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DEPARTMENT OF WATER AFFAIRS
AND FORESTRY

in association with

UMGENI WATER
Corporate Services Division

MKOMAZI/MOOI-MGENI TRANSFER SCHEME PRE-FEASIBILITY STUDY

MKOMAZI-MGENI TRANSFER SCHEME

SUPPORTING REPORT No 7

ECONOMICS

VOLUME 2

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MKOMAZI/MOOI-MGENI TRANSFER SCHEME PRE-FEASIBILITY STUDY

SUPPORTING REPORT NO 7: ECONOMICS

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VOLUME 2: SUPPLEMENTARY DOCUMENT

UMGENI WATER

Socio-economic impact of outcomes relating to the

MKOMAZI-MGENI AUGMENTATION SCHEME

26 October 1998

Graham Muller Associates
CLOSE CORPORATION CK NO 97/05924/23

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EXECUTIVE SUMMARY

BACKGROUND

The Mgeni river system represents the main source of water for both domestic and industrial use in Durban and Pietermaritzburg, and any supply shortage would have the effect of constraining economic growth and development in the region. Umgeni Water and the Department of Water Affairs and Forestry are planning ahead in an attempt to pre-empt this situation from occurring, and have devised a scheme that involves the augmentation of the Mgeni system with water from the Mkomazi River. However, pressure from environmentalists has forced the review and quantification of the need for augmentation. Graham Muller Associates has therefore been appointed by to assess the socio-economic consequences of non-augmentation in the Umgeni operational area and in KwaZulu-Natal, and to determine whether or not water demand management represents a viable alternative to augmentation.

WATER DEMAND MANAGEMENT

The need for tighter water demand management and a more efficient utilisation of water is currently being legislated, and is recognised by Umgeni Water, and it's two major clients, Durban Metro and Pietermaritzburg TLC. Water losses through leaks and non payment have in the past been excessive. In the Durban Metropolitan Area (DMA) alone, past losses have been estimated at about 30 percent of total water consumption. However, there is now a strategy in place to reduce these losses. Durban Metro Water intends, through a programme of effective demand management, to maintain bulk water purchases from Umgeni Water at a constant level for the next five years, even though they aim to provide 75 000 new connections within this period. This will be achieved through a strategy that aims to reduce losses to 15 percent over the five-year period 1998-2002.

THE MKOMAZI-MGENI AUGMENTATION SCHEME

At present, the study to determine the optimal transfer scheme to augment the Mgeni system from the Mkomazi system is still in the reconnaissance stage, and two schemes have been recommended for further investigation, namely the Impendle and the Smithfield schemes. Since both schemes are equally favoured, the Impendle scheme was arbitrarily chosen for the purposes of this evaluation. However, as the cost and timing of both schemes are very similar, it is not anticipated that there would be any significant changes to the outcome of this study if, instead, the Smithfield scheme becomes the more favoured alternative.

The Impendle scheme consists of a dam on the Mkomazi River, near Impendle, a gravity tunnel to Midmar Dam, a pumpstation feeding an extended Midmar Waterworks and a clearwater conveyance system consisting of gravity pipelines and tunnels. The scheme will be completed in 3 phases, and at a total cost, in 1997 prices, of R2 285 million.

WATER DEMAND AND SUPPLY

With the inclusion of stepped pumping from the Mooi River, the maximum current 1:100 year stochastic yield of the Mgeni system is estimated to be 310 million m^3 per annum. This total can be increased to 360 million m^3 per annum, through 3 separate schemes, namely the raising of the Midmar Dam wall, and the construction of the Mearns and Springgrove Dams. The 3 phases of the Impendle scheme will increase the maximum yield to 720 million m^3 per annum.

METHODOLOGY

The study is divided into two sections, the base case scenario that assumes that the proposed Mkomazi-Mgeni augmentation scheme does not occur, and the augmentation scenario in which the proposed scheme is implemented. In each scenario, gross geographic product and employment within the study area, and within KwaZulu-Natal, are projected for the period 1998-2038. In addition, the model tests the effectiveness of improvements in water-use productivity, resulting from better water demand management, as a substitute for augmentation.

Finally, two separate sensitivity analyses are conducted. In the first instance, the sensitivity in terms of supply shortfalls, of the projected timing of the proposed augmentation scheme is tested against successes in water demand management. In the second instance, delays in implementation of the augmentation scheme are estimated in terms of supply shortfalls.

RESULTS

The study shows that cumulative GGP throughout the study period, within the study area and within KwaZulu-Natal, is 26% higher in the augmentation scenario than in the non-augmentation scenario. Furthermore, due to the capital intensive nature of the proposed project, the impact of the construction and operational expenditure is negligible. Instead, the greatest impact attributable to augmentation stems from the growth that is accommodated through an unconstrained water supply.

In the augmentation scenario, employment in the study area, over the lifetime of the study, is 34% higher than in the non-augmentation scenario. The corresponding figure for KwaZulu-Natal as a whole is also 34%.

The water-use productivity analysis in the non-augmentation scenario shows that a 10% improvement in water-use productivity results in a 7% improvement in cumulative GGP throughout the study period, as opposed to the 26% improvement resulting from augmentation.

The first sensitivity analysis highlights the importance of effective water demand management, and in particular the plan by Durban Metro Water to limit losses to 15% of total consumption, to the projected timing of the augmentation implementation. If, for instance, losses are only limited to 20%, instead of the planned 15%, then a 10% shortfall in supply will occur in the year prior to implementation of phase 1 of the augmentation scheme. The second sensitivity analysis

shows that a delay of 2 years or more in the implementation of the augmentation scheme will result in a supply shortfall in excess of 10%.

CONCLUSION

Based on the assumptions around which this model is built, there is a clear socio-economic case for augmentation of the water supply to the Mgeni system. In the augmentation scenario, achievable GGP and employment levels are significantly higher than in the non-augmentation scenario. An analysis of the impact of initiatives to improve water-use productivity, and sensitivity analysis around these initiatives, illustrates the importance of effective water demand management, but also demonstrates that water demand management on its own is not a viable alternative to augmentation. Instead, water demand management and augmentation should be seen as complementing one another. Non-augmentation will incur a considerable cost in terms of lost output and constraints on employment generation.

The only alternative to augmentation would be to embark on a long term population and industrial relocation programme to a region with better water resources. The complexities involved and the distortions that would result make this an unattractive alternative. In any event, as few regions in South Africa are better endowed with water resources than the study area under scrutiny, the question has to be asked: Where would the people and economic activity relocate to? And at what cost?

RECOMMENDATIONS

Based on our analysis and the information available to us, it is the recommendation of GMA that the Mkomazi-Mgeni augmentation scheme be proceeded with on a phased basis commencing soon enough to permit commissioning of the initial works during the year 2010. This will ensure that no constraints to economic growth or employment creation are imposed by water shortages in the study area in years of normal rainfall. According to the engineers commissioned to undertake a reconnaissance level study of the proposed scheme, this would require that construction commence in the year 2004.

We further recommend that a fully researched water demand model be constructed for on going scenario analysis at Umgeni Water, covering areas of interest such as:

- Pricing policy;
- Population trends (especially in the light of the HIV/AIDS epidemic); and
- The timing of demand driven capital investment programmes.

1.0 BACKGROUND

The Mgeni River system represents the main source of water for both domestic and industrial use in Durban and Pietermaritzburg. However, the water provided by this river system is finite, and given the current levels of urban growth in the Durban Metropolitan (DMA) and Pietermaritzburg TLC (PMB) areas, it is inevitable that without augmentation, the demand for water in the Mgeni system will eventually exceed the supply. If water supply is constrained within the DMA, then so too will economic growth and development be constrained. Output will be reduced, and job creation will be slowed, industry will be forced to relocate and populations will be displaced. The effects of this future possible constraint will not only be felt within the Mgeni system, but throughout the province. Faced with the inevitable water supply constraint, Umgeni Water are planning ahead to meet future demands and ensure that water does not in fact, at some time in the future, become a constraint to growth and development.

In addressing possible future water supply constraints, the Department of Water Affairs and Forestry (DWAF), and Umgeni Water, have identified two alternative schemes that involve the augmentation of the Mgeni system from the Mkomazi River. These are the Smithfield and the Impendle schemes. At the time at which this study began, both schemes were equally favoured and the Impendle scheme was thus arbitrarily chosen for the purposes of estimating the socio-economic impacts which could be attributed to augmentation, but which would be forgone in the event of non-augmentation. However, from a socio-economic perspective, the outcome of this study would not differ greatly if alternatively, the Smithfield scheme had been investigated, due to the similarities in the capital expenditure and timing of both schemes.

At the time at which this study was conducted, the planning process was still in the early stages and much of the available data pertaining to costs and timing was only available at a reconnaissance level. This study should therefore be recognised as a reconnaissance level study.

The Impendle scheme comprises the construction of a dam on the Mkomazi River, and a tunnel/pipeline combination that will transfer water between the two river systems (see figure 4.1 on page 4). However, this planned scheme has met with concern from environmentalists who argue that the positive socio-economic benefits associated with this planned scheme may well be outweighed by the negative environmental impacts. Umgeni Water acknowledge that while water usage could become more efficient through effective demand management, non-augmentation of the Mgeni River will restrict growth and development in those areas which are dependent on the Mgeni River for water. They have therefore appointed Graham Muller Associates (GMA) to assess the socio-economic consequences of the non-augmentation option, and to determine, through a reconnaissance level study, whether or not improved water demand management represents a viable alternative to augmentation.

2.0 TERMS OF REFERENCE

The main focus of the study is to identify the socio-economic impact that non-augmentation will have on the area under study, which is roughly defined as the corridor which extends west from the city of Durban, through Pietermaritzburg, extending as far as Mooi River, and which has the Mgeni River as its spine. In other words, this study attempts to quantify the potential cost to the regional and provincial economies of a constrained water supply in those areas that are dependent upon the Mgeni River system for water.

Two alternate scenarios are examined in this study which is based on a reconnaissance level assessment of the engineering aspects of the proposed project:

- **Non-augmentation scenario**
  Unconstrained economic growth occurs within the study area until such time as water becomes a constraint to further growth. The proposed Mkomazi-Mgeni augmentation scheme is not commissioned but water demand is managed in order to minimise the impact of a constraint to water supply.

- **Augmentation scenario**
  The Mkomazi-Mgeni augmentation scheme is commissioned according to the time frame specified by Umgeni Water. In addition, the relevant authorities manage water demand. Unconstrained economic growth is permitted to occur within the study area.

3.0 SCOPE OF THE STUDY

3.1 Study area defined

The study area is defined as the supply area of Umgeni Water which, for the purposes of this study, is represented by the magisterial districts of Durban, Umlazi, Chatsworth, Pinetown, Ntuzuma, Inanda, Ndwedwe, Camperdown, Mpumalanga, Pietermaritzburg, New Hanover, Lions River, Mooi River and Vulindlela.

Although the proposed augmentation scheme will have many positive spin-offs for the communities adjacent to, and within, the location of the proposed dam on the Mkomazi River, these impacts are ignored since they fall outside of the defined study area. In the augmentation scenarios, only those items of capital and operational expenditure that have been identified in a reconnaissance level engineering study and which directly affect the study area will be factored into the model.

3.2 Economic indicators

The specific indicators that have been chosen to measure the socio-economic impacts are gross geographic product (GGP) and formal employment. In addition, an attempt is made to estimate the impact that water supply constraints will have on the population within the study area. The

time frame over which the impacts are assessed is 40 years i.e. 1998-2038, since this considered to be the time period over which the project will be financed.

4.0 THE MKOMAZI-MGENI AUGMENTATION SCHEME

As previously mentioned, the study to determine the optimal transfer scheme to augment the Mgeni system from the Mkomazi system is still in the reconnaissance stage, and two schemes have been recommended for further investigation. The economic characteristics of both schemes are similar and for the purposes of this study, it was therefore decided to select only one scheme, the Impendle Scheme, for evaluation.

The Impendle Scheme will ultimately yield approximately 340 million m^3/annum and will consist of a dam on the Mkomazi River near Impendle, a gravity tunnel to Midmar Dam, a pumpstation feeding an extended Midmar Waterworks, and a clearwater conveyance system consisting of gravity pipelines and tunnels. With the exception of the tunnels, all scheme components would be implemented in two to three phases. For the purposes of this report, it is assumed that the implementation will consist of three phases. The estimated total cost of all phases, in 1997 prices, is R2 300 million. A schematic layout of the proposed augmentation infrastructure is provided in figure 4.1 on the following page.

5.0 STUDY AREA CHARACTERISTICS

In terms of economic output and water consumption, the study area is dominated by the Durban Metropolitan Area (DMA) as evidenced in the following table.

Table 5.1: Projected GGP and water demand within the study area (1998)

	STUDY AREA	DURBAN METRO	PMB TLC	OTHER
Projected GGP[1+2] (Percentage of total)	52,856 (100)	44,007 (83)	6,498 (12)	2,351 (5)
Projected water demand[3] (Percentage of total)	311 (100)	262 (84)	42 (14)	7 (2)

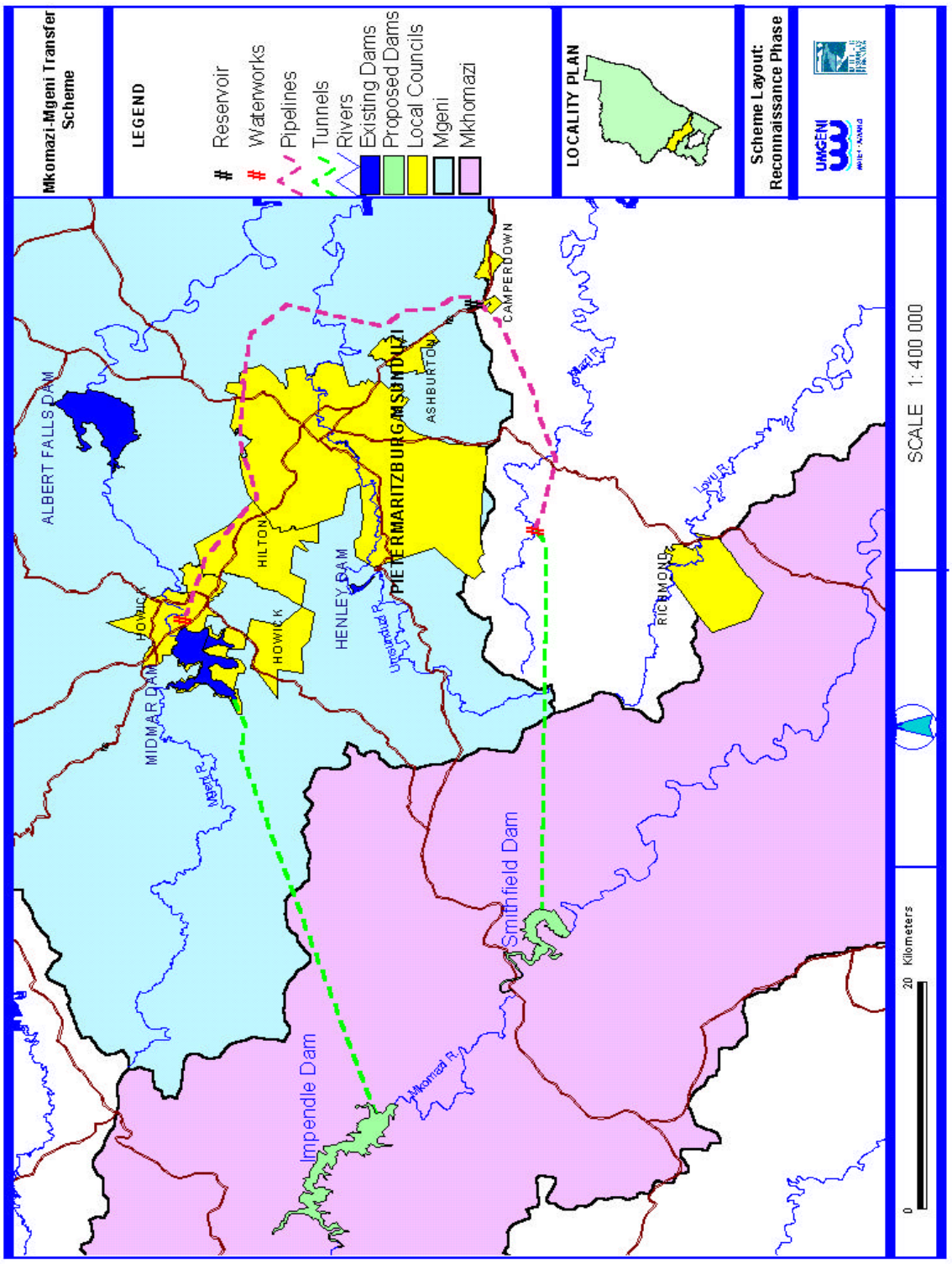
[1] Estimated GGP at factor cost and 1997 prices (R'000 000)

