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ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

DEA REF. No 14/12/16/3/3/2/677 (Dam Construction)
14/12/16/3/3/2/678 (Electricity Generation)
14/12/16/3/3/1/1169 (Roads)

ECONOMIC IMPACT ASSESSMENT

FINAL
January 2015

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

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ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

LIST OF REPORTS

REPORT TITLE	DWS REPORT NUMBER
Inception Report	P WMA 12/T30/00/5314/1
Scoping Report	P WMA 12/T30/00/5314/2
Environmental Impact Assessment Report	P WMA 12/T30/00/5314/3
Environmental Management Programme	P WMA 12/T30/00/5314/14
Integrated Water Use License Application for the Mzimvubu Water Project: Technical Report	P WMA 12/T30/00/5314/4
Ntabelanga Dam borrow pits and quarry Environmental Management Plan	P WMA 12/T30/00/5314/5
Lalini Dam borrow pits and quarry Environmental Management Plan	P WMA 12/T30/00/5314/6
SUPPORTING REPORTS	
Social Impact Assessment	P WMA 12/T30/00/5314/7
Economic Impact Assessment	P WMA 12/T30/00/5314/8
Visual Impact Assessment	P WMA 12/T30/00/5314/9
Floral Impact Assessment	P WMA 12/T30/00/5314/10
Faunal Impact Assessment	P WMA 12/T30/00/5314/11
Heritage Impact Assessment	P WMA 12/T30/00/5314/12
Water Quality Study	P WMA 12/T30/00/5314/13
Aquatic Ecology Assessment	P WMA 12/T30/00/5314/15
Wetland Assessment	P WMA 12/T30/00/5314/16
Rapid Reserve Determination: Tsitsa River at Lalini	P WMA 12/T30/00/5314/17

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DECLARATION OF INDEPENDENCE

I, William Mullins as authorised representative of Mosaka Economic Consultants cc (trading as Conningarth Economists) hereby confirm my independence as a specialist and declare that neither I nor Mosaka Economic Consultants cc (trading as Conningarth Economists) have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Mosaka Economic Consultants cc (trading as Conningarth Economists) was appointed as economic impact assessment specialists in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed, specifically in connection with the Economic Impact Assessment for the Mzimvubu Water Project Environmental Impact Assessment. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it – as is described in my attached report.

Signed: W. Mullins Date: January 2015

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

ECONOMIC IMPACT ASSESSMENT

Executive summary

BACKGROUND

The Department of Water and Sanitation (DWS) commissioned the Mzimvubu Water Project, an integrated multi-purpose (domestic water supply, agriculture, power generation, transport, tourism, conservation and industry) project, with the intention of providing a socio-economic development opportunity for the region.

The Environmental Impact Assessment (EIA) study is in the process of investigating the impact of the Ntabelanga and conjunctive Lalini Dams, the proposals regarding the proposed development of an irrigation farming scheme, the distribution of potable water to rural households and the generation of hydro-electricity. The economic impact study of the Mzimvubu Water Project includes the proposed irrigation scheme, the water distribution network and the hydro-electricity network.

APPROACH

The approach to the study is to determine the economic viability of the proposals made and discussing and demonstrating the difference between financial and economic viability. This was necessary as one of the main purposes of the construction of the dams is to contribute to the development of an impoverished rural area of the Eastern Cape by making water available to the area.

The difference between economic viability and financial viability is perhaps best explained by the following:

- *Economic viability implies that the project is evaluated at prices which reflect the relative scarcity of inputs and outputs.*
- *Financial viability implies the project is evaluated at market prices.*

It is important that the level of government support should form part of the continued investigation and implementation of the project, now that the project has shown up as being economically viable. It is imperative that it be borne in mind that an economic cost benefit analysis (ECBA) was done and not a financial cost benefit analysis.

The economic analysis normally follows the analysis of the source and application of productive funds, which is done at market prices. In the economic analysis, prices actually represent

opportunity costs and reflect the actual economic value of inputs and outputs. The opportunity cost is the value of the best alternative application of an input or an output of the project. The market price of land, for example, does not necessarily reflect the opportunity cost of the land. Thus, when a price has to be determined, a piece of agricultural land used for maize farming but on which an airport is planned, the opportunity cost of the land is the discounted net output from the maize. The uses and calculation of shadow prices as a substitute for market prices are set out in more detail in the ***Appendix C****.*

IRRIGATION

In the following table a comparison is made between the evaluation of capital investment in the public sector and that of the private sector.

Attributes	***Public Sector***	***Private Sector***
Perspective	*The broader community*	*Project shareholders/capital providers*
Goal	*The most effective application of scarce resources*	*Maximization of net value*
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*

From the above it is clear that in the case of the public sector the broader community interests play a more important role in decision making than in the case of the private sector.

Using the above comparison it is accepted that economic viability is a very important aspect and that government grants and subsidies will be acceptable. However, any government grants and possible subsidies must be transparent and government support can only be defended if the project is economically viable. The level of government support will be part of the investigation, if the project shows up economically viable.

The approach adopted to determine the economic viability of the project is:

- *Using an Economic Cost Benefit Analysis (ECBA) to determine the economic viability (see* ***Appendix C*** *for a background to the Cost benefit Analysis), and*
- *Macro-economic Impact Analysis to determine the economic impacts of the project.*

It is important to keep in mind that this major development will take place in an under-developed and impoverished area. The investment by government must be evaluated against the background of the projected contribution to social and economic development.

It is a known and accepted fact that the specific area of the Eastern Cape Province has a largely untapped agricultural potential. However, any agricultural development based on commercial principles will be faced with a number of stumbling blocks which include:

- *The problem of land ownership,*
- *A shortage of management skills, specifically for commercial farming,*
- *Available markets, as the project area is located far from the main markets,*
- *Support structures such as production inputs, funding, etc.*

In the Feasibility Report the irrigation proposals are calculated up to the level of Gross Margin per proposed commercial unit. In the analysis the estimated fixed cost and management cost per proposed unit is estimated and the Net Income calculated.

The Feasibility Report also makes no mention of the potential markets for the produce. As this is a crucial and important issue for the long term viability of the proposals, a desk top analysis was performed identifying potential markets.

The vegetable group was investigated in terms of the following:

- *Firstly the Mthatha Fresh Produce Market: Can the market absorb the additional produce?*
- *The East London Fresh Produce Market as an option?*
- *The local "bakkie"[1] market: Can it be an alternative market to the Mthatha Fresh Produce Market?*
- *Sophistication of the local market to absorb the specific crop.*

In the table below the following scale was applied with the aim of providing a final opinion on the marketability of the specific vegetable crops:

- *A – Very Marketable;*
- *B – Some Scope*
- *C – Little Scope;*
- *D – No Scope.*

[1] Produce sold from a utility vehicle by a vendor.

Crop	*Estimated tons per month*	*Sophisticated Market*	*Local Market*	*Current Mthatha Market*	*Current East London Market*	*Overall Opinion*
Green beans	*120*	*Reasonable*	*No scope*	*No data*	*6 tons/m*	*D*
Carrots	*340*	*Reasonable*	*Little scope*	*24 tons/m*	*424 tons/m*	*B*
Lettuce	*220*	*Highly*	*No scope*	*No data*	*21 tons/m*	*D*
Potatoes	*660*	*Low*	*Can be absorbed*	*243 tons/m*	*2550 tons/m*	*A*
Cabbages	*1 100*	*Low*	*Can be absorbed*	*62 tons/m*	*311 tons/m*	*A*
Spinach	*220*	*Reasonable*	*No scope*	*0.5 tons/m*	*10 tons/m*	*D*
Onions	*140*	*Reasonable*	*Little scope*	*98 tons/m*	*827 tons/m*	*B*
Tomatoes	*550*	*Highly*	*Little scope*	*12 tons/m*	*265 tons/m*	*C*

From the above it is clear that Mosaka Economic Consultants are of the opinion that for green beans, lettuce and spinach very little marketing opportunities exist.

In the Feasibility Report recommendations on the production of lucerne, rye grass and oats for livestock utilisation is made. This investigation and the recommendations on the harvesting and storage of lucerne are formulated in the report. Also, it is accepted that the current livestock quality will be upgraded with the improved grazing and fodder availability.

Cognisance must be taken of the fact that it will not be possible to develop and get a nearly 2 800 hectare irrigation scheme operational within a five year period as proposed. Mosaka Economists are of the opinion that the scheme will only be reaching full production in the 8th to 10th year.

With due consideration given to the above comments, the final analysis has led Mosaka Economic Consultants to support the irrigation proposals with certain reservations.

As the overall commercial unit proposal is supported, it is necessary that the following realities also be considered:

a. *This development will take place in a very poor and currently under-developed area. This dam and available water could act as a stimulus for the much needed development.*
b. *The irrigation units must be financially viable within the shortest period possible. Long term subsidization is not recommended. However, it must be kept in mind that the total area will only come into production over a period of time.*
c. *Support structures should be available right from the start to assist with management. This support must cover the whole spectrum from planting to marketing and overall management. Higher level and periodic monitoring of the progress of the irrigation project must be introduced.*
d. *It must be accepted that the start-up capital will not be recoverable; this includes the infra-structure, implements and irrigation. It will probably have to include items of the first production costs, for example items like wages.*

e. *The best possible management will have to be available right from the start, which means the selection of the unit managers as well as the accepted management structure will eventually determine the success of the irrigation.*

f. *A long term agreement should be reached with the local tribal authorities and a long term lease be negotiated. A 30 year period should be the minimum.*

g. *The original crop mix proposal does not make any mention of marketing structures. This will have to be investigated and could influence the crop mix as discussed in the relevant section.*

h. *The business model decided on will have to make provision for strong management leadership with a shareholder basis. The Eastern Cape Province unfortunately has a number of failed irrigation projects that were based on the small farmer model and subsequently failed due to incompetent management structures.*

i. *The proposal regarding a livestock section for every unit will necessitate an upgrade in the quality of the current livestock. As the proposed grazing crops will only be available during winter, a grazing agreement with the local land owners will have to be in place for the summer period.*

POTABLE WATER SUPPLY

The provision of potable water to a number of rural and small urban areas is a very important aspect of the total project and as discussed in the report, it is also a constitutional requirement. The district municipalities that will benefit from the distribution system are:

- *Alfred Nzo DM with the head office in Mount Ayliff and it includes the towns of Bizana, Cedarville, Matatiele, Mount Ayliff, Mount Frere, and Tabankulu;*
- *Joe Gqabi DM with the head office in Barkly East and it includes the towns of Aliwal North, Barkly East, Burgersdorp, Jamestown, Lady Grey, Maclear, Mount Fletcher, Rhodes, Sterkspruit, Steynsburg, Ugie, and Venterstad;*
- *OR Tambo DM with the head office in Mthatha and it includes the towns of Flagstaff, Libode, Lusikisiki, Mthatha, Ngqeleni, Port St. Johns, Qumbu, and Tsolo.*

The table below provides an indication of the current population of the three district municipalities as well as population growth.

District Municipality[2]	***Current population***	***Population Growth***	***Unemployment Rate***	***Youth Unemployment rate***	***Population under 15 years***
Alfred Nzo DM	*801 344*	*0.35%*	*43.50%*	*52.3%*	*40.9%*
Joe Gqabi DM	*349 768*	*0.23%*	*35.40%*	*43.3%*	*34.1%*
OR Tambo DM	*1 364 943*	*0.52%*	*44.10%*	*54.2%*	*39.0%*
Total	***2 516 055***				

[2] Source: The Local Government Handbook.

The above table shows that all three district municipalities currently experience an unemployment rate varying from 35.4% to 44.10%.

The population is very young with an average of nearly 40% for the three district municipalities younger than 15 years. The weighted estimated average population growth rate per annum in the three district municipalities is 0.43%. This compares with the official population growth rate for the Eastern Cape Province of 0.44% per annum as reported by Statistics SA.

A further analysis shows that nearly 60% of the households are headed by women.

The Feasibility Report uses a 1% growth rate for the water supply beneficiaries over time, but the official Statistics SA growth rate is around 0.44% per annum. Three scenarios were used to determine if there are major differences in the economic viability if the different growth rates are used.

Scenario	***Population Numbers***	***Water Volume***	***Estimated Construction Cost***
1	*Feasibility Report*	*Feasibility Report*	*Feasibility Report*
2	*Eastern Cape Growth Rate*	*Feasibility Report*	*Feasibility Report*
3	*Eastern Cape Growth Rate*	*Reduced Volume 19%*	*Reduced Cost 19%*

The proposed Lalini Dam and hydro-electricity generation plant was also analysed and the results attained are very positive.

The capital costs, as presented in the Feasibility Report, were used (unchanged) in the Economic Cost Benefit Analysis together with an estimation of the social costs based on the latest survey information.

ECONOMIC COST BENEFIT ANALYSIS

The results of the ECBA are presented in the following table.

Parameter	***Scenario 1***	***Scenario 2***	***Scenario 3***
Net Present Value (R million)	*R1 718.89*	*R1 464.99*	*R2 764.66*
Internal Rate of Return	*10.31%*	*10.01%*	*12.52%*
Benefit Cost Ratio	*1.27*	*1.23*	*1.53*

As all three parameters are above the minimum standards the project is economically viable, but this will only be possible with the correct implementation of the different proposed benefits.

SOCIO AND MACRO-ECONOMIC IMPACT

The macro-economic contribution of the project was also calculated and presented for the National as well as the Eastern Cape Province economy.

The results for the construction of the Ntabelanga Dam and its impact on the provincial economy shows that during the peak of the construction period, 2 299 direct employment opportunities will be created with another 843 indirect and 1 036 induced jobs in the provincial economy. Of the direct jobs an estimated 1 057 will be semi-skilled and 771 low-skilled of which probably most will be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R282.7 million. Low income households also receive a total of R82.42 million out of a total of R528.11 million of the total impact on households.

Although only for a short period, during the construction phase of the Ntabelanga Dam the capital spending will contribute considerably to the economy of the region and the province.

The proposed construction of the Lalini Dam and accompanying hydro-electricity plant will also contribute considerably to the economy. In the final year of the construction of the dam 815 direct jobs will be created with another 491 indirect and 604 induced jobs in the provincial economy. Of the direct jobs an estimated 375 will be semi-skilled and 273 low-skilled, of which probably most will be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R164.6 million. Low income households also receive a total of R52.38 million out of a total of R335.64 million of the total impact on households.

Once the irrigation scheme is in full production it will also make a very positive contribution in terms of job creation and income to specifically low-income households. An estimated 4 000 individuals will be employed, although not all permanently.

The macro-economic contribution of the irrigation scheme is estimated at a total annual GDP contribution of R129.3 million per year and the total household income at R146.6 million with R38.6 million for low-income households, when expressed in 2013 prices.

The total fulltime employment opportunities are estimated at 1 976 of which 1 301 is direct on the farms. The figure of 1 301 needs to be unpacked because the model provides only fulltime opportunities, while in agriculture and specifically the proposed crop mix will involve a large number of temporary employees. A separate calculation was done based on the accepted employment norms per hectare and the 1 301 unpacked, represents the following number of people:

- *Permanently on the farms – 7 per unit and 315 in total. This will be tractor drivers, irrigation workers and workshop staff.*
- *The temporary workers are estimated at 80 per unit with a total of 3 600. This is very often the only job that these workers have and over time a clearer picture will emerge regarding their social situation.*

FUNDING

The funding of the project is an important issue and it is necessary that a number of issues be taken into consideration. During this analysis it became clear that the following aspects are important in terms of the different proposals:

- *Irrigation Scheme: - It will take up to 10 years to attain maximum production and possibly financial profitability. Financial viability can only be attained by grant funding on an annual basis without any repayment pre-conditions.*
- *Domestic Water Supply: - The high poverty levels in the project area are such that it is improbable that more than 10% of the users will be able to pay for the water. Therefore, a long term annual subsidy will have to be provided for.*
- *Lalini Dam Hydro-Electricity Generation: - This project is financially viable and can be funded by loans.*

Grant funding and annual subsidisation is acceptable in a developmental situation as is experienced in the project area as long as it is properly motivated, controlled, managed and budgeted for. Mosaka Economic Consultants are therefore of the opinion that the capital for the construction of the Ntabelanga Dam, the domestic water supply and the irrigation scheme will have to be grant funds.

As far as the operational capital is concerned Mosaka Economic Consultants are convinced that the annual maintenance of the dam, the domestic water supply infrastructure and the water supply must be subsidised. In the case of the irrigation scheme the operational capital will have to be provided as a subsidy on a sliding scale for the first number of years until full crop production is reached. It will gradually build up and then decrease and by the 10th year the situation should be such that it could probably be terminated. This, however, will depend on the management situation of the scheme and general prevailing agricultural economic conditions.

The Lalini Dam and accompanying hydro-electricity generation units could be funded with loan capital and the scheme should be in a position to repay the loans.

The economic impact of the different activities and recommended proposed mitigation was assessed as listed below:

- *The Ntabelanga and Lalini Dams;*
- *Primary and secondary bulk potable water infrastructure:*
  - *Primary infrastructure: main water treatment works, including four major treated water pumping stations and three minor treated water pumping stations, main bulk treated water rising mains, and eight Command Reservoirs that will supply the whole region;*
  - *Secondary distribution lines: conveying bulk treated water from Command Reservoirs to existing and new District Reservoirs;*
- *Bulk raw water conveyance infrastructure (abstraction, pipelines, one raw water pumping station, one reservoir and two booster pumps) for irrigated agriculture (raw water supply up to field edge);*

- *Impact of commercial agriculture in earmarked irrigation areas;*
- *Waste Water Treatment Works (WWTW) at the Ntabelanga and Lalini Dam sites;*
- *Accommodation for operational staff at the Ntabelanga and Lalini Dam sites; and*
- *Information centres at the two dam sites.*

No fatal flaws were identified and the conclusion is that identified mitigation measures can be introduced.

