financial viability.

Given these outcomes, the CBA clearly demonstrates the economic feasibility of The Duel Coal Project above the minimum levels.

In South Africa the last producing hard coking coal mine is closing and in the process of rehabilitation. The Tshikondeni Mine produced in the order of 316 000 tonnes of hard coking coal (HCC) and was the only HCC producer in the country since 1984. Its demise spells a total shortage of local HCC for the metals industry in South Africa. Tshikondeni sold coking coal to AcelorMittal, however, the mine was not very profitable because of the pricing arrangement, but had a captive market and only closed due to the depletion of its resources.

The demand for thermal coal in the future will largely depend on the extent of global reliance on coal for electricity production, while the demand for coking coal will depend on the growth in steel production. Coal demand is expected to increase significantly, especially on the back of increases in power and industrial production.

It is accepted that The Duel Coal Project, if implemented, will have a negative impact on the on current economic activities of the identified area. However the construction phase of the coal mine will create and sustain 1 230 employment opportunities which will occur over the duration of the construction phase only. The annualised impact on employment in the operational phase amounts to 503 direct employment opportunities that will be created and sustained over the lifespan of The Duel Coal Project in the Vhembe District Municipality.

The following table presents a comparison of the current economic activities versus the operational phase of the mine during its lifetime.

Table 49: Estimated Net Benefit to the Vhembe district and Limpopo Province of the planned Mining Project.

Macro –Economic Parameter	Created and Supported by the Mining Activity	Created and Supported by the Current Activities	Estimated losses due to Mining Activities	Net Additional Benefit
Total GDP (Rand million)	R146	R77	R-8.4	R137.6
Direct Employment	503	399	-48	455
Total Employment	611	550	-70	541
Payments to Low-income HH	R58	R6.47	R-0.81	R57.19
Total Payments to HH	R161	R29.43	R-3.62	R158.61

The table show that the net benefit to the area will be considerable after the estimation of the possible negative impact on macro-economic parameters. In terms of direct jobs, 455 additional jobs

will be created locally and the payment to low-income households will increase by R57 million per annum.

Although current activities will bear the negative brunt of the mining project, the overall conclusion is that from a macro-economic point of view The Duel Coal Project will be beneficial for the region, province and national economy.

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8 APPENDIX A – COST BENEFIT ANALYSIS

Introduction

The CBA method provides a logical framework for evaluating development programmes, and can serve as an aid in decision-making processes. The following is a brief overview of the theory underlying the CBA method.

The theoretical foundations of CBA are: benefits are defined as increases in human wellbeing (utility) and costs are defined as reduction in human wellbeing. For a project of policy to qualify on cost-benefit grounds, its social benefits must exceed its social costs. "Society" is simply the sum of individuals. The geographical boundary for a CBA is usually the nation, but can be readily extended to wider limits.

Basic Aggregation Rules

There are two basic aggregation rules. Firstly, aggregating benefits across different social groups or nations involves summing willingness to pay for benefits, its willingness to accept compensation for losses (WTP and WTA, respectively), regardless of the circumstances of the beneficiaries or losers. A second aggregation rule requires that higher weights be given to benefits and costs accruing to disadvantages or low income groups. One rationale for the second rule is that marginal utilities or income will vary, being higher for the low income group.

The notions of WTP and WTA are firmly grounded in the theory of welfare economics and correspond to the notions of compensation and equivalent variations. WTP and WTA should not, according to past theory, diverge very much. In practice they appear to diverge, often substantially, and with WTA > WTP. Hence, the choice of WTP or WTA may be of importance when conducting a CBA.

Discounting

Aggregating over time involves discounting. Expressing future benefits and costs in present value is known as discounting. Inflation can result in future benefits and costs appearing to be higher than is really the case. Inflation should be netted out to secure constant price estimates.

Costs and benefits that are immediately incurred are judged differently by the community from costs and benefits that materialize over a period of time. Usually a community would prefer receiving a benefit today rather than reaping the benefits in the future, while deferred costs are more attractive than immediate payment. Therefore, the money value of costs and benefits over time cannot simply be added together, and the time preference of the community has to be taken into account through the use of a weighting process. This is done by calculating the net present value by discounting future cash-flows at a rate that reflects the value of a benefit or cost over time, known as the social discount rate. In other words, at what real interest rate will the community be prepared to forego immediate benefits in exchange for longer term benefits?

Suppose b0, b1, b2, …, bn are the project benefits in years 0, 1, 2, …, n and c0, c1, c2, …, cn are the costs in years 0, 1, 2, …, n, respectively, and I is the social discount rate, then the present value of the benefits is given by

b_0÷〖(1+i)〗^0 + b_1÷〖(1+i)〗^1 + … +b_n÷〖(1+i)〗^n

And the present value of the costs are given by

$c_0 \div 〖(1+i)〗^0 + c_1 \div 〖(1+i)〗^1 + \ldots + c_n \div 〖(1+i)〗^n$

These present values are then used to calculate various assessment criteria, while assisting in the evaluation of each development sphere. These criteria are:

- Net Present Value (NPV).
- Internal Rate of Return (IRR).
- Benefit Cost Ratio (BCR).

Net Present Value (NPV)

The difference between the benefits and costs (the net benefits) in the specific year is discounted to the present by using the social discount rate. The discounted sum of all these net benefits over the economic project life is defined as the NPV. In terms of terminology set out above:

$NPV = \sum b_j \div 〖(1+i)〗^j - \sum c_j \div 〖(1+i)〗^j$

The criteria for the acceptance of a project are that the NPV must be positive; in other words, funds will be voted for a project only if the analysis produces a positive net present value. Where a choice has to be made between mutually exclusive projects, the project with the highest present value will be chosen since it maximizes the net benefits to the community.

Internal Rate of Return (IRR)

The IRR is the discount rate at which the present value of costs and benefits are equal. It is therefore the value of the discount rate, r, which satisfies the following criteria:

$\sum b_j \div 〖(1+r)〗^j - \sum c_j \div 〖(1+r)〗^{(j)} = 0$

Only projects with an IRR higher than the social discount rate, which forms a limit, will be considered for funding. The IRR must be handled carefully, because there are situations in which mathematical solution of the above equation is not unique. This happens when the stream of net benefits over the assessment period changes its sign (positive or negative) more than once.

Benefit Cost Ration (BCR)

The discounted BCR is the ratio of the present value of the benefits to the present value of the costs, i.e.

$BCR = \{\sum b_j \div (1+r)^j\} \div \{\sum c_j \div (1+r)^{(j)}\}$

A project will be considered for funding if the BCR is greater than 1.

Appropriate Discount Rate

When considering an appropriate discount rate, note must be taken of the various points of departure in the economic literature as well as of the rates applied in other countries and by international development institutions.