[2] See section 7.1 for methodology regarding GGP projections

[3] Projected by Umgeni Water (measured in million m^3 per annum)

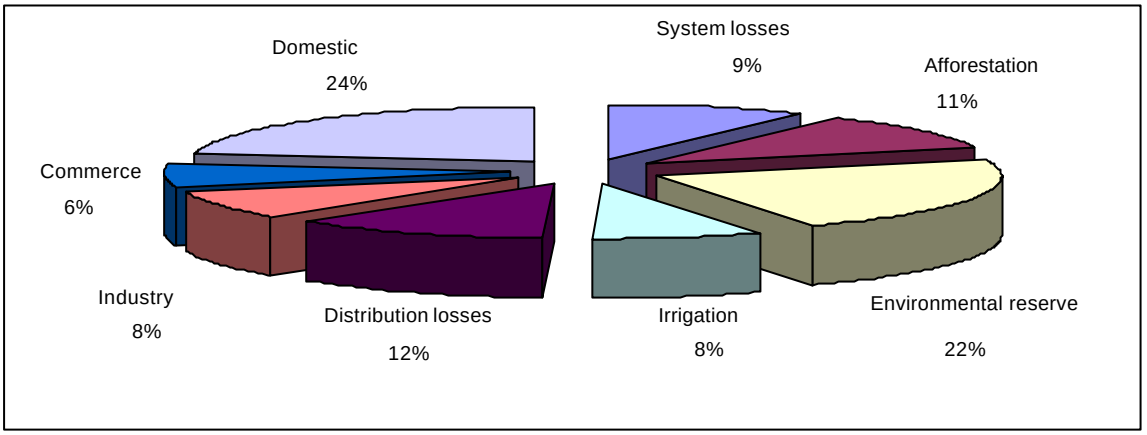
Further to the above table, it is worth noting that the study area accounts for 69% of KwaZulu-Natal's GGP, and that the magisterial districts of Durban and Pinetown account for 91 percent of GGP within the DMA. The magisterial district of Pietermaritzburg accounts for 95 percent of economic value added within the Pietermaritzburg TLC. **From observation, and not unexpectedly, the pattern of water demand appears to closely follow that of economic output within the study area.** This is a fundamental assumption upon which much of this socio-economic evaluation is based.

Figure 4.1: Mkomazi-Mgeni Transfer Scheme Layout



The breakdown of total system demand for the Mgeni system is illustrated in figure 5.1. These demands are categorised into (i) diffuse demands (system losses, afforestation, environmental reserve and irrigation) and (ii) urban and industrial demands (distribution losses, industry, commerce and domestic).

Figure 5.1: Comparison of total Mgeni system demands



Source: Umgeni Water

It is worth noting that of the total diffuse demands, system losses and environmental reserves, which together account for 31% of total system demand, are fixed components of the water balance which cannot be manipulated for greater efficiency. The remaining diffuse demands, namely afforestation and irrigation, account for only 19% of total demand. The significance of these numbers will become apparent in the conclusion to this report.

6.0 WATER DEMAND AND SUPPLY

6.1 Water supply

The current maximum supply, or yield, of the Mgeni system is estimated to be 280 million m^3/annum. However, water supply to the Mgeni system is already being augmented to the extent that stepped pumping from the Mooi River is currently providing an additional 30 million m^3/annum of water. The maximum current 1:100 year stochastic yield is therefore estimated to be 310 million m^3/annum.

In order to increase this maximum yield in the short to medium term, Umgeni Water and DWAF have identified three further schemes. The first involves the raising of the Midmar Dam wall. This will provide an additional 20 million m^3/annum, and will increase the maximum yield to 330 million m^3/annum. The second scheme involves the building of Mearns dam on the Mooi River, just below its confluence with the Little Mooi River, which will provide a further 30 million m^3/annum, thus increasing the 1:100 year stochastic yield of the system at Inanda Dam to 360 million m^3/annum. The third scheme involves the construction of the Springgrove Dam on the Mooi River, just upstream of Rosetta, and about 18 km upstream of the Mearns

site, which will finally increase the 1:100 year stochastic yield of the system at Inanda Dam to 383 million m^3/annum.

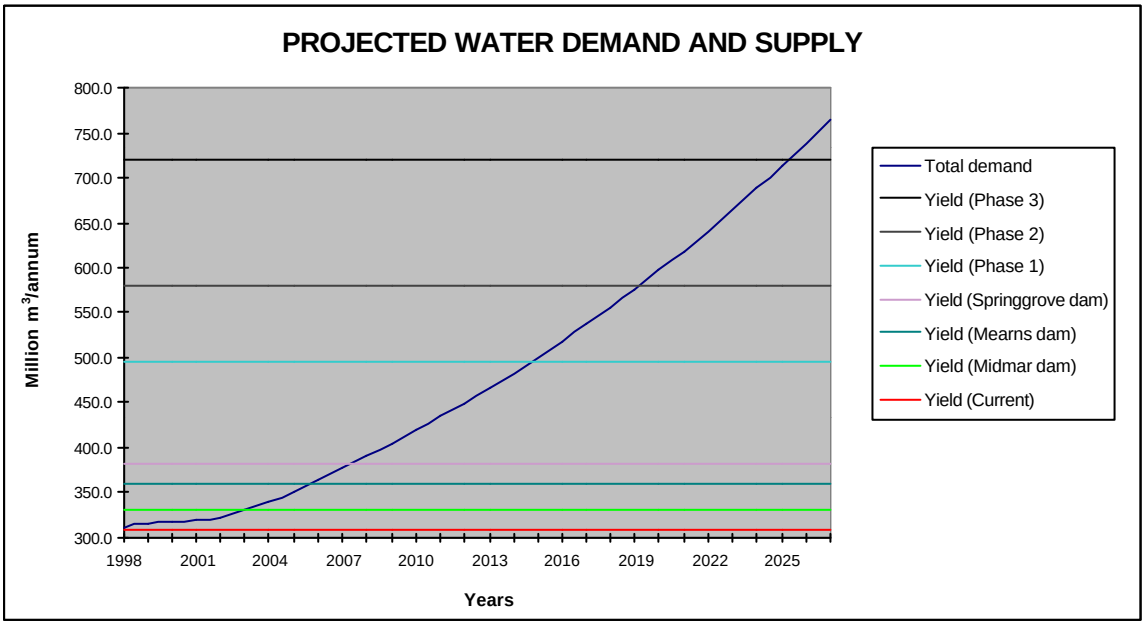
Based on a reconnaissance level study, the first phase of the Mkomazi-Mgeni augmentation is expected to raise the maximum yield to 495 million m^3/annum, while the subsequent two phases will raise the yield to 580 and 720 million m^3/annum respectively.

Throughout the report, all water supply and demand figures are given at a conservative 99 percent assurance level (1:100 year). Although a less conservative assurance level would facilitate a more relaxed timing of events, this will not have a significant impact on the findings of this study.

6.2 Water demand

The following graph illustrates the projected water demand and supply within the study area, as determined by Umgeni Water. These projections assume effective demand management, especially in respect of the commitment by Durban Metro Water to maintain bulk water purchases from Umgeni Water at a constant level, through effective demand management, for the next five years. Further details regarding demand management can be found in the following section of this report.

Figure 6.1: Projected water demand and supply



Source: Umgeni Water All projections at a 99% assurance level

Figure 6.1 illustrates the required operational timing (in terms of ensuring that demand never exceeds supply) of the various augmentation options. However, the scheduled timing of events differs slightly, as evidenced in table 6.1 overleaf. The effects of the water demand management programme of Durban Metro Water, as detailed in section 6.3 of this report, are evidenced by

the flattened beginning section of the water demand curve (between 1998 and 2002). Without these water demand management measures, the demand curve would be steeper, and the augmentation timing would be earlier than the required timing given in table 6.1.

Table 6.1: Augmentation timing

	Raise Midmar	Mearns dam	Spring-grove dam	Phase 1	Phase 2	Phase 3
Required timing	1998	2003	2006	2008	2015	2020
Actual timing	2000	2005	2008	2010	2016	2020
Supply shortfall (%)	1.7	3.0	4.7	5.6	1.0	0

Source: Ninham Shand and Umgeni Water

From table 6.1, it is apparent that the actual scheduled timing of events, as established by Umgeni Water, implies periodic shortfalls where demand exceeds supply. These shortfalls are for short periods of time, and it is not anticipated that they will impact negatively on growth and development for the following reasons:

- In the short term, dams supplying the Mgeni operational area are at high levels and therefore there is excess capacity with which to manage these shortfalls; and

- Projected supply figures are presented at a very conservative 99 year assurance level. In the short term actual supply figures are likely to be higher than those projected.

6.3 Water demand management

The need for tighter water demand management and a more efficient utilisation of water is currently being legislated, and is recognised by Umgeni Water, and it's two major clients, Durban Metro and Pietermaritzburg TLC. Inevitably, some proportion of the water supplied to domestic and industrial users remains unaccounted for through leaks and faulty metering. This problem is further exacerbated by lost revenue resulting from non-payment of accounts. In the past, and in the DMA alone, such losses have been estimated at about 30 percent of total water consumption. However, there is now a strategy in place to reduce these losses. Durban Metro Water intends, through a programme of effective demand management, to maintain bulk water purchases from Umgeni Water at a constant level for the next five years, even though they aim to provide 75 000 new connections within this period. This will be achieved through a strategy that aims to reduce losses to 15 percent over the five-year period 1998-2002. Measures that are aimed at reducing losses include leak fixing, increased billing, progressive tariffs, a cut-off policy for non-payment, and recycling. The effects of these measures can be seen in the flattened beginning section of the water demand curve in figure 6.1 (between 1998 and 2002).

These savings are aimed at achieving greater water-use efficiency and can almost certainly be achieved without noticeably affecting or constraining economic growth and development in the study area. For the purposes of this study, this is therefore assumed to be the case.

There are however, other demand management measures which can be implemented in periods of acute water shortage i.e. droughts. Such measures may adversely affect growth and development, and are not sustainable in the long term. These include such measures as bans on watering gardens, filling swimming pools and washing cars. In view of the nature of these measures, it is assumed that they will only be implemented as a last resort in a crisis situation. For this reason these measures are not factored into the demand projections as presented in figure 6.1. The spare capacity inherent in these stringent demand management measures remains therefore to be used in a crisis situation, and for a short period of time.

7.0 SOCIO-ECONOMIC BASE DATA

7.1 Gross Geographic Product

Gross geographic product (GGP) data by sector and magisterial district was projected over a forty year period from 1998-2038. Base figures were obtained from the 1995 Statistical Macro-Economic Review of KwaZulu-Natal by the Development Bank of Southern Africa (DBSA). The Central Statistical Service (CSS) took these figures in turn from the 1991 Census. These 1991 figures were projected to 1998 using two separate growth rates, both of which were taken from a 1995 report on the KwaZulu-Natal economy conducted for Eskom by Data Research Africa (DRA). In the first instance, projections to 1993 were based on the historical average annual growth rate by economic sector. In the second instance a projected growth rate for the period 1993-98, by economic sector, was utilised. For a more detailed description of the methodology used by DRA to derive the sectoral growth rates for the periods 1993-98 and 1999-2013, see Appendix 1.

For the period 1999-2013, further sets of projected growth rates were taken from the same DRA report. Due to the time limitations imposed by this project, these growth rates were used to project GGP beyond 2013, to 2038.

The base year of the GGP data throughout this study was shifted from 1990 to 1997 using a Gross Domestic Product (GDP) price deflator calculated from GDP data for the corresponding time period

7.2 Formal employment

Formal employment data by magisterial district and economic sector was also taken from the 1995 DBSA Macro-Economic Review of KwaZulu-Natal. In a similar manner to that described above, these figures were projected to 1998, and then through to 2038, using growth rates determined by DRA. As in all economies, a strong positive relationship between economic output (GGP) and employment is expected, except in instances where technology impacts negatively on the capital to labour ratio.

7.3 Population projections

Population projections by magisterial district, for the 40 year time frame of the study, were provided by consultants, Scott Wilson, based upon a desk top study. The base figures were obtained from the 1991 census conducted by the Central Statistical Service (CSS). These figure were projected to 1995 using growth rates obtained from a 1995 population study by ESKOM, and then to 2040 using growth rates obtained from a 1995 study by the Centre for Development and Enterprise.

7.4 GGP and employment multipliers

The GGP and employment multipliers used throughout this analysis were obtained from the Manual for the Economic Evaluation of Water Projects, produced by Conningarth Consultants for the Department of Water Affairs and Forestry in 1992. The GGP multipliers are specific to KwaZulu-Natal, but the employment multipliers are based on the South African economy as a whole.

7.5 Effect of HIV/AIDS

The effect of AIDS was factored into the population data by Scott Wilson, in accordance with the findings of a 1995 study by Whiteside and Wilkens. It is doubtful though, whether or not the GGP growth rate projections found in the Eskom study take into account the full impact of HIV/AIDS. However, the research which is necessary in order to fully account for the impact of HIV/AIDS on GGP is well beyond the scope of this study. Hence it is a recommendation of this report that further research into the socio-economic effect of HIV/AIDS be conducted.

8.0 SCENARIO ONE

Scenario one, the base case, is founded on the assumption that the proposed Mkomazi-Mgeni augmentation scheme does not occur. However, the raising of the Midmar Dam wall, and the construction of Mearns and Springgrove Dams are factored into the estimation of water supply in this scenario since these projects are scheduled to occur independently of the Mkomazi-Mgeni augmentation.

The base case scenario assumes that water supply will not constrain economic growth during the period 1998-2009. Although shortfalls will in fact occur during this time period (see table 6.1 and table 1 in Appendix 2 of this report), it is not anticipated that these will have any adverse effect on GGP growth for reasons previously mentioned in section 6.2. From 2010, an under supply of water will constrain GGP growth throughout the remainder of the study period.

8.1 Gross Geographic Product

For the purposes of these projections it is assumed in this section that during the study period, no constraint to growth exists other than that presented by a possible water shortage. It is further assumed, unrealistically, that water productivity, as defined by GGP per unit of water consumed remains constant throughout the study period i.e. there is a linear relationship between output and consumption. In section 10, in order to introduce more realism into the

study, sensitivity analyses relating to water productivity improvements during periods of water supply constraint are conducted.

8.1.1 Projected GGP growth in study area

Table 8.1 shows two sets of GGP projections for the study area. In the first instance, GGP is unconstrained throughout the study period. The second set of figures assumes that water supply is unconstrained during the period 1998-2009, and since it is assumed that no other constraints to economic growth exist, GGP growth is therefore also unconstrained during this period. From 2010, water supply is effectively constrained and remains constant, as does GGP.