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT – ECONOMIC IMPACT ASSESSMENT

DEA REF No. 14/12/16/3/3/2/677 (Dam construction application)
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Acronyms and abbreviations

BCR	Benefit-cost Ratio
Capex	Capital Expenses
CBA	Cost Benefit Analysis
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DM	District Municipality
DPLG	Department of Provincial and Local Government
DWS	Department of Water and Sanitation (previously DWA)
E&M	Electrical and Mechanical
ECBA	Economic Cost Benefit Analysis
EIA	Environmental Impact Assessment
EIRR	Economical Internal Rate of Return
EMP	Environmental Management Plan
EWR	Environmental Water Requirements
FPM	Fresh Product Market
GM	Gross Margin
GMA	Gross Margin Analysis
IRR	Internal Rate of Return
KZN	KwaZulu-Natal
MAR	Mean annual runoff (water from a catchment)
NI	Net Income
NFI	Net Farm Income
NPV	Net Present Value
Opex	Operational Expenses
SAM	Social Accounting Matrix
SARB	South African Reserve Bank
StatsSA	Statistics South Africa
WRC	Water Research Commission
WWTW	Waste Water Treatment Works

List of units

%	Percentage
ha	Hectare
km^2	Square Kilometres
kWh	Kilo Watt Hour
m	Metres
m^3	Cubic Metres
MW	Mega Watt
R per kl	Rand per Kilolitre

1. INTRODUCTION

1.1 BACKGROUND

The Department of Water and Sanitation (DWS) commissioned the Mzimvubu Water Project, an integrated multi-purpose (domestic water supply, agriculture, power generation, transport, tourism, conservation and industry) project, with the intention of providing a socio-economic development opportunity for the region.

Environmental authorisation is required for the infrastructure components of the project. The purpose of the Environmental Impact Assessment (EIA) is to assess the components of the project that are listed activities by the National Environmental Management Act (NEMA) for which the Department of Water and Sanitation (DWS) has the mandate and intention to implement. The EIA process will provide the information that the environmental authorities require to decide whether the project should be authorised or not, and if so, then under what conditions.

As part of this EIA process Mosaka Economic Consultants cc (trading as Conningarth Economists) was contracted to do the Economic Impact Assessment of the proposals on the usage of the available water.

The economic analysis normally follows the analysis of the source and application of productive funds, which is done at market prices. In the economic analysis, prices actually represent opportunity costs and reflect the actual economic value of inputs and outputs. The opportunity cost is the value of the best alternative application of an input or an output of the project. The market price of land, for example, does not necessarily reflect the opportunity cost of the land. Thus, when a price has to be determined for a piece of agricultural land used for maize farming on which an airport is planned, the opportunity cost of the land is the discounted net output from the maize. The uses and calculation of shadow prices as a substitute for market prices are set out in more detail in **Appendix C**.

The purpose of the Environmental Impact Assessment (EIA) is to investigate the impact of the Ntabelanga and Lalini Dams and the proposals regarding the proposed development of the irrigation farming scheme, the distribution of the water to rural households and the generation of hydro-electricity. The economic impact of the dam includes the proposed irrigation scheme, the water distribution network and the hydro-electricity network.

The approach to the study will be to determine the economic viability of the proposals and discussing and showing the difference between financial and economic viability. This is necessary as one of the main purposes of the dam is to contribute to the economic development of a very disadvantaged rural area of the Eastern Cape by supplying and giving access to water resources.

The difference between economic viability and financial viability is perhaps best explained by the following:

- Economic viability implies that the project is evaluated at prices which reflect the relative scarcity of inputs and outputs.
- Financial viability implies the project is evaluated at market prices.

This does not exclude the reality that some of the projects that will stem from the availability of water must be financially viable over the medium to longer term.

It is accepted that the provision of water for infrastructural development is part of government's constitutional duty. Who actually pays for basic infrastructure is presently a very topical issue in the South African context, as a general rule it has been stated that the "user pay" principle must be applied. However, this is not generally accepted at all levels of Government and the population at large, especially in the light of the large discrepancies as far as household income is concerned.

If infrastructure is necessary as part of the uplifting of the population then the affordability of the infrastructure comes into play and very often it is not feasible to expect the users to pay. For example: If the government wishes to kick-start development in the deep rural areas, it will have to deliver the infrastructure, otherwise the development cannot take place.

The construction of infrastructure for the supply of water to the rural and urban poor areas of a project is an example where the "user pay" principle will be tested. The following will rather be the norms to be applied when evaluating the project:

- The social acceptability;
- The ecological sustainability;
- The financial sustainability;
- The economic efficiency; and
- The affordability.

The proposed irrigation scheme is an "Economic Impact"; the same applies to the domestic water supply and hydro-electricity generation.

1.2 PURPOSE OF THIS REPORT

The purpose of this report is to communicate the findings of the study on the economic viability based on the recommendations made in the Feasibility Report regarding the Mzimvubu Water Project. The report will therefore focus on key issues identified in terms of the economic viability as well as the overall economic viability of the project.

1.3 DETAILS AND EXPERTISE OF THE SPECIALIST

Mosaka Economic Consultants is a South African multi-disciplinary economic consulting firm that applies economic principles in the solution of practical problems, and in analysing

emerging economic issues. Its strength lies in the high calibre of its core professional staff, complemented by the backing it receives from a number of international institutions and expert specialists in the fields of economics, econometrics, and other complementary disciplines. Mosaka clientele are mostly from sub-Saharan African countries, although it has also undertaken projects in Northern Africa. The company has a versatile management structure that enables it to enter contracts both as main consultant, as well as a sub-consultant.

1.4 STRUCTURE OF THE REPORT

This specialist study is undertaken in compliance with Regulation 32 of GN 543. **Table 1-1** below indicates how the requirements of Regulation 32 of GN 543 have been fulfilled in this report.

Table 1-1: Report content requirements in terms of Regulation 32 of GN 543

Regulatory Requirements in terms of Regulation 32 of GN 543	Section of Report
(a) The person who prepared the report; and the expertise of that person to carry out the specialist study or specialised process.	Preamble and Chapter 1
(b) a declaration that the person is independent.	Preamble
(c) an indication of the scope of, and the purpose for which, the report was prepared.	Chapters 1 and 3
(d) a description of the methodology adopted in preparing the report or carrying out the specialised process.	Chapter 4, 5 and 6
(e) a description of any assumptions made and any uncertainties or gaps in knowledge.	Chapter 5 and 6
(f) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified	Chapters 6 to 7
(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority.	Chapter 7
(h) a description of any consultation process that was undertaken during the course of carrying out the study.	N/A
(i) a summary and copies of any comments that were received during any consultation process.	N/A
(j) any other information requested by the competent authority.	N/A

2. PROJECT BACKGROUND SUMMARY

2.1 LOCALITY

The project footprint spreads over three District Municipalities (DMs) namely the Joe Gqabi DM in the north west, the OR Tambo DM in the south west and the Alfred Nzo DM in the east and north east. See Figure 2-1 for the locality map.

The proposed Ntabelanga Dam site is located approximately 25 km east of the town of Maclear and north of the R396 Road. The proposed Lalini Dam site is situated approximately 17 km north east of the small town of Tsolo. Both dam sites are situated on the Tsitsa River.

2.2 MAIN PROJECT COMPONENTS

Water Resource Infrastructure includes:

- A dam at the Ntabelanga site with a proposed storage capacity of 490 million m^3;
- A dam at the Lalini site with a proposed storage capacity of approximately 150 million m^3;
- A pipeline and tunnel, and a power house at the Lalini Dam site for generating hydropower;
- Five new flow measuring weirs will be required in order to measure the flow that is entering and released from the dams. These flow gauging points will be important for monitoring the implementation of the Reserve and for operation of the dams;
- Wastewater treatment works at the dam sites;
- Accommodation for operations staff at the dam sites; and
- Two information centres at the dam sites.

According to the Feasibility Report the Ntabelanga Dam will supply potable water to 539 000 people, rising to 730 000 people by year 2050. The domestic water supply infrastructure will include:

- An intake structure and associated works at Ntabelanga Dam;
- Water treatment works;
- Potable bulk water distribution infrastructure for domestic and industrial water requirements (primary and secondary distribution lines);
- Bulk treated water storage reservoirs strategically located; and
- Pumping stations.

The Ntabelanga Dam will also provide water to irrigate approximately 2 900 ha. This project includes bulk water conveyance infrastructure for raw water supply to “edge of field”.

About 2 450 ha of the high potential land suitable for irrigated agriculture are in the Tsolo area and the rest near the proposed Ntabelanga Dam and along the river, close to the villages of Machibini, Nxotwe, Culunca, Ntshongweni, Caba, Kwatsha and Luxeni.

There will be a small hydro-power plant at the Ntabelanga Dam to generate between 0.75 MW and 5 MW (average 2.1 MW). This will comprise a raw water pipeline from the dam to a building containing the hydro-power turbines and associated equipment, and a discharge pipeline back to the river just below the dam wall. The impact is expected to be similar to that of a pumping station.

Another small hydropower plant will be constructed at the proposed Lalini Dam.

The larger hydropower plant at the Lalini Dam and tunnel (used conjunctively with the Ntabelanga Dam) will generate an average output of 30 MW if operated as a base load power station and up to 150 MW if operated as a peaking power station. The power plant will require a pipeline (approximately 4.6 km) and tunnel (approximately 3.2 km) linking the dam to the power plant downstream of the dam and below the gorge.

The power line to link the Lalini power station to the existing Eskom grid will be approximately 13 km. Power lines will be constructed to supply power for construction at the two dam sites and for operating five pumping and booster stations along the bulk distribution infrastructure.

The area to be inundated by the dams will submerge some existing roads. Approximately 80 km of local roads will therefore have to be re-aligned. Additional local roads will also be upgraded to support social and economic development in the area. The road design will be very similar to the existing roads and be constructed using similar materials.

The project is expected to cost R 12.45 billion in 2013 prices (including all components, Value Added Tax and escalation).

2.3 ALTERNATIVES

The following project level alternatives will be assessed:

- Three hydro-power tunnel positions and associated power lines;
- Peak *versus* Base load power generation;
- Three different dam sizes for the Lalini Dam; and
- The no project option.

For the construction camps, pipeline routes and new roads, the specialist will identify any sensitive areas and propose deviations to the technical team, to avoid these areas.

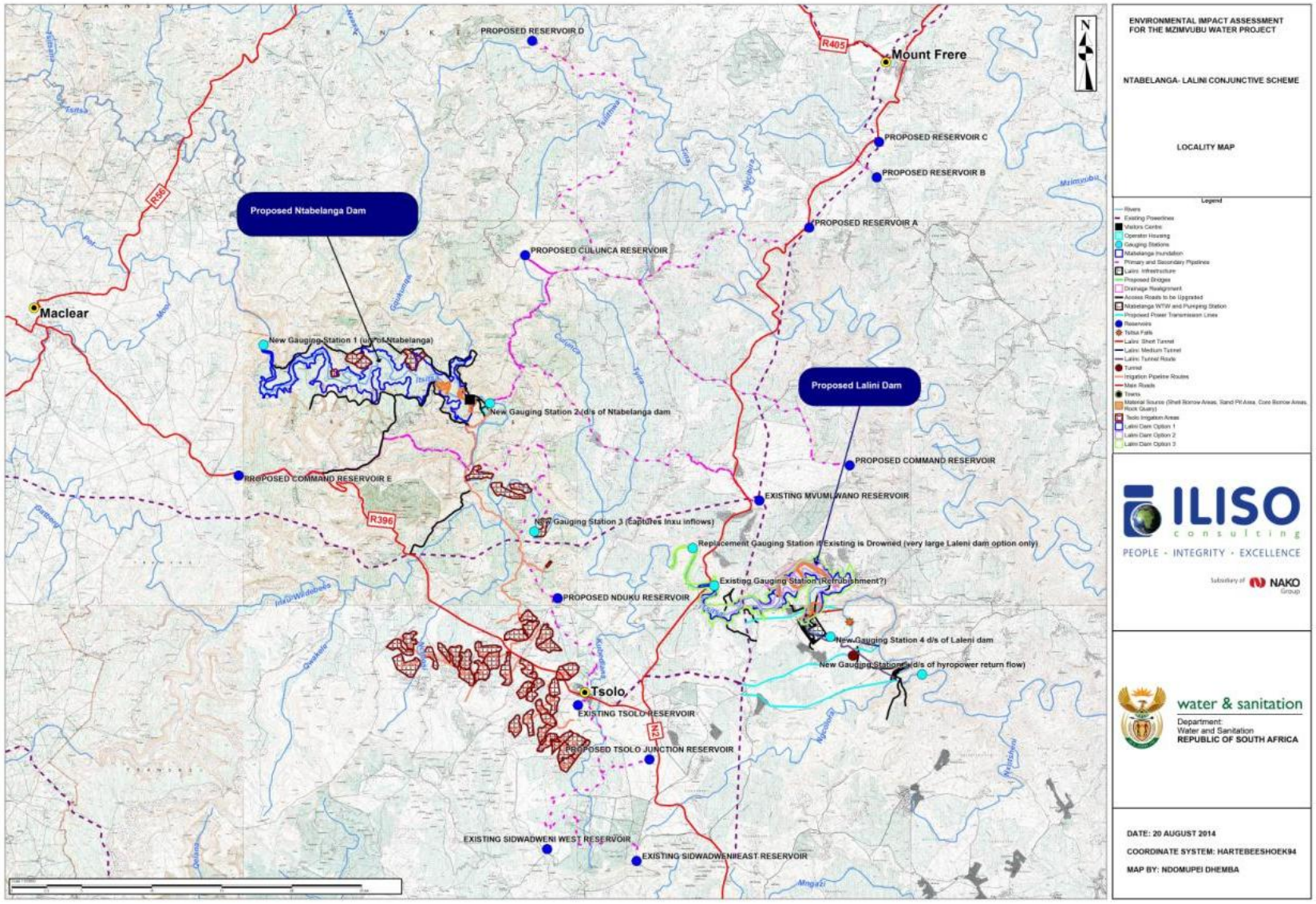

Figure 2-1: Locality map

3. PARAMETERS OF THE STUDY

3.1 ECONOMIC REVIEW PARAMETERS

As stated previously the dam will be built to assist in the development of an impoverished rural area. The dam can thus be classified as a developmental project, which then immediately introduces another dimension to the economic viability and financial viability.

In **Table 3-1** a comparison is made between the evaluation of capital investment in the public sector and that of the private sector.

Table 3-1: Evaluation comparison of capital investment in the public sector and private sector

Attributes	Public Sector	Private Sector
Perspective	The broader community.	Project shareholders/capital providers.
Goal	The most effective application of scarce resources.	Maximization of net value.
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.

From the above it is clear that in the case of the public sector the interest of the broader community plays a more important role in decision making than is the case of the private sector.

Using the above comparison it is accepted that economic viability is a very important aspect and that government grants and subsidies will be acceptable. However, any government grants and possible subsidies must be transparent and government support can only be defended if the project is economically viable.

It is important to keep in mind that this major development will take place in an under developed and impoverished area. The investment by government must be evaluated against the background of the projected contribution to social and economic development. It is a known and accepted fact that the specific area of the Eastern Cape Province has a large untapped agricultural potential. However, any agricultural development based on commercial principles will be faced with a number of stumbling blocks, such as:

- The land ownership problem,
- A shortage of management skills, specifically in commercial farming,
- Available markets; the project area is located far from the main markets,
- Support structures like production inputs, funding, etc.

It must also be kept in mind that two of the recommendations, namely the irrigation units and the hydro-electricity generation must be financially self-supporting. It would be an easier target to reach for the hydro-electricity generation section than for the irrigation sector.

The different reports contained in the Feasibility Study of the Mzimvubu Water Project recommend the following uses for the water of the Ntabelanga Dam:

- Irrigation scheme,
- Domestic water supply to a sizeable portion of the rural population, and
- A small hydro-electricity generator of 0.75 to 5 MW.

Although, not originally part of the Ntabelanga Dam project, the feasibility study reports that two thirds of the yield from the dam is allocated to hydro-power generation at Lalini. It also states that the two dam projects are to be considered as one conjunctive scheme.

The possible relocation of some of the homesteads and infrastructure currently in the project area can also be added to the project.

These recommendations cover the socio-economic impacts emanating from the proposed dam and are as such part of the environmental impact of the water of the dam.

3.2 IRRIGATION

A sizeable irrigation scheme below the dam and close to Tsolo is proposed. The proposal recommends a number of commercially based units that will operate independently. It also recommends a crop selection on which the financial feasibility of a unit is to be based. Detail is provided in terms of estimated crop yields and expected gross margins.

A number of issues have been identified and will be investigated to determine the financial and economic viability of the irrigation proposal over the longer to medium term of the project:

- The concept of a commercial unit on tribal land;
- Management structure;
- Crop selection;
- Marketing options;

- Fixed costs; and
- Financing.

3.2.1 Land Ownership

The establishment of the irrigation units on tribal land and the question of land ownership is not part of this EIA investigation. Where necessary it will be referred to but this has not been investigated.

3.2.2 Financial Viability

The relevant feasibility report[3] calculates the gross margin[4] of a unit based on a specific crop selection without taking into consideration the fixed costs associated with a commercial farming unit.

The accepted structure for a farm budget used in this evaluation is as follows:

- A - Product Income
- B – Variable Production Costs
- C = A – B > = Gross Margin (GM)
- D – Fixed Costs – costs incurred unrelated to the cost of production
- E = C – D > = Net Farm Income (NFI)
- G – Management Costs and Yield on Capital
- H = E – G > = Net Income (NI)

An estimation of the fixed costs was calculated and applied to estimate potential Net Farm Income. As the commercial units are still to be established, the management cost will be estimated and applied in order to arrive at a Net Income for the units.

As these units are part of a developmental plan, no capital yield will be included in the calculations.

3.3 DOMESTIC WATER

Issues that must be considered in the regulatory environment in which the supply of domestic water operates are the South African Constitution and accompanying acts.