The points of departure described in the literature can be broadly divided into three schools of thought, namely those who argue that the discount rate should be equal to the marginal return on capital (opportunity cost of capital), those whose arguments rests on long-term real interest rate (cost of funding to the State), and those who advocate a social time preference rate.

The first two schools take an economic view, whilst the third school adopts a multiple-goal approach which includes social aims. There is no consensus which method should be used to determine the

social discount rate that would apply for a specific country. Therefore, a relative pragmatic approach takes the following factors into account:

- The discount rate should not be influenced by business cycle conditions and policy, since the preferences that find expression in this rate are aimed at the extension of the long-term welfare structure.
- A low discount rate generally favours projects with a higher capital cost and low future current costs, while the opposite applies to high discount rates. Since labour costs are part of current expenditure, a high discount rate favours the employment of labour in the future. If the real social discount rate is lower than the real implicit discount rate in the private sector, then investment by the public sector will be encouraged at the expense of investment by the private sector. The larger the gap between the two discount rates, the stronger the effect.

Financial Discount Rate

In the case of public projects, where CBA is being performed for financial purposes, calculations are done at either current price, where inflation is taken into consideration or at constant/real prices, where inflation is excluded.

In terms of the financial analysis, the discount rate used is equal to the market rate, or weighted marginal cost of capital, plus uncertainty and a risk premium. It should be noted that if the calculation is being done in constant/real prices, the discount rate used should be in real terms. For instance, if the discount rate in current prices is 10% and the prospects for inflation over the project appraisal period is 5%, then the real discount rate is approximately 5%. It can be calculated as follows:

((1.10÷1.05)-1)×100=4.76%

Therefore the real discount rate is not exactly 5% but 4.76%.

Due to the fact that projections are made over a long period into the future, and the fact that the future inflation rate is dependent on various economic factors (e.g. worldwide shocks such as oil price, etc.), it is generally difficult to estimate long-term price movements. In this study, the Consultants have used a real discount rate of 5%, and an inflation rate of 6%. Using the methodology described above, this yields a nominal discount rate of 11%.

Economic Discount Rate

Although the calculation of the social time preference rate (STPR) is very difficult to determine, this has not stopped some analysts attempting empirical estimates. According to Kirkpatrick and Weiss (1996) "… such estimates are normally in the 1 percent to 5 percent range, since per capita consumption growth will rarely exceed 3 percent annually, and the conventional estimates of the elasticity of the marginal utility of consumption are typically between 1.0 and 1.5." Walshe and Dafferen calculated that the STPR is slightly in excess of the potential growth rate of an economy.

The study uses an economic discount rate of 8%, which is standard to most studies of this nature.

Market *versus* Shadow Prices

As indicated above, the CBA can be conducted in financial (market) as well as economic (shadow) prices. Market prices are those perceived prices at which products and services are traded in the market place, irrespective of the level of interference in the market, e.g. the market wage rate of

labour, the price of 2kg of maize meal, the price of 1 kilowatt-hour of electricity, etc. In theory, market prices are mainly manifestations of consumers' willingness to pay.

Shadow prices (economic prices) are regarded as the opportunity costs of products and services when the market price, for whatever reasons, does not reflect these costs in full. Examples are the shadow wages of labour, where minimum wages are fixed at levels higher than market prices; shadow price for fuel, where taxes and subsidies are excluded; and shadow exchange rates are pegged and/or some kind of exchange control is still in place. The shadow price is therefore nominal (market) price, adjusted for the effect of interventions or other factors that are causing the market not to perform its natural role.

In practice, shadow prices should only be use when the market price of products and services do not reflect their scarcity value or economic contributions. In cases where market prices give an indication of the scarcity of products and services, market prices are used not only for financial analysis, but also for economic analysis.

Financial and Economic Cost Benefit Analysis

The private and public sectors evaluate projects very differently. The private sector is mostly interested in the profitability of a project and the return on capital that will be achieved. In doing so, the private sector makes use of market prices (i.e. the prices that would be paid in the open market for inputs, labour, etc.) when determining the value of direct project-related costs and financial benefits. Furthermore, a financial CBA evaluated the project using market-determined interest and return rates that reflect the cost of private funds, uncertainties and risk.

In contrast, evaluating a public sector project involves determining a broader range of costs and benefits that will affect the community. Furthermore, when calculating the value of costs and benefits, economic analysis re-evaluates the project by making use of prices that reflect the relative economic scarcity/value of inputs and outputs. As such, in the public sector it is necessary to evaluate and weigh the wider benefits emanating from a project against the capital expenditure and costs associated with a project, using discount and return rates that reflect the time preferences of the community, known as the social discount rate.

The table below summarises the main differences between a financial and economic CBA.

Table 50: Comparison of Financial and Economic Costs Benefit Analysis

Attributes	Economic CBA	Financial CBA
Perspective	The broader community	Project shareholders/capital providers
Goal	The most effective application of scarce	Maximization of net value
Discount Rate	Social discount rate	Market determined weighted cost of capital
Unit of Valuation	Opportunity costs	Market prices
Scope	All aspects necessary for a rational, economic decision	Limited to aspects that affect profits
Benefits	Additional goods, services, income and/or cost saving	Profit and financial return on capital employed
Costs	Opportunity costs of goods and services foregone	Financial payments and depreciation calculated according to generally accepted accounting principles

9 APPENDIX B – THE SOCIAL ACCOUNTING MATRIX

A Social Accounting Matrix (SAM) is a comprehensive, economy-wide database, which contains information on the flow of resources that take place between the different economic agents that exist within an economy (i.e. business enterprises, households, government, etc.) during a given period of time – usually one calendar year.

When economic agents in an economy are involved in transactions, financial resources change hands. The SAM provides a complete database of all transactions that take place between these agents in a given period, thereby presenting a "snapshot" of the structure of the economy for that time period. As a system for organising information, a SAM presents a powerful tool in terms of which the economy can be described in a complete and consistent way:

Complete in the sense that it provides a comprehensive accounting of all economic transactions for the entity being represented (i.e. country, region/province, city, etc.), and Consistent in that all incomes and expenditures are matched.

Consequently, a SAM can provide a unifying structure within which the statistical authorities can compile and present the national accounts.

Like the traditional Input-Output Table, the SAM reflects the inter-sectorial linkages in terms of sales and purchases of goods and services, as well as the remuneration of production factors that forms the essence of any economy's functioning. What is also of importance is that a SAM reflects the economic related activities of households in some detail. Households are responsible for decisions that have a direct and indirect effect on important economic variables such as private consumption expenditures and savings. These economic aggregates are important drivers of the economic growth processes and ultimately the creation of employment opportunities and wealth. Private consumption expenditure, for example, comprises approximately 60 percent of total gross final domestic spending in the economy. By combining households into meaningful categories, such as a range of income levels, the impact on these households' welfare of a changing economic environment is made possible by the SAM.