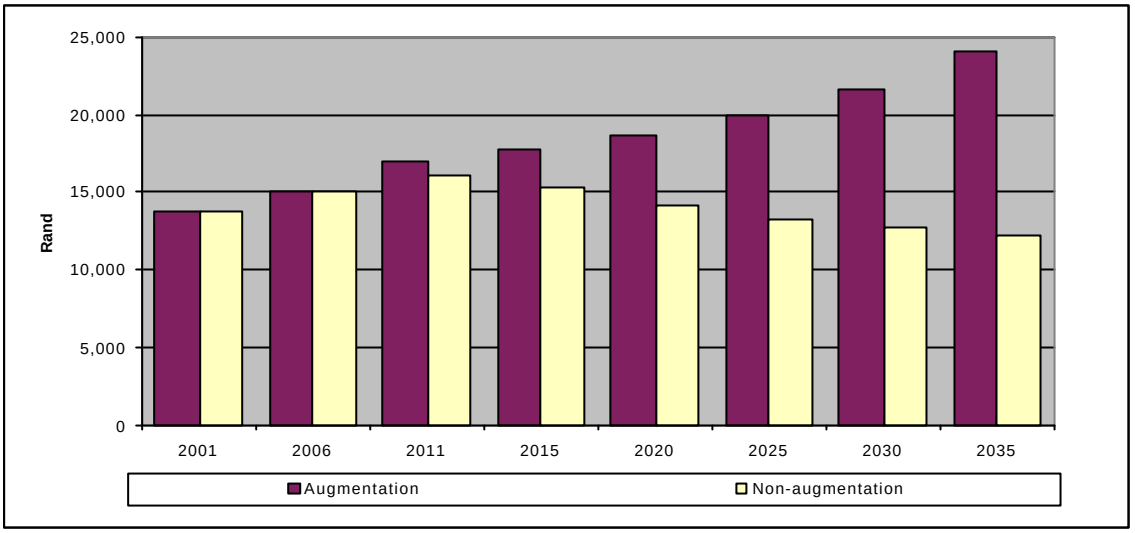
Table 8.1: Projected GGP (study area)

STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	1998	2003	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
UNCONSTRAINED GROWTH PROJECTIONS (assuming water is never constrained throughout the time frame of the study)	52,856	59,488	67,099	75,859	85,975	97,695	111,323	127,232	145,878	3,713,965
CONSTRAINED GROWTH PROJECTIONS (assuming water is constrained after 2009)	52,856	59,488	67,099	68,753	68,753	68,753	68,753	68,753	68,753	2,719,117

In terms of these projections, cumulative GGP throughout the study period is 27% lower than it would otherwise be if water supply were not constrained. Even more significant is the fact that by 2038, GGP in the constrained scenario is less than half of the corresponding figure in the unconstrained scenario.

Based on the above provisions and the population projections (which take AIDS into account) from Scott Wilson, the GGP per capita is presented in figure 8.1 overleaf. The augmentation projections give a GGP per capita which is very nearly double that resulting from the non-augmentation projections.

Figure 8.1: GGP per capita (study area)



As was noted previously, the constrained scenario presented in the above table does not allow for any improvement in water productivity. In future years, however, more sophisticated demand measures, greater use of recycled water and revised tariff structures will, in all likelihood, allow for some improvement in water productivity during the constrained years. It is however, difficult to assess the impacts of these possible productivity improvements and any estimation of their effectiveness and timing is pure guesswork. Nevertheless, a speculative attempt to determine the possible impacts of improvements in water productivity is presented in table 8.2.

Each of the three growth scenarios in table 8.2 assumes a 10, 15 and 20 percent water productivity increase respectively. These increases are factored into the base GGP projections in the year in which growth is first constrained i.e. 2010. This is done in a phased and realistic manner such that GGP in any subsequent year does not exceed the potential unconstrained GGP for that year. If this were to occur, GGP for that year would be unrealistically high.

Table 8.2: Improvements in water-use productivity (study area)

STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	1998	2003	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	52,856	59,488	67,099	75,628	75,628	75,628	75,628	75,628	75,628	2,908,281
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	52,856	59,488	67,099	75,859	79,066	79,066	79,066	79,066	79,066	2,993,154
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	52,856	59,488	67,099	75,859	82,504	82,504	82,504	82,504	82,504	3,072,131

From the above table it is clear that the 10% improvement in water productivity results in a 7% increase in GGP over the study period, when compared to GGP growth without any productivity increases. The 15 and 20 percent scenarios show greater increases. Realistically however, while there may be a case for perhaps achieving a 10% improvement in water productivity, it is quite likely that the marginal cost of achieving further savings will exceed the

marginal return, thus eliminating the likelihood of achieving 15% and 20% productivity improvements over the forty year period of this study.

It is worth noting that even with a 20% increase in productivity; cumulative GGP is still 21% below the unconstrained equivalent. **It would appear therefore, that improvements in water demand management, including the impact of improved water productivity, are not in themselves enough to relieve the constraints on economic growth in the face of water shortages.**

8.1.2 Projected GGP growth in KwaZulu-Natal

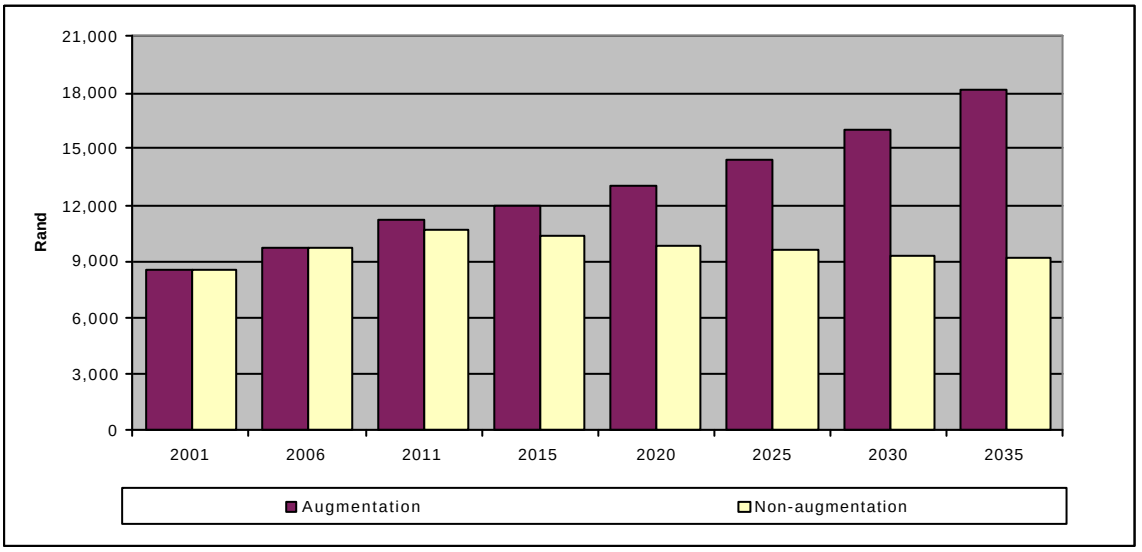
In exactly the same manner as described in the study area analysis, GGP growth in KwaZulu-Natal is presented in the following table.

Table 8.3: Projected GGP (KwaZulu-Natal)

KWAZULU-NATAL GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	1998	2003	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
UNCONSTRAINED GROWTH PROJECTIONS (assuming water is never constrained throughout the time frame of the study)	76,791	86,038	96,398	108,005	123,395	140,977	161,065	184,015	210,235	5,353,681
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (thereafter growth is constrained due to non-augmentation)	76,791	86,038	96,398	98,615	98,615	98,615	98,615	98,615	98,615	3,907,309

In terms of these projections, cumulative GGP throughout the study period is 27% lower than it would otherwise be if water supply were not constrained.

Figure 8.2: GGP per capita (KwaZulu-Natal)



GGP per capita, as evidenced in figure 8.2, will be significantly reduced if growth is constrained due to a water shortage, and since these figures are skewed as a result of the concentration of economic activity within the study area, GGP per capita in the outlying areas of the province will

be much lower than the average figures shown in the above table. The economic impact of non-augmentation will thus be greater in the rural areas that fall outside of the study area.

The impact of water productivity increases is shown in table 8.4. The outcome of this sensitivity analysis for KwaZulu-Natal mirrors that of the study area in terms of proportional increases in GGP.

Table 8.4: Improvements in water productivity (KwaZulu-Natal)

KWAZULU-NATAL GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	1998	2003	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	76,791	86,038	96,398	108,005	108,476	108,476	108,476	108,476	108,476	4,177,055
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	76,791	86,038	96,398	108,005	113,407	113,407	113,407	113,407	113,407	4,297,838
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	76,791	86,038	96,398	108,005	118,338	118,338	118,338	118,338	118,338	4,410,409

8.2 Employment

Growth in formal employment is projected in a manner similar to that with which GGP is projected. Unconstrained base employment figures are adjusted when the water supply constraint is reached in 2009.

8.2.1 Projected employment in study area

The implication of non-augmentation on formal employment in the study area is a cumulative loss of 3.27 million potential new jobs by the year 2038. The results can be seen in table 5 in Appendix 3.

8.2.2 Projected employment in KwaZulu-Natal

The implication of non-augmentation on formal employment in KwaZulu-Natal is a cumulative loss of 4.99 million potential new jobs by the year 2038. The results can be seen in table 6 in Appendix 3.

9.0 SCENARIO TWO

Scenario two, the augmentation scenario, is founded on the assumption that the proposed Mkomazi-Mgeni augmentation scheme does occur. In addition, the raising of the Midmar Dam wall, and the construction of Mearns and Springgrove Dams are also factored into the estimation of water supply in this scenario, as was the case in the first scenario.
This second (augmentation) scenario follows the base case scenario in respect of demand and supply up to the year 2009, whereafter phase one of the Mkomazi-Mgeni transfer scheme becomes operational.

The structure of the augmentation analysis is divided into three components. Firstly, the economic impact, in terms of GGP and employment, of the capital expenditure on construction of the scheme is assessed. Secondly, the economic impact of operational expenditure is assessed, and thirdly the accommodating effect that an unconstrained water supply will have on base GGP projections is measured. There then follows a series of sensitivity analyses that are not intended to add direct weight to the augmentation/non-augmentation argument, but are rather intended to guide decision makers in respect of the timing of the various augmentation phases. An analysis of water supply and demand, after commissioning of all three phases of the augmentation project is provided in table 1 of Appendix 2 of this report.

This analysis shows that demand will exceed supply in 2015. However, it is assumed that this shortfall can be accommodated through short term demand management and will not therefore impact negatively on GGP. From 2026-2038, water supply is again constrained – unless further augmentation occurs. In summary therefore, the augmentation scenario assumes an unconstrained supply of water from 1998-2025, and based on the assumptions identified in the base case scenario, GGP will also be unconstrained during this period, but will again become constrained from the year 2026 unless water productivity is improved.

9.1 Construction cost of augmentation

The augmentation scheme consists of three phases, each of which will, for the purposes of this study, be commissioned in 2010, 2016 and 2020 respectively. The estimated capital cost of each phase, as provided by Ninham Shand Consulting Engineers, based on a reconnaissance level study, is summarised in table 9.1.

Table 9.1: Capital cost of construction

COST OF AUGMENTATION	CAPITAL COST (R'000)			
Component	**Phase 1**	**Phase 2**	**Phase 3**	**Total**
Civil	891,750	461,000	346,000	1,698,750
Mechanical and electrical	100,750	82,000	92,500	275,250
Professional fees	148,875	81,450	65,775	296,100
Social and environmental	5,000	5,000	5,000	15,000
Total	**1,146,375**	**629,450**	**509,275**	**2,285,100**

This costing was then further disaggregated, on the basis of annual expenditure, into the direct and indirect effects, for each phase, on materials services and interest. In order to assess the economic impacts within and outside the study area, expenditure was then further disaggregated into those items that could be supplied within KwaZulu-Natal, and those which would have to be sourced outside of KwaZulu-Natal. Initially it was also intended that expenditure would be disaggregated into items that could be supplied within the study area. However, since the study area includes the economic powerhouse of the province, and accounts for around 70% of KwaZulu-Natal's economic output, it was decided that little value could be gained through disaggregating expenditure to this level. Therefore the construction effect, and for that matter the operational effect, is only analysed at the provincial level.

The resulting expenditure was then subject to a multiplier analysis to determine the economic impacts of the capital cost of construction. The results can be found in table 3 of Appendix 4 of this report.

9.2 Operational cost of augmentation

The operating costs of augmentation were disaggregated in exactly the same manner as capital costs and the aggregate results over the entire study period are presented in table 5 of Appendix 4.

9.3 Gross Geographic Product

The same assumptions that were used to build the base case scenario are used in the augmentation scenario.

9.3.1 Projected GGP growth in study area

Table 9.2 illustrates the effect which augmentation will have on the study area, and includes the base case scenario for comparative purposes.

Table 9.2: Study area GGP after augmentation

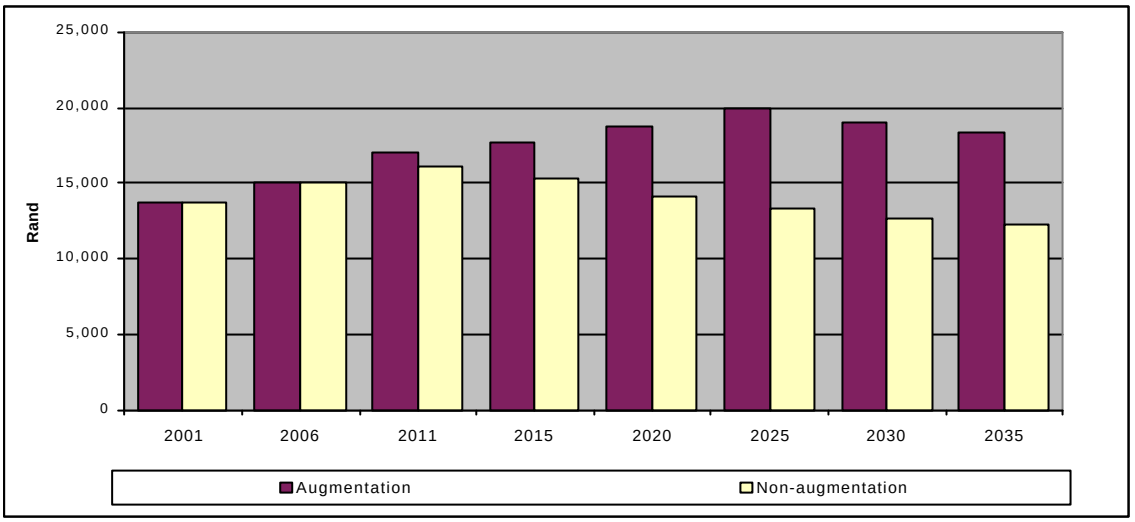
STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
Base case (non-augmentation) scenario	67,099	68,753	68,753	68,753	68,753	68,753	68,753	2,719,117
Base growth projections before construction and operational effects	67,099	75,859	85,975	97,695	102,898	102,898	102,898	3,432,021
Construction effect on GGP	130	14	66	0	0	0	0	854
Operational effect on GGP	0	22	28	29	18	10	6	600
Total impact of augmentation on GGP	130	36	94	29	18	10	6	1,454
Projected GGP after augmentation	67,229	75,895	86,068	97,723	102,916	102,908	102,904	3,433,474

From the above table, it is immediately apparent that the impact of the construction and operational expenditures is negligible. The greatest impact stems from the growth that is accommodated by the unconstrained water supply. Cumulative GGP which could be accommodated through an unconstrained water supply, throughout the study period, is 26% higher than in the base case scenario and therefore lends considerable weight in support of the argument for augmentation.

In this second scenario, a water constraint comes into effect in 2026, which is why GGP growth is slightly lower than the 27% reported in section 8.1.1, which referred to unconstrained growth throughout the entire study period.

GGP per capita, accommodated under the augmentation scenario, is presented in figure 9.1, along with the non-augmentation scenario (both of which are based on population projections that take AIDS into account) for comparative purposes.

Figure 9.1: GGP per capita (study area)



As in the base case scenario, a series of sensitivities that explored the impact of increased water productivity were conducted. The results are provided in the table below.

Table 9.3: Improvements in water productivity (study area)

STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
GROWTH UNCONSTRAINED BETWEEN 1998-2025 (water productivity increases by 10% after constraint)	67,229	75,895	86,068	97,723	113,206	113,198	113,194	3,554,915
GROWTH UNCONSTRAINED BETWEEN 1998-2025 (water productivity increases by 15% after constraint)	67,229	75,895	86,068	97,723	111,342	118,343	118,339	3,599,534
GROWTH UNCONSTRAINED BETWEEN 1998-2025 (water productivity increases by 20% after constraint)	67,229	75,895	86,068	97,723	111,342	123,488	123,484	3,637,783

A 10% increase in water productivity results in a 4% increase in cumulative GGP. As previously mentioned, although a 10% increase in water productivity is perhaps realistic, the 15 and 20 percent projections are not likely to be achievable.