The first issue to be addressed is the **South African Constitution**:

The following is quoted from **Chapter 2 "Bill of Rights" number 27 of the Constitution**

"27. Health care, food, water and social security.-

[3] Feasibility Study for the Mzimvubu Water Project: Irrigation Development - P WMA 12/T30/00/5212/9.

[4] Gross Margin: Income minus Direct Production Costs.

(1) Everyone has the right to have access to –
  (a) health care services, including reproductive health care;
  (b) sufficient food and water; and
  (c) social security, including, if they are unable to support themselves and their dependants, appropriate social assistance.
(2) The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of each of these rights.
(3) No one may be refused emergency medical treatment."

The second issue related to and impacting on the regulating sphere is the Water Services Act drawn up by Government to provide and regulate water services.

In this section the availability of water is discussed together with the "applicable condition" under which the resources are made available.

The **Government promulgated Act 108 of 1997, the Water Services Act**, the main objectives of the Act are:

2. The main objectives of this Act are to provide for—
  (a) the right of access to basic water supply and the right to basic sanitation necessary to secure sufficient water and an environment not harmful to human health or well-being;
  (b) the setting of national standards and norms and standards for tariffs in respect of water services
  (c) the preparation and adoption of water services development plans by water services authorities;
  (d) a regulatory framework for water services institutions and water services intermediaries;
  (e) the establishment and disestablishment of water boards and water services committees and their duties and powers;
  (f) the monitoring of water services and intervention by the Minister or by the relevant province;
  (g) financial assistance to water services institutions;
  (h) the gathering of information in a national information system and the distribution of that information;
  (i) the accountability of water services providers: and the promotion of effective water resource management and conservation.

From the above it is clear that the provision of domestic water is a constitutional duty and that the social function is as important as the economic feasibility. In this very much rural area the social and economic issues must outweigh financial viability.

In practical terms the “Value of the Water” provided to the rural households will be more important than the “Tariff” payable for the water.

In the evaluation the value of the water and the projected number of beneficiaries will be revisited and commented on.

3.4 HYDRO-ELECTRICITY GENERATION

As previously discussed the proposed hydro-electricity generation will consist of three separate units namely; a mini hydro plant at the Ntabelanga Dam and the second mini hydro plant at Lalini Dam and the main plant below the Tsitsa Falls linked to the Lalini Dam. The larger units planned for the Tsitsa falls are not directly part of this specific study but the output of the units will depend on the volume of water available in the Ntabelanga Dam. The electricity output thus makes a contribution to the viability of the project and must be calculated and added.

The feasibility study recommends that the small unit at the Ntabelanga Dam be used to reduce the pumping cost of the water to the irrigation area.

3.5 SOCIAL COSTS

A number of cost items that must be considered as cost items in the socio-economic evaluation that can be identified are the following:

- Relocation of homesteads;
- Possible relocation of graves;
- Relocation of Infrastructure;
- Possible loss of agricultural and grazing land.

4. ENVIRONMENTAL EVALUATION

As discussed the socio-economic environmental impact of the Mzimvubu Water Project is the following:

- Proposed irrigation;
- Domestic water supply;
- Hydro-electricity generation;
- Relocation of some homes;
- Relocation of roads and other infrastructure.

In the following sections the parameters of the study will be discussed, when evaluating the socio-economic impact of the availability of the water.

4.1 APPROACH AND METHODOLOGY

The approach adopted to determine the economic viability of the project is:

- Using an Economic Cost Benefit Analysis (ECBA) to determine the economic viability, and
- Macro-economic Impact Analysis to determine the economic impacts of the project.

4.1.1 Cost Benefit Analysis

The CBA method provides a logical framework for evaluating development programmes, and can serve as an aid in decision-making processes. The theoretical foundations of a CBA are: benefits which are defined as increases in human wellbeing (utility) and costs which 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.

To the extent it was possible, all social, economic and environmental costs and benefits were identified and included in the analysis. Applicable opportunity costs were applied instead of the financial costs and shadow pricing, where necessary.

The normal cost-benefit analysis was carried out to determine the Net Present Value (NPV) and the Economical Internal Rate of Return (EIRR).

These various parameter criteria were then used to assist in the evaluation of the project. These criteria are:

- Net Present Values (NPV).
  The criterion for the acceptance of a project is that the net present value 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 net present value will be chosen since it maximizes the net benefit to the community.

- The internal rate of return (IRR).
  Only projects with an internal rate of return higher than the social discount rate, which forms a lower limit, will be considered for funding.
- The discounted benefit-cost ratio (BCR).
  A project will only be considered for funding if the benefit-cost ratio is greater than one.

The analysis was based on data collected and the design criteria established as provided by the rest of the project team and approved by the client during the basic data collection stage. The most critical linkages between the options and the national macro-economic policies and variables that are most likely to affect the viability of the selected options have been highlighted.

4.1.2 Macro-Economic Impact Analysis

4.1.2.1 Objective

The objective of this section 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 Cost Benefit Analysis (CBA) preceded the macro-economic impact analysis and the information requirements for the CBA 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 Eastern Cape Province. 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 macro-economic 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.

4.1.2.2 Macro-Economic Impact Analysis Modelling

The compilation of the updated South African and Eastern Cape Social Accounting Matrices (SAM) 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 Eastern Cape SAM was finalized in October 2009, and was overseen by an expert group of people from the Eastern Cape Province, chaired by the Eastern Cape 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 spread sheets 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 quality 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.

A detailed description of these SAMs is provided in **Appendix A** and the magnitude of linkages in **Appendix B**.

5. DATA AND DATA SOURCES

In determining the economic viability of the proposed project using an Economic Cost Benefit Analysis (ECBA) the costs and benefits used is detailed in the next sections.

The costs can broadly be divided in two sections namely the:

- Construction Capital Cost;
- Social Costs;
- Operational Costs.

The benefits from the scheme can be broadly divided into the following:

- Irrigation Activity;
- Domestic Water Supply;
- Hydro-electricity Generation.

5.1 COSTS

5.1.1 Construction Costs

The data used is taken from the relevant feasibility report and used for the different sections of the construction as well as the spending per year. **Table 5-1** presents the data as used in the model as stated in the Feasibility Report.

Table 5-1: Construction costs for Ntabelanga and Lalini as used in CBA (2013 prices)

COMPONENT	Capital Cost R million	Annual expenditures R million 2014	2015	2016	2017	2018	2019	2020
Ntabelanga Dam and associated works	1 023		307	307	307	102		
Ntabelanga Dam hydro-power works	88			44	44			
Ntabelanga water treatment works	640			320	320			
Ntabelanga bulk treated water distribution system	1 269			423	423	423		
Ntabelanga irrigated agriculture developments	536			268	268			
Ntabelanga power transmission	38			19	19			
Engineering and EMP Costs	580	116	116	116	116	116		
Sub-Total Ntabelanga	**4 174**	**116**	**423**	**1 497**	**1 497**	**641**		

COMPONENT	Capital Cost R million	2014	2015	2016	2017	2018	2019	2020
Lalini Dam and associated works	840				280	280	280	
Lalini water delivery tunnel, shafts and penstocks	900			225	225	225	225	
Lalini hydro-power E&M equipment	300					150	150	
Lalini hydro-power civil works	250					125	125	
Lalini power transmission lines to grid	86					43	43	
Feasibility Study, Engineering and EIA Costs	265	20	49	49	49	49	49	
Sub-Total Lalini	**2 641**	**20**	**49**	**274**	**554**	**872**	**872**	
Total Ntabelanga and Lalini		**136**	**472**	**1 771**	**2 051**	**1 513**	**872**	

5.1.2 Operational Costs

The operational costs used in the feasibility report are used in the ECBA as well as some estimations made on outstanding costs. Operational expenditure was estimated at 5% of construction cost for the dam and associated works. Operational cost for water distribution was estimated applying the factors recommended in the DWA's "Technical Guidelines for the Development of Water and Sanitation Infrastructure".

5.1.3 Social Costs

The following is referred to as social costs:

- Relocation costs of homesteads and possible compensation.
- Costs associated with the replacement of infrastructure: roads, schools, etc.
- Possible environmental costs.

The following explains the values as applied in the ECBA model.

The total expenditure related to land compensation totals R38.52 million which is spent over the period from 2015 to 2018 as recalculated by Mosaka Economic Consultants.

The expropriation and resettlement costs total R73.83 million and the servitudes total R1 million. These figures were obtained using the information obtained from fieldwork and estimating the cost of relocating these structures with costs taken from the Africa Property and Construction Handbook, 2013 and calculated by Mosaka Economic Consultants.

5.2 BENEFITS GENERATED BY THE PROPOSED NTABELANGA DAM

As stated the benefits generated by the dam can be grouped as follows:

- The irrigation proposals,
- The provision of domestic water, and
- The generation of hydro-electricity.

The macro-economic impacts of the benefits are estimated separately using the Macro-economic Impact model.

In this section the value of the water provided by the Ntabelanga Dam will be used to determine the economic viability of the project.

5.3 IRRIGATION PROPOSALS

The feasibility report proposals can be broadly summarised as follows:

- Commercial irrigation units;
- Recommendations on crop selection;

The executive summary of the report on irrigation development[5] states: *Determination of farming unit size has been determined on the premise that each farming unit should own their own tractor and farming implements, and the appropriate farm size to economically justify this approach. This has been determined as 60 ha per farming unit. The 2 868 ha of irrigable land around the Ntabelanga Dam can be reasonably grouped into 45 farming units of average size 63.7 ha per unit.*

The current system of land tenure is communal dry-land farming on State owned land. It is suggested that commercial leases of at least 20 years be entered into with

[5] Feasibility Study for the Mzimvubu Water Project: Irrigation Development – P WMA 12/T30/00/5212/9.

prospective farmers, with leases being conditional upon proper and effective use of the land.

Technical, training and support structures do exist in the area. The Department of Rural Development and Agrarian Reform is well positioned to provide training and extension services in the area. Tsolo Agricultural College and Jongiliswe Agricultural College for Traditional Leaders are local resources that could be used to train, mentor and support developing farmers.

Business training will need to be a focus area for the farmers, as the farms need to be economically sustainable. A 60 ha farming unit will potentially have a turnover of between R3 million and R5 million.

On Agricultural Economics the following is stated: *A Gross Margin Analysis (GMA) has been carried out for the crops that are suited to the area.*

The GMA per crop is presented in the report body. A typical crop planting scenario on a 60 ha farming unit with a mix of vegetables, row crops and forage/fodder crops indicates that a Gross Margin of around R580 000 is realistic per 60 ha farming unit. It is stressed that this is a gross margin on directly allocatable costs, and not a measure of profit.

In conclusion, the following is stated: *Introduction of a commercial irrigation farming model is recommended. However, this will constitute a major change from the current system of land use. Extensive community consultation will be required. Failure to garner broad community support for the proposal will constitute the biggest risk to failure of the scheme, both in the short and long term.*

Key issues that will need to be resolved are:

- *Land reform and a change of mind set as regards agrarian practices and land tenure.*
- *This will require extensive consultation with Traditional Leaders and the affected people in the areas to be developed.*
- *Investment in training, facilitation, and support services.*

The economics of the identified development option are based upon:

- *Grant funding of the main bulk water supply infrastructure to ensure that the water supplied is affordable.*
- *Reduction of power costs through the beneficial usage of the hydro-power generated by the Project.*

As the land ownership situation is not part of this EIA study no comments will be made regarding the implications of the proposal.

The comments will be restricted to the crop mix and the Gross Margin Analysis and the possible profitability or not of the proposed units.

5.3.1 Crops

It must be stated upfront that the Feasibility Report, as far as the suitable crops and estimated yields are concerned, is in much detail and it is accepted without any comments in this report.

The crop mix in **Table 5-2** below is recommended in the feasibility study.

Table 5-2: Recommended crop mix in the Feasibility Report

Cropped	Crops	
(ha)	Crop 1	Crop 2
1	Green Beans	
		Carrot
1	Lettuce	
		Lettuce
2	Potatoes	
		Cabbage
10	Lucerne	
5	Oats	
1	Spinach	
		Onion
4	Soybean	
5	Rye grass	
1	Tomatoes	
30	Maize	

The above crop mix is based on an irrigation area of 60 hectares with potential double cropping which can be expanded to 65 crop hectares.

If **Table 5.2** is converted to the total irrigation area the total number of hectares shown in **Table 5-3** becomes available with the total expected crop.

Table 5-3: Total number of hectares available with the total expected crop of the scheme

Crop	Percentage Recommended	Total hectares	Estimated Yield Tons/ha	Total Annual Yield Tons	Estimated Marketing Period Months
Green beans	1.54%	44.12	8	353.0	3
Carrot	1.54%	44.12	30	1 323.7	4
Lettuce	3.08%	88.25	20	1 764.9	8
Potatoes	3.08%	88.25	30	2 647.4	4
Cabbage	3.08%	88.25	50	4 412.3	4
Lucerne	15.38%	441.23	18	7 942.2	6
Oats	7.69%	220.62	7	1 544.3	2
Spinach	1.54%	44.12	20	882.5	4
Onions	1.54%	44.12	25	1 103.1	6
Soybean	6.15%	176.49	3	529.5	8
Rye grass	7.69%	220.62	10	2 206.2	5
Tomatoes	1.54%	44.12	35	1 544.3	3
Maize	46.15%	1 323.69	8	10 589.5	12
Total	100.00%	2 868.00			

5.3.1.1 Vegetables

The marketing channels available for the different crops were analysed at desktop level in terms of the vegetable group, maize, soya and the grazing crops.

The vegetable group was investigated in terms of the following:

- Firstly the Mthatha Fresh Produce Market: Can the market absorb the additional produce?
- The East London Fresh Produce Market option?
- The local "bakkie" market[6]: Can it be an alternative market to the Mthatha Fresh Produce Market?
- Sophistication of the local market to absorb the specific crop.

In **Table 5-4** below the following scale was applied with the aim to provide a final opinion on the marketability of the specific vegetable crop:

- A – Very Marketable;
- B – Some Scope
- C – Little Scope;
- D – No Scope.

[6] Produce sold from a utility vehicle by a vendor.

Table 5-4: Scale applied to determine the marketability of the specific vegetable crop

Crop	Estimated tons per month	Sophisticated Market	Local Market	Current Mthatha Market	Current East London Market	Overall Opinion
Green beans	120	Reasonable	No scope	No data	6 tons/m	D
Carrots	340	Reasonable	Little scope	24 tons/m	424 tons/m	B
Lettuce	220	Highly	No scope	No data	21 tons/m	D
Potatoes	660	Low	Can be absorbed	243 tons/m	2 550 tons/m	A
Cabbages	1 100	Low	Can be absorbed	62 tons/m	311 tons/m	A
Spinach	220	Reasonable	No scope	0.5 tons/m	10 tons/m	D
Onions	140	Reasonable	Little scope	98 tons/m	827 tons/m	B
Tomatoes	550	Highly	Little scope	12 tons/m	265 tons/m	C

The conclusion is that potatoes and cabbages will be readily marketed in the local rural market as well as the Mthatha and East London Fresh Produce Markets. Carrots and onions will have to be marketed mainly in the Mthatha and East London Fresh Produce Markets. Tomatoes will probably sell in small volumes at the local rural and Mthatha markets and larger volumes in the East London Fresh produce market. We are very negative towards lettuce, green beans and spinach to be marketed successfully in the specific area due to the limited marketing opportunities available.

In the above analysis the possibility of vegetable processing unit in Mthatha is not taken into consideration because of the vagueness of the concept currently.

Table 5-5 shows the average prices for the different vegetables realised at the two markets.

Table 5-5: Average prices for the different vegetables realised at the two markets

Vegetable	Mthatha FPM R/ton	East London FPM R/ton	Price Difference between Markets
Green beans	0	4 983	n/a
Carrots	3 142	3 660	16.5%
Lettuce	0	2 971	n/a
Potatoes	2 255	2 639	17.0%
Cabbages	1 571	1 476	-6.0%
Spinach	2 534	5 489	55.3%
Onions	0	4 983	n/a
Tomatoes	4 449	4 942	11.1%

From **Table 5-5** it appears that, except for cabbages, the prices attained at East London is approximately 15% higher than those realised in Mthatha. With the two

centres roughly 230 km apart it would be worthwhile to also utilise the East London facility as the difference in price would compensate for the additional travelling costs.

5.3.1.2 Maize and Soya

The maize and soya beans would probably be easy to market in the local area, because the area is presently a net importer of the two crops. Prices would also be better than those realised in the main maize production areas of the Free State, North West and Mpumalanga, because of the savings in transport costs. Either some storage facilities would be necessary or local traders in Maclear, Tsolo and Mthatha may be used to take over the marketing function.

An agreement with the established local traders will probably be the best option as they will already have markets and storage available.

5.3.1.3 Lucerne, Oats and Rye grass

The situation as far as the lucerne, oats and rye grass production recommendation is concerned, is more complicated. Oats and rye grass are recommended for grazing and specifically winter grazing. The lucerne is recommended to be used as a fodder crop.

All three crops are well adapted to the area and should easily meet the estimated yield targets. As the local communal farmers are mostly stock farmers it appears to be a logical step to be taken. However, there are a number of issues that have not been clarified in the feasibility report. The determination of the value of the grazing of the oats and rye grass is also not explained.

It is a fact that the present quality of the livestock is below accepted commercial standards, however, the availability of the grazing would contribute to the lowering of natural deaths and improve the reproduction numbers. The following issues are not addressed in the feasibility report:

- A period will have to be allowed for the breeding of a commercial group of animals.
- The way the numbers will be controlled to arrive at an acceptable value for the grazing?
- Either additional fencing will be necessary or some manpower to herd the livestock.
- It appears that the value of the grazing is based on the projected tonnage produced without any motivation.

Lucerne production is well adapted to the area as a fodder crop and the current proposals make provision for a total area of plus minus 440 hectares at 18 tons per hectare. An estimated total production of 7 920 tons and at 25 kg per square bale,

the total number of bales can be around 317 000. Local sources state that the square bale is preferred to the large round bales because of the high rainfall and the fact that they are easier to store. Round bales can, however, be stored by covering them with plastic covers, a common practice.