It is clear from the above that because of the intrinsic characteristics of the SAM, once compiled, it renders itself as a useful tool for analytical purposes. Especially, based on the mathematical traits of the matrix notations that describe its structure, a SAM can be transformed into a powerful econometric tool/model. For example, the model can be used to quantify the probable impact on the economy of a new infrastructural project such as a new power station – both the construction phase and the operational phase will be modelled.

Thus apart from serving as an extension to a country's National Accounts, the SAM in its model form opens up many opportunities for the economic analyst to conduct rigorous policy and other impact analyses for the purpose of ensuring optimal benefit to the stakeholders concerned.

Application(s) of the SAM

The development of the SAM is very significant as it provides a framework within the context of the International System of National Accounts (SNA) in which the activities of all economic agents are accentuated and prominently distinguished. By combining these agents into meaningful groups, the SAM makes it possible to clearly distinguish between groups, to research the effects of interaction between groups, and to measure the economic welfare of each group. There are two key reasons for compiling a SAM:

Firstly, a SAM provides a framework for organising information about the economic and social structure of a particular geographical entity (i.e. a country, region or province) for a particular time period (usually one calendar year), and

Secondly, to provide a database that can be used by any one of a number of different macro-economic modelling tools for evaluating the impact of different economic decisions and/or economic development programmes.

Because the SAM is a comprehensive, disaggregated, consistent, and complete data system of economic entities that captures the interdependence that exists within a socio-economic system, it can be used as a conceptual framework for exploring the impact of exogenous changes in such variables as exports, certain categories of government expenditure, and investment on the entire interdependent socio-economic system. The SAM, because of its finer disaggregation of private household expenditure into relatively homogenous socio-economic categories that are recognisable for policy purposes, has been used to explore issues related to income distribution.

The SAM's main contribution in the field of economic policy planning and impact analysis is divided into two categories:

As a Primary Source of Economic Information

As a detailed and integrated national and regional accounting framework consistent with officially published socio-economic data, a SAM instantly projects a picture of the nature of a country or region's economy. It lends itself to both descriptive and structural analysis.

As a Planning Tool

Due to its mathematical/statistical underpinnings it can be transformed into a macro-econometric model that can be used to:

- Conduct economic forecasting exercises/scenario building.
- Conduct economic impact analysis both for policy adjustments at a national and provincial level and for large project evaluation.
- Conduct self-sufficiency analysis i.e. gap analysis to determine, with the help of the inter industry and commodity flows contained in the provincial SAM, where possible investment opportunities exist, and
- Calculate the inflationary impacts on provincial level of price changes instigated at national level (i.e. administered prices, VAT, etc.).

To summarise, the SAM mechanism provides a universally acceptable framework within which the economic impact of development projects and policy adjustments can be reviewed and assessed at both national and provincial/regional levels. It serves as an extension to the official National Accounts of a country's economy and, therefore, provides a wealth of additional information, especially when disaggregated to more detailed levels.

10 APPENDIX C - REHABILITATION, GENERAL AND ADMINISTRATION

Y1 - Y8										
Rehabilitation, General and Administration Cost	**Unit**	**Y0**	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**
Total		**0**	**12 301 746**	**16 167 709**	**16 859 063**	**17 726 585**	**17 662 077**	**17 785 678**	**17 998 855**	**18 026 942**
G & A Cost	R	0	5 791 937	7 331 371	8 022 757	8 890 550	8 825 602	8 949 403	9 162 482	9 190 625
Rehabilitation	R	0	6 509 809	8 836 339	8 836 306	8 836 035	8 836 474	8 836 276	8 836 373	8 836 317

Y9 - Y16										
Rehabilitation, General and Administration Cost	**Unit**	**Y9**	**Y10**	**Y11**	**Y12**	**Y13**	**Y14**	**Y15**	**Y16**	**Y17**
Total		**18 639 311**	**22 985 964**	**23 077 169**	**23 667 285**	**23 673 194**	**22 457 152**	**18 494 544**	**18 300 924**	**18 193 865**
G & A Cost	R	9 803 173	14 149 006	14 240 778	14 830 880	14 836 777	13 620 916	9 940 084	9 746 655	9 640 402
Rehabilitation	R	8 836 138	8 836 958	8 836 390	8 836 406	8 836 417	8 836 237	8 554 460	8 554 269	8 553 462

Y17 - Y24									
Rehabilitation, General and Administration Cost	**Unit**	**Y18**	**Y19**	**Y20**	**Y21**	**Y22**	**Y23**	**Y24**	**Total**
Total		**14 568 893**	**10 921 449**	**8 641 867**	**7 349 386**	**6 723 485**	**6 058 030**	**632 904**	**378 914 078**
G & A Cost	R	8 224 413	7 000 010	6 223 648	5 758 206	5 482 883	5 187 139	587 912	215 437 609
ehabilitation	R	6 344 480	3 921 438	2 418 219	1 591 180	1 240 602	870 891	44 993	163 476 469

11 APPENDIX D – RISK ANALYSIS

AREA 1 – The Duel ONLY – RISK ANALYSIS

Infringement	Activity	Sub -Activity	Extent	Duration	Magnitude	Probability	Significance	Score	Weight	Negative Impact
Noise	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	-	-	-	8.00	-
		Community	*0*	*0*	*0*	-	-	-	8.00	-
	Game Farming	*Game (breeding)*	*1*	*5*	*1*	1	7	0.07	8.00	0.56
		Live Sales	*0*	*0*	*0*	-	-	-	8.00	-
		Trophy Hunting	*1*	*5*	*10*	2	32	0.32	8.00	2.56
		Biltong Hunting	*1*	*5*	*5*	2	22	0.22	8.00	1.76
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	-	-	-	8.00	-
		Hunters	*1*	*5*	*4*	2	20	0.20	8.00	1.60
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	8.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	8.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	8.00	-
	Environment (birds & plants)		*3*	*5*	*6*	3	42	0.42	8.00	3.36
	Sub-total	*8*					123	1.23	96.00	9.84
Dust	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	-	-	-	25.00	-
		Community	*0*	*0*	*0*	-	-	-	25.00	-
	Game Farming	*Game (breeding)*	*3*	*5*	*6*	3	42	0.42	25.00	10.50
		Live Sales	*0*	*0*	*0*	-	-	-	25.00	-
		Trophy Hunting	*3*	*5*	*6*	2	28	0.28	25.00	7.00
		Biltong Hunting	*3*	*5*	*5*	2	26	0.26	25.00	6.50
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	-	-	-	25.00	-
		Hunters	*3*	*5*	*6*	1	14	0.14	25.00	3.50
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	25.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	25.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	25.00	-