9.3.2 Projected GGP growth in KwaZulu-Natal

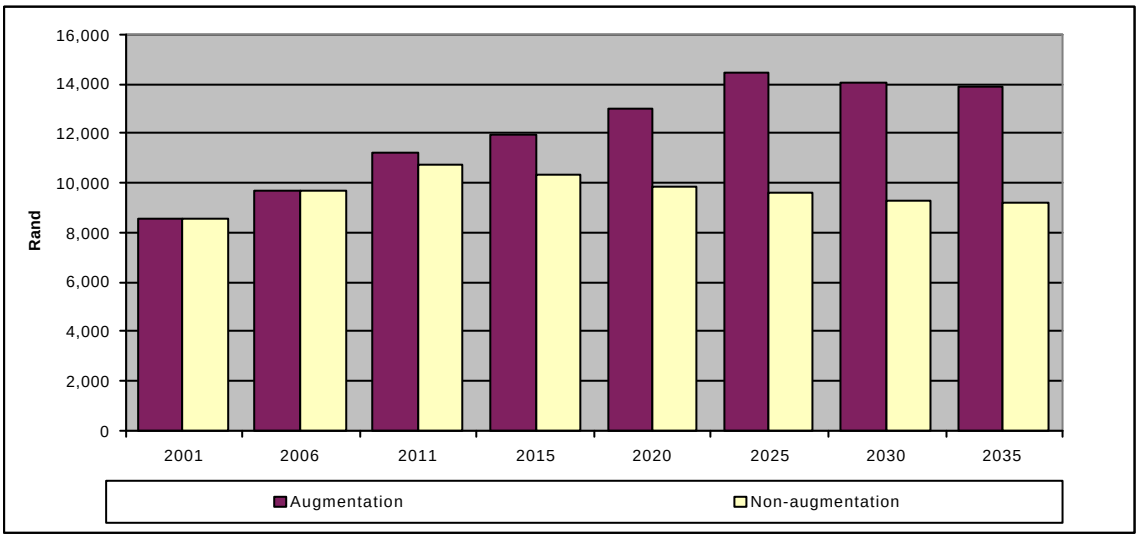
The methodology employed in estimating the impacts of augmentation in KwaZulu-Natal as a whole is the same as that used within the study area. A summary table of results is given in the following table, and once again the base case GGP scenario is also provided for comparative purposes.

Table 9.4 KwaZulu-Natal GGP after augmentation

KWAZULU-NATAL GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
Base case (non-augmentation) scenario assuming no further demand management	96,398	98,615	98,615	98,615	98,615	98,615	98,615	3,907,309
Base growth projections before construction and operational effects	96,398	108,005	123,395	140,977	148,693	148,693	148,693	4,945,792
Construction effect on GGP	130	14	66	0	0	0	0	854
Maintenance and operational effect on GGP	0	22	28	29	18	10	6	600
Total impact of augmentation on GGP	130	36	94	29	18	10	6	1,454
Projected GGP after augmentation	96,528	108,041	123,489	141,006	148,711	148,703	148,699	4,947,245

As in the case of the study area, cumulative GGP that could be accommodated in KwaZulu-Natal after augmentation is 26% higher than the base case scenario. GGP per capita is given in figure 9.2.

Figure 9.2: GGP per capita (KwaZulu-Natal)



The effect of a change in water productivity is demonstrated in table 9.5. A 10% increase in productivity results in a 4% increase in cumulative GGP.

Table 9.5: Improvements in water productivity (KwaZulu-Natal)

KWAZULU-NATAL GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000 000)	2008	2013	2018	2023	2028	2033	2038	SUM OF PROJECTED GGP FOR 1998-2038
GROWTH UNCONSTRAINED BETWEEN 1998-2025 (water productivity increases by 10% after constraint)	96,528	108,041	123,489	141,006	161,083	163,573	163,568	5,120,463
GROWTH UNCONSTRAINED BETWEEN 1998-2025 (water productivity increases by 15% after constraint)	96,528	108,041	123,489	141,006	161,083	171,007	171,003	5,188,110
GROWTH UNCONSTRAINED BETWEEN 1998-2025 (water productivity increases by 20% after constraint)	96,528	108,041	123,489	141,006	161,083	178,442	178,437	5,243,622

9.4 Employment

Formal employment projections are made with the assumption that growth continues in an unconstrained manner until 2025. The employment effect of construction and operational expenditure is calculated by subjecting the respective expenditures within the study area to a multiplier analysis.

9.4.1 Projected employment in study area

The construction and operational effect of augmentation on employment is negligible. However, free from the burden of a water constraint, the level of employment that could be accommodated continues to increase until 2025. The overall effect of augmentation on potential employment levels is a 34% increase over and above the base case scenario. See table 5 in Appendix 5 for further details.

9.4.2 Projected employment in KwaZulu-Natal

In KwaZulu-Natal as a whole, cumulative employment that could be accommodated during the study period is 32% higher than in the base case scenario. See table 6 in Appendix 5 for further details.

10.0 SENSITIVITY ANALYSIS

The final part of this report comprises two sensitivity analyses. The first examines the impact that water losses will have on augmentation timing. In section 6.3 of this report it was stated that underlying the projected water demand projections was the assumption that Durban Metro Water would reduce water losses from 30 percent to 15 percent over the period 1998-2002, and in so doing would maintain their bulk water purchases from Umgeni Water at a constant level during this period. The first sensitivity assesses the consequences of water losses being reduced by lesser amounts. The impact of these changes is measured in relation to water supply in order to assess the need for changes to the proposed timing of the Mkomazi-Mgeni transfer scheme.

The second sensitivity looks at the effect of changes to the timing of the Mkomazi-Mgeni transfer scheme in terms of water supply and demand. The analysis calculates the anticipated

shortfalls in supply that will occur for each year that the project is delayed, and is therefore very similar to the first sensitivity. However, to examine the economic implications of resulting supply shortfalls would be purely academic because the socio-economic case for augmentation has already been demonstrated quite convincingly, and if a decision is taken to proceed with the scheme, it serves no purpose to quantify the inevitable and substantial cost to the economy that will arise from demonstrable levels of water shortages that will follow delays in implementation.

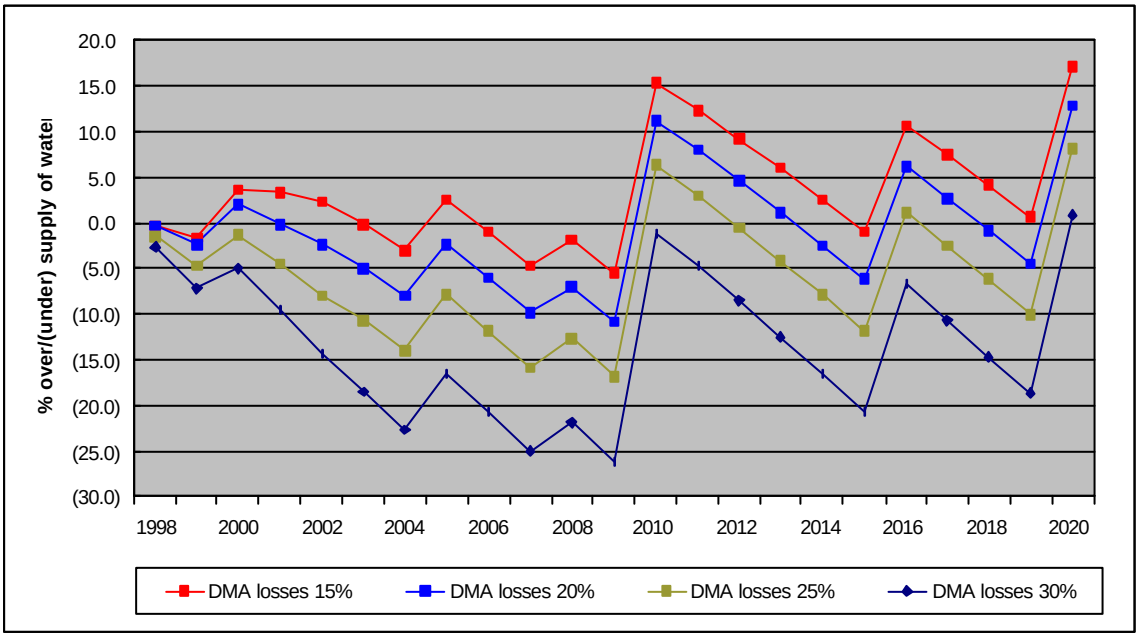
10.1 Water loss

The water demand projections which inherently assume that water losses in the DMA will be reduced from 30 percent to 15 percent during the period 1998-2002, are recalculated on the assumption that water losses:

- remain at 30 percent,
- are reduced to 25 percent, and
- are reduced to 20 percent.

After 2002, demand continues to escalate at the same projected rate that has been used throughout this study. The water supply figures remain constant throughout the analysis. The results of the analysis, up to the year 2020 when phase 3 is commissioned, are shown in figure 10.1.

Figure 10.1: Percentage over/under supply of water



The results show that even with losses limited to 20 percent, the deficits which result may be too high to manage without constraining economic growth. At higher levels of loss, economic growth will be severely constrained. **It is therefore clearly vital that every effort be made to control water loss, and thereby improve water productivity, in addition to proceeding with plans for water supply augmentation.**

10.2 Delays in timing

In estimating the shortage of water as a result of a delay in implementation, it has been assumed that the timing of the phases remain constant relative to each other i.e. the entire project timing is delayed.

Table 10.1: Supply surpluses/shortfalls due to timing delays

PROJECTED WATER OVER/UNDER SUPPLY (%)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
SUPPLY AS PLANNED	(5.6)	15.4	12.3	9.2	5.9	2.5	(1.0)	10.7	7.5	4.1	0.7	17.1	14.1	11.0	7.8	4.4	1.0
SUPPLY (Augmentation delay 1 year)	(5.6)	(7.2)	12.3	9.2	5.9	2.5	(1.0)	(3.9)	7.5	4.1	0.7	(2.3)	14.1	11.0	7.8	4.4	1.0
SUPPLY (Augmentation delay 2 years)	(5.6)	(7.2)	(10.3)	9.2	5.9	2.5	(1.0)	(3.9)	(7.2)	4.1	0.7	(2.3)	(5.3)	11.0	7.8	4.4	1.0
SUPPLY (Augmentation delay 3 years)	(5.6)	(7.2)	(10.3)	(13.4)	5.9	2.5	(1.0)	(3.9)	(7.2)	(10.5)	0.7	(2.3)	(5.3)	(8.4)	7.8	4.4	1.0
SUPPLY (Augmentation delay 4 years)	(5.6)	(7.2)	(10.3)	(13.4)	(16.7)	2.5	(1.0)	(3.9)	(7.2)	(10.5)	(14.0)	(2.3)	(5.3)	(8.4)	(11.7)	4.4	1.0
SUPPLY (Augmentation delay 5 years)	(5.6)	(7.2)	(10.3)	(13.4)	(16.7)	(20.1)	(1.0)	(3.9)	(7.2)	(10.5)	(14.0)	(14.1)	(5.3)	(8.4)	(11.7)	(15.0)	1.0

The results of the analysis (deficits are shaded) show that a deficit of 10 percent occurs, even if timing is delayed by only two years. Beyond this the shortages are greater and last for a longer period of time. It thus appears that the timing of the augmentation scheme is critical, and any delay in excess of two years beyond the required implementation date will probably result in a constraint on GGP and employment growth.

11.0 CONCLUSIONS

Based on the assumptions around which this model is built, there is a clear socio-economic case for augmentation of the water supply to the Mgeni system. The results show that a significantly higher level of GGP and employment can be accommodated under the augmentation scenario, as evidenced below.

- Cumulative GGP in KwaZulu-Natal and the study area, throughout the study period, is 26% higher in the augmentation scenario, than in the non-augmentation scenario;
- In 2038 (the end of the study period), GGP in KwaZulu-Natal and in the study area is 50% higher in the augmentation scenario, than in the non-augmentation scenario; and
- Employment in the augmentation scenario is 34% higher in KwaZulu-Natal, and 32% higher within the study area, when compared to the non-augmentation scenario.

The model also clearly shows that within the study time frame, the largest economic benefits to the region stem from the manner in which an unconstrained water supply can be expected to facilitate unconstrained economic growth. Being a capital intensive project, the benefits, in terms of growth and employment, attributable to the construction and operation of the scheme are, in contrast, relatively minimal.

Sensitivity analyses show that improved water demand management is not an alternative to augmentation, and that any material delay in augmentation would incur costs in terms of constrained output and employment. The water-use productivity analyses in the non-augmentation scenario show that a 10% improvement in water–use productivity results in a 7% increase in GGP (in both the study area and in KwaZulu-Natal), over the entire study period, as opposed to the 26% increase which is projected in the augmentation scenario.

If the supply figures used in the model were calculated at a less than 99 percent assurance level, there would be some greater flexibility regarding the timing of the scheme. However, by using less conservative figures, water authorities would have a lower surplus capacity with which to handle crisis situations.

Another theoretical means of increasing water availability for urban and industrial use would be to impose restrictions on water consumption for irrigation and to reduce afforestation. However, given the relatively small water demand (19%) for afforestation and irrigation, and the larger (49%) urban and industrial demand, any savings achieved in the former category are likely to have little impact on the latter. Furthermore, water restrictions on agriculture and forestry would have a pronounced negative impact on the economy. Therefore it would appear that savings and efficiencies achieved in forestry and agriculture would not represent a realistic alternative to augmentation.

The only other alternative to augmentation would be to embark on a long term population and industrial relocation programme to a region with better water resources. The complexities involved and the distortions that would result really make this a non-viable alternative. In any event, as few regions in South Africa are better endowed with water resources than the study area under scrutiny, the question has to be asked: Where would the people and economic activity relocate to? And at what cost?

12.0 RECOMMENDATIONS

This study is based on desktop research. Full account could not therefore be taken of emerging factors such as the full impact of the current HIV and AIDS epidemic in KwaZulu-Natal. With this qualification, based on our analysis and the information available to us it is the recommendation of GMA that the Mkomazi-Mgeni augmentation scheme be proceeded with on a phased basis commencing soon enough to permit commissioning of the initial works during the year 2010. This will ensure that no constraints to economic growth or employment creation are imposed by water shortages in the study area in years of normal rainfall. According to the engineers commissioned to undertake a reconnaissance level study of the proposed scheme, this would require that construction commence in the year 2004.

It is our further recommendation that a fully researched demand model be constructed in the future to provide Umgeni Water with the capability of producing more refined scenario forecasts and an ongoing capability for "what if" analysis and scenario updates. This model should address the following areas of interest:

- Pricing policy;
- Population trends (especially in the light of the HIV/AIDS epidemic); and
- The timing of demand driven capital investment programmes.

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APPENDIX 1

Methodology for GGP and employment growth projections
Discussion on impact analysis

METHODOLOGY FOR GGP AND EMPLOYMENT GROWTH PROJECTIONS

The GGP and employment forecasts were produced by Data Research Africa from an econometric model developed by Economic Analysis Systems. The model forecast the growth of final demand in the KwaZulu-Natal economy, related this to growth rates in the different sectors and sub-sectors, and allocated this growth by magisterial district in the province. Likely trends in the growth of thirty components of final demand were determined and a 38 sector input-output model was used to calculate the implications for the production sectors in the South African economy.

The share of KwaZulu-Natal in each of the sectors was determined by analysing detailed information from various sources. Correlations were drawn between the regional gross geographic product (GGP) figures for 1968 to 1988 and the national figures, to determine trends in the KwaZulu-Natal share by sector. Cross tabulations were made on individual records in the 1991 population census, identifying the economic sectors and the income groups in which the people of KwaZulu-Natal found themselves. The census information only indicates main economic sectors. For KwaZulu/Natal as a whole, additional information was therefore used to break up the main sectors into the 38 sectors used in the national forecast. These trends were then adjusted in line with historical trends to develop growth rates specific to KwaZulu-Natal. These trends were then disaggregated so as to develop sectoral growth rates by magisterial district. Using past trends in labour productivity, growth in employment was then forecast by district and sector.