The feasibility analysis makes no provision for hay making equipment. **Table 5-6** presents the basic implements per unit as mentioned in the feasibility report.

Table 5-6: Basic implements per farming unit

Implement	Number Required	Work rate	Number of Days to Prepare and Plant 60 ha.
50 kW Tractor	1		
Plough	1	6 ha/day	10
Disc	1	15 ha/day	4
Planter	1	15 ha/day	4
Cultivator	1	20 ha/day	3

The feasibility report states: *This is a total of 21 days, which would allow 14 non-working days for rainy spells and mechanical breakdowns.*

According to some local sources the lucerne will probably be cut 5 to 6 times during the spring and summer seasons. According to the Mechanisation Guide 2014 by JP le Roux and ME le Roux an average of between 9 and 10 hectares are attainable per day. Furthermore at least one day for allowing the crop to dry and the third day for raking and baling is required. This would convert to between 15 and 20 days per annum per unit.

In **Table 5-7** the historical rainy day detail from two towns, Aliwal North and Grahamstown are provided for the summer month period. No relevant data for Mthatha or Kokstad could be obtained.

Table 5-7: Historical precipitation days

Month	Aliwal North	Grahamstown
	Average number of days with precipitation	Average number of days with precipitation
October	6	11
November	7	10
December	6	9
January	8	9
February	8	9
March	8	10
Total	**43**	**58**

The percentage summer rainy days vary from 24% in the case of Aliwal North to 32% in the case of Grahamstown. Adding an average 28% to the required days per unit provides for 19 to 23 days per unit per season necessary to finish the haymaking process.

The options available for the harvesting of the lucerne crop over the total irrigation area are either:

- Using a contractor;
- Develop a sharing model for the total area, or
- Let every unit acquire their own equipment.

The following price structure[7] applies for the hay mowers and rakes, balers and trailers to cart the crop:

- Hay mowers – R71 300;
- Hay rake – R12 300;
- Baler – R269 000.
- Utility trailer that will also be used for other activities on the irrigation unit – R32 000.

In the above analysis it was accepted that the 50 kW tractor of each irrigation unit will also be available for use by the unit.

If the decision is that a shared structure should be developed the following extra equipment would be needed for the total irrigation area, taking into consideration the estimated number of rainy days during spring and summer:

- Tractors – 5
- Mowers – 5
- Hay rakes – 5
- Balers – 5
- Trailers – 5

Provision for hay sheds would be a necessity if square baling is used. The average sized open sided shed with the following measurements will be needed: length – 30 m; width – 10 m; height – 4 m. The construction cost should be around R75 000.

After considering the total required implements per commercial unit and taking into consideration the variety of crops to be planted the implements listed in **Table 5.8** are proposed with the 2013 prices.

[7] Source: - Mechanisation Guide 2013 by JP and ME le Roux.

Table 5-8: Implements required with costs

Implements	Number	Price 2013
50kw Tractor	1	R 292 000
Plough	1	R 30 552
Disc	1	R 26 961
Planter	1	R 193 580
Cultivator - seedbed preparation	1	R 16 620
Fertiliser Spreader	1	R 59 300
Boom Sprayer	1	R 31 870
Tine Ripper	1	R 9 576
Trailer	1	R 31 000
Total		R 691 459

The total estimated investment per irrigation unit is R691 459.

5.3.2 Fixed Investments

A number of fixed structures, stores and sheds will be required per unit and **Table 5-9** provides an indication of the estimated costs of the minimum envisaged structures.

Table 5-9: Fixed structures, stores and sheds required per unit

The following outbuildings and stores are identified as part of the projected commercial unit.	**Length (m)**	**Width (m)**	**Area (m2)**	**Cost/sq. m**	**Total**
Tractor and Implement store	15	6	90	R 1 050	R 94 500
Workshop	4	6	24	R 2 800	R 67 200
Hay Shed	30	10	300	R 250	R 75 000
					R 236 700

The estimated cost is R236 000 per unit, for all the units the amount would come to around R10.62 million.

5.3.3 Housing

The provision of housing is necessary if the current situation regarding farm labour is taken into consideration. Provision is made for the manager/owner and a number of permanent staff.

The total estimated cost is presented in **Table 5-10**.

Table 5-10: Estimated housing requirement and cost

Type	Unit Cost	Number	Total
Manager	R810 000	1	R810 000
Staff	R99 000	6	R594 000
Total			**R1 404 000**

5.3.4 Unit Profitability

The feasibility analysis[8] provides a Gross Margin per 60 hectare unit based on the proposed crop mix of R580 737. The report then states the following: *From this, the farmer would need to draw a salary, pay the interest and capital redemption on any loans, and pay for any other services he may require such as crop insurance etc.*

This statement refers to the so-called fixed and management costs which if subtracted from the Gross Margins provided the Net Farm Income (NFI) which determines financial viability. In the next section the fixed and management costs per unit are estimated and the Net Income per unit estimated.

5.3.4.1 Fixed Costs

The Feasibility Report calculated up to Gross Margin level which is accepted by Mosaka. As no fixed costs are calculated in the Feasibility Report, the fixed costs were determined on farm basis and based on the original crop mix as discussed in the Feasibility Report and are presented in **Table 5-11**.

Table 5-11: Fixed costs on farm basis based on the original crop mix

Fixed Costs	**R 359 354.00**
- Depreciation	R 195 383.00
- Labour	R 81 900.00
- Insurance	R 23 814.00
- Repairs & Maintenance - Fixed	R 9 297.00
- Administration Costs	R 14 400.00
- Fuel & Electricity	R 32 400.00
- Sundry	R 2 400.00

The different approaches followed to estimate the different fixed cost elements are explained in the following paragraphs.

Depreciation estimation is presented in **Table 5-12** on a farm basis and is based on the estimated capital investment per irrigation unit.

[8] Feasibility Study for the Mzimvubu Water Project: Irrigation Development – P WMA 12/T30/00/5212/9.

Table 5-12: Depreciation estimation

Item	Total Capital Investment	Total Investment per Hectare	Replacement Period	Annual Depreciation
Farm Implements	R691 459	R11 524	15 years	R46 097
Shared hay making implements	R58 470	R5 846	10 years	R5 846
Irrigation Equipment	R1 659 391	R27 657	15 years	R110 626
Fixed Developments	R1 640 700	R27 345	50 years	R32 814
Total	**R4 140 020**	**R72 372**		**R195 383**

The total investment, expressed in 2013 prices appears to be around R4 140 020 per irrigation unit with an estimated annual depreciation of R195 383.

The labour component is the fixed labour not associated with any specific crop action. **Table 5-13** presents the estimated annual cost.

Table 5-13: Estimated annual fixed labour cost

Labour - Fixed	*Per month*	*per Annum*
Workshop - assistant	R 4 200	R 50 400.00
General assistant	R 2 625	R 31 500.00
Total		R 81 900.00

The total fixed labour is estimated to be around R81 900, this amount excludes the permanent staff involved in the actual crop producing activities.

The insurance refers to the fixed cost element and is not crop orientated, it is already included in the Gross Margin calculations, but represents the cost to insure fixed and moveable assets. **Table 5-14** presents the estimation.

Table 5-14: Estimation of cost to insure fixed and moveable assets

Insurance	Capital	Rate	Annual Amount
- Farm Equipment	839 926	1.00%	R 8 399
- Irrigation Equipment	R 1 659 391	0.60%	R 9 956
- Fixed	R 1 091 700	0.50%	R 5 459
Total	R 3 591 017		**R 23 814**

The total amount is estimated at R23 814 per annum.

The following amounts are based on work done on the proposed Cofamosa irrigation scheme on the Inkomati River in Mozambique. The repairs and maintenance costs on fixed assets is estimated at R 9 297, the administration cost at R14 400 and electricity and fuel for non-production purposes at R32 400. A sundry cost item is added for the amount of R2 400 per annum.

5.3.4.2 Management Costs

In the calculation of the management costs a number of factors play a role:

- A trained individual accepting a lot of responsibility;
- Management experience;
- Farming experience.

Sources were contacted in other parts of the Eastern Cape where farm managers are utilised in irrigation farming operations. Eventually the following structure as presented in **Table 5-15** was developed to arrive at an estimated cost.

Table 5-15: Remuneration of farm managers in irrigation farming operations (2013 prices)

General Salary	R/month	Months	Total
Salary	R 25 000.00	12	R 300 000
Medical Fund Contribution	R 2 100.00	12	R 25 200
Pension Fund Contribution (of R300 000)		7.50%	R 22 500
Secretarial Services	R 2 500.00	12	R 30 000
Total Household income			**R 377 700**
Benefits Derived from Farm			
Housing	R 4 200.00	12	**R 50 400**
Produce Used	R 300.00	12	**R 3 600**
Total Benefits			**R 54 000**
Cost to Company			**R 323 700**

The total “cost to company” is then estimated at R323 700.

5.3.4.3 Different Crop Mixes

The financial viability of the irrigation unit is determined for the original proposed crop mix and then for at least two different crop mix combinations.

a) Original Recommended Crop Mix

The Gross margin calculations were duplicated and for all the crops the results are within a 5% difference from the results presented by the Feasibility Study.

By applying the original crop mix to estimate the financial viability of the irrigation units the results in **Table 5-16** were obtained.

Table 5-16: Estimate of the financial viability of the irrigation units with the original crop mix

Gross Margin	R580 737
Fixed Costs	R359 354
Net Farm Income (NFI)	***R221 383***
Management Cost	R323 700
Net Income	***-R102 317***

From Table 5-16 it can be deduced that an irrigation unit is not financially viable as a negative Net Income of R102 317 is obtained.

The role of the depreciation, R195 383, in the total fixed costs calculations will be discussed in a later paragraph together with the funding of the units.

b) Crop Mix taking Marketing into consideration

As previously discussed we are of the opinion that the market possibilities for some of the crops are limited and volume sizes of the proposed crops will not be marketable.

The following crops were removed from the list:

- Spinach,
- Green beans,
- Lettuce.

No alternative crops were added to the list, but additional hectares have been added to the other listed crops and the production marketing season was extended. The following crops have been allocated additional hectares:

- Potatoes 4 from 2 hectares;
- Cabbages 4 from 2 hectares;
- Carrots 2 from 1 hectare.

An estimate of the financial viability of the irrigation units with existing crops and hectares increased is presented in **Table 5-17**.

Table 5-17: Estimated adjusted financial viability of the irrigation units

Gross Margin	R588 724
Fixed Costs	R359 354
Net Farm Income (NFI)	***R229 370***
Management Cost	R323 700
Net Income	***-R94 330***

From Table 5-17 it can be deduced that this crop mix also provides a negative Net Income of R94 330.

c) Crop Mix with production yield changes

Table 5-18 shows the production limits that were established in the feasibility report.

Table 5-18: Established production limits

Crop	Uses	Suitability	Expected Yield
Cabbage	Food	Moderate	50
Carrot	Food	High	30
Green Bean	Food	High	8
Italian Rye grass	Nutritious grazing	High	10
Lettuce	Food	Moderate	20
Lucerne	Fodder crop	Moderate	18
Lupine	Forage	High	3
Maize	Grain	Moderate	8
Oats	Winter grazing or green feed	High	7
Onion	Food	High	25
Potato	Food	High	30
Soya bean	Food, oil seed, animal feed	Moderate	3
Spinach	Food	High	20
Tomato	Food	Moderate	35

The crops which were classified as moderate or with high suitability were investigated by obtaining information from local producers in the Elliot to Maclear area. It appears that over the last number of years crop yields in a number of crops have improved due to better management practises, but also newer seed varieties that became available.

Taking the above into consideration, a new crop mix with changed yields shown in **Table 5-19** was developed.

Table 5-19: New Crop mix with changed yields

Crop	Original Proposal		New Proposal	
	Yield ton/ha	Hectares	Yield Ton/ha	Hectares
Cabbage	50	2	65	4
Carrot	30	1	45	2
Green beans	8	1	Not used	
Italian rye grass	10	5	10	5
Lettuce	20	2	Not used	
Lucerne	18	10	18	10
Lupine	3	0	Not used	
Maize	8	30	8	30
Oats	7	5	7	5
Onion	25	1	30	1
Potato	30	2	45	4
Soya bean	3	5	3	5
Spinach	20	1	Not used	
Tomato	35	1	40	1

Using the assumptions in Table 5-20 an alternative Gross Margin of R688 822 was established. By using this Gross Margin the results shown in **Table 5-20** were obtained.

An estimate of the financial viability of the irrigation units with a new crop mix and changed yields is presented in **Table 5-20**.

Table 5-20: Estimated financial viability of the adjusted irrigation

Gross Margin	R688 822
Fixed Costs	R359 354
Net Farm Income (NFI)	***R329 468***
Management Cost	R323 700
Net Income	***R5 765***

This application of the crop mix and resultant crop yields shows a positive outcome of R5 765.

5.3.5 Summary and Conclusion - Irrigation Units

It is necessary that the following be recaptured and taken into consideration in the summary before the conclusions are discussed.

a. This development will take place in a very poor and currently under developed area. This proposed dam project with the water made available could act as a stimulus for much needed development.

b. The irrigation units must be financially viable within the shortest period possible. Long term subsidization is not recommended. However, it must be kept in mind that the total area will only come into production over a period of time.
c. Support structures should be available right from the start to assist with management. This support must cover the whole spectrum from planting to marketing and overall management. Higher level and periodic monitoring of the progress of the irrigation project must be introduced.
d. It must be accepted that the start-up capital is not recoverable; this includes the infrastructure, implements and irrigation. It will probably have to include sections of the first production costs including items like wages.
e. The best possible management will have to be available right from the start, which means the selection of the unit managers as well as the accepted management structure will eventually determine the success of the irrigation scheme.

5.3.5.1 Depreciation

It is necessary to explain that the reason why the depreciation amount is included in the "Fixed Costs" is to make provision for the replacement of the equipment. The intention is that a reserve over time is built up to finance the replacement of the farming implements, irrigation on-field equipment and fixed structures. If this is not applied and a fund not established then the replacement of equipment will have to take place with loan capital and interest repayment.

The exclusion of the depreciation changes the Net Income situation as shown in **Table 5-21**.

Table 5-21: Net Income with and without depreciation

Crop Mix Option	Net Income with Depreciation Provision	Net Income ignoring Depreciation
Original Recommended Option	-R102 317	R93 066
Crops Eliminated based on Marketing Options	-R94 330	R101 080
Crop Yields Increased based on local experience	R5 768	R201 151

Table 5-21 shows that the cash flow improves dramatically the first number of years if all the equipment is new and replacement will only probably start after year 10. By then the management and support structures should be well established and it should be possible to finance the repayment of new equipment from the current business surplus.

A possible timeline for the development of the irrigation units will be discussed in a separate chapter.

5.3.5.2 Commercial Units

The recommendation of the establishment of commercial irrigation units is sound although controversial. In the past many irrigation schemes in rural communal areas have failed because of a number of reasons.

The following is quoted from the referred Water Research Commission (WRC) report:

The WRC ***Report number 1353/1/06: - Investigation of different farm tenure systems and support structure for establishing small scale irrigation farmers in long term viable conditions*** provide the following:

- *Economic Efficiency (sustainability) – The ultimate goal of the development is not only equity but also economic efficiency that would lead to sustainable agriculture. Defining efficiency is not that clear-cut because a very large commercial farmer might be sustainable but need not necessarily be an efficient user of resources. We will use the concept of economic efficiency to imply that a farmer makes the most of opportunities and resources and is able to provide for himself and his family, without being dependent on Government support.*
- *Commercial versus subsistence farming – It is necessary to capture the farmer's objectives in entering small scale farming, and these are basically either to farm at a "subsistence" level or as a commercial undertaking. Inseparable from these objectives are the underlying concepts of land availability and a community-based approach to projects, as well as the use of the most appropriate technology to achieve the results required. Implicit in the drive towards full commercial farming is the need to derive the returns of scale which would stem from increasing the size of the land being used as a factor of production.*

If the allocation per participating member was too small, support services could not accommodate the large number of beneficiaries and management structures were weak and production never reached projected levels.

5.3.5.3 Funding

For the irrigation project to be successful it must be accepted that to start farming with no capital is, in the modern era impossible. ***The Government must accept the responsibility to establish these units with total grant funding and not loan funding as they will find it impossible to repay any loans in the first number of years***. Start-up capital, as well as production funds for a number of years should be included in the funding.

It will be necessary for a possible timeline to be developed for the irrigation units as it is impossible to develop the 2 868 hectares in one season and have all 45 units up and running. It is also accepted that it will take a number of years for each individual unit to attain maximum production levels. It is not only the physical installation of the

irrigation infrastructure that will take time, but also the training of staff, the improvement of the soils and the development of the markets that will take time. A realistic analysis of the situation leads to a five year period of installation and a five year period to get to full projected production.

Table 5-22 below provides an indication of a development program and an expected production over the first 10 year period.

Table 5-22: Possible development programme with production first 10 years

Year		1	2	3	4	5	6	7	8	9	10
Development Program											
Average Units - hectares	63.73										
Group		1	2	3	4	5					
Number of Units per Annum		5	8	10	11	11					
Hectares per Annum		319	510	637	701	701					
Estimated production reached	Percentage per annum										
Group 1		30	50	75	90	95	100	100	100	100	100
Group 2			30	50	75	90	95	100	100	100	100
Group 3				30	50	75	90	95	100	100	100
Group 4					30	50	75	90	95	100	100
Group 5						30	50	75	90	95	100
Estimated Total Production		3	11	24	42	63	79	90	96	99	100

Table 5-22 indicates that the expected total production could be reached between the 8th and the 10th year of the project.

5.3.5.4 Land Ownership

As the land ownership issue is not part of the EIA study no comments are made in this respect. Considering the fact that this is a very sensitive and crucial issue, it is essential that it be resolved for the commercial based irrigation proposal to be successful.