	Environment (birds & plants)		*4*	*5*	*7*	3	48	0.48	25.00	12.00
	Sub-total	*25.00*					158	1.58	300.00	39.50
Blasting	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	-	-	-	8.00	-
		Community	*0*	*0*	*0*	-	-	-	8.00	-
	Game Farming	*Game (breeding)*	*1*	*5*	*2*	1	8	0.08	8.00	0.64
		Live Sales	*0*	*0*	*0*	-	-	-	8.00	-
		Trophy Hunting	*4*	*3*	*6*	2	26	0.26	8.00	2.08
		Biltong Hunting	*3*	*3*	*4*	2	20	0.20	8.00	1.60
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	-	-	-	8.00	-
		Hunters	*2*	*3*	*4*	2	18	0.18	8.00	1.44
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	8.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	8.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	8.00	-
	Environment (birds & plants)		*1*	*3*	*4*	2	16	0.16	8.00	1.28
	Sub-total	*8.00*					88	0.88	96.00	7.04
Social, Crime and other impacts	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	-	-	-	4.00	-
		Community	*0*	*0*	*0*	-	-	-	4.00	-
	Game Farming	*Game (breeding)*	*2*	*5*	*6*	2	26	0.26	4.00	1.04
		Live Sales	*0*	*0*	*0*	-	-	-	4.00	-
		Trophy Hunting	*2*	*5*	*2*	1	9	0.09	4.00	0.36
		Biltong Hunting	*2*	*5*	*4*	1	11	0.11	4.00	0.44
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	-	-	-	4.00	-
		Hunters	*2*	*5*	*4*	1	11	0.11	4.00	0.44
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	4.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	4.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	4.00	-
	Environment (birds & plants)		*2*	*5*	*6*	2	26	0.26	4.00	1.04
	Sub-total	*4.00*					83	0.83	48.00	3.32
Destroying	***Beef and other Livestock***	*Commercial*	*0*	*0*	*0*	-	-	-	20.00	-

the sense of place -Visual	***Farming***	*Community*	*0*	*0*	*0*	-	-	-	20.00	-
	Game Farming	*Game (breeding)*	*0*	*0*	*0*	-	-	-	20.00	-
		Live Sales	*0*	*0*	*0*	-	-	-	20.00	-
		Trophy Hunting	*4*	*5*	*6*	4	60	0.60	20.00	12.00
		Biltong Hunting	*2*	*5*	*5*	2	24	0.24	20.00	4.80
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	-	-	-	20.00	-
		Hunters	*2*	*5*	*4*	2	22	0.22	20.00	4.40
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	20.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	20.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	20.00	-
	Environment (birds & plants)		*3*	*5*	*6*	3	42	0.42	20.00	8.40
	Sub-total	*20.00*					148	1.48	240.00	29.60
Underground water - contamination and water levels	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	-	-	-	12.00	-
		Community	*0*	*0*	*0*	-	-	-	12.00	-
	Game Farming	*Game (breeding)*	*1*	*5*	*2*	2	16	0.16	12.00	1.92
		Live Sales	*0*	*0*	*0*	-	-	-	12.00	-
		Trophy Hunting	*0*	*0*	*0*	-	-	-	12.00	-
		Biltong Hunting	*0*	*0*	*0*	-	-	-	12.00	-
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	-	-	-	12.00	-
		Hunters	*1*	*5*	*4*	2	20	0.20	12.00	2.40
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	12.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	12.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	12.00	-
	Environment		*0*	*0*	*0*	-	-	-	12.00	-
	Sub-total	*12.00*					36	0.36	144.00	4.32
Surface water - contamination and run-off	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	-	-	-	23.00	-
		Community	*0*	*0*	*0*	-	-	-	23.00	-
	Game Farming	*Game (breeding)*	*1*	*5*	*4*	1	10	0.10	23.00	2.30
		Live Sales	*0*	*0*	*0*	-	-	-	23.00	-

		Trophy Hunting	*1*	*5*	*2*	1	8	0.08	23.00	1.84
		Biltong Hunting	*1*	*5*	*1*	1	7	0.07	23.00	1.61
	Tourism & Accommodation	*Eco - tourists*	*0*	*0*	*0*	-	-	-	23.00	-
		Hunters	*0*	*0*	*0*	-	-	-	23.00	-
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	23.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	23.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	23.00	-
	Environment		*2*	*5*	*6*	2	26	0.26	23.00	5.98
	Sub-total	*23.00*					51	0.51	276.00	11.73
	Total							**6.87**	**1 200.00**	**210.70**

AREA 1 – RESULTS

		Score	**Applicability**	**Negative Impact**
Beef Farming	Commercial	-	100.00	0.00%
	Community	-	100.00	0.00%
Game Farming	*Game*	16.96	100.00	-16.96%
	Live Sales	-	100.00	0.00%
	Trophy Hunting	25.84	100.00	-25.84%
	Biltong Hunting	16.71	100.00	-16.71%
Tourism & Accommodation	*Eco - tourism*	-	100.00	0.00%
	Hunting	13.78	100.00	-13.78%
Irrigation	*Citrus*	-	100.00	0.00%
	Other Crops	-	100.00	0.00%
Community		-	100.00	0.00%
Environment		32.06	100.00	-32.06%
	Average	**105.35**	**1 200.00**	**-8.8%**

AREA 2: 5 KILOMETER RADIUS – RISK ANALYSIS

Infringement	Activity	Sub -Activity	Extent	Duration	Magnitude	Probability	Significance	Score	Weight	Negative Impact
Noise	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*2*	1	8	0.08	7.00	0.56
		Community	*1*	*5*	*2*	1	8	0.08	7.00	0.56
	Game Farming	*Game (breeding)*	*1*	*5*	*2*	1	8	0.08	7.00	0.56
		Live Sales	*0*	*0*	*0*	-	-	-	7.00	-
		Trophy Hunting	*2*	*5*	*4*	2	22	0.22	7.00	1.54
		Biltong Hunting	*1*	*5*	*4*	1	10	0.10	7.00	0.70
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*7*	3	42	0.42	7.00	2.94
		Hunters	*2*	*5*	*5*	2	24	0.24	7.00	1.68
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	7.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	7.00	-
	Community	*Life Style*	*0*	*0*	*0*	-	-	-	7.00	-
	Environment (birds & plants)		*2*	*5*	*5*	3	36	0.36	7.00	2.52
	Sub-total	*7*					158	1.58	84.00	**11.06**
Dust	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*2*	3	24	0.24	25.00	6.00
		Community	*1*	*5*	*2*	3	24	0.24	25.00	6.00
	Game Farming	*Game (breeding)*	*1*	*5*	*2*	3	24	0.24	25.00	6.00
		Live Sales	*0*	*0*	*0*	-	-	-	25.00	-
		Trophy Hunting	*3*	*5*	*6*	1	14	0.14	25.00	3.50
		Biltong Hunting	*3*	*5*	*5*	1	13	0.13	25.00	3.25
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*5*	2	24	0.24	25.00	6.00
		Hunters	*2*	*5*	*4*	2	22	0.22	25.00	5.50
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	25.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	25.00	-
	Community	*Life Style*	*3*	*5*	*6*	3	42	0.42	25.00	10.50
	Environment (birds & plants)		*2*	*5*	*5*	2	24	0.24	25.00	6.00
	Sub-total	*25.00*					211	2.11	300.00	52.75