Unfortunately, detailed sectoral information on the economies of individual magisterial districts was not available in the format necessary for entering into the econometric model. As a result, census data pertaining to employment patterns had to be used as a surrogate for actual output. Thus, since the base-year information on this level of detail was for main sectors only, it was deemed prudent to limit the forecasts for magisterial districts to twenty main sectors. Even at this level, the results of the model should be treated with some caution, since economic growth as measured in terms of a change in gross geographic product has been spatially located at the place of residence rather that at the place of employment. This distorts the economic structure of magisterial districts, particularly in those parts of the province which have served as labour dormitories.

It is obvious that the political transition currently under way in South Africa can rapidly render mere extrapolation of historical trends irrelevant. The long-term trends in the growth of the components of final demand were studied against the background of world and domestic events, including domestic political policies. Future growth rates were based on the existing momentum of the South African economy, as well as policy statements by the main political parties, particularly in respect of backlogs to be addressed.

Despite these measures, forecasting growth rates by economic sector for magisterial districts is always a complex task due to micro-economic influences which distort the analysis that is involved. Moreover, the forecasts presented in this study are particularly vulnerable to error for a number of unique reasons. These include:

- the rapid and often unpredictable political changes in South Africa;
- the opening of South Africa to new and unknown influences from the global economy;
- intensifying competition globally as well as nationally, with declining protection of local industries;
- the pressures and demands of reconstruction which might stimulate some sectors, while depressing others;
- rising domestic incomes resulting from the opening of new opportunities to all sectors of the population;
- the inadequate and political biased collection of economic and social data in the past.

IMPACT ANALYSIS

In examining the impacts of any economic activity there are three well-defined types of impacts that are commonly used. As a very simple example, consider a fruit juice stand. Sales at the stand, the employment of the stand operator and the profit the operator earns are all **direct impacts** of the existence of the fruit juice stand.

In order to supply the fruit juice stand, the operator must purchase fresh fruit and sugar at the local grocery and fresh produce market. Thus, a part of the profits, employment, and payroll of the grocery and fresh produce market are attributable to the existence of the fruit juice stand, as are a portion of the profits, employment and payroll of suppliers to the grocery and fresh produce market. These impacts flow through all businesses that are in some way responsible for ultimately supplying the fruit juice stand and are called the **indirect impacts**.

Finally, all along the path from direct impacts to the final indirect impacts, recipients of wages and salaries (employees at the stand, the grocery, and grocery suppliers, fruit farmers, for example) spend a portion of their earnings, creating further cycles of profits, jobs, and income throughout the economy. These impacts are known as the **induced impacts** or **income impacts**. The indirect and induced impacts are the most difficult to identify and measure, requiring a model of the economy.

Impact (multiplier) analysis attempts to relate the total impact (all three types) created by an economic activity to the most easily measured type(s). For example, an impact analysis might reveal that every job created in the fruit juice business represents a total of 3 jobs created in the local economy, meaning that the indirect and induced employment impacts created 2 additional jobs.

Direct, indirect and induced impacts

In general, direct impacts are those created immediately by the economic activity being examined. In the case of a water augmentation scheme, the direct impacts are the expenditures, employment, and income created through the distribution and sale of bulk water. These are always the simplest although not always simple to identify and estimate.

Indirect impacts are the changes in economic activity that result from supplying goods and services to businesses that create the direct impacts. In this case, indirect impacts accrue through suppliers of plant, machinery and construction materials, as well as consumables utilised in the operation of the water augmentation scheme.

Induced impacts are the impacts that are by-products of the industry being studied or initiated by the expenditures of employees of the businesses creating the direct and indirect impacts. For example an Umgeni Water employee will use his or her income to purchase food and clothing locally, creating revenues, jobs, and income at local retailers. Not only do these businesses purchase supplies from other businesses, but their employees make purchases with their income

as well. Furthermore, the availability of an unconstrained water supply may enable local businesses to increase their output and encourage new businesses to come into the area. This creates a new stream of employment and income impacts. The induced impacts include all of the resulting impacts on income, profits, employment, and earnings along these paths.

The multiplier concept and leakages

The preceding discussion might make it seem that an initial expenditure somewhere in the economy would eventually create infinite impacts. This is because we have ignored the matter of **leakages**. In general we are interested only in the impacts that accrue within some local region. Therefore, it is essential to consider only the indirect and induced impacts on businesses and residents within the region. In the fruit juice example, if the local Durban grocery purchased sugar from KwaZulu-Natal, but outside of Durban, and the fresh fruit from Mpumalanga, aside from jobs and earnings at the grocery and fresh produce market, all indirect impacts would flow out of the local economy. The flow of impacts out of the region is the **inter-regional leakage** if it is within the South Africa's borders and the **international leakage** if it is outside South Africa's borders. Another leakage emanates from the fact that wage earners in a region might not spend all their income on consumption but are likely to save a portion of it.

Usually, of course, only a portion of the impact leaks out of the region or income stream at each round of expenditures. Since the sequence of indirect impacts is theoretically infinite, if we knew the share of expenditures that leaked out at each round we could simply calculate the multiplier based on the resulting infinite sequence. For example, if one-third of all expenditures leaked out at each round (so that two two-thirds of each round of expenditures was respent in the region in the subsequent round), the total impact resulting from an initial expenditure of one rand would be:

$$1 + 2/3 + 4/9 + 8/27 + 16/81 + 32/243 + \ldots = l/(l-2/3) = 3$$

Thus, we could apply an expenditure multiplier of 3 to all expenditures to say that every rand injected into the local economy creates two additional rands of expenditures elsewhere in the region. If only 10 percent of the impact leaked out at each round, a multiplier of 1/(1-9) = 10 would result.

The difference between these two multipliers already suggests the importance of accurate leakage estimates for multipliers calculated in this way. In this example a 34 percent change in the estimated share or expenditures remaining in the local economy after each round of expenditure creates a 233 percent change in the multiplier estimate. For leakages that are closer to 0, this relationship worsens (creating infinite multiplier errors for infinitesimal leakage estimation errors in the limit). For example, if 85 percent of each round of expenditures remained in the local economy and we estimated instead that 90 percent remained - a 5,6 percent error - the multiplier would jump from 6,7 to 10,0 - a 50 percent error.

We have therefore used an officially recognised and conservatively estimated set of multipliers in constructing the analytical model for the purposes of the present study. Our source is the Manual for Economic Evaluation of Water Projects, published in 1992 by the Department of Water Affairs and Forestry, Pretoria.

APPENDIX 2

1. Water demand and supply in the Mgeni operational area

Table 1. Projected water demand and supply in the Mgeni operational area

PROJECTED WATER DEMAND AND SUPPLY: UMGENI OPERATIONAL AREA (Million m^3/year)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
DEMAND																
Durban Metro	258.8	261.9	263.8	264.2	263.4	264.5	270.3	277.6	286.3	296.3	306.7	317.5	328.6	340.1	352.1	364.4
Pietermaritzburg TLC	40.2	41.7	43.1	44.5	45.9	47.3	49.0	50.8	52.6	54.5	56.5	58.5	60.6	62.8	65.1	67.4
Other	6.2	7.3	8.3	9.4	9.9	10.4	11.0	11.6	12.2	12.9	13.6	14.3	15.1	15.9	16.7	17.6
Total demand	305.2	310.9	315.2	318.1	319.2	322.2	330.3	339.9	351.1	363.7	376.7	390.3	404.3	418.8	433.9	449.5
SUPPLY																
Yield (Current)	310.0	310.0	310.0													
Yield (Midmar dam)				330.0	330.0	330.0	330.0	330.0								
Yield (Mearns dam)									360.0	360.0	360.0					
Yield (Springgrove dam)												383.0	383.0			
Yield (Phase 1)														495.0	495.0	495.0
Yield (Phase 2)																
Yield (Phase 3)																
Total supply	**310.0**	**310.0**	**310.0**	**330.0**	**330.0**	**330.0**	**330.0**	**330.0**	**360.0**	**360.0**	**360.0**	**383.0**	**383.0**	**495.0**	**495.0**	**495.0**

PROJECTED WATER DEMAND AND SUPPLY: UMGENI OPERATIONAL AREA (Million m^3/year)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
DEMAND															
Durban Metro	377.2	390.5	404.2	418.4	433.2	448.4	464.2	480.5	497.5	515.0	533.1	551.9	571.3	591.4	612.2
Pietermaritzburg TLC	69.8	72.4	75.0	77.7	80.5	83.3	86.3	89.5	92.7	96.0	99.5	103.1	106.8	110.6	114.6
Other	18.6	19.6	20.7	21.8	22.9	24.2	25.5	26.9	28.3	29.8	31.5	33.2	34.9	36.8	38.8
Total demand	465.6	482.4	499.8	517.9	536.6	556.0	576.0	596.9	618.5	640.8	664.0	688.1	713.0	738.8	765.6
SUPPLY															
Yield (Current)															
Yield (Midmar dam)															
Yield (Mearns dam)															
Yield (Springgrove dam)															
Yield (Phase 1)	495.0	495.0	495.0												
Yield (Phase 2)				580.0	580.0	580.0	580.0								
Yield (Phase 3)								720.0	720.0	720.0	720.0	720.0	720.0	720.0	720.0
Total supply	**495.0**	**495.0**	**495.0**	**580.0**	**580.0**	**580.0**	**580.0**	**720.0**	**720.0**	**720.0**	**720.0**	**720.0**	**720.0**	**720.0**	**720.0**

APPENDIX 3: **Scenario 1 (non-augmentation) tables**

1. Study area GGP
2. KwaZulu-Natal GGP
3. Study area water-use productivity sensitivity
4. KwaZulu-Natal water-use productivity sensitivity
5. Study area employment projections
6. KwaZulu-Natal employment projections

Table 1. Study area GGP

SCENARIO 1: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
UNCONSTRAINED GROWTH PROJECTIONS (assuming water is never constrained throughout the time frame of the study)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,927,149	62,406,312	63,927,107	65,490,893	67,099,078	68,753,128	70,454,561	72,204,954	74,005,948	75,859,244	77,766,610	79,729,885	81,750,978	83,831,876	85,974,644
CONSTRAINED GROWTH PROJECTIONS (assuming water is constrained after 2009)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,927,149	62,406,312	63,927,107	65,490,893	67,099,078	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128

SCENARIO 1: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
UNCONSTRAINED GROWTH PROJECTIONS (assuming water is never constrained throughout the time frame of the study)	88,181,428	90,454,462	92,796,069	95,208,668	97,694,773	100,257,004	102,898,087	105,620,862	108,428,285	111,323,436	114,309,525	117,389,894	120,568,030	123,847,565	127,232,287	130,726,146	134,333,262	138,057,933	141,904,643	145,878,071	3,713,965,499
CONSTRAINED GROWTH PROJECTIONS (assuming water is constrained after 2009)	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	2,719,117,077

Table 2. KwaZulu-Natal GGP

SCENARIO1: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
UNCONSTRAINED GROWTH PROJECTIONS (assuming water is never constrained throughout the time frame of the study)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,016,529	90,040,909	92,111,850	94,230,422	96,397,722	98,614,870	100,883,012	103,203,321	105,576,997	108,005,268	110,921,411	113,916,289	116,992,029	120,150,813	123,394,885
CONSTRAINED GROWTH PROJECTIONS (assuming water is constrained after 2009)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,016,529	90,040,909	92,111,850	94,230,422	96,397,722	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870

SCENARIO1: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
UNCONSTRAINED GROWTH PROJECTIONS (assuming water is never constrained throughout the time frame of the study)	126,726,547	130,148,164	133,662,164	137,271,043	140,977,361	144,783,750	148,692,911	152,707,620	156,830,725	161,065,155	165,413,914	169,880,090	174,466,852	179,177,457	184,015,248	188,983,660	194,086,219	199,326,547	204,708,364	210,235,490	5,353,681,222
CONSTRAINED GROWTH PROJECTIONS (assuming water is constrained after 2009)	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	3,907,309,140

Table 3. Study area water-use productivity

SCENARIO1: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,927,149	62,406,312	63,927,107	65,490,893	67,099,078	68,753,128	70,454,561	72,204,954	74,005,948	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,927,149	62,406,312	63,927,107	65,490,893	67,099,078	68,753,128	70,454,561	72,204,954	74,005,948	75,859,244	77,766,610	79,066,097	79,066,097	79,066,097	79,066,097
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,927,149	62,406,312	63,927,107	65,490,893	67,099,078	68,753,128	70,454,561	72,204,954	74,005,948	75,859,244	77,766,610	79,729,885	81,750,978	82,503,753	82,503,753

SCENARIO1: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	75,628,441	2,908,281,289
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	79,066,097	2,993,154,014
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	82,503,753	3,072,131,123

Table 4. KwaZulu-Natal water-use productivity

SCENARIO1: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,016,529	90,040,909	92,111,850	94,230,422	96,397,722	98,614,870	100,883,012	103,203,321	105,576,997	108,005,268	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,016,529	90,040,909	92,111,850	94,230,422	96,397,722	98,614,870	100,883,012	103,203,321	105,576,997	108,005,268	110,921,411	113,407,100	113,407,100	113,407,100	113,407,100
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,016,529	90,040,909	92,111,850	94,230,422	96,397,722	98,614,870	100,883,012	103,203,321	105,576,997	108,005,268	110,921,411	113,916,289	116,992,029	118,337,844	118,337,844

SCENARIO1: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	108,476,357	4,177,055,434
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	113,407,100	4,297,838,332
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	118,337,844	4,410,408,805

Table 5. Study area employment projections

SCENARIO 1: STUDY AREA EMPLOYMENT PROJECTIONS	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
EMPLOYMENT PROJECTIONS (assuming that growth is never constrained)	1,607,181	1,657,589	1,709,577	1,763,196	1,818,496	1,875,531	1,934,355	1,995,024	2,057,595	2,122,129	2,188,687	2,257,333	2,328,131	2,401,150	2,476,459	2,554,131	2,634,238	2,716,857	2,802,068	2,889,952	2,980,592
EMPLOYMENT PROJECTIONS (assuming growth is constrained after 2009)	1,607,181	1,657,589	1,709,577	1,763,196	1,818,496	1,875,531	1,934,355	1,995,024	2,057,595	2,122,129	2,188,687	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333

SCENARIO 1: STUDY AREA EMPLOYMENT PROJECTIONS	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
EMPLOYMENT PROJECTIONS (assuming that growth is never constrained)	3,074,074	3,170,489	3,269,928	3,372,485	3,478,259	3,587,350	3,699,863	3,815,905	3,935,586	4,059,021	4,186,327	4,317,626	4,453,043	4,592,708	4,736,752	4,885,315	5,038,537	5,196,564	5,359,548	5,527,644	130,527,298
EMPLOYMENT PROJECTIONS (assuming growth is constrained after 2009)	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	2,257,333	88,449,344

Table 6. KwaZulu-Natal employment projections

SCENARIO 1: KZN EMPLOYMENT PROJECTIONS	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
EMPLOYMENT PROJECTIONS (assuming that growth is never constrained)	2,665,682	2,745,499	2,827,706	2,912,375	2,999,579	3,089,394	3,181,898	3,277,172	3,375,299	3,476,364	3,580,455	3,687,662	3,798,080	3,911,804	4,028,934	4,149,570	4,273,819	4,401,787	4,533,588	4,669,335	4,809,147
EMPLOYMENT PROJECTIONS (assuming growth is constrained after 2009)	2,665,682	2,745,499	2,827,706	2,912,375	2,999,579	3,089,394	3,181,898	3,277,172	3,375,299	3,476,364	3,580,455	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662

SCENARIO 1: KZN EMPLOYMENT PROJECTIONS	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
EMPLOYMENT PROJECTIONS (assuming that growth is never constrained)	4,953,144	5,101,454	5,254,204	5,411,528	5,573,563	5,740,450	5,912,333	6,089,363	6,271,694	6,459,484	6,652,898	6,852,102	7,057,271	7,268,584	7,486,223	7,710,379	7,941,248	8,179,028	8,423,929	8,676,163	209,410,192
EMPLOYMENT PROJECTIONS (assuming growth is constrained after 2009)	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	3,687,662	144,761,295