5.3.5.5 Conclusion

In the final instance the conclusion is that the irrigation proposal can be financially viable and therefore also economically viable if the right crops are produced, marketing channels are available and management and support are of a high standard.

It must however be accepted that the initial start-up development and operational capital must be a grant and that it can take as long 10 years for the project to be 100% operational and profitable.

5.3.6 Value of Irrigation Water

A popular method of estimating the economic value of irrigation agriculture is the farm crop budget analysis. It is calculated as the total crop revenue less non-water input costs. This residual can be defined as the maximum amount the farmer could pay for water and still cover costs of production. It thus represents the on-site value of water. If water procurement costs are further subtracted, the net value for irrigation is then comparable to in-stream water values. This monetary value divided by the total quantity of water used on the crop, determines a maximum average value, or willingness to pay, for water for that crop.

This approach is applied on the irrigation area in totality and a value of R1.60 per m^3 is obtained.

According to the feasibility report a total of 32 723 880 m^3 per annum must be available from the dam. The total of the value of the irrigation water is then established at R52.2 million per annum.

It must be kept in mind that this figure does not represent the full picture regarding the value of the irrigation, which will be calculated in the Macro-Economic Impact Analysis section where the multiplier impacts will be calculated. Issues like employment creation in the local area will also be addressed.

5.3.7 Domestic Water Provision

5.3.7.1 Population Growth Parameters

The provision of potable water to a number of rural and small urban areas is a very important aspect of the total project and, as previously discussed, it is also a constitutional requirement. The district municipalities that will benefit from the distribution system are:

- Alfred Nzo DM with the head office in Mount Ayliff and it includes the towns of Bizana, Cedarville, Matatiele, Mount Ayliff, Mount Frere, and Tabankulu;
- Joe Gqabi DM with the head office in Barkly East and it includes the towns of Aliwal North, Barkly East, Burgersdorp, Jamestown, Lady Grey, Maclear, Mount Fletcher, Rhodes, Sterkspruit, Steynsburg, Ugie, and Venterstad;
- OR Tambo DM with the head office in Mthatha and it includes the towns of Flagstaff, Libode, Lusikisiki, Mthatha, Ngqeleni, Port St. Johns, Qumbu, and Tsolo.

Table 5-23 presents a number of socio-economic issues related to the three district municipalities.

Table 5-23: Social-Economic issues by District Municipality

District Municipality[9]	Current population	Population Growth	Unemployment Rate	Youth Unemployment rate	Population under 15 years
Alfred Nzo DM	801 344	0.35%	43.50%	52.3%	40.9%
Joe Gqabi DM	349 768	0.23%	35.40%	43.3%	34.1%
OR Tambo DM	1 364 943	0.52%	44.10%	54.2%	39.0%
Total	**2 516 055**				

Table 5-23 shows that all three district municipalities currently experience an unemployment rate varying from 35.4% to 44.10%.

The population is very young with an average of nearly 40% for the three district municipalities younger than 15 years. The weighted estimated average population growth rate per annum in the three district municipalities is 0.43%. This compares with the official population growth rate for the Eastern Cape Province of 0.44% per annum as reported by Statistics SA.

Table 5.24 shows that an average of 56.9% of the households is headed by women. The weighted average household income for the three district municipalities is R41 800 per annum

Table 5-24: Household income and percentage female headed households

District Municipality	Average Household Income Rand/a	Percentage Women Headed Households
Alfred Nzo DM;	R37 147	58.8%
Joe Gqabi DM;	R45 295	49.3%
OR Tambo DM.	R43 652	57.7%

Table 5.25 presents the estimated number of individuals that will be provided with water with the population estimates as provided in the feasibility report. The numbers are based on 1% per annum population growth rate.

[9] Source: The Local Government Handbook.

Table 5-25: Beneficiaries of water per DM based on 1% pa growth rate

District Municipality	Potential Beneficiaries 2013	Potential Beneficiaries 2020	Potential Beneficiaries 2030	Potential Beneficiaries 2040	Potential Beneficiaries 2050
Alfred Nzo DM	165 735	177 691	196 281	216 816	239 500
Joe Gqabi DM	33 513	35 931	39 690	43 842	48 429
OR Tambo DM	303 574	325 472	359 524	397 138	438 687
Total	**502 822**	**539 094**	**595 495**	**657 797**	**726 617**

These population numbers are problematic if the current official growth rate of 0.44% per annum in the Eastern Cape is taken into consideration or the estimated 0.43% per annum for the three district municipalities.

Together with this it is a fact that once a water service is made available, the use of water increases. It appears that the feasibility report uses the 1% population growth rate with a constant use per individual.

In **Table 5-26** the estimated population figures are presented applying the individual population growth rates as determined by Statistics SA during the 2011 Census.

Beneficiaries of water per district municipality based on the growth are shown in Table 5-26 below.

Table 5-26: Beneficiaries of water per district municipality

District Municipality	Potential Beneficiaries 2013	Potential Beneficiaries 2020	Potential Beneficiaries 2030	Potential Beneficiaries 2040	Potential Beneficiaries 2050
Alfred Nzo DM	165 735	169 838	175 877	182 131	188 607
Joe Gqabi DM	33 513	34 056	34 848	35 658	36 486
OR Tambo DM	303 574	314 798	331 556	349 206	367 795
Total	**502 822**	**518 693**	**542 281**	**566 994**	**592 888**

Tables 5-25 and **5-26** indicate a possible difference in beneficiaries of 133 729 by 2050, a 19% difference.

It must be stated that the water demand projections used in the feasibility report make provision for other uses which are difficult to quantify, such as business and small industries.

The next issue is the question of the impact on water use; will it also be about 19% less than estimated in the feasibility report; also what possible impact will it have on the construction costs.

To make provision for these variations the scenarios in **Table 5-27** were used in the Cost Benefit Analysis.

Table 5-27: Scenarios used in the Cost Benefit Analysis

Scenario	Population Numbers	Water Volume	Estimated Construction Cost
1	Feasibility Report	Feasibility Report	Feasibility Report
2	Eastern Cape Growth Rate	Feasibility Report	Feasibility Report
3	Eastern Cape Growth Rate	Reduced Volume 19%	Reduced Cost 19%

The reduction in the estimated construction cost in Scenario 3 is based on the assumption that a reduction of 19% in water supply will reduce the construction cost by the same percentage. This is not necessarily correct; however a reduction in domestic water can make more water available for the generation of hydro-power. Taking this into account we decided to use the 19% reduction in cost to include the value of the additional electricity generation.

5.3.8 Value of Rural Domestic Water

As discussed in the previous section, the conclusion is that the households are very poor, based on an average annual household income of R41 800 over the three district municipalities. However, the reality is that in the rural areas the figure will be lower. The 2011 census figures indicate an average household size of 4 for the three district municipalities.

The deduction is that very few households would actually be able to afford the tariffs. As already explained the approach is to determine the economic feasibility of the project using an Economic Cost Benefit Analysis (ECBA). Therefore the “Value of the Water” to the population will be used in the ECBA.

According to the WRC publication: A Manual for Cost Benefit Analysis in South Africa with Specific Reference to Water Resource Development – Third Edition, the following is applicable to the calculation of the value of the water: *The economic value of water is determined in two components. The first component deals with the social (public) portion of 25 litres of water per capita/per day. This portion is in accordance with the government’s policy on minimum water requirements for urban and rural households.*

The second component deals with the volume of water consumed above the 25 litres per capita per day. This water is regarded as a pure private good.

The social portion of water consumption is calculated using the following methodology:

$$Economic\ value\ of\ social\ water = \frac{4\%\ of\ actual\ household\ income}{Monthly\ water\ consumption\ per\ household}$$

The monthly income for low-income households in the Eastern-Cape is R3 483 per month. Dividing this by the minimum of 3.50 kl/month/household yields a social portion value of R30.52 per kl.

The private portion is calculated using the following methodology:

$$Private\ value\ of\ water = \frac{Value\ of\ social\ portion\ in\ R\ per\ kl + Current\ tarrif\ in\ R\ per\ kl}{2}$$

Given the current tariff of R5.60 per kl this equation yields a value of R18.06/kl for the private portion.

The Economic Value of the water is thus:

- Social Portion – R30.52/kl;
- Private Portion – R18.06/kl.

The total value of the water is thus R48.58/kl.

5.4 HYDRO-ELECTRICITY GENERATION

5.4.1 Connection to the grid

It appears that the electricity generated by the three units will be connected to the Eskom grid and that a negotiated volume will be sold back to the project in order to reduce the pumping cost to the irrigation scheme.

5.4.2 Output

The projected hydro-power output is estimated at 281 896 513kWh per annum[10] with the Ntabelanga Dam at 1.15 MAR and Lalini Dam at 0.15 MAR. The established MAR at the Ntabelanga Dam is 415 million m^3/annum and at the Lalini Dam 828 million m^3/annum.

The proposed yield of Ntabelanga Dam is 241 million m^3/annum, after release of an average of 23% of MAR (96 million m^3/annum) for EWR (Class C River).

A volume of 61 million m^3 of the above yield is allocated to domestic and irrigation use and 180 million m^3 are reserved for hydro-power generation.

[10] Feasibility Study for the Mzimvubu Water Project: Cost Estimates and Economic Analysis P WMA 12/T30/00/5212/15.

The value of the hydro-power can then be addressed in the following way. The output multiplied with the Eskom price, where price is the tariff together with cost of the water provision.

Our approach is then:

- Output – 281.896 million kWh,
- The tariff is R0.61 per kWh plus the levelled cost at 8% discount of R0.94 per kWh = R1.61/kWh;
- Total value of = R453.85 million per annum.

5.5 OVERALL ECONOMIC FEASIBILITY – COST BENEFIT ANALYSIS

5.5.1 Objective of the Cost Benefit Analysis

5.5.1.1 Purpose of the CBA

The principles underlying the Economic Cost Benefit Analysis (ECBA) are applied to evaluate the economic viability of the proposed dam. By economic analysis is meant that the project is evaluated at prices which reflect the relative scarcity of inputs and outputs. In the economic analysis prices actually represent opportunity costs and reflect the actual economic value of inputs and outputs. The opportunity cost is the value of the best alternative application of an input or an output of the project. The market price of generating hydro-electricity, for example, does not necessarily reflect the opportunity cost of generating electricity. Thus, when a price has to be determined, for example for the generation of hydro-electricity, the opportunity cost of hydro-electricity can be priced against the best alternative, which, in this case will be electricity generated from Eskom's coal power plants. See **Appendix C** for a background to the Cost Benefit Analysis.

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.

5.5.1.2 The aim of the analysis

The primary aim of the CBA analysis is to identify the economic and social implications of the identified costs and benefits of the proposed dam on the rural community. This implication is assessed by the NPV of the costs against the benefits, the benefits to cost ratio and the internal rate of return of the project.

5.5.1.3 Cost Benefit Analysis Methodology

A CBA comprises two distinct portions, a financial CBA component and an economic CBA component. Since this EIA involves only the economic CBA component the financial CBA will not be discussed further. 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 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 feasible or not. Within the framework, the estimated cost of the project is compared by means of a ratio (Benefit Cost Ratio) to the estimated benefits of the project. In order for a project to be considered economically viable, this ratio must have a value greater than one (1) in order to indicate that the 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 ECBA components.

5.5.1.4 Overview of the costs and benefits aspects of the project

a) Costs

Within the CBA framework, the costs related to the project can be separated into four distinct components:

- Capital expenditure.
- Operational expenditure.
- External costs (externalities).
- Environmental cost.

b) The capital expenditure on the Ntabelanga Dam is made up of the following components:

- Construction of Ntabelanga Dam and associated works.
- Ntabelanga dam hydro-power works.
- Ntabelanga water treatment works.
- Ntabelanga bulk treated water distribution system.
- Ntabelanga irrigated agriculture developments.
- Ntabelanga power transmission.
- Engineering and EMP Costs.

c) The capital expenditure on the Lalini Dam is made up of the following components:

- Lalini Dam and associated works.
- Lalini water delivery tunnel and penstocks.
- Lalini hydro-power electromechanical equipment.
- Lalini hydro-power civil works.
- Lalini power transmission lines to grid.
- Engineering and EMP costs.

d) Other costs:

- Tertiary pipelines.
- Investment costs for farming units.
- Upgrading surfaced main access roads.
- Upgrade and realignment of access roads to villages.
- Temporary haul roads.
- Downstream bridge across river.
- Operators housing complex.
- Visitors centre.
- Temporary water supply, abstraction, treatment and supply.
- Wastewater treatment plant.
- Power lines and transformers.
- Gauging weirs.
- Other items.

Table 5-28 shows the total capital expenditure used in the ECBA as reported in the feasibility report expressed in constant 2013 prices.

Table 5-28: Total capital expenditure used in the CBA (2013 Prices)

CAPEX 2013 constant Rand prices	YEAR:	1	2	3	4	5	6
	Total						
Ntabelanga CAPEX	**0.00**						
Ntabelanga Dam and associated works	**1023.00**	0.00	307.00	307.00	307.00	102.00	0.00
Ntabelanga Dam hydro-power works	**88.00**	0.00	0.00	44.00	44.00	0.00	0.00
Ntabelanga water treatment works	**640.00**	0.00	0.00	320.00	320.00	0.00	0.00
Ntabelanga bulk treated water distribution system	**1269.00**	0.00	0.00	423.00	423.00	423.00	0.00
Ntabelanga irrigated agriculture developments	**536.00**	0.00	0.00	268.00	268.00	0.00	0.00
Ntabelanga power transmission	**38.00**	0.00	0.00	19.00	19.00	0.00	0.00
Engineering and EMP Costs	**580.00**	116.00	116.00	116.00	116.00	116.00	0.00
Lalini CAPEX	**0.00**						
Laleni Dam and associated works	**840.00**	0.00	0.00	0.00	280.00	280.00	280.00
Laleni water delivery tunnel, shafts and penstocks	**900.00**	0.00	0.00	225.00	225.00	225.00	225.00
Laleni hydro-power E&M equipment	**300.00**	0.00	0.00	0.00	0.00	150.00	150.00
Laleni hydro-power civil works	**250.00**	0.00	0.00	0.00	0.00	125.00	125.00
Laleni power transmission lines to grid	**86.00**	0.00	0.00	0.00	0.00	43.00	43.00
Engineering and EMP Costs	**265.00**	20.00	49.00	49.00	49.00	49.00	49.00
Other Costs							
Tertiary pipelines	**1870.00**	374.00	374.00	374.00	374.00	374.00	0.00
Investment costs for farming units	**180.00**	36.00	36.00	36.00	36.00	36.00	0.00
Upgrading surfaced main access roads	**56.00**	11.20	11.20	11.20	11.20	11.20	0.00
Upgrading gravel main access roads	**40.00**	8.00	8.00	8.00	8.00	8.00	0.00
Upgrade and realignment of villages access roads	**24.75**	4.95	4.95	4.95	4.95	4.95	
Temporary haul roads	**5.00**	1.00	1.00	1.00	1.00	1.00	
Downstream bridge across river	**25.00**	5.00	5.00	5.00	5.00	5.00	
Operator Housing Complex	**26.00**	5.20	5.20	5.20	5.20	5.20	
Visitors Centre	**15.00**	3.00	3.00	3.00	3.00	3.00	
Temporary water supply, abstraction, treatment and supply	**1.50**	0.30	0.30	0.30	0.30	0.30	
Wastewater treatment plant	**15.00**	3.00	3.00	3.00	3.00	3.00	
Power lines & Transformers (2 x 11 kVA)	**26.00**	5.20	5.20	5.20	5.20	5.20	
Gauging Weir	**3.00**	0.60	0.60	0.60	0.60	0.60	
Other items	**20.83**	4.17	4.17	4.17	4.17	4.17	
		1.00	1.00	1.00	1.00	1.00	1.00
Total Capital Expenditure	**9123.08**	**597.62**	**933.62**	**2232.62**	**2512.62**	**1974.62**	**872.00**

e) Operational expenditure

Operational expenditure was estimated at a maximum of 5% of construction cost for the dam and associated works. Operational cost for water distribution was estimated applying the factors recommended in the DWS's "Technical Guidelines for the Development of Water and Sanitation Infrastructure".

5.5.1.5 Assumptions underlying the CBA

Regarding the costs relating to the project, the assumptions that were used in relation to the costs for the economic CBA are briefly discussed below.

The growth rate used in the feasibility report for the three municipalities was 1%. Using a weighted average of growth rates for the three district municipalities, a different rate of 0.4446% was acquired. This new rate was run against the 1% growth rate to determine whether it will have a significant impact.

The cost of electricity was escalated annually at a real rate of 2% to compensate for the annual 8% increase on Eskom tariffs.

a) Capital expenditure

All capital expenditure is assumed to occur over a period of six years as presented in **Table 5-28**. The proposed dam will operate indefinitely but for the purpose of the CBA the project will be operational for a period of 35 years from the first year of construction.

b) Externalities

The externalities were already stated in social costs but are repeated here for clarity.

The externalities related to the project included environmental mitigation, catchment restoration, land compensation, expropriation costs, resettlement and servitudes.

A budget of R450 million has been allocated by the DEA to be spent over the next ten years for the catchment restoration and rehabilitation program.

The total expenditure related to land compensation totals R38.52 million which is spent over the period from 2015 to 2018.

The expropriation and resettlement costs total R73.83 million and the servitudes total R1 million. These figures were obtained using the information obtained from fieldwork and estimating the cost of relocating these structures with costs from the Africa Property and Construction Handbook 2013.

c) Benefits relating to the project

The benefits included in the CBA are benefits from hydro-power, potable water, irrigation scheme benefits and the income generated by the proposed farming units.

While this CBA may cover the major benefits it must be noted that this is not the only benefits related to the project. With time, the dam may become a viable tourist attraction which may attract small business owners to set up accommodation in the nearby region.