Blasting	***Beef and other Livestock Farming***	*Commercial*	*1*	*2*	*2*	1	5	0.05	7.00	0.35
		Community	*1*	*2*	*2*	1	5	0.05	7.00	0.35
	Game Farming	*Game (breeding)*	*1*	*5*	*2*	1	8	0.08	7.00	0.56
		Live Sales	*0*	*0*	*0*	-	-	-	7.00	-
		Trophy Hunting	*2*	*5*	*2*	2	18	0.18	7.00	1.26
		Biltong Hunting	*2*	*5*	*2*	1	9	0.09	7.00	0.63
	Tourism & Accommodation	*Eco - tourists*	*1*	*5*	*3*	2	18	0.18	7.00	1.26
		Hunters	*1*	*5*	*2*	1	8	0.08	7.00	0.56
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	7.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	7.00	-
	Community	*Life Style*	*2*	*5*	*2*	2	18	0.18	7.00	1.26
	Environment (birds & plants)		*1*	*2*	*4*	2	14	0.14	7.00	0.98
	Sub-total	*7.00*					103	1.03	84.00	7.21
Social, Crime and other impacts	***Beef and other Livestock Farming***	*Commercial*	*2*	*5*	*6*	2	26	0.26	18.00	4.68
		Community	*2*	*5*	*7*	2	28	0.28	18.00	5.04
	Game Farming	*Game (breeding)*	*2*	*5*	*6*	2	26	0.26	18.00	4.68
		Live Sales	*0*	*0*	*0*	-	-	-	18.00	-
		Trophy Hunting	*1*	*5*	*3*	1	9	0.09	18.00	1.62
		Biltong Hunting	*1*	*5*	*3*	1	9	0.09	18.00	1.62
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*4*	2	22	0.22	18.00	3.96
		Hunters	*2*	*5*	*2*	2	18	0.18	18.00	3.24
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	18.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	18.00	-
	Community	*Life Style*	*3*	*5*	*6*	2	28	0.28	18.00	5.04
	Environment (birds & plants)		*1*	*5*	*4*	2	20	0.20	18.00	3.60
	Sub-total	*18.00*					186	1.86	216.00	33.48
Destroying the sense of place - Visual	***Beef and other Livestock Farming***	*Commercial*	*1*	*1*	*2*	1	4	0.04	18.00	0.72
		Community	*1*	*1*	*2*	1	4	0.04	18.00	0.72
	Game Farming	*Game (breeding)*	*1*	*1*	*2*	1	4	0.04	18.00	0.72

		Live Sales	*0*	*0*	*0*	-	-	-	18.00	-
		Trophy Hunting	*4*	*5*	*7*	3	48	0.48	18.00	8.64
		Biltong Hunting	*2*	*5*	*6*	2	26	0.26	18.00	4.68
	Tourism & Accommodation	*Eco - tourists*	*4*	*5*	*7*	3	48	0.48	18.00	8.64
		Hunters	*1*	*5*	*4*	1	10	0.10	18.00	1.80
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	18.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	18.00	-
	Community	*Life Style*	*2*	*5*	*5*	2	24	0.24	18.00	4.32
	Environment (birds & plants)		*3*	*5*	*5*	3	39	0.39	18.00	7.02
	Sub-total	*18.00*					207	2.07	216.00	37.26
Underground water - contamination and water levels	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*2*	1	8	0.08	10.00	0.80
		Community	*1*	*5*	*2*	1	8	0.08	10.00	0.80
	Game Farming	*Game (breeding)*	*1*	*5*	*2*	1	8	0.08	10.00	0.80
		Live Sales	*0*	*0*	*0*	-	-	-	10.00	-
		Trophy Hunting	*1*	*5*	*2*	1	8	0.08	10.00	0.80
		Biltong Hunting	*1*	*5*	*2*	1	8	0.08	10.00	0.80
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*4*	1	11	0.11	10.00	1.10
		Hunters	*2*	*5*	*4*	1	11	0.11	10.00	1.10
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	10.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	10.00	-
	Community	*Life Style*	*3*	*5*	*4*	1	12	0.12	10.00	1.20
	Environment		*1*	*5*	*3*	1	9	0.09	10.00	0.90
	Sub-total	*10.00*					83	0.83	120.00	8.30
Surface water - contamination and run-off	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*3*	2	18	0.18	15.00	2.70
		Community	*1*	*5*	*3*	2	18	0.18	15.00	2.70
	Game Farming	*Game (breeding)*	*1*	*5*	*3*	2	18	0.18	15.00	2.70
		Live Sales					-	-	15.00	-
		Trophy Hunting	*1*	*5*	*2*	1	8	0.08	15.00	1.20
		Biltong Hunting	*1*	*5*	*2*	1	8	0.08	15.00	1.20

	Tourism & Accommodation	*Eco - tourists*	*1*	*5*	*5*	1	11	0.11	15.00	1.65
		Hunters	*1*	*5*	*4*	1	10	0.10	15.00	1.50
	Irrigation	*Citrus*				-	-	-	15.00	-
		Other Crops				-	-	-	15.00	-
	Community	*Life Style*	*2*	*5*	*4*	1	11	0.11	15.00	1.65
	Environment		*2*	*5*	*4*	1	11	0.11	15.00	1.65
	Sub-total	*15.00*					113	1.13	180.00	16.95
	Total							**10.61**	**1 200.00**	**334.02**

AREA 2 RESULTS

		Score	**Applicability**	**Negative Impact**
Beef Farming	Commercial	15.81	100.00	-16%
	Community	16.17	100.00	-16%
Game Farming	*Game*	16.02	100.00	-16%
	Live Sales	-	100.00	0%
	Trophy Hunting	18.56	100.00	-19%
	Biltong Hunting	12.88	100.00	-13%
Tourism & Accommodation	*Eco - tourism*	25.55	100.00	-26%
	Hunting	15.38	100.00	-15%
Irrigation	*Citrus*	-	100.00	0%
	Other Crops	-	100.00	0%
Community	***Community***	23.97	100.00	-24%
Environment	***Environment***	22.67	100.00	-23%
	Average	**167.01**	**1 200.00**	**-14%**