APPENDIX 4: Construction and operational expenditure tables

1. Construction expenditure by phase and by year
2. Allocation of construction costs
3. Construction expenditure within study area and multiplier effect
4. Employment opportunities attributable to construction expenditure
5. Allocation of operational expenditure
6. Operational expenditure in study area and multiplier effect
7. Employment opportunities attributable to operational expenditure

Table 1. Construction expenditure by phase and by year

PHASE 1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
Tunnel	0	0	220,400	110,200	110,200	110,200	0	551,000
Treatment works	0	0	0	0	88,500	59,000	0	147,500
Pipeline	0	0	0	0	117,600	78,400	0	196,000
Dam	0	0	0	43,400	24,800	24,800	0	93,000
Pump station	0	0	0	0	0	5,000	0	5,000
SUB-TOTAL	**0**	**0**	**220,400**	**153,600**	**341,100**	**277,400**	**0**	**992,500**
Social and environmental	0	0	0	0	1,500	2,000	1,500	5,000
Professional fees	19,285	22,540	32,910	24,486	27,463	22,192	0	148,875
TOTAL	**19,285**	**22,540**	**253,310**	**178,086**	**370,063**	**301,592**	**1,500**	**1,146,375**

PHASE 2	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
Canal	0	0	65,400	43,600	0	0	0	109,000
Pipeline	0	0	196,800	131200	0	0	0	328,000
Dam	0	0	47,133	26,933	26,933	0	0	101,000
Pump station	0	0	0	5,000	0	0	0	5,000
SUB-TOTAL	**0**	**0**	**309,333**	**206,733**	**26,933**	**0**	**0**	**543,000**
Social and environmental	0	0	1,500	2,000	1,500	0	0	5,000
Professional fees	18,830	19,005	24,922	16,539	2,155	0	0	81,451
TOTAL	**18,830**	**19,005**	**335,755**	**225,272**	**30,588**	**0**	**0**	**629,451**

PHASE 3	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
Dam	0	0	117,133	66,933	66,933	0	0	251,000
Treatment works	0	0	0	108000	72,000	0	0	180,000
Pump station	0	0	0	0	7,500	0	0	7,500
SUB-TOTAL	**0**	**0**	**117,133**	**174,933**	**146,433**	**0**	**0**	**438,500**
Social and environmental	0	0	0	1,500	2,000	1,500	0	5,000
Professional fees	8,785	15,085	15,933	14,258	11,715	0	0	65,776
TOTAL	**8,785**	**15,085**	**133,066**	**190,691**	**160,148**	**1,500**	**0**	**509,275**

Table 2a. Allocation of construction costs (%)

ALLOCATION OF PROJECTED CONSTRUCTION COSTS		% ECONOMIC IMPACT BY LOCALITY				
Item	**Economic sector**	**Total**	**Study area**	**Rest of RSA and outside RSA**	**GDP Yield Multipliers**	**Labour Yield Multipliers**
MATERIALS						
Cement	Non-metallic mineral products	100	100	0	0.5494	20.0953
Sand and stone	Other mining	100	100	0	0.6675	14.7817
Timber	Wood and wood products	100	100	0	0.4128	41.1317
Fuel	Chemicals	100	100	0	0.2958	8.2837
Steel	Iron and steel	100	30	70	0.3542	18.0680
POWER						
Electricity	Electricity, gas and water	100	100	0	0.7515	13.4415
PLANT AND EQUIPMENT						
Mechanical equipment	Machinery	100	20	80	0.6744	12.7425
Electrical equipment	Electrical machinery	100	20	80	0.3505	12.4123
Transport equipment	Transport equipment	100	30	70	0.6571	12.0114
OTHER						
Professional fees	Other services	100	50	50	0.3972	37.1021
Interest	Financial services	100	10	90	0.8142	12.1589
Social and environmental	Other services	100	100	0	0.3972	37.1021

Table 2b. Allocation of construction costs (Rand)

ALLOCATION OF PROJECTED CONSTRUCTION COSTS		PROPORTION OF ECONOMIC IMPACT BY LOCALITY				
Item	**Economic sector**	**Total cost allocation (R'000)**	**Study area**	**Rest of RSA and outside RSA**	**GDP Yield Multipliers**	**Labour Yield Multipliers**
MATERIALS						
Cement	Non-metallic mineral products	191,478	191,478	0	0.5494	20.0953
Sand and stone	Other mining	287,217	287,217	0	0.6675	14.7817
Timber	Wood and wood products	47,870	47,870	0	0.4128	41.1317
Fuel	Chemicals	47,870	47,870	0	0.2958	8.2837
Steel	Iron and steel	382,956	114,887	268,069	0.3542	18.0680
SUB-TOTAL		**957,390**	**689,321**	**268,069**		
POWER						
Electricity	Electricity, gas and water	59,220	59,220	0	0.7515	13.4415
PLANT AND EQUIPMENT						
Mechanical equipment	Machinery	574,434	114,887	459,547	0.6744	12.7425
Electrical equipment	Electrical machinery	287,217	57,443	229,774	0.3505	12.4123
Transport equipment	Transport equipment	95,739	28,722	67,017	0.6571	12.0114
SUB-TOTAL		**957,390**	**201,052**	**756,338**		
OTHER						
Professional services	Other services	296,100	148,050	148,050	0.3972	37.1021
Social and environmental cos	Other services	15,000	15,000	0	0.3972	37.1021
SUB-TOTAL		**311,100**	**155,550**	**155,550**		
TOTAL		**2,285,100**	**1,105,143**	**1,179,957**		

Table 3a. Phase 1 construction expenditure within study area and multiplier effect

PHASE 1 CONSTRUCTION EXPENDITURE (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	19,285	22,540	32,910	24,486	27,463	22,192	0	148,875
Interest	2,507	5,252	37,793	58,144	101,946	133,601	0	339,242
SUB-TOTAL	**21,792**	**27,792**	**70,702**	**82,630**	**129,409**	**155,793**	**0**	**488,117**
INDIRECT EFFECT								
Materials								
Cement	0	0	21,379	14,899	33,087	26,908	0	96,273
Sand and stone	0	0	32,068	22,349	49,630	40,362	0	144,409
Timber	0	0	5,345	3,725	8,272	6,727	0	24,068
Fuel	0	0	5,345	3,725	8,272	6,727	0	24,068
Steel	0	0	42,758	29,798	66,173	53,816	0	192,545
Power								
Electricity	0	0	6,612	4,608	10,233	8,322	0	29,775
Plant and equipment								
Mechanical equipment	0	0	64,136	44,698	99,260	80,723	0	288,818
Electrical equipment	0	0	32,068	22,349	49,630	40,362	0	144,409
Transport equipment	0	0	10,689	7,450	16,543	13,454	0	48,136
Other								
Social and environmental costs	0	0	0	0	1,500	2,000	1,500	5,000
SUB-TOTAL	**0**	**0**	**220,400**	**153,600**	**342,600**	**279,400**	**1,500**	**997,500**
TOTAL	**21,792**	**27,792**	**291,102**	**236,230**	**472,009**	**435,193**	**1,500**	**1,485,617**

PHASE 1 CONSTRUCTION EXPENDITURE WITHIN STUDY AREA (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	9,643	11,270	16,455	12,243	13,732	11,096	0	74,438
Interest	251	525	3,779	5,814	10,195	13,360	0	33,924
SUB-TOTAL	**9,893**	**11,795**	**20,234**	**18,057**	**23,926**	**24,456**	**0**	**108,362**
INDIRECT EFFECT								
Materials								
Cement	0	0	21,379	14,899	33,087	26,908	0	96,273
Sand and stone	0	0	32,068	22,349	49,630	40,362	0	144,409
Timber	0	0	5,345	3,725	8,272	6,727	0	24,068
Fuel	0	0	5,345	3,725	8,272	6,727	0	24,068
Steel	0	0	12,827	8,940	19,852	16,145	0	57,764
Power								
Electricity	0	0	6,612	4,608	10,233	8,322	0	29,775
Plant and equipment								
Mechanical equipment	0	0	12,827	8,940	19,852	16,145	0	57,764
Electrical equipment	0	0	6,414	4,470	9,926	8,072	0	28,882
Transport equipment	0	0	3,207	2,235	4,963	4,036	0	14,441
Other								
Social and environmental costs	0	0	0	0	1,500	2,000	1,500	5,000
SUB-TOTAL	**0**	**0**	**106,023**	**73,889**	**165,586**	**135,443**	**1,500**	**482,442**
TOTAL	**9,893**	**11,795**	**126,257**	**91,946**	**189,512**	**159,899**	**1,500**	**590,804**

PHASE 1 CONSTRUCTION MULTIPLIER EFFECT WITHIN STUDY AREA (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	13,473	15,746	22,991	17,106	19,186	15,503	0	104,004
Interest	455	953	6,856	10,549	18,495	24,238	0	61,545
SUB-TOTAL	**13,927**	**16,699**	**29,847**	**27,654**	**37,681**	**39,741**	**0**	**165,549**
INDIRECT EFFECT								
Materials								
Cement	0	0	11,746	8,186	18,178	14,783	0	52,892
Sand and stone	0	0	21,406	14,918	33,128	26,941	0	96,393
Timber	0	0	2,206	1,538	3,415	2,777	0	9,935
Fuel	0	0	1,581	1,102	2,447	1,990	0	7,119
Steel	0	0	4,543	3,166	7,032	5,718	0	20,460
Power								
Electricity	0	0	4,969	3,463	7,690	6,254	0	22,376
Plant and equipment								
Mechanical equipment	0	0	8,651	6,029	13,388	10,888	0	38,956
Electrical equipment	0	0	2,248	1,567	3,479	2,829	0	10,123
Transport equipment	0	0	2,107	1,469	3,261	2,652	0	9,489
Other								
Social and environmental costs	0	0	0	0	596	794	596	1,986
SUB-TOTAL	**0**	**0**	**59,457**	**41,436**	**92,613**	**75,628**	**596**	**269,729**
TOTAL	**13,927**	**16,699**	**89,303**	**69,090**	**130,294**	**115,369**	**596**	**435,279**

Table 3b. Phase 2 construction expenditure within study area and multiplier effect

PHASE 2 CONSTRUCTION EXPENDITURE (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	18,830	19,005	24,922	16,539	2,155	0	0	81,451
Interest	2,448	4,737	48,035	73,742	0	0	0	128,962
SUB-TOTAL	**21,278**	**23,742**	**72,957**	**90,281**	**2,155**	**0**	**0**	**210,413**
INDIRECT EFFECT								
Materials								
Cement	0	0	30,005	20,053	2,613	0	0	52,671
Sand and stone	0	0	45,008	30,080	3,919	0	0	79,007
Timber	0	0	7,501	5,013	653	0	0	13,168
Fuel	0	0	7,501	5,013	653	0	0	13,168
Steel	0	0	60,011	40,106	5,225	0	0	105,342
Power								
Electricity	0	0	9,280	6,202	808	0	0	16,290
Plant and equipment								
Mechanical equipment	0	0	90,016	60,159	7,838	0	0	158,013
Electrical equipment	0	0	45,008	30,080	3,919	0	0	79,007
Transport equipment	0	0	15,003	10,027	1,306	0	0	26,336
Other								
Social and environmental costs	0	0	1,500	2,000	1,500	0	0	5,000
SUB-TOTAL	**0**	**0**	**310,833**	**208,733**	**28,433**	**0**	**0**	**548,000**
TOTAL	**21,278**	**23,742**	**383,790**	**299,015**	**30,588**	**0**	**0**	**758,413**

PHASE 2 CONSTRUCTION EXPENDITURE WITHIN STUDY AREA (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	9,415	9,503	12,461	8,270	1,078	0	0	40,726
Interest	245	474	4,803	7,374	0	0	0	12,896
SUB-TOTAL	**9,660**	**9,976**	**17,264**	**15,644**	**1,078**	**0**	**0**	**53,622**
INDIRECT EFFECT								
Materials								
Cement	0	0	30,005	20,053	2,613	0	0	52,671
Sand and stone	0	0	45,008	30,080	3,919	0	0	79,007
Timber	0	0	7,501	5,013	653	0	0	13,168
Fuel	0	0	7,501	5,013	653	0	0	13,168
Steel	0	0	18,003	12,032	1,568	0	0	31,603
Power								
Electricity	0	0	9,280	6,202	808	0	0	16,290
Plant and equipment								
Mechanical equipment	0	0	18,003	12,032	1,568	0	0	31,603
Electrical equipment	0	0	9,002	6,016	784	0	0	15,801
Transport equipment	0	0	4,501	3,008	392	0	0	7,901
Other								
Social and environmental costs	0	0	1,500	2,000	1,500	0	0	5,000
SUB-TOTAL	**0**	**0**	**150,305**	**101,449**	**14,456**	**0**	**0**	**266,210**
TOTAL	**9,660**	**9,976**	**167,569**	**117,093**	**15,534**	**0**	**0**	**319,832**

PHASE 2 CONSTRUCTION MULTIPLIER EFFECT WITHIN STUDY AREA (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	13,155	13,277	17,411	11,554	1,505	0	0	56,902
Interest	444	859	8,714	13,378	0	0	0	23,396
SUB-TOTAL	**13,599**	**14,136**	**26,125**	**24,932**	**1,505**	**0**	**0**	**80,298**
INDIRECT EFFECT								
Materials								
Cement	0	0	16,485	11,017	1,435	0	0	28,937
Sand and stone	0	0	30,043	20,078	2,616	0	0	52,737
Timber	0	0	3,097	2,069	270	0	0	5,436
Fuel	0	0	2,219	1,483	193	0	0	3,895
Steel	0	0	6,377	4,262	555	0	0	11,194
Power								
Electricity	0	0	6,974	4,661	607	0	0	12,242
Plant and equipment								
Mechanical equipment	0	0	12,141	8,114	1,057	0	0	21,313
Electrical equipment	0	0	3,155	2,109	275	0	0	5,538
Transport equipment	0	0	2,957	1,977	258	0	0	5,192
Other								
Social and environmental costs	0	0	596	794	596	0	0	1,986
SUB-TOTAL	**0**	**0**	**84,044**	**56,564**	**7,862**	**0**	**0**	**148,469**
TOTAL	**13,599**	**14,136**	**110,169**	**81,497**	**9,367**	**0**	**0**	**228,767**

Table 3c. Phase 3 construction expenditure within study area and multiplier effect

PHASE 3 CONSTRUCTION EXPENDITURE (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	8,785	15,085	15,933	14,258	11,715	0	0	65,776
Interest	1,142	3,019	20,094	43,395	61,000	0	0	128,649
SUB-TOTAL	**9,927**	**18,104**	**36,027**	**57,652**	**72,715**	**0**	**0**	**194,424**
INDIRECT EFFECT								
Materials								
Cement	0	0	11,362	16,969	14,204	0	0	42,534
Sand and stone	0	0	17,043	25,453	21,306	0	0	63,802
Timber	0	0	2,840	4,242	3,551	0	0	10,634
Fuel	0	0	2,840	4,242	3,551	0	0	10,634
Steel	0	0	22,724	33,937	28,408	0	0	85,069
Power								
Electricity	0	0	3,514	5,248	4,393	0	0	13,155
Plant and equipment								
Mechanical equipment	0	0	34,086	50,906	42,612	0	0	127,603
Electrical equipment	0	0	17,043	25,453	21,306	0	0	63,802
Transport equipment	0	0	5,681	8,484	7,102	0	0	21,267
Other								
Social and environmental costs	0	0	0	1,500	2,000	1,500	0	5,000
SUB-TOTAL	**0**	**0**	**117,133**	**176,433**	**148,433**	**1,500**	**0**	**443,500**
TOTAL	**9,927**	**18,104**	**153,160**	**234,086**	**221,148**	**1,500**	**0**	**637,924**