An excerpt of the benefits is demonstrated in **Table 5-29** below shown in Rand million expressed in 2013 prices:

Table 5-29: Benefits relating to the Mzimvubu Water Project

Year	5	6	7	8	9	35	36	37	38	39
Hydro-power	94.59	241.2	393.6	501.9	511.9	856.7	873.8	891.3	909.1	927.3
Potable water	182.96	276.6	464.7	468.4	472.1	580.2	584.8	589.5	594.2	598.9
Irrigation water	1.75	5.70	12.51	21.87	32.87	52.36	52.36	52.36	52.36	52.36
Farm income			0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Benefits per annum	**279.30**	**523.5**	**871.0**	**992.4**	**1 017.1**	**1 489.4**	**1 511.2**	**1 533.3**	**1 555.9**	**1 578.8**

As can be seen from Table 5-29 the benefits generated by hydro-power and potable water are quite significant.

5.6 CBA RESULTS

A number of scenarios have been run to analyse whether the difference in population numbers had a significant impact on the economic viability of the project.

Table 5-30: Scenarios used in the Economic Cost Benefit Analysis:

Scenario	Population Numbers	Water Volume	Estimated Construction Cost
1	Feasibility Report	Feasibility	Feasibility Report
2	Eastern Cape	Reduced	Feasibility Report
3	Eastern Cape	Reduced	Reduced Cost 19%

5.6.1.1 Scenario 1 results and interpretation

Table 5-31: Scenario 1 Results

Assessment Criteria	Result
Net Present Value (NPV) Rand million	R 1 718.89
Benefit-Cost Ratio (BCR) Ratio	1.27
Internal Rate of Return (IRR) Percentage	10.31%

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 NPV in **Table 5-31** shows that the net benefit accrued is positive; there is a net gain of approximately R1 718.89 million expected with a population growth rate of 1%.

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 one (1). The BCR of 1.27 above indicates that for each Rand invested in the project there is an expected economic return of R1.27.

The Internal Rate of Return (IRR) is the discount rate at which present values of both benefits and costs are equal. Projects should have an IRR greater than the discount rate to be considered viable. For the CBA, with population growth rates of 1%, the IRR of 10.31% indicates a return of 2.31% more than the discount rate. Thus, with a population growth rate of 1% the IRR indicates a viable project.

The NPV, BCR and IRR all indicate that the project will be economically viable with the data as used in the feasibility reports.

5.6.1.2 Scenario 2 results and interpretation

Table 5-32: Scenario 2 Results

Assessment Criteria	Result
Net Present Value (NPV) Rand million	R 1 464.99
Benefit-Cost Ratio (BCR) Ratio	1.23
Internal Rate of Return (IRR) Percentage	10.01%

The NPV in **Table 5-32** shows that the net benefit accrued is positive; there is a net gain of approximately R1 464.99 million expected with a population growth rate of 0.4446%. The NPV value with a lower growth rate is only 15% less than that of the NPV with growth rate used in the feasibility report. Thus, the NPV still indicates economic viability with a lower population growth rate.

The BCR of 1.23 above indicates that for each Rand invested in the project there is an expected economic return of R1.23. This BCR is only marginally less than that of Scenario 1; nonetheless it is still a positive indication of the economic viability of the project.

For the CBA with a population growth rate of 0.4446% the IRR of 10.01% indicates a return of 2.01% more than the discount rate. Thus, with a population growth rate of 0.4446% the IRR indicates a viable project.

The NPV, BCR and IRR all indicate that the project will be economically viable even when population growth rate is reduced from 1% to 0.4446%.

5.6.1.3 Scenario 3 results and interpretation

Table 5-33: Scenario 3 Results

Assessment Criteria	Result
Net Present Value (NPV) Rand million	R 2 764.66
Benefit-Cost Ratio (BCR) Ratio	1.53
Internal Rate of Return (IRR) Percentage	12.52%

The third scenario was proposed to see what implication a lower cost of construction will have on the economic viability of the project. Since the previous two scenarios already had such positive results it was expected that Scenario 3 will only improve on that. This was indeed the case and these results are discussed briefly below.

The NPV in **Table 5-33** shows that the net benefit accrued is positive; there is a net gain of approximately R 2 764.66 million expected with a population growth rate of 0.4446%. The NPV still indicates an excellent economic viability.

The BCR of 1.53 indicates that for each Rand invested in the project there is an expected economic return of R1.53. This BCR is a significant improvement on that of Scenario 1.

The IRR of 12.52% indicates a return of 4.52% more than the discount rate. Thus, with reduced construction cost the IRR indicates a viable project.

5.7 CONCLUSION

For the purposes of this report, a CBA was applied in order to consider the viability of the Mzimvubu Water Project.

In conducting the CBA, the various stakeholders, who will be either positively or negatively impacted on by the project, have been identified. The various impacts have been calculated for each year over the period that was used to evaluate the project, and then discounted to present values, using an appropriate discount rate. The economic CBA has been done in constant prices and discounted by a social discount rate of 8%.

The results of the CBA indicate that the Mzimvubu Water Project is indeed an economically viable project. This is due largely to the benefit from hydro-power generation.

6. MACRO-ECONOMIC IMPACT

6.1 OBJECTIVE

The objective of this section 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 Cost Benefit Analysis (CBA) preceded the macro-economic impact analysis and the information requirements for the CBA will serve as a major data source needed to initiate the macro-economic modelling 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 was the Eastern Cape Province and the Oliver Tambo District Municipality areas 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 macro-economic 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 35 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.

6.2 METHODOLOGY

6.2.1 Overview of the Methodology

As indicated previously in the report, the main purpose of this chapter of the study is to estimate the impact of the proposed Mzimvubu Water Project on the South African economy as well as to give an indication of the impact it will have on the provincial economy of the Eastern Cape and the economies of the Local Municipalities. It is important to note that the National and Provincial macro-economic impact results are shown in a separate format for the construction and operational phases. For purposes of the impact analysis Mosaka Economists have compiled and updated the Social Accounting Matrixes (SAMs) for the South African and Eastern Cape

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 Eastern Cape SAMs was part of a major initiative by the Development Bank of Southern Africa (DBSA), Department of Provincial and Local Government (DPLG), Statistics South Africa (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 Eastern Cape SAM was finalized in October 2009, and was overseen by an expert group of people from the Province, chaired by the Eastern Cape 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 Mosaka 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 spread sheets 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.

6.3 DATA SOURCES AND ASSUMPTIONS

Modelling the macro-economic impact of the construction and operational phases of the Mzimvubu Water Project requires certain detailed information. The construction data used in the analysis is the capital cost for a peak year during the construction

period as provided in the Feasibility Study Reports[11]. Note the assessment that follows only looks at the construction of the Ntabelanga and Lalini Dams respectively. A full impact assessment covering all sections is shown in Chapter 8 under the heading project impact assessment.

When evaluating the construction and operational phases the model requires information on the project such as costs of buildings, machinery and equipment, etc. This data, as well as the planned benefits of the project, etc. have been discussed in detail in the appropriate section. There are, however, also externalities linked to the operational phase, such as the possible negative impact on the environment and positive impacts on government spending. The possible magnitude of these externalities is discussed in detail in the previous chapters.

6.3.1 Ntabelanga and Lalini Construction

The Feasibility Study presents the following table with estimated costs per annum.

[11] Feasibility Study for the Mzimvubu Water Project *Legal, Institutional and Financing Arrangements* P WMA 12/T30/00/5212/16. First Draft March 2014 and Feasibility Study for the Mzimvubu Water Project *Regional Economics* P WMA 12/T30/00/5212/14. First Draft March 2014.

Table 6-1: Estimated costs per annum (2013 prices)

	Year	1	2	3	4	5	6
	Capital Cost	Annual expenditures R'million					
COMPONENT - Ntabelanga	**R'million**						
Ntabelanga Dam and associated works	1 023		307	307	307	102	
Ntabelanga Dam hydro-power works	88			44	44		
Ntabelanga water treatment works	640			320	320		
Ntabelanga bulk treated water distribution system	1 269			423	423	423	
Ntabelanga irrigated agriculture developments	536			268	268		
Ntabelanga power transmission	38			19	19		
Engineering and EMP Costs	580	116	116	116	116	116	
Sub-Total Ntabelanga	4 174	116	423	1 497	1 497	641	
	Capital Cost	**1**	**2**	**3**	**4**	**5**	**6**
COMPONENT - Lalini	**R'million**						
Lalini Dam and associated works	840				280	280	280
Lalini water delivery tunnel, shafts and penstocks	900			225	225	225	225
Lalini hydro-power E&M equipment	300					150	150
Lalini hydro-power civil works	250					125	125
Lalini power transmission lines to grid	86					43	43
Feasibility Study, Engineering and EIA Costs	265	20	49	49	49	49	49
Sub-Total Lalini	2 641	20	49	274	554	872	872
Total Ntabelanga and Lalini		136	472	1 771	2 051	1 513	872

According to the above table the construction of the Ntabelanga Dam will take place over a period of five years, with the largest amounts being spent in years 3 and 4, namely R1 497 per annum.

The construction of the Lalini Dam and hydro-electric scheme will start in year 3 and reach a maximum expenditure flow in years 5 and 6, namely; R872 million per annum.

The macro-economic impact results for the Ntabelanga Dam and the Lalini Dam will be presented separately; the Ntabelanga Dam for year 3, and for the Lalini construction year 5.

6.3.2 Operational Phase

The macro-economic impact of the irrigation, hydro-electricity and domestic water supply will be presented separately.

6.4 MACRO-ECONOMIC IMPACT RESULTS

6.4.1 Construction Phase

6.4.1.1 Results of the Construction of the Ntabelanga Dam

In **Tables 6-2** and **6-3** the macro-economic construction impacts of the Ntabelanga Dam on the national as well the Eastern Cape Province economies are presented.

The national macro-economic impact of the Ntabelanga Dam shown in R million, 2013 prices or numbers during the construction phase is presented in **Table 6.2**.

Table 6-2: Construction macro-economic national impact - Ntabelanga Dam

	Construction Impact: *National*			
	Building & Construction			
	Direct impact	**Indirect impact**	**Induced impact**	**Total impact**
Impact on Gross Domestic Product (GDP)	353	385	512	**1 251**
Impact on capital formation	514	635	954	**2 102**
Impact on employment [person years]	2 299	1 894	2 504	**6 697**
Skilled impact on employment [person years]	472	240	338	1 049
Semi-skilled impact on employment [person years]	1 057	435	579	2 071
Unskilled impact on employment [person years]	771	354	478	1603
Impact on Households				**846.51**
Low Income Households				132.11
Medium Income Households				163.26
High Income Households				551.15
Fiscal Impact				**380.39**
National Government				349.58
Provincial Government				4.29
Local Government				26.52
Impact on the Balance of Payments				**-825**

Note: All Rand values reflected are expressed in Rand million

From **Table 6-2** it can be seen that at the peak of construction period of Ntabelanga Dam and related activities 2 299 direct employment opportunities will be created, with another 1 894 indirect and 2 504 induced jobs in the national economy. Of the direct jobs an estimated 1 057 will be semi-skilled and 771 low-skilled, which would probably mostly be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R1 251 million. Low income households also receive a total of R132.1 million out of a total of R846.5 million total impacts on households.

Although most impacts are positive there is a negative impact on the balance of payments to the value of R825 million during construction.

In **Table 6-3** the macro-economic impact on the Provincial economy is presented, although the Fiscal impact shows a separate tax benefit to the national government. It must be kept in mind that the provincial results are not additional, but are embedded in the national results.

The macro-economic provincial impact of the Ntabelanga Dam during the construction phase shown in R million, 2013 prices or numbers is presented in **Table 6-3**.

Table 6-3: Construction macro-economic provincial impact - Ntabelanga Dam

	Construction Impact: *Provincial*			
	Building & Construction			
	Direct impact	**Indirect impact**	**Induced impact**	**Total impact**
Impact on Gross Domestic Product (GDP)	193.0	41.6	48.1	**282.7**
Impact on capital formation	309.3	104.1	131.9	**545.2**
Impact on employment [person years]	2 299	843	1 036	**4 178**
Skilled impact on employment [person years]	472	180	156	808
Semi-skilled impact on employment [person years]	1 057	371	425	1 853
Unskilled impact on employment [person years]	771	292	455	1 517
Impact on Households				**528.11**
Low Income Households				82.42
Medium Income Households				101.85
High Income Households				343.84
Fiscal Impact				**63.91**
National Government				60.17
Provincial Government				0.67
Local Government				2.07

Note: All Rand values reflected are expressed in Rand million

Table 6-3 shows that during the peak of the construction period, 2 299 direct employment opportunities will be created with a further 843 indirect and 1 036 induced jobs in the provincial economy. Of the direct jobs an estimated 1 057 will be semi-skilled and 771 low-skilled, which would probably mostly be recruited from the local community.

There is also a positive impact on the provincial Gross Domestic Product to the value of R282.7 million. Low income households also receive a total of R82.42 million out of a total of R528.11 million of the total impact on households.

Chart 6-1 presents the distribution of the employment created on a provincial basis and the chart shows the impact on employment during the Ntabelanga Dam construction phase.

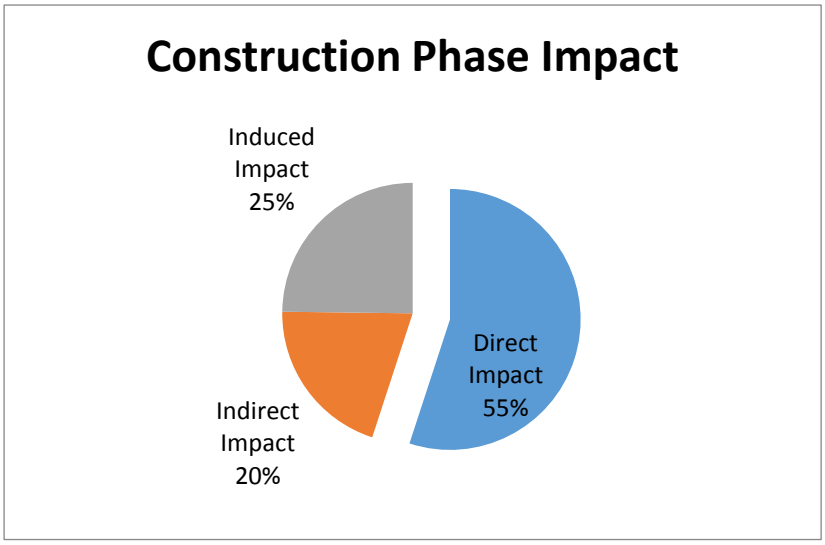

Chart 6-1: Impact on employment during the construction phase

Chart 6-1 indicates that 55% of the employment opportunities created will be direct, with 20% indirect and 25% induced.

6.4.1.2 Results of the construction of the Lalini Dam, Hydro-Electricity Generation and Distribution

Tables 6-4 and **6-5** present the macro-economic construction impacts of the Lalini Dam in the final year of construction for both the national as well as the provincial economies.

The national macro-economic impact of the Lalini Dam shown in R million, 2013 prices or numbers during the construction phase is presented in **Table 6.4**.

Table 6-4: Macro-economic national impact - construction phase Lalini Dam

	Construction Impact: *National*			
	Building & Construction			
	Direct impact	**Indirect impact**	**Induced impact**	**Total impact**
Impact on Gross Domestic Product (GDP)	206	224	298	**729**
Impact on capital formation	299	370	556	**1225**
Impact on employment [person years]	815	1103	888	**2806**
Skilled impact on employment [person years]	167	140	197	504
Semi-skilled impact on employment [person years]	375	253	337	965
Unskilled impact on employment [person years]	273	206	279	758
Impact on Households				**493.09**
Low Income Households				76.95
Medium Income Households				95.10
High Income Households				321.04
Fiscal Impact				**221.58**
National Government				203.63
Provincial Government				2.50
Local Government				15.45
Impact on the Balance of Payments				**-481**
Note: All Rand values reflected are expressed in Rand million				

From **Table 6-4** it can be seen that at the peak of the construction period of the Lalini dam, 815 direct jobs will be created with another 1 103 indirect and 888 induced jobs in the national economy. Of the direct jobs an estimated 375 will be semi-skilled and 273 low-skilled, which would probably mostly be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R729 million. Low income households also receive a total of R76.95 million out of a total of R493.09 million total impacts on households.

Although most impacts are positive there is a negative impact on the balance of payments to the value of R481 million during construction.

In **Table 6-5** the macro-economic impact on the Provincial economy is presented. It must be kept in mind that the provincial results are not additional, but are embedded in the national results.

The macro-economic provincial impact of the Lalini Dam during the construction phase shown in R million, 2013 prices or numbers is presented in **Table 6-5**.

Table 6-5: Provincial Macro-economic construction impact - Lalini Dam

	Construction Impact: *Provincial*			
	26.Building & Construction			
	Direct impact	**Indirect impact**	**Induced impact**	**Total impact**
Impact on Gross Domestic Product (GDP)	112.4	24.2	28.0	**164.6**
Impact on capital formation	180.2	60.6	76.8	**317.6**
Impact on employment [person years]	815	491	604	**1 910**
Skilled impact on employment [person years]	167	105	91	363
Semi-skilled impact on employment [person years]	375	216	248	838
Unskilled impact on employment [person years]	273	170	265	708
Impact on Households				**335.64**
Low Income Households				52.38
Medium Income Households				64.73
High Income Households				218.53
Fiscal Impact				**36.64**
National Government				35.05
Provincial Government				0.39
Local Government				1.20
Note: All Rand values reflected are expressed in Rand million				

From **Table 6-5** it can be seen that at the peak of the construction period of Lalini dam, 815 direct jobs will be created with another 491 indirect 604 induced jobs in the provincial economy. Of the direct jobs an estimated 375 will be semi-skilled and 273 low-skilled, which would probably mostly be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R164.6 million. Low income households also receive a total of R52.38 million out of a total of R335.64 million total impacts on households.

Chart 6-2: The distribution of the employment created on a provincial basis.