AREA 3: 10 KILOMETER RADIUS – RISK ANALYSIS

Infringement	Activity	Sub -Activity	Extend	Duration	Magnitude	Probability	Significance	Score	Weight	Negative Impact
Noise	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*1*	2	14	0.14	5.00	0.70
		Community	*1*	*5*	*1*	1	7	0.07	5.00	0.35
	Game Farming	*Game (breeding)*	*1*	*5*	*1*	1	7	0.07	5.00	0.35
		Live Sales	*1*	*1*	*1*	1	3	0.03	5.00	0.15
		Trophy Hunting	*2*	*5*	*2*	2	18	0.18	5.00	0.90
		Biltong Hunting	*2*	*3*	*2*	1	7	0.07	5.00	0.35
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*3*	2	20	0.20	5.00	1.00
		Hunters	*2*	*5*	*3*	1	10	0.10	5.00	0.50
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	5.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	5.00	-
	Community	*Life Style*	*1*	*5*	*1*	1	7	0.07	5.00	0.35
	Environment (birds & plants)		*0*	*0*	*0*	-	-	-	5.00	-
	Sub-total	*5*					93	0.93	60.00	4.65
Dust	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*1*	2	14	0.14	10.00	1.40
		Community	*1*	*5*	*1*	2	14	0.14	10.00	1.40
	Game Farming	*Game (breeding)*	*2*	*5*	*1*	1	8	0.08	10.00	0.80
		Live Sales	*0*	*0*	*0*	-	-	-	10.00	-
		Trophy Hunting	*1*	*5*	*2*	2	16	0.16	10.00	1.60
		Biltong Hunting	*1*	*5*	*2*	2	16	0.16	10.00	1.60
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*3*	2	20	0.20	10.00	2.00
		Hunters	*2*	*5*	*2*	1	9	0.09	10.00	0.90
	Irrigation	*Citrus*	*3*	*5*	*4*	2	24	0.24	10.00	2.40
		Other Crops	*3*	*5*	*4*	2	24	0.24	10.00	2.40
	Community	*Life Style*	*2*	*5*	*1*	1	8	0.08	10.00	0.80
	Environment (birds & plants)		*2*	*5*	*2*	1	9	0.09	10.00	0.90
	Sub-total	*10.00*					162	1.62	120.00	16.20

Blasting	***Beef and other Livestock Farming***	*Commercial*	*0*	*0*	*0*	-	-	-	5.00	-
		Community	*0*	*0*	*0*	-	-	-	5.00	-
	Game Farming	*Game (breeding)*	*0*	*0*	*0*	-	-	-	5.00	-
		Live Sales	*0*	*0*	*0*	-	-	-	5.00	-
		Trophy Hunting	*1*	*3*	*2*	1	6	0.06	5.00	0.30
		Biltong Hunting	*1*	*3*	*1*	1	5	0.05	5.00	0.25
	Tourism & Accommodation	*Eco - tourists*	*1*	*5*	*1*	1	7	0.07	5.00	0.35
		Hunters	*1*	*5*	*1*	1	7	0.07	5.00	0.35
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	5.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	5.00	-
	Community	*Life Style*	*1*	*3*	*2*	1	6	0.06	5.00	0.30
	Environment (birds & plants)		*1*	*1*	*1*	1	3	0.03	5.00	0.15
	Sub-total	*5.00*					34	0.34	60.00	1.70
Social, Crime and other impacts	***Beef and other Livestock Farming***	*Commercial*	*2*	*5*	*4*	2	22	0.22	20.00	4.40
		Community	*3*	*5*	*7*	2	30	0.30	20.00	6.00
	Game Farming	*Game (breeding)*	*0*	*0*	*0*	-	-	-	20.00	-
		Live Sales	*0*	*0*	*0*	-	-	-	20.00	-
		Trophy Hunting	*1*	*5*	*1*	1	7	0.07	20.00	1.40
		Biltong Hunting	*1*	*5*	*1*	1	7	0.07	20.00	1.40
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*4*	3	33	0.33	20.00	6.60
		Hunters	*2*	*5*	*3*	3	30	0.30	20.00	6.00
	Irrigation	*Citrus*	*1*	*3*	*2*	3	18	0.18	20.00	3.60
		Other Crops	*1*	*3*	*2*	3	18	0.18	20.00	3.60
	Community	*Life Style*	*3*	*5*	*6*	2	28	0.28	20.00	5.60
	Environment (birds & plants)		*1*	*1*	*4*	3	18	0.18	20.00	3.60
	Sub-total	*20.00*					211	2.11	240.00	42.20
Destroying the sense of place -Visual	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*1*	1	7	0.07	16.00	1.12
		Community	*1*	*5*	*1*	1	7	0.07	16.00	1.12
	Game Farming	*Game (breeding)*	*0*	*0*	*0*	-	-	-	16.00	-

		Live Sales	*0*	*0*	*0*	-	-	-	16.00	-
		Trophy Hunting	*1*	*3*	*3*	2	14	0.14	16.00	2.24
		Biltong Hunting	*1*	*3*	*2*	2	12	0.12	16.00	1.92
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*4*	2	22	0.22	16.00	3.52
		Hunters	*2*	*3*	*2*	1	7	0.07	16.00	1.12
	Irrigation	*Citrus*	*0*	*0*	*0*	-	-	-	16.00	-
		Other Crops	*0*	*0*	*0*	-	-	-	16.00	-
	Community	*Life Style*	*1*	*5*	*3*	2	18	0.18	16.00	2.88
	Environment (birds & plants)		*2*	*5*	*2*	2	18	0.18	16.00	2.88
	Sub-total	*16.00*					105	1.05	192.00	16.80
Underground water - contamination and water levels	***Beef and other Livestock Farming***	*Commercial*	*1*	*5*	*1*	1	7	0.07	18.00	1.26
		Community	*1*	*5*	*2*	1	8	0.08	18.00	1.44
	Game Farming	*Game (breeding)*	*1*	*3*	*1*	1	5	0.05	18.00	0.90
		Live Sales	*0*	*0*	*0*	-	-	-	18.00	-
		Trophy Hunting	*1*	*3*	*1*	1	5	0.05	18.00	0.90
		Biltong Hunting	*1*	*3*	*1*	1	5	0.05	18.00	0.90
	Tourism & Accommodation	*Eco - tourists*	*2*	*5*	*3*	3	25	0.25	18.00	4.50
		Hunters	*2*	*5*	*3*	3	30	0.30	18.00	5.40
	Irrigation	*Citrus*	*3*	*5*	*3*	2	22	0.22	18.00	3.96
		Other Crops	*3*	*5*	*3*	2	22	0.22	18.00	3.96
	Community	*Life Style*	*3*	*5*	*3*	2	22	0.22	18.00	3.96
	Environment		*3*	*5*	*4*	3	36	0.36	18.00	6.48
	Sub-total	*18.00*					187	1.87	216.00	33.66
Surface water - contamination and run-off	***Beef and other Livestock Farming***	*Commercial*	*2*	*5*	*3*	1	10	0.10	26.00	2.60
		Community	*2*	*5*	*3*	1	10	0.10	26.00	2.60
	Game Farming	*Game (breeding)*	*1*	*3*	*1*	1	5	0.05	26.00	1.30
		Live Sales	*0*	*0*	*0*	-	-	-	26.00	-
		Trophy Hunting	*2*	*3*	*2*	1	7	0.07	26.00	1.82
		Biltong Hunting	*2*	*3*	*2*	1	7	0.07	26.00	1.82