PHASE 3 CONSTRUCTION EXPENDITURE WITHIN STUDY AREA (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	4,393	7,543	7,967	7,129	5,858	0	0	32,888
Interest	114	302	2,009	4,339	6,100	0	0	12,865
SUB-TOTAL	**4,507**	**7,844**	**9,976**	**11,468**	**11,957**	**0**	**0**	**45,753**
INDIRECT EFFECT								
Materials								
Cement	0	0	11,362	16,969	14,204	0	0	42,534
Sand and stone	0	0	17,043	25,453	21,306	0	0	63,802
Timber	0	0	2,840	4,242	3,551	0	0	10,634
Fuel	0	0	2,840	4,242	3,551	0	0	10,634
Steel	0	0	6,817	10,181	8,522	0	0	25,521
Power								
Electricity	0	0	3,514	5,248	4,393	0	0	13,155
Plant and equipment								
Mechanical equipment	0	0	6,817	10,181	8,522	0	0	25,521
Electrical equipment	0	0	3,409	5,091	4,261	0	0	12,760
Transport equipment	0	0	1,704	2,545	2,131	0	0	6,380
Other								
Social and environmental costs	0	0	0	1,500	2,000	1,500	0	5,000
SUB-TOTAL	**0**	**0**	**56,347**	**85,652**	**72,442**	**1,500**	**0**	**215,940**
TOTAL	**4,507**	**7,844**	**66,323**	**97,120**	**84,399**	**1,500**	**0**	**261,693**

PHASE 3 CONSTRUCTION MULTIPLIER EFFECT WITHIN STUDY AREA (R'000)								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
DIRECT EFFECT								
Professional fees	6,137	10,538	11,131	9,960	8,184	0	0	45,951
Interest	207	548	3,645	7,873	11,067	0	0	23,339
SUB-TOTAL	**6,344**	**11,086**	**14,776**	**17,833**	**19,251**	**0**	**0**	**69,290**
INDIRECT EFFECT								
Materials								
Cement	0	0	6,242	9,323	7,804	0	0	23,368
Sand and stone	0	0	11,376	16,990	14,222	0	0	42,588
Timber	0	0	1,173	1,751	1,466	0	0	4,390
Fuel	0	0	840	1,255	1,050	0	0	3,145
Steel	0	0	2,415	3,606	3,019	0	0	9,039
Power								
Electricity	0	0	2,641	3,944	3,301	0	0	9,886
Plant and equipment								
Mechanical equipment	0	0	4,597	6,866	5,748	0	0	17,211
Electrical equipment	0	0	1,195	1,784	1,494	0	0	4,473
Transport equipment	0	0	1,120	1,673	1,400	0	0	4,192
Other								
Social and environmental costs	0	0	0	596	794	596	0	1,986
SUB-TOTAL	**0**	**0**	**31,599**	**47,787**	**40,297**	**596**	**0**	**120,279**
TOTAL	**6,344**	**11,086**	**46,375**	**65,620**	**59,548**	**596**	**0**	**189,569**

Table 4. Employment opportunities attributable to construction expenditure

PHASE 1 EMPLOYMENT OPPORTUNITIES CREATED DUE TO CONSTRUCTION EXPENDITURE WITHIN STUDY AREA								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
Materials								
Cement	0	0	430	299	665	541	0	1,935
Sand and stone	0	0	474	330	734	597	0	2,135
Timber	0	0	220	153	340	277	0	990
Fuel	0	0	44	31	69	56	0	199
Steel	0	0	232	162	359	292	0	1,044
Power								
Electricity	0	0	89	62	138	112	0	400
Plant and equipment								
Mechanical equipment	0	0	163	114	253	206	0	736
Electrical equipment	0	0	80	55	123	100	0	358
Transport equipment	0	0	39	27	60	48	0	173
Other								
Professional fees	358	418	611	454	509	412	0	2,762
Interest	3	6	46	71	124	162	0	412
Social and environmental costs	0	0	0	0	56	74	56	186
TOTAL	**361**	**425**	**2,426**	**1,758**	**3,428**	**2,876**	**56**	**11,330**

PHASE 2 EMPLOYMENT OPPORTUNITIES CREATED DUE TO CONSTRUCTION EXPENDITURE WITHIN STUDY AREA								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
Materials								
Cement	0	0	603	403	52	0	0	1,058
Sand and stone	0	0	665	445	58	0	0	1,168
Timber	0	0	309	206	27	0	0	542
Fuel	0	0	62	42	5	0	0	109
Steel	0	0	325	217	28	0	0	571
Power								
Electricity	0	0	125	83	11	0	0	219
Plant and equipment								
Mechanical equipment	0	0	229	153	20	0	0	403
Electrical equipment	0	0	112	75	10	0	0	196
Transport equipment	0	0	54	36	5	0	0	95
Other								
Professional fees	349	353	462	307	40	0	0	1,511
Interest	3	6	58	90	0	0	0	157
Social and environmental costs	0	0	56	74	56	0	0	186
TOTAL	**352**	**358**	**3,061**	**2,131**	**312**	**0**	**0**	**6,214**

PHASE 3 EMPLOYMENT OPPORTUNITIES CREATED DUE TO CONSTRUCTION EXPENDITURE WITHIN STUDY AREA								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	TOTAL
Materials								
Cement	0	0	228	341	285	0	0	855
Sand and stone	0	0	252	376	315	0	0	943
Timber	0	0	117	174	146	0	0	437
Fuel	0	0	24	35	29	0	0	88
Steel	0	0	123	184	154	0	0	461
Power								
Electricity	0	0	47	71	59	0	0	177
Plant and equipment								
Mechanical equipment	0	0	87	130	109	0	0	325
Electrical equipment	0	0	42	63	53	0	0	158
Transport equipment	0	0	20	31	26	0	0	77
Other								
Professional fees	163	280	296	264	217	0	0	1,220
Interest	1	4	24	53	74	0	0	156
Social and environmental costs	0	0	0	56	74	56	0	186
TOTAL	**164**	**284**	**1,261**	**1,778**	**1,542**	**56**	**0**	**5,084**

Table 5. Allocation of operational expenditure

ALLOCATION OF PROJECTED OPERATIONAL COSTS		% TOTAL ECONOMIC IMPACT BY LOCALITY				
Item	**Economic sector**	**Total cost allocation (%)**	**Study area (%)**	**Rest of RSA and outside RSA (%)**	**GDP Yield Multipliers**	**Labour Yield Multipliers**
CIVIL						
Materials		**15**				
Cement	Non-metallic mineral products	5	100	0	0.5494	20.0953
Sand and stone	Other mining	5	100	0	0.6675	14.7817
Timber	Wood and wood products	5	100	0	0.4128	41.1317
Fuel	Chemicals	5	100	0	0.2958	8.2837
Steel	Iron and steel	5	30	70	0.3542	18.0680
Plastic	Plastic products	25	40	60	0.3214	20.5910
Rubber	Rubber products	25	20	80	0.3436	21.3213
Paint	Chemicals	25	90	10	0.2958	8.2837
Plant and equipment		**15**				
Mechanical equipment	Machinery	10	20	80	0.6744	12.7425
Electrical equipment	Other machinery	10	20	80	0.3505	12.4123
Transport equipment	Transport equipment	80	30	70	0.6571	12.0114
Labour		**70**				
Salaries and wages	Other services	100	20	80	0.3972	37.1021
MECHANICAL AND ELECTRICAL						
Materials		**10**				
Timber	Wood and wood products	5	100	0	0.4128	41.1317
Fuel	Petroleum products	5	100	0	0.2958	8.2837
Steel	Iron and steel	10	30	70	0.3542	18.0680
Plastic	Plastic products	27	40	60	0.3214	20.5910
Rubber	Rubber products	27	20	80	0.3436	21.3213
Paint	Chemicals	27	90	10	0.2958	8.2837
Plant and equipment		**70**				
Mechanical equipment	Machinery	60	20	80	0.6744	12.7425
Electrical equipment	Other machinery	30	20	80	0.3505	12.4123
Transport equipment	Transport equipment	10	30	70	0.6571	12.0114
Labour		**20**				
Salaries and wages	Other services	100	20	80	0.3972	37.1021
FINANCE						
Interest	Financial services	100	10	90	0.8142	12.1589
POWER						
Electricity	Electricity, gas and water	100	100	0	0.7515	13.4415

Table 6a. Phase 1 operational expenditure in study area and muliplier effect

PHASE 1 PRIMARY AND SECONDARY EFFECTS (DIRECT AND INDIRECT) OF OPERATIONAL EXPENDITURE WITHIN STUDY AREA (R'000)																											
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
CIVIL																											
DIRECT EFFECT																											
Salaries and wages	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277
INDIRECT EFFECT																											
Cement	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Sand and stone	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Timber	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Fuel	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Steel	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Plastic	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Rubber	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Paint	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Mechanical equipment	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Electrical equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transport equipment	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
SUB-TOTAL	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**	**361**
MECHANICAL AND ELECTRICAL																											
DIRECT EFFECT																											
Salaries and wages	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
INDIRECT EFFECT																											
Timber	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Fuel	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Steel	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Plastic	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Rubber	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Paint	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
Mechanical equipment	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228
Electrical equipment	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
Transport equipment	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56
SUB-TOTAL	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**	**637**
Interest	26,968	24,820	22,822	20,965	19,235	17,625	16,123	14,723	13,415	12,192	11,047	9,975	8,968	8,021	7,129	6,288	5,491	4,736	4,019	3,334	2,680	2,052	1,448	864	297	0	0
Electricity	31	57	83	111	139	168	199	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230
TOTAL	**27,997**	**25,875**	**23,904**	**22,074**	**20,373**	**18,791**	**17,320**	**15,951**	**14,643**	**13,420**	**12,276**	**11,203**	**10,196**	**9,249**	**8,358**	**7,516**	**6,720**	**5,965**	**5,247**	**4,563**	**3,908**	**3,280**	**2,676**	**2,092**	**1,526**	**1,228**	**1,228**

NB: Years 28-40 same as year 27

Table 6b. Phase 2 operational expenditure and multiplier effect

PHASE 2 PRIMARY AND SECONDARY EFFECTS (DIRECT AND INDIRECT) OF OPERATIONAL EXPENDITURE WITHIN STUDY AREA (R'000)																											
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
CIVIL																											
DIRECT EFFECT																											
Salaries and wages	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
INDIRECT EFFECT																											
Cement	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Sand and stone	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Timber	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Fuel	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Steel	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Plastic	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Rubber	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Paint	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Mechanical equipment	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Electrical equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transport equipment	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
SUB-TOTAL	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**	**294**
MECHANICAL AND ELECTRICAL																											
DIRECT EFFECT																											
Salaries and wages	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183
INDIRECT EFFECT																											
Timber	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Fuel	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Steel	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Plastic	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Rubber	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Paint	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
Mechanical equipment	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186
Electrical equipment	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Transport equipment	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
SUB-TOTAL	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**	**518**
Interest	14,808	13,628	12,531	11,511	10,562	9,677	8,853	8,084	7,366	6,694	6,066	5,477	4,924	4,404	3,915	3,452	3,015	2,601	2,207	1,831	1,471	1,127	795	474	163	0	0
Electricity	31	57	83	111	139	168	199	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230
TOTAL	**15,651**	**14,497**	**13,427**	**12,434**	**11,513**	**10,658**	**9,864**	**9,126**	**8,408**	**7,737**	**7,108**	**6,519**	**5,966**	**5,446**	**4,957**	**4,495**	**4,057**	**3,643**	**3,249**	**2,873**	**2,514**	**2,169**	**1,837**	**1,516**	**1,205**	**1,042**	**1,042**

NB: Years 28-40 same as year 27

Table 6c. Phase 3 operational expenditure in study area and multiplier effect

PHASE 3 PRIMARY AND SECONDARY EFFECTS (DIRECT AND INDIRECT) OF OPERATIONAL EXPENDITURE WITHIN STUDY AREA (R'000)																											
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
CIVIL																											
DIRECT EFFECT																											
Salaries and wages	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169
INDIRECT EFFECT																											
Cement	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sand and stone	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Timber	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Fuel	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Steel	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Plastic	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Rubber	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Paint	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Mechanical equipment	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Electrical equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transport equipment	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
SUB-TOTAL	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**	**221**
MECHANICAL AND ELECTRICAL																											
DIRECT EFFECT																											
Salaries and wages	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207
INDIRECT EFFECT																											
Timber	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Fuel	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Steel	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Plastic	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Rubber	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Paint	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Mechanical equipment	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
Electrical equipment	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
Transport equipment	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51
SUB-TOTAL	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**	**585**
Interest	11,981	11,026	10,139	9,313	8,545	7,830	7,163	6,541	5,959	5,416	4,908	4,431	3,984	3,563	3,167	2,793	2,440	2,104	1,785	1,481	1,191	912	643	384	132	0	0
Electricity	31	57	83	111	139	168	199	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230
TOTAL	**12,817**	**11,888**	**11,027**	**10,229**	**9,490**	**8,803**	**8,167**	**7,576**	**6,995**	**6,451**	**5,943**	**5,467**	**5,019**	**4,599**	**4,202**	**3,829**	**3,475**	**3,139**	**2,821**	**2,516**	**2,226**	**1,947**	**1,678**	**1,419**	**1,167**	**1,035**	**1,035**

NB: Years 28-40 same as year 27

Table 7a. Phase 1 employment opportunities attributable to operational expenditure

PHASE 1 EMPLOYMENT OPPORTUNITIES CREATED DUE TO OPERATIONAL EXPENDITURE WITHIN STUDY AREA (R'000)																										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
CIVIL																											
Salaries and wages	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36
Cement	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Sand and stone	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Timber	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Fuel	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Steel	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Plastic	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Rubber	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Paint	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Mechanical equipment	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Electrical equipment	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Transport equipment	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
SUB-TOTAL	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**	**10.10**
MECHANICAL AND ELECTRICAL																											
Salaries and wages	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98
Timber	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Fuel	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Steel	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Plastic	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Rubber	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Paint	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Mechanical equipment	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31	4.31
Electrical equipment	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Transport equipment	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
SUB-TOTAL	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**	**16.77**
Interest	180.74	166.34	152.96	140.51	128.92	118.12	108.06	98.67	89.91	81.71	74.04	66.85	60.10	53.76	47.78	42.14	36.80	31.74	26.93	22.35	17.96	13.75	9.70	5.79	1.99	0.00	0.00
Electricity	0.55	1.01	1.49	1.98	2.49	3.01	3.55	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11
TOTAL	**208.16**	**194.23**	**181.32**	**169.36**	**158.28**	**148.00**	**138.48**	**129.66**	**120.89**	**112.70**	**105.03**	**97.84**	**91.09**	**84.74**	**78.77**	**73.12**	**67.79**	**62.73**	**57.92**	**53.33**	**48.95**	**44.74**	**40.69**	**36.77**	**32.98**	**30.99**	**30.99**

NB: Years 28-40 same as year 27

Table 7b. Phase 2 employment opportunities attributable to operational expenditure

PHASE 2 EMPLOYMENT OPPORTUNITIES CREATED DUE TO OPERATIONAL EXPENDITURE WITHIN STUDY AREA (R'000)																										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
CIVIL																											
Salaries and wages	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99
Cement	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Sand and stone	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Timber	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Fuel	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Steel	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Plastic	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Rubber	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Paint	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Mechanical equipment	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Electrical equipment	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Transport equipment	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
SUB-TOTAL	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**	**8.21**
MECHANICAL AND ELECTRICAL																											
Salaries and wages	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87
Timber	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Fuel	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Steel	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Plastic	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Rubber	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
Paint	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Mechanical equipment	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51
Electrical equipment	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71
Transport equipment	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
SUB-TOTAL	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**	**13.65**
Interest	99.24	91.34	83.99	77.15	70.79	64.86	59.33	54.18	49.37	44.87	40.65	36.71	33.00	29.52	26.24	23.14	20.21	17.43	14.79	12.27	9.86	7.55	5.33	3.18	1.09	0.00	0.00
Electricity	0.55	1.01	1.49	1.98	2.49	3.01	3.55	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11
TOTAL	**121.65**	**114.21**	**107.34**	**100.99**	**95.13**	**89.73**	**84.74**	**80.15**	**75.34**	**70.84**	**66.63**	**62.68**	**58.97**	**55.49**	**52.21**	**49.11**	**46.18**	**43.40**	**40.76**	**38.24**	**35.84**	**33.53**	**31.30**	**29.15**	**27.07**	**25.97**	**25.97**