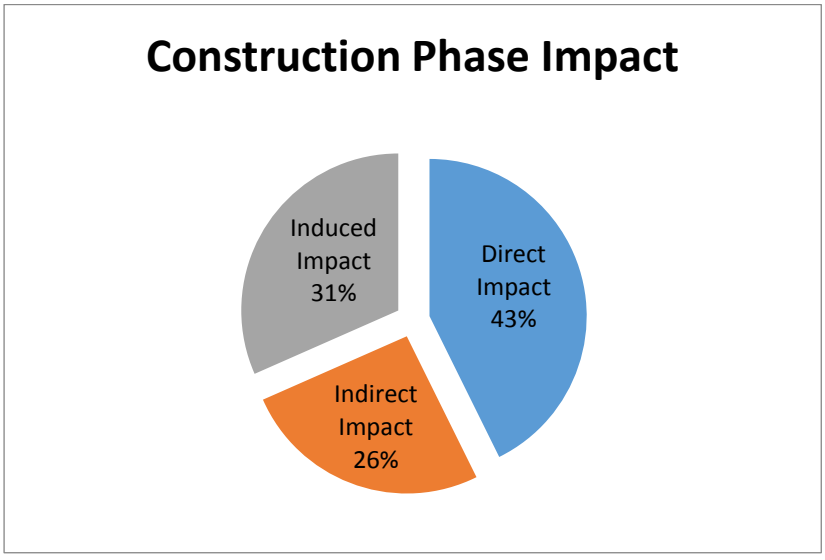

Chart 6-2: Impact on employment during the Lalini Dam construction phase

Chart 2 indicates that 43% of the employment opportunities created will be direct, with 26% indirect and 31% induced.

6.4.2 Interpretation

The analysis indicates that, during the construction period from 2015 to 2019, for both the dams and the accompanying infrastructure, a very positive macro-economic impact will be experienced by both the national economy as well as the provincial economy.

Local employment will reach 2 000 from time to time and the total employment in the national economy can approach 6 700. This figure is in line with the number shown in the feasibility report.

It must be kept in mind that this is for a very limited period of time only.

6.5 OPERATIONAL PHASE

6.5.1 Irrigation Units

Table 6-6 shows the GDP, employment and household income results for the irrigation units at full production in 2013 Prices.

Table 6-6: GDP, employment and household income results for irrigation units

GDP (Rand Mil)			Employment (Numbers)			Household Income (Rand Mil)		
Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total	Total	Medium	Low
R 54.2	R 75.0	R 129.3	1 301	675	1 976	R 146.6	R 108.0	R 38.6

The total annual GDP contribution is estimated at R129.3 million per year and the total household income at R146.6 million with R38.6 million for low-income households, when expressed in 2013 prices.

The total fulltime employment opportunities is estimated at 1 976 of which 1 301 is direct on the farms. The figure of 1 301 needs to be unpacked because the model provides only fulltime opportunities, while in agriculture, and specifically the proposed crop mix, will involve a large number of temporary employees. A separate calculation was done based on the accepted employment norms per hectare and the 1 301 unpacked, represents the following number of people:

- Permanently on the farms – 7 per unit and 315 in total. This will be tractor drivers, irrigation workers and workshop staff.
- The temporary workers are estimated at 80 per unit at different periods of the year, with a total of 3 600. This is very often the only job that these workers have and over time a clearer picture will emerge regarding their social situation.

6.5.2 Domestic Water Supply

As the water is domestic water the value thereof is already included in the Economic Cost Benefit Analysis (ECBA) and no further macro-economic benefits were identified, except the operational staff that will provide the maintenance.

The operational staff is estimated at 25 for the Ntabelanga WTW and 48 for the primary and secondary bulk water supply system per operational year of domestic water supply.

6.5.3 Hydro-Electricity Generation

As the electricity generated will link into the main Eskom grid, the value of the benefits are already accommodated in the ECBA. Any benefit of a lower pumping cost for the irrigators was included in the crop budgets.

The macro-economic benefit of the additional available electricity is a forward calculation and it is not possible to estimate it realistically with the available backward linked multipliers.

The staff employed at the Ntabelanga hydro-power plant is estimated at 9 per operational year and 20 for the Lalini hydro-power plant.

7. PROJECT IMPACT ASSESSMENT

7.1 IMPACT ASSESSMENT: NTABALENGA AND LALINI DAMS AND WATER STRUCTURE

This section presents the findings of the economic impact assessment for the dams and associated activities (DEA Ref no. 14/12/16/3/3/2/677).

The economic impact of the different activities and recommended proposed mitigation was assessed as listed below:

- The Ntabelanga and Lalini Dams;
- Primary and secondary bulk potable water infrastructure:
  - Primary infrastructure: main water treatment works, including four major treated water pumping stations and three minor treated water pumping stations, main bulk treated water rising mains, and eight Command Reservoirs that will supply the whole region;
  - Secondary distribution lines: conveying bulk treated water from Command Reservoirs to existing and new District Reservoirs;
- Bulk raw water conveyance infrastructure (abstraction, pipelines, one raw water pumping station, one reservoir and two booster pumps) for irrigated agriculture (raw water supply up to field edge);
- Impact of commercial agriculture in earmarked irrigation areas;
- Waste Water Treatment Works (WWTW) at the Ntabelanga and Lalini Dam sites;
- Accommodation for operational staff at the Ntabelanga and Lalini Dam sites; and
- Information centres at the two dam sites.

7.1.1 Construction and Decommissioning Phases

7.1.1.1 Growth and poverty alleviation – Construction of Ntabelanga and Lalini Dams and associated infrastructure

The economic impact of the construction phase relates mainly to value added to GDP as well as employment and the benefit to the local rural community.

This economic impact includes the construction of WWTWs at the Ntabelanga and Lalini Dam sites, accommodation for operational staff at the Ntabelanga and Lalini Dam sites, information centres and miscellaneous construction camps lay down areas and storage sites.

Recommended mitigation: The construction phase will provide short term employment and mitigation measures can be set so that the local community benefits in the form of payments to households and an increase in expenditure in the region. Payments to households refer to the circular flow of income in an economy, thus an increase in payments to households result in an increase in expenditure on goods and services for a specific region, promoting economic growth of that region.

Table 7-1: Economic impact of Ntabelanga and Lalini Dams construction

Impact on GDP and low-income households	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Construction of Ntabelanga and Lalini dams – Impact on GDP							
Without Mitigation	Provincial	Short term	High	Medium	High	Medium	Medium-high (+)
With Mitigation	Regional	Short term	Very high	Low	Definite	High	Medium-high (+)
Construction of Ntabelanga and Lalini dams – Impact on low-income households							
Without Mitigation	Provincial	Short term	High	Medium	High	Medium	Medium-high (+)
With Mitigation	Regional	Short term	Very high	Low	Definite	High	Medium-high (+)
Cumulative Impact – during the peak of the construction of the Ntabelanga and Lalini Dams and associated infrastructure, 2500 direct employment opportunities will be created with another 1 247 indirect and 1 767 induced jobs in the national economy. Of the direct jobs an estimated 1 102 will be semi-skilled and 807 low-skilled of which probably most will be recruited from the local community if mitigation is set in place. There is also a positive impact on the Gross Domestic Product to the value of R1 494 million. Low income households also receive a total of R158 million out of a total of R984 million of the total impact on households. The significance of the impact on GDP and household income is rated at medium-high in all cases. These impacts are important and mitigation can benefit the local community by providing employment and income directly to them rather than to outsiders.							

7.1.1.2 Economic growth and poverty alleviation – Construction of primary and secondary bulk potable water infrastructure

The economic impact of the construction phase relates mainly to value added to GDP as well as employment and the benefit to the local rural community.

Recommended mitigation: The construction phase will provide short term employment and mitigation measures which can be set so that the local community benefits in the form of payments to households and an increase in expenditure in the region. Payments to households refer to the circular flow of income in an economy, thus an increase in payments to households result in an increase in expenditure on goods and services for a specific region, promoting economic growth of that region.

The economic impact of the construction of the primary and secondary bulk potable water infrastructure is shown in **Table 7-2**.

Table 7-2: Economic impact of construction of potable water infrastructure

Impact on GDP and low-income households	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Construction of primary and secondary bulk potable water infrastructure – Impact on GDP							
Without Mitigation	Regional	Short term	Medium	Medium	Low	Medium	Medium-low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Medium-low (+)
Construction of primary and secondary bulk potable water infrastructure – Impact on low-income households							
Without Mitigation	Regional	Short term	Medium	Medium	Low	Medium	Medium-low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Medium-low (+)
Cumulative Impact – during the peak of the construction of the primary and secondary bulk potable water infrastructure, 630 direct employment opportunities will be created with another 434 indirect and 522 induced jobs in the national economy. Of the direct jobs an estimated 283 will be semi-skilled and 187 low - of which probably most will be recruited from the local community if mitigation is set in place. There is also a positive impact on the Gross Domestic Product to the value of R435 million. Low income households also receive a total of R45 million out of a total of R290 million of the total impact on households. The significance of the impact on GDP and household income is rated at medium-low in all cases. These impacts are mild and mitigation can benefit the local community by providing employment and income directly to them rather than to outsiders.							

7.1.1.3 Economic growth and poverty alleviation – Construction of bulk raw water conveyance infrastructure

The economic impact of the construction phase relates mainly to value added to GDP as well as employment and the benefit to the local rural community.

Recommended mitigation: The construction phase will provide short term employment and mitigation measures can be set so that the local community benefits in the form of payments to households and an increase in expenditure in the region. Payments to households refer to the circular flow of income in an economy, thus an

increase in payments to households result in an increase in expenditure on goods and services for a specific region, promoting economic growth of that region.

Table 7-3: Economic impact of bulk potable raw water conveyance infrastructure construction

Impact on GDP and low-income households	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Construction of bulk raw water conveyance infrastructure – Impact on GDP							
Without Mitigation	Regional	Short term	Medium	Medium	Low	Medium	Medium-low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Medium-low (+)
Construction of bulk raw water conveyance infrastructure – Impact on low-income households							
Without Mitigation	Regional	Short term	Medium	Medium	Low	Medium	Medium-low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Medium-low (+)
Cumulative Impact – during the peak of the construction of the bulk raw water conveyance infrastructure, 1 054 direct employment opportunities will be created with another 443 indirect and 937 induced jobs in the national economy. Of the direct jobs an estimated 471 will be semi-skilled and 326 low-skilled of which probably most will be recruited from the local community if mitigation is set in place. There is also a positive impact on the Gross Domestic Product to the value of R269 million. Low income households also receive a total of R43 million out of a total of R139 million of the total impact on households. It then follows that the overall cumulative impact is of medium-low significance on GDP and on low-income households.							

7.1.2 Operational Phase

7.1.2.1 Economic growth and poverty alleviation – Operational phase of Ntabelanga and Lalini Dams

The economic impact of the operational phase of the Ntabelanga and Lalini Dams is assessed by the benefits created from a successful implementation of the dam and associated infrastructure. The impact of these benefits is assessed below.

7.1.2.2 Economic growth and poverty alleviation – Operational phase of primary and secondary bulk potable water infrastructure

The economic impact of the operational phase relates to the change in overall welfare of the rural community as a result of clean potable water.

Recommended mitigation: The operational phase will create the environment for improved welfare to the local community if mitigation is set in place to maintain the potable water infrastructure, control the pollution and curb illegal taps. If no such measures are implemented the community may be worse off as a result of water borne diseases or no water at all.

Table 7-4: Economic impact of operational phase of primary and secondary bulk potable water

Impact on community welfare	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Operation phase of primary and secondary bulk potable water – Impact on community welfare							
Without Mitigation	Site	Short term	Very high	High	Medium	Medium	Medium-low (-)
With Mitigation	Local	Long term	Very high	Low	Definite	High	High (+)
Cumulative Impact – The impact of water on community welfare can be described by the value of the water that is added to the community. This value is usually expressed in the form of tariffs charged for the water. This is not applicable to rural households since very few households would actually be able to afford the tariffs. Therefore the value of the water added to the community is calculated by the following method: The economic value of water is determined in two components. The first component deals with the social (public) portion of 25 litres of water per capita/per day. This portion is in accordance with the government's policy on minimum water requirements for urban and rural households. The second component deals with the volume of water consumed above the 25 litres per capita per day. This water is regarded as a purely private good. The value of water then computes to R472 million in 2020 to R599 million in 2050. It then follows that the overall cumulative impact is of medium-low significance on community welfare if mitigation is not set in place, without proper mitigation potable water supply may cease to exist. With mitigation the overall cumulative impact on community welfare will be high. This is because an essential need in a very rural community will be fulfilled.							

7.1.2.3 Economic growth and poverty alleviation – Operational phase of commercial irrigation agriculture and the local market

The economic impact of the operational phase relates mainly to value added to GDP as well as employment and the benefit to the local rural community.

Recommended mitigation: Support structures should be available right from the start to assist the management. This support must cover the whole spectrum of the undertaking, from planting to marketing and the overall management.

The best possible management will have to be available right from the start, which means the selection of the unit managers as well as the accepted management structure will eventually determine the success of the irrigation scheme.

Table 7-5: Economic impact of the operational phase of agriculture

Impact on GDP and low-income households	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Operation of commercial agriculture – Impact on GDP							
Without Mitigation	Regional	Permanent – no mitigation	Medium	High	Definite	Medium	High (-)
With Mitigation	Provincial	Permanent - Mitigated	High	Medium	High	High	High (+)
Operation of commercial agriculture – Impact on low income households							
Without Mitigation	Regional	Permanent – no mitigation	Medium	High	Definite	Medium	High (-)
With Mitigation	Provincial	Permanent - Mitigated	High	Medium	High	High	High (+)

Cumulative Impact – during the operational phase of the commercial agriculture at full production, 1 301 direct employment opportunities will be created with another 675 indirect and induced jobs in the national economy.

The total fulltime employment opportunities is estimated at 1 976 of which 1 301 are direct on the farms. The figure of 1 301 needs to be unpacked because the model provides only fulltime opportunities, while in agriculture and specifically the proposed crop mix will involve a large number of temporary employees. A separate calculation was done based on the accepted employment norms per hectare and the 1 301 unpacked, represents the following number of people:

- Permanently on the farms – 7 per unit and 315 in total. This will be tractor drivers, irrigation workers and workshop staff.
- The temporary workers are estimated at 80 per unit with a total of 3 600. This is very often the only job that these workers have and over time a clearer picture will emerge regarding their social situation.

There is also a positive impact on the Gross Domestic Product to the value of R129.3 million. Low income households also receive a total of R38.6 million.

The potential for irreplaceable loss of resources is high, given the historical performance of such projects.

It then follows that the overall cumulative impact is of high significance on GDP and on low-income households if there is no mitigation in place, this is evident in the historical commercial agriculture projects in South Africa, where unattended land is all that remained of such projects. On the other hand, a successful implementation of a commercial agriculture scheme will have a high positive economic impact on GDP and low-income households if proper mitigation is set in place.

7.2 IMPACT ASSESSMENT FOR ELECTRICITY GENERATION AND DISTRIBUTION INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the generation of electricity and distribution related activities (DEA Ref no. 14/12/16/3/3/2/678).

The activities assessed under this chapter are listed below:

- Pipeline and tunnel (including tunnel alternatives) at the proposed Lalini Dam;
- Generation of hydro-power and feeding of this power into the existing grid; and
- 18.5km power line from the Lalini Dam tunnel,

7.2.1 Construction and Decommissioning Phases

7.2.1.1 Economic growth and poverty alleviation – Construction of the tunnel and power lines

The economic impact of the construction phase relates mainly to value added to GDP as well as employment and the benefit to the local rural community.

The three different tunnels and power line alternatives were considered and the worst-case scenario was run in the model so that the other scenarios will only improve on this impact.

Recommended mitigation: The construction phase will provide short term employment and mitigation measures can be set so that the local community benefit in the form of payments to households and an increase in expenditure in the region. Payments to households refer to the circular flow of income in an economy, thus an increase in payments to households result in an increase in expenditure on goods and services for a specific region, promoting economic growth of that region.

Table 7-6: Economic impact of construction of the tunnel at Lalini Dam

Impact on GDP and low-income households	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Construction of tunnel at the proposed Lalini Dam – Impact on GDP							
Without Mitigation	Regional	Short term	Low	Low	Low	Medium	Very low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Low (+)
Construction of tunnel at the proposed Lalini Dam – Impact on low-income households							
Without Mitigation	Regional	Short term	Low	Low	Low	Medium	Very low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Low (+)
Cumulative Impact – during the peak of the construction of the tunnel and power lines, 593 direct employment opportunities will be created in the national economy with another 288 indirect and 427 induced jobs. Of the direct jobs an estimated 265 will be semi-skilled and 203 low-skilled and which probably most will be recruited from the local community if mitigation is set in place. There is also a positive impact on the Gross Domestic Product to the value of R362 million. Low income households also receive a total of R39 million out of a total of R237 million of the total impact on households. It then follows that the overall cumulative impact is of very low significance on GDP and low-income households without mitigation and the impact is of low significance on GDP and low-income households if mitigation to employ local labour is set in place.							

7.2.1.2 Economic growth and poverty alleviation – Construction of hydro-power scheme

The economic impact of the construction phase relates mainly to value added to GDP as well as employment and the benefit to the local rural community.

Recommended mitigation: The construction phase will provide short term employment and mitigation measures can be set so that the local community benefits in the form of payments to households and an increase in expenditure in the region. Payments to households refer to the circular flow of income in an economy, thus an increase in payments to households result in an increase in expenditure on goods and services for a specific region, promoting economic growth of that region.