	Tourism & Accommodation	*Eco - tourists*	*3*	*5*	*3*	4	44	0.44	26.00	11.44
		Hunters	*3*	*5*	*3*	4	44	0.44	26.00	11.44
	Irrigation	*Citrus*	*2*	*5*	*2*	1	9	0.09	26.00	2.34
		Other Crops	*2*	*5*	*2*	1	9	0.09	26.00	2.34
	Community	*Life Style*	*4*	*5*	*3*	5	60	0.60	26.00	15.60
	Environment		*4*	*5*	*5*	3	42	0.42	26.00	10.92
	Sub-total	*26.00*					247	2.47	312.00	64.22
	Total							**10.39**	**1 200.00**	**358.86**

AREA 3 RESULTS

		Score	**Applicability**	**Negative Impact**
Beef Farming	Commercial	11.48	100.00	-11.48
	Community	12.91	100.00	-12.91
Game Farming	*Game*	3.35	100.00	-3.35
	Live Sales	0.15	100.00	-0.15
	Trophy Hunting	9.16	100.00	-9.16
	Biltong Hunting	8.24	100.00	-8.24
Tourism & Accommodation	*Eco - tourism*	29.41	100.00	-29.41
	Hunting	25.71	100.00	-25.71
Irrigation	*Citrus*	12.30	100.00	-12.30
	Other Crops	12.30	100.00	-12.30
Community		29.49	100.00	-29.49
Environment		20.77	100.00	-20.77
	Average	**175.27**	**1 200.00**	**-14.61**

12 APPENDIX E – ECONOMIC CBA – EXAMPLE POSITIVE RESULTS

				Construction		Production	Production	Production	Production	Production	Production
	Discount Rate		8%	1	2	3	4	5	6	7	8
	COSTS	PV	TOTAL	6 months	12 months						
1	Capital Expenditure										
	Capex	R 1 861.86	R 2 307.75	R 546.39	R 1 060.64	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
	Total Capital Expenditure	R 1 861.86	R 2 307.75	R 546.39	R 1 060.64	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
2	Operating Expenditure										
	Operating Costs	R 1 244.35	R 3 314.18	R 0.00	R 0.00	R 104.73	R 108.65	R 103.42	R 113.35	R 107.82	R 118.45
	Transport Costs	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
	Total Operating Expenditure	R 1 244.35	R 3 314.18	R 0.00	R 0.00	R 104.73	R 108.65	R 103.42	R 113.35	R 107.82	R 118.45
3	Externalities	R 182.27	R 448.73	R 0.00	R 0.00	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70
4	Regulatory Costs	R 13.31	R 50.97	R 0.00	R 0.00	R 0.64	R 0.11	R 0.00	R 0.00	R 0.00	R 0.01
5	Environmental Costs	R 156.23	R 357.78	R 0.00	R 0.00	R 11.62	R 15.27	R 15.92	R 16.74	R 16.68	R 16.79
6	Social Costs	R 158.09	R 209.08	R 0.00	R 0.00	R 164.13	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95
6	TOTAL COSTS	R 3 598.75	R 5 036.51	R 546.39	R 1 060.64	R 299.82	R 142.72	R 138.04	R 148.79	R 143.19	R 153.95
	BENEFITS										
	Total Revenue	R 3 759.15	R 10 016.55	R 0.00	R 0.00	R 315.98	R 324.64	R 308.75	R 335.42	R 321.67	R 361.81
7	Revenue from Coal Sales	R 3 759.15	R 10 016.55	R 0.00	R 0.00	R 315.98	R 324.64	R 308.75	R 335.42	R 321.67	R 361.81
8	SURPLUS/DEFECIT	R 160.40	R 4 980.03	R -546.39	R -1 060.64	R 16.16	R 181.92	R 170.71	R 186.64	R 178.48	R 207.86
9	CUMULATIVE SURPLUS/DEFECIT			R -546.39	R -1 607.03	R -1 590.87	R -1 408.95	R -1 238.23	R -1 051.60	R -873.12	R -665.26
	Inflation rate p.a.	0%									
	Discount rate	8%	Viability Criteria met?								
	Net Present Value (NPV)	R 160.40	yes								
	Benefit-Cost Ratio (BCR)	1.16	yes								
	Internal Rate of Return (IRR)	9.0%	yes								

Production	Production	Production	Production	Production	Production	Production	Production	Production	Production	Production	Production
9	10	11	12	13	14	15	16	17	19	20	21
R 0.00	R 238.25	R 462.48	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
R 0.00	R 238.25	R 462.48	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
R 136.80	R 139.22	R 147.95	R 96.54	R 122.24	R 131.45	R 121.02	R 112.03	R 167.59	R 141.77	R 149.34	R 185.95
R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
R 136.80	R 139.22	R 147.95	R 96.54	R 122.24	R 131.45	R 121.02	R 112.03	R 167.59	R 141.77	R 149.34	R 185.95
R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70	R 18.70
R 0.25	R 0.34	R 0.48	R 3.78	R 3.23	R 3.42	R 3.13	R 2.11	R 0.68	R 0.19	R 1.11	R 3.97
R 16.99	R 17.02	R 17.60	R 21.70	R 21.79	R 22.35	R 22.35	R 21.20	R 17.46	R 17.18	R 13.76	R 10.31
R 1.95	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95	R 1.95
R 172.74	R 413.52	R 647.21	R 140.73	R 165.96	R 175.91	R 165.21	R 154.04	R 204.43	R 177.84	R 182.90	R 218.93
R 418.88	R 430.80	R 468.64	R 286.52	R 362.97	R 392.33	R 361.56	R 334.90	R 503.85	R 431.20	R 459.39	R 570.42
R 418.88	R 430.80	R 468.64	R 286.52	R 362.97	R 392.33	R 361.56	R 334.90	R 503.85	R 431.20	R 459.39	R 570.42
R 246.14	R 17.28	R -178.57	R 145.79	R 197.00	R 216.41	R 196.35	R 180.86	R 299.42	R 253.36	R 276.48	R 351.48
R -419.12	R -401.84	R -580.41	R -434.61	R -237.61	R -21.20	R 175.15	R 356.02	R 655.44	R 1 175.58	R 1 452.06	R 1 803.55

Production	Production	Production	Production	Production
22	23	24	25	26
R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
R 207.22	R 215.62	R 212.47	R 208.68	R 10.93
R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
R 207.22	R 215.62	R 212.47	R 208.68	R 10.93
R 18.70	R 18.70	R 18.70	R 18.70	R 18.70
R 5.90	R 7.01	R 7.14	R 7.08	R 0.07
R 8.16	R 6.94	R 6.35	R 5.72	R 0.60
R 1.95	R 1.95	R 1.95	R 1.95	R 1.95
R 239.97	R 248.27	R 244.66	R 240.18	R 30.29
R 625.74	R 650.88	R 640.79	R 623.11	R 32.31
R 625.74	R 650.88	R 640.79	R 623.11	R 32.31
R 385.77	R 402.60	R 396.14	R 382.93	R 2.02
R 2 189.31	R 2 591.92	R 2 988.05	R 3 370.99	R 3 373.00

13 APPENDIX F – SHADOW PRICE FACTORS

RELATIVE IMPORTANCE OF INPUTS WHERE SHADOW PRICES ARE APPLICABLE	DIESEL	PETROL	PETROLEUM PRODUCTS (includes petrol and diesel)	ELECTRICITY	UNSKILLED LABOUR	(EXCHANGE RATE)	CUSTOMS DUTY	WEIGHTED SHADOW PRICE FACTOR
A. ASSETS CONTAINED IN THE SOUTH AFRICAN SOCIAL ACCOUNTING MATRIX								
Furniture	0.00	0.00	0.01	0.01	0.00	0.57	0.57	0.995
Rubber products	0.00	0.00	0.06	0.02	0.02	0.43	0.43	0.984
Structural Metal Products	0.00	0.00	0.00	0.00	0.02	0.47	0.47	0.988
Other Fabricated metal products	0.00	0.00	0.02	0.01	0.01	0.19	0.19	0.992
Machinery and equipment	0.00	0.00	0.02	0.00	0.01	0.67	0.67	0.986
Electrical machinery and apparatus	0.00	0.00	0.02	0.00	0.01	0.46	0.46	0.988
Manufacturing of transport equipment	0.00	0.00	0.01	0.00	0.01	0.84	0.84	0.986
Other manufacturing and recycling	0.00	0.00	0.01	0.00	0.01	0.28	0.28	0.992
Buildings	0.00	0.00	0.02	0.00	0.02	0.14	0.14	0.987
Civil Construction	0.00	0.00	0.05	0.00	0.02	0.14	0.14	0.982
Business activities (architects, attorneys, ect)	0.00	0.00	0.02	0.00	0.01	0.10	0.10	0.990
B. OPERATIONAL SECTORS CONTAINED IN THE SOUTH AFRICAN SOCIAL ACCOUNTING MATRIX								
Agriculture	0.00	0.00	0.06	0.00	0.06	0.30	0.30	0.960
Coal mining	0.00	0.00	0.02	0.01	0.03	0.34	0.34	0.984
Gold mining	0.00	0.00	0.01	0.03	0.07	0.08	0.08	0.977
Other mining	0.00	0.00	0.01	0.01	0.02	0.39	0.39	0.989
Meat, Fish, Fruit, Vegetables, Oils and Fat Industries	0.00	0.00	0.01	0.01	0.01	0.34	0.34	0.992
Dairy Industry	0.00	0.00	0.01	0.01	0.03	0.33	0.33	0.985
Grain Mill, Bakery and Animal Feed Industries	0.00	0.00	0.01	0.01	0.02	0.41	0.41	0.989
Other Food Industries	0.00	0.00	0.01	0.00	0.02	0.17	0.17	0.987
Beverages and Tobacco Industries	0.00	0.00	0.01	0.00	0.02	0.43	0.43	0.987
Textiles, Clothing, Leather and Footwear Industries	0.00	0.00	0.01	0.01	0.02	0.40	0.40	0.988
Wood and Wood Products Industry	0.00	0.00	0.00	0.00	0.02	0.30	0.30	0.985
Paper and Paper Products Industry	0.00	0.00	0.00	0.00	0.01	0.32	0.32	0.991
Publishing and Printing Industry	0.00	0.00	0.00	0.00	0.04	0.41	0.41	0.978
Petroleum Industry	0.00	0.00	0.10	0.01	0.00	0.44	0.44	0.980

Chemicals Industry (incl Plastics)	0.00	0.00	0.06	0.01	0.01	0.46	0.46	0.984
Non-Metallic Minerals Industry	0.00	0.00	0.01	0.01	0.02	0.35	0.35	0.989
Basic Metals Industry	0.00	0.00	0.04	0.02	0.01	0.31	0.31	0.995
Communication, Medical and other Electronic Equipment Industries	0.00	0.00	0.01	0.00	0.01	0.75	0.75	0.988
Electricity Industry	0.00	0.00	0.01	0.09	0.01	0.08	0.08	1.023
Water Industry	0.00	0.00	0.01	0.05	0.02	0.12	0.12	1.004
Trade	0.00	0.00	0.01	0.00	0.03	0.10	0.10	0.987
Accommodation Industry	0.00	0.00	0.01	0.02	0.03	0.36	0.36	0.989
Transport Services Industry	0.00	0.00	0.15	0.01	0.01	0.16	0.16	0.970
Communications Industry	0.00	0.00	0.04	0.01	0.01	0.50	0.50	0.989
Insurance Industry	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.997
Real Estate Industry	0.00	0.00	0.02	0.00	0.00	0.11	0.11	0.997
General Government	0.00	0.00	0.02	0.01	0.01	0.09	0.09	0.996
Health and social work	0.00	0.00	0.02	0.00	0.02	0.10	0.10	0.987
Other Services Industries	0.00	0.00	0.01	0.01	0.03	0.17	0.17	0.987
C. WATER AUGMENTATION COMPONENTS								
Bulk water (dams)	0.12	0.06	0.00	0.02	0.13	0.00	0.00	0.913
Reservoirs	0.03	0.00	0.00	0.00	0.17	0.07	0.07	0.913
Pump stations (water & sewer)	0.03	0.00	0.00	0.00	0.17	0.10	0.10	0.913
Bulk pipelines (water & sewer)	0.07	0.00	0.00	0.00	0.17	0.17	0.17	0.904
Treatment works (water & sewer)	0.03	0.00	0.00	0.00	0.17	0.07	0.07	0.913
Reticulation (water & sewer)	0.03	0.00	0.00	0.00	0.17	0.10	0.10	0.913
Storm water	0.10	0.05	0.00	0.01	0.13	0.00	0.00	0.915
D. Other Assets								
Roads	0.21	0.12	0.00	0.00	0.12	0.00	0.00	0.884
Parks and Recreation	0.21	0.12	0.00	0.00	0.12	0.00	0.00	0.884
Schools, Creches, etc.	0.08	0.02	0.00	0.05	0.14	0.00	0.00	0.932
E. Costs Associated with Construction								
Maintenance and operation	0.16	0.09	0.00	0.02	0.17	0.00	0.00	0.882
Earth works	0.00	0.00	0.11	0.00	0.10	0.06	0.06	0.932
Research and development	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.997
Relocation costs	0.00	0.00	0.01	0.00	0.04	0.06	0.06	0.977
Shadow Price Adjustment Factor	**0.800**	**0.856**	**0.828**	**1.337**	**0.530**	**1.039**	**0.950**	