Table 7-7: Economic impact of construction of hydro-power scheme

Impact on GDP and low-income households	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Construction of hydro-power scheme – Impact on GDP							
Without Mitigation	Provincial	Short term	High	Medium	High	Medium	Medium-high (+)
With Mitigation	Regional	Short term	Very high	Low	Definite	High	Medium-high (+)
Construction of hydro-power scheme – Impact on low-income households							
Without Mitigation	Provincial	Short term	High	Medium	High	Medium	Medium-high (+)
With Mitigation	Regional	Short term	Very high	Low	Definite	High	Medium-high (+)
Cumulative Impact – during the peak of the construction of the hydro-power scheme, 712 direct employment opportunities will be created in the national economy with another 283 indirect and 529 induced jobs. Of the direct jobs an estimated 311 will be semi-skilled and 252 low-skilled of which probably most will be recruited from the local community if mitigation is set in place. There is also a positive impact on the Gross Domestic Product to the value of R448 million. Low income households also receive a total of R48 million out of a total of R294 million of the total impact on households. It then follows that the overall cumulative impact is of medium-high significance on GDP and low-income households.							

7.2.2 Operational Phase

The operational phase of the tunnel and power lines will not have any significant economic impact and is therefore not assessed.

7.2.2.1 Economic growth and poverty alleviation – Generation of hydro-power

The economic impact of the operational phase relates to the benefit added to GDP.

Recommended mitigation: Mitigation measures that can be set in place relate mainly to proper management structures.

Table 7-8: Impact of operational phase of hydro-electricity generation

Benefit to GDP	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Generation of hydro-power – Benefit to GDP							
Without Mitigation	Regional	Permanent – No mitigation	High	High	Medium	Medium	Medium-high (+)
With Mitigation	Provincial	Permanent – Mitigated	Very high	Medium	High	High	High (+)
Cumulative Impact – the value of the hydro-power can then be addressed in the following way. The output multiplied with the Eskom price, where price is the tariff together with cost of the water provision. Our approach is then: • Output – 281.896 million kWh,- • The tariff is R0.61 per kWh plus the levelled cost at 8% discount of R0.94 per kWh = R1.61/kWh; • Total value of = R453.85 million per annum. The potential for irreplaceable loss of resources is high without mitigation, there will be unrecoverable capital lost if the hydro-power scheme is not managed properly. It then follows that the overall cumulative impact is of medium-high significance on benefit to GDP without mitigation and the impact is of high significance on benefit to GDP when mitigation is set in place to ensure proper operation.							

7.3 IMPACT ASSESSMENT FOR ROADS INFRASTRUCTURE

This section presents the findings of the environmental impact assessment for the road infrastructure (DEA Ref no. 14/12/16/3/3/1/1169).

The activities included under this chapter are listed below:

- Upgrading and relocation of roads and bridges.
- Construction of new access roads around the Lalini Dam site.

This section only looks at the construction phase of upgrading and relocation of roads and bridges since the economic impact of the operational phase will not be significant to the overall economic viability of the project.

7.3.1 Construction and Decommissioning Phases

7.3.1.1 Economic growth and poverty alleviation – Upgrading and relocation of roads and bridges

The economic impact of the construction phase relates mainly to value added to GDP as well as employment and the benefit to the local rural community.

Recommended mitigation: The construction phase will provide short term employment and mitigation measures can be set so that the local community benefits in the form of payments to households and an increase in expenditure in the region. Payments to households refer to the circular flow of income in an economy, thus an increase in payments to households result in an increase in expenditure on goods and services for a specific region, promoting economic growth of that region.

Table 7-9: Impact of construction and upgrading of roads and bridges

Impact on GDP and low-income households	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Construction and upgrading of roads and bridges – Impact on GDP							
Without Mitigation	Local	Short term	Low	Medium	Low	Medium	Low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Low (+)
Construction and upgrading of roads and bridges – Impact on low-income households							
Without Mitigation	Local	Short term	Low	Medium	Low	Medium	Low (+)
With Mitigation	Local	Short term	Medium	Low	High	High	Low (+)
Cumulative Impact – during the peak of the construction and upgrading of the roads and bridges, 67 direct employment opportunities will be created with another 27 indirect and 50 induced jobs in the national economy. Of the direct jobs an estimated 29 will be semi-skilled and 24 low-skilled of which probably most will be recruited from the local community if mitigation is set in place. There is also a positive impact on the Gross Domestic Product to the value of R42 million. Low income households also receive a total of R4.52 million out of a total of R28 million of the total impact on households. It then follows that the overall cumulative impact is of low significance on GDP and low-income households.							

8. CONCLUSION

This study forms part of the comprehensive Environmental Impact Assessment (EIA) and comprises the economic impact the construction of the Ntabelanga and Lalini Dams have in terms of the proposed irrigation, domestic water supply and hydro-electricity generation. This study therefore concentrates on the Economic Impacts of the project, two supporting approaches have been used, namely the Economic Cost Benefit Analysis and Macro-Economic Impact Analysis.

The technical data, as reported in the different Feasibility Study reports, was accepted and was used in the evaluation process.

8.1 ECONOMIC VIABILITY

Overall the project proposals are economically viable when evaluated against a background of a developmental situation. It is against this background of poverty and under developed status of the specific area in the Eastern Cape Province that the project was evaluated. The ECBA results are shown in the table below:

Table 8-1: Economic Cost Benefit Analysis Scenario Results

Parameter	Scenario 1	Scenario 2	Scenario 3
Net Present Value (R million)	R1 718.89	R1 464.99	R2 764.66
Internal Rate of Return	10.31%	10.01%	12.52%
Benefit Cost Ratio	1.27	1.23	1.53

As all three parameters are above the minimum standards the project is economically viable, but this will only be possible with the correct implementation of the different mitigations proposed.

It is important that the level of government support should form part of the continued investigation of the project, now that the project has shown up as being economically viable. It is important to bear in mind that an economic cost benefit analysis (ECBA) was done and not a financial cost benefit analysis.

8.1.1 Irrigation Proposal

The concept of the proposed commercially based irrigation units is sound, but will only be successful if a number of conditions are in place:

a) The original crop mix proposal does not make any mention of marketing structures. This will have to be investigated and could influence the crop mix as discussed in the relevant section.
b) The land issue will have to be addressed and some type of long term lease agreement reached with the local population.
c) The business model decided on will have to make provision for strong management structures with a shareholder basis. The Eastern Cape

Province unfortunately has a number of failed irrigation projects that were based on the small farmer model and subsequently failed due to incompetent management structures.

d) The proposal regarding a livestock section for every unit will necessitate an upgrade in the quality of the current livestock. As the proposed grazing crops will only be available during winter, a grazing agreement with the local land owners will have to be in place for the summer period.

e) It will be impossible to have all 45 units up and running within a year or two, it is proposed that the implementation period be stretched to five years. For purposes of the ECBA it was accepted that it will take a unit another five seasons to be at full production and become financially independent.

f) Under current agricultural economic conditions it must be accepted that the start-up capital, Capex and Opex, will have to be through grant funding. It will be impossible for the units to start from scratch and for government agencies to expect them to repay the start-up capital.

g) Proper management and financial support structures will have to be in place for the irrigation proposals to be viable.

8.1.2 Domestic Water Supply

The domestic water supply is a very important component of the project and it was necessary to analyse it in depth. In **Chapter 3** it is shown that the provision of domestic water is a constitutional condition and adds to the necessity of the project. However, in the analytical process certain questions arise which again lead to some different viewpoints.

In the relevant Feasibility Report a future population growth of 1% per annum was used to estimate the number of beneficiaries to the year 2050. The latest StatsSA growth figures indicate an overall growth rate for the Eastern Cape Province of 0.44%, while some of the municipalities even show a decrease in the population. This leads to a difference of 133 729 potential beneficiaries with a possible reduced water demand and cost implications. To accommodate the issue a number of scenarios were considered in the ECBA as presented in **Table 8-2**.

Table 8-2: Scenarios used in the ECBA

Scenario	Population Numbers	Water Volume	Estimated Construction Cost
1	Feasibility Report	Feasibility Report	Feasibility Report
2	Eastern Cape Growth Rate	Feasibility Report	Feasibility Report
3	Eastern Cape Growth Rate	Reduced Volume 19%	Reduced Cost 19%

The analysis of the socio-economic situation in the proposed area indicates very high levels of unemployment and household poverty which is seen as an indication that a very small number of households will be able to pay for the water.

The recommendation is that this be seen as part of a developmental project and that government accepts that the project will be grant funded with subsidised funding over a very long period.

8.1.3 Hydro-Electricity Generation

The Lalini Dam and the accompanying hydro-electricity generation are both, in our opinion, economically and financially viable and the Mosaka Economic Consultants analysis is in agreement with that of the Feasibility Report.

8.2 MACRO-ECONOMIC IMPACT ANALYSIS

A Macro-Economic Impact Analysis was performed for the construction period of the Ntabelanga and Lalini Dams and the accompanying infrastructure. The analysis was aimed to estimate the impact on Gross Domestic Product, Employment and Household Income. The motive being the direct employment and payments made to low-income households which provide a good indication of the contribution of the project to poverty alleviation in the area.

8.2.1 Construction of the Ntabelanga Dam

The benefits were calculated to estimate the impact on the national as well as the provincial economies. The impact on the provincial economy per annum expressed in 2013 prices is presented below.

During the peak period of the construction of the dam 2 299 direct employment opportunities will be created with another 843 indirect and 1 036 induced jobs in the provincial economy. Of the direct jobs an estimated 1 057 will be semi-skilled and 771 low-skilled, of which probably most will be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R282.7 million. Low income households also receive a total of R82.42 million out of a total of R528.11 million total impacts on households.

8.2.2 Construction of the Lalini Dam

In the final year of construction of the dam 815 direct jobs will be created with another 491 indirect and 604 induced jobs in the provincial economy. Of the direct jobs an estimated 375 will be semi-skilled and 273 low-skilled, which would probably mostly be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R164.6 million. Low income households also receive a total of R52.38 million out of a total of R335.64 million of the total impact on households.

The deduction is that, during the 5 to 6 year construction period, a very positive contribution will be made to the provincial as well as to the national economy.

8.2.3 Irrigation

Once the irrigation scheme is in full production it will also make a very positive contribution in terms of job creation and income to specifically low-income households. An estimated 4 000 individuals will be employed, although not all permanently.

The annual payment to households expressed in 2013 prices is R146.6 million of which R38.6 million is destined for the low-income group.

It is expected that a well-managed commercial orientated 2 800 hectare irrigation area will over time lead to the development of a number of private support entities that can only be to the advantage of the Tsolo area.

8.3 FUNDING

The funding of the project is an important issue and it is necessary that a number of issues be taken into consideration. During this analysis it became clear that the following aspects are important in terms of the different proposals:

- Irrigation Scheme: - It will take up to 10 years to attain maximum production and possibly financial profitability. Financial viability can only be attained by grant funding and subsidisation of tariffs on an annual basis without any repayment pre-conditions.
- Domestic Water Supply: - The high poverty levels in the project area are such that it is improbable that more than 10% of the users will be able to pay for the water. Therefore, a long term annual subsidy will have to be provided for.
- Lalini Dam Hydro-Electricity Generation: - This project is financially viable and can be funded by loans.

Grant funding and annual subsidisation is acceptable in a developmental situation as is experienced in the project area as long as it is properly motivated, controlled, managed and budgeted for. Mosaka Economic Consultants are therefore of the opinion that the capital for the construction of the Ntabelanga Dam, the domestic water supply and the irrigation scheme will have to be grant funds.

As far as the operational capital is concerned Mosaka Economic Consultants are convinced that the annual maintenance of the dam, the domestic water supply infrastructure and the water supply must be subsidised. In the case of the irrigation scheme the operational capital will have to be provided as a subsidy on a sliding scale for the first number of years until full crop production is reached. It will gradually build up and then decrease and by the 10th year the situation should be

such that it could probably be terminated. This, however, will depend on the management situation of the scheme and general prevailing agricultural economic conditions.

The Lalini Dam and accompanying hydro-electricity generation units could be funded with loan capital and the scheme should be in a position to repay the loans.

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APPENDIX A

THE SOCIAL ACCOUNTING MATRIX (SAM)

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.

APPENDIX B

THE MAGNITUDE OF LINKAGES AND DEFINITION OF MACRO-ECONOMIC AGGREGATES

Formally, economists distinguish between direct, indirect and induced economic effects. Indirect and induced effects are sometimes collectively called secondary effects. The total economic impact is the sum of direct, indirect and induced effects within a region. Any of these impacts may be measured in terms of gross output or sales, income, employment or value added.

Direct Impacts

The direct impacts refer to the effect of the activities that take place in the mining and electricity industries. It refers to the income and expenditure that is associated with the everyday operation of each of the components of the relevant industry. For instance if the mining component is taken as an example the direct impacts refer to the total production/turnover of the mine; the intermediate goods bought by the mine; the salaries and wages paid by the mine; the profits generated by the mine.

Indirect Impacts

The indirect impacts refer to economic activities that arise in the sectors that provide inputs to the mining and electricity industries' components and other backward linked industries. For example, if the electricity sector uses steel, the indirect impacts refer to the activity (paying of salaries and wages; and profit generation) that occurs in the steel sector as well as the sectors that provide materials to the steel sector.

Induced Impacts

Induced impacts refer, inter alia, to the economic impacts that result from the payment of salaries and wages to people who are (directly) employed at the various consecutive stages of beneficiation of the mining and electricity industries. In additional the induced impact also includes the salaries and wages paid by businesses operating in the sectors indirectly linked to these industries through the supply of inputs. These additional salaries and wages lead to an increased demand for various consumable goods that need to be supplied by other sectors of the economy that then have to raise their productions in tandem with the demand for their products and services.

These induced impacts can then be expressed in terms of their contributions to GDP, employment creation and investment or other useful macro-economic variables.

Added together, the direct, indirect and induced impacts provide the total impact that these industries will have on the South African and Limpopo economies.

Definitions of Macro-Economic Aggregates

Impact analysis will be based on a number of standard economic parameters and the results will be presented under the following headings:

- Impact on Gross Domestic Product (GDP).
- Impact on Capital Utilisation.
- Impact on Employment Creation.
- Skilled labourers.
- Semi-skilled labourers.
- Unskilled labourers.
- Impact on Households Income (Income distribution).
- Impact on Balance of Payments, as a result of Imports and Exports.

The following is a brief overview of the definition of each of these economic parameters.

Impact on Gross Domestic Product (GDP)

The impact on GDP reflects the magnitude of the values added to the chrome mining industry from activities within the industry. Value added is made up of three elements, namely:

- Remuneration of employees,
- Gross operating surplus (which includes profit and depreciation), and
- Net indirect taxes.

Impact on Capital Utilisation

For an economy to operate at a specific level of activity, investment in capital assets (i.e. buildings, machinery, equipment, etc.) is needed. Capital, together with labour and entrepreneurship, are the basic factors needed for production in an economy.

The effectiveness and efficiency with which these factors are combined influence the overall level of productivity/profitability processes, bearing in mind that productivity is affected by an array of factors of which appropriate technology and skill level of the labour force are two important elements.

Impact on Employment Creation

Labour is a key element of the production process. The study will determine the number of new employment opportunities that will be created by investment in the chrome mining industry. These employment opportunities will be broken down into those created directly by a particular project and those indirectly created and induced throughout the broader economy. Furthermore, a distinction will be made between skilled, semi-skilled and unskilled labourers.

Impact on Household Income

One of the elements of the additional value added (i.e. GDP) which will result from the proposed expansion is remuneration of employees, which, in turn, affects households income.

The SAM measures the magnitude of changes that will occur to both household income and spending/savings pattern. As such, the study will highlight the impact of the chrome mining industry on the low income households as this can be used as an indicator of the extent to which the chrome mining industry contributed to poverty alleviation throughout the economy.

Impact on the Current Account of the Balance of Payments

The chrome mining industry will have direct, indirect and induced impacts on the exports and imports of goods and services that will take place across all of the various economic sectors that are affected by the chrome mining industry. Imports consist of direct and indirect material imports, as well as goods consumed by households that are imported as a result of the induced impact.

Input Data Required Conducting the Macro-Economic Impact Analysis

Modelling the macro-economic impact of the construction and operational phases of the total development project requires detailed information regarding these two

phases of the project. The relevant "building blocks: containing the required data and information are given and discussed below.

Construction Phase

The information required to model the macro-economic impact of the construction phase of a project relate to the nature and costs of the capital assets that are actually created. The following standard breakdown of the asset types is used:

- Civil engineering costs:
  - Earth works (site clearance, foundations, etc.).
  - Structures (bridges, dams and other structures built mainly from concrete).
  - Roads (freeways, other arterials and streets).
- Building and construction costs:
  - Residential buildings (houses, etc.).
  - Non-residential buildings (factories, offices, shopping centres, etc.).
- Machinery and other equipment costs:
  - Mechanical equipment.
  - Electrical and electronic equipment.
  - Research, design, architecture and development costs.
  - Furniture.
  - Rubber products.
  - Structural metal products.
  - Other fabricated metal products.
  - Manufacturing of transport equipment.
  - Other manufacturing and recycling.
- Water related construction costs:
  - Bulk water (dams).
  - Reservoirs.
  - Pump stations (water and sewerage).
  - Bulk pipelines (water and sewerage).
  - Treatment works (water and sewerage).
  - Reticulation (water and sewerage).
  - Storm water.
  - Parks and recreation.

Operational Phase

In order to quantify the macro-economic impact of the operational component of a project, the following information is required by the model:

- Production/turnover, divided between:
- Sales/turnover destined for domestic consumption; and
- Export sales.

Production/Operation Costs, Broken Down Into:

- Intermediate input costs, i.e. all materials and services necessary for the production process broken down by industries from which inputs are sources (classified according to the Standard Industrial Classification (SIC) code system),
- Remuneration of staff, broken down by skill levels (i.e. skilled, semi-skilled and unskilled workers), and
- Gross operating surplus (i.e. remuneration of capital).

The table below gives an example of the exogenous vector for Water – Water Supply. These figures are used as the inputs for the operational phase of the model,

but are only used as an example to give the reader more clarity on the input requirements for such a model.

APPENDIX C

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 is 5%, then the real discount rate is approximately 5%. It can be calculated as follows:

$((1.10 \div 1.05)-1) \times 100 = 4.76\%$

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 1: 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 resources	Maximization of net value
Discount Rate	Social discount rate	Market determined weighted cost of capital
Unit of	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