NB: Years 28-40 same as year 27

Table 7c. Phase 3 employment opportunities attributable to operational expenditure

PHASE 3 EMPLOYMENT OPPORTUNITIES CREATED DUE TO OPERATIONAL EXPENDITURE WITHIN STUDY AREA (R'000)																										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
CIVIL																											
Salaries and wages	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49
Cement	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Sand and stone	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Timber	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Fuel	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Steel	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Plastic	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Rubber	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Paint	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Mechanical equipment	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Electrical equipment	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Transport equipment	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
SUB-TOTAL	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**	**6.16**
MECHANICAL AND ELECTRICAL																											
Salaries and wages	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49	5.49
Timber	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Fuel	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Steel	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Plastic	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Rubber	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Paint	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Mechanical equipment	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Electrical equipment	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Transport equipment	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
SUB-TOTAL	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**	**15.40**
Interest	80.29	73.90	67.95	62.42	57.27	52.48	48.01	43.84	39.94	36.30	32.89	29.70	26.70	23.88	21.23	18.72	16.35	14.10	11.96	9.93	7.98	6.11	4.31	2.57	0.89	0.00	0.00
Electricity	0.55	1.01	1.49	1.98	2.49	3.01	3.55	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11
TOTAL	**102.40**	**96.47**	**91.00**	**85.96**	**81.32**	**77.05**	**73.12**	**69.51**	**65.61**	**61.97**	**58.57**	**55.37**	**52.37**	**49.56**	**46.90**	**44.39**	**42.02**	**39.78**	**37.64**	**35.60**	**33.65**	**31.78**	**29.98**	**28.25**	**26.56**	**25.67**	**25.67**

NB: Years 28-40 same as year 27

APPENDIX 5: **Scenario 2 (augmentation) tables**

1. Study area GGP
2. KwaZulu-Natal GGP
3. Study area water-use productivity sensitivity
4. KwaZulu-Natal water-use productivity sensitivity
5. Study area employment projections
6. KwaZulu-Natal employment projections

Table 1. Study area GGP after augmentation

SCENARIO 2: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Base case (non-augmentation) scenario	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,927,149	62,406,312	63,927,107	65,490,893	67,099,078	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128
Base growth projections before construction and operational effects	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,927,149	62,406,312	63,927,107	65,490,893	67,099,078	68,753,128	70,454,561	72,204,954	74,005,948	75,859,244	77,766,610	79,729,885	81,750,978	83,831,876	85,974,644
Construction effect on GGP	0	0	0	0	0	0	13,927	16,699	89,303	69,090	130,294	115,369	596	0	13,599	14,136	110,169	87,841	20,453	46,375	65,620
Operational effect on GGP	0	0	0	0	0	0	0	0	0	0	0	0	27,997	25,875	23,904	22,074	20,373	18,791	32,971	30,448	28,070
Total impact of augmentation on GGP	0	0	0	0	0	0	13,927	16,699	89,303	69,090	130,294	115,369	28,593	25,875	37,503	36,210	130,541	106,632	53,424	76,823	93,690
Projected GGP after augmentation	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,941,077	62,423,011	64,016,411	65,559,983	67,229,372	68,868,497	70,483,154	72,230,829	74,043,451	75,895,454	77,897,151	79,836,517	81,804,402	83,908,699	86,068,334

SCENARIO 2: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
Base case (non-augmentation) scenario	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	68,753,128	2,719,117,077
Base growth projections before construction and operational effects	88,181,428	90,454,462	92,796,069	95,208,668	97,694,773	100,257,004	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	102,898,087	3,432,020,695
Construction effect on GGP	59,548	596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	853,615
Operational effect on GGP	25,854	36,605	33,749	31,087	28,605	26,255	24,056	21,994	20,060	18,208	16,461	14,808	13,241	11,753	10,333	8,977	7,930	7,217	6,537	5,886	600,119
Total impact of augmentation on GGP	85,402	37,201	33,749	31,087	28,605	26,255	24,056	21,994	20,060	18,208	16,461	14,808	13,241	11,753	10,333	8,977	7,930	7,217	6,537	5,886	1,453,733
Projected GGP after augmentation	88,266,830	90,491,663	92,829,818	95,239,755	97,723,378	100,283,259	102,922,143	102,920,082	102,918,147	102,916,295	102,914,548	102,912,895	102,911,329	102,909,840	102,908,421	102,907,064	102,906,017	102,905,304	102,904,624	102,903,973	3,433,474,428

Table 2. KwaZulu-Natal GGP after augmentation

SCENARIO 2: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Base case (non-augmentation) scenario	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,016,529	90,040,909	92,111,850	94,230,422	96,397,722	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870
Base growth projections before construction and operational effects	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,016,529	90,040,909	92,111,850	94,230,422	96,397,722	98,614,870	100,883,012	103,203,321	105,576,997	108,005,268	110,921,411	113,916,289	116,992,029	120,150,813	123,394,885
Construction effect on GGP	0	0	0	0	0	0	13,927	16,699	89,303	69,090	130,294	115,369	596	0	13,599	14,136	110,169	87,841	20,453	46,375	65,620
Operational effect on GGP	0	0	0	0	0	0	0	0	0	0	0	0	27,997	25,875	23,904	22,074	20,373	18,791	32,971	30,448	28,070
Total impact of augmentation on GGP	0	0	0	0	0	0	13,927	16,699	89,303	69,090	130,294	115,369	28,593	25,875	37,503	36,210	130,541	106,632	53,424	76,823	93,690
Projected GGP after augmentation	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,030,456	90,057,608	92,201,153	94,299,513	96,528,016	98,730,239	100,911,605	103,229,196	105,614,500	108,041,478	111,051,952	114,022,921	117,045,452	120,227,636	123,488,575

SCENARIO 2: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
Base case (non-augmentation) scenario	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	98,614,870	3,907,309,140
Base growth projections before construction and operational effects	126,726,547	130,148,164	133,662,164	137,271,043	140,977,361	144,783,750	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	148,692,911	4,945,791,723
Construction effect on GGP	59,548	596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	853,615
Operational effect on GGP	25,854	36,605	33,749	31,087	28,605	26,255	24,056	21,994	20,060	18,208	16,461	14,808	13,241	11,753	10,333	8,977	7,930	7,217	6,537	5,886	600,119
Total impact of augmentation on GGP	85,402	37,201	33,749	31,087	28,605	26,255	24,056	21,994	20,060	18,208	16,461	14,808	13,241	11,753	10,333	8,977	7,930	7,217	6,537	5,886	1,453,733
Projected GGP after augmentation	126,811,949	130,185,365	133,695,913	137,302,130	141,005,966	144,810,005	148,716,967	148,714,905	148,712,971	148,711,119	148,709,371	148,707,719	148,706,152	148,704,664	148,703,244	148,701,888	148,700,841	148,700,128	148,699,448	148,698,797	4,947,245,457

Table 3. Study area water-use productivity

SCENARIO 2: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,941,077	62,423,011	64,016,411	65,559,983	67,229,372	68,868,497	70,483,154	72,230,829	74,043,451	75,895,454	77,897,151	79,836,517	81,804,402	83,908,699	86,068,334
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,941,077	62,423,011	64,016,411	65,559,983	67,229,372	68,868,497	70,483,154	72,230,829	74,043,451	75,895,454	77,897,151	79,836,517	81,804,402	83,908,699	86,068,334
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	52,856,332	54,111,607	55,401,331	56,726,595	58,088,530	59,488,309	60,941,077	62,423,011	64,016,411	65,559,983	67,229,372	68,868,497	70,483,154	72,230,829	74,043,451	75,895,454	77,897,151	79,836,517	81,804,402	83,908,699	86,068,334

SCENARIO 2: STUDY AREA GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	88,266,830	90,491,663	92,829,818	95,239,755	97,723,378	100,283,259	102,922,143	105,642,856	108,448,345	113,206,104	113,204,356	113,202,704	113,201,137	113,199,649	113,198,229	113,196,873	113,195,826	113,195,113	113,194,433	113,193,782	3,554,915,296
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	88,266,830	90,491,663	92,829,818	95,239,755	97,723,378	100,283,259	102,922,143	105,642,856	108,448,345	111,341,644	114,325,985	117,404,702	118,346,042	118,344,553	118,343,134	118,341,777	118,340,730	118,340,017	118,339,337	118,338,686	3,599,533,698
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	88,266,830	90,491,663	92,829,818	95,239,755	97,723,378	100,283,259	102,922,143	105,642,856	108,448,345	111,341,644	114,325,985	117,404,702	120,581,271	123,489,457	123,488,038	123,486,682	123,485,635	123,484,921	123,484,241	123,483,591	3,637,783,258

Table 4. KwaZulu-Natal water-use productivity

SCENARIO 2: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,030,456	90,057,608	92,201,153	94,299,513	96,528,016	98,730,239	100,911,605	103,229,196	105,614,500	108,041,478	111,051,952	114,022,921	117,045,452	120,227,636	123,488,575
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,030,456	90,057,608	92,201,153	94,299,513	96,528,016	98,730,239	100,911,605	103,229,196	105,614,500	108,041,478	111,051,952	114,022,921	117,045,452	120,227,636	123,488,575
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	76,791,020	78,557,213	80,364,029	82,212,402	84,103,287	86,037,663	88,030,456	90,057,608	92,201,153	94,299,513	96,528,016	98,730,239	100,911,605	103,229,196	105,614,500	108,041,478	111,051,952	114,022,921	117,045,452	120,227,636	123,488,575

SCENARIO 2: KZN GGP AT FACTOR COST AND CONSTANT 1997 PRICES (R'000)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 10% after constraint)	126,811,949	130,185,365	133,695,913	137,302,130	141,005,966	144,810,005	148,716,967	152,729,614	156,850,785	161,083,363	163,578,663	163,577,010	163,575,443	163,573,955	163,572,536	163,571,179	163,570,132	163,569,419	163,568,739	163,568,088	5,120,463,134
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 15% after constraint)	126,811,949	130,185,365	133,695,913	137,302,130	141,005,966	144,810,005	148,716,967	152,729,614	156,850,785	161,083,363	165,430,375	169,894,898	171,010,089	171,008,600	171,007,181	171,005,824	171,004,777	171,004,064	171,003,384	171,002,734	5,188,109,898
GROWTH UNCONSTRAINED BETWEEN 1998-2009 (water productivity increases by 20% after constraint)	126,811,949	130,185,365	133,695,913	137,302,130	141,005,966	144,810,005	148,716,967	152,729,614	156,850,785	161,083,363	165,430,375	169,894,898	174,480,094	178,443,246	178,441,827	178,440,470	178,439,423	178,438,710	178,438,030	178,437,379	5,243,622,422

Table 5. Study area employment projections

SCENARIO 2: STUDY AREA EMPLOYMENT PROJECTIONS	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
BASE CASE EMPLOYMENT PROJECTIONS (non-augmentation)	1,607,181	1,657,589	1,709,577	1,763,196	1,818,496	1,875,531	1,934,355	1,995,024	2,057,595	2,122,129	2,188,687	2,257,333	2,328,131	2,401,150	2,476,459	2,554,131	2,634,238	2,716,857	2,802,068	2,889,952	2,980,592
BASE EMPLOYMENT PROJECTIONS (augmentation)	1,607,181	1,657,589	1,709,577	1,763,196	1,818,496	1,875,531	1,934,355	1,995,024	2,057,595	2,122,129	2,188,687	2,257,333	2,328,131	2,401,150	2,476,459	2,554,131	2,634,238	2,716,857	2,802,068	2,889,952	2,980,592
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO CONSTRUCTION OF AUGMENTATION SCHEME	0	0	0	0	0	0	0	0	0	0	0	0	208	194	181	169	158	148	260	244	228
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO OPERATION OF AUGMENTATION SCHEME	0	0	0	0	0	0	361	425	2,426	1,758	3,428	2,876	56	0	352	358	3,061	2,295	595	1,261	1,778
PROJECTED EMPLOYMENT AFTER AUGMENTATION	1,607,181	1,657,589	1,709,577	1,763,196	1,818,496	1,875,531	1,934,716	1,995,448	2,060,022	2,123,888	2,192,116	2,260,209	2,328,395	2,401,345	2,476,993	2,554,658	2,637,457	2,719,301	2,802,924	2,891,456	2,982,598

SCENARIO 2: STUDY AREA EMPLOYMENT PROJECTIONS	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
BASE CASE EMPLOYMENT PROJECTIONS (non-augmentation)	3,074,074	3,170,489	3,269,928	3,372,485	3,478,259	3,587,350	3,699,863	3,815,905	3,935,586	4,059,021	4,186,327	4,317,626	4,453,043	4,592,708	4,736,752	4,885,315	5,038,537	5,196,564	5,359,548	5,527,644	130,527,298
BASE EMPLOYMENT PROJECTIONS (augmentation)	3,074,074	3,170,489	3,269,928	3,372,485	3,478,259	3,587,350	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	3,699,863	118,520,940
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO CONSTRUCTION OF AUGMENTATION SCHEME	214	303	284	267	251	235	221	208	195	183	171	160	149	139	130	121	114	109	104	100	5,447
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO OPERATION OF AUGMENTATION SCHEME	1,542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22,572
PROJECTED EMPLOYMENT AFTER AUGMENTATION	3,075,830	3,170,792	3,270,212	3,372,752	3,478,510	3,587,586	3,700,084	3,700,071	3,700,058	3,700,046	3,700,034	3,700,023	3,700,012	3,700,002	3,699,993	3,699,984	3,699,977	3,699,972	3,699,967	3,699,963	118,548,959

Table 6. KwaZulu-Natal employment projections

SCENARIO 2: KZN EMPLOYMENT PROJECTIONS	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
BASE CASE EMPLOYMENT PROJECTIONS (non-augmentation)	2,665,682	2,745,499	2,827,706	2,912,375	2,999,579	3,089,394	3,181,898	3,277,172	3,375,299	3,476,364	3,580,455	3,687,662	3,798,080	3,911,804	4,028,934	4,149,570	4,273,819	4,401,787	4,533,588	4,669,335	4,809,147
BASE EMPLOYMENT PROJECTIONS (augmentation)	2,665,682	2,745,499	2,827,706	2,912,375	2,999,579	3,089,394	3,181,898	3,277,172	3,375,299	3,476,364	3,580,455	3,687,662	3,798,080	3,911,804	4,028,934	4,149,570	4,273,819	4,401,787	4,533,588	4,669,335	4,809,147
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO CONSTRUCTION OF AUGMENTATION SCHEME	0	0	0	0	0	0	0	0	0	0	0	0	208	194	181	169	158	148	260	244	228
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO OPERATION OF AUGMENTATION SCHEME	0	0	0	0	0	0	361	425	2,426	1,758	3,428	2,876	56	0	352	358	3,061	2,295	595	1,261	1,778
PROJECTED EMPLOYMENT AFTER AUGMENTATION	2,665,682	2,745,499	2,827,706	2,912,375	2,999,579	3,089,394	3,182,259	3,277,596	3,377,725	3,478,122	3,583,883	3,690,538	3,798,344	3,911,999	4,029,467	4,150,098	4,277,037	4,404,231	4,534,444	4,670,839	4,811,153

SCENARIO 2: KZN EMPLOYMENT PROJECTIONS	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
BASE CASE EMPLOYMENT PROJECTIONS (non-augmentation)	4,953,144	5,101,454	5,254,204	5,411,528	5,573,563	5,740,450	5,912,333	6,089,363	6,271,694	6,459,484	6,652,898	6,852,102	7,057,271	7,268,584	7,486,223	7,710,379	7,941,248	8,179,028	8,423,929	8,676,163	209,410,192
BASE EMPLOYMENT PROJECTIONS (augmentation)	4,953,144	5,101,454	5,254,204	5,411,528	5,573,563	5,740,450	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	5,912,333	191,202,157
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO CONSTRUCTION OF AUGMENTATION SCHEME	214	303	284	267	251	235	221	208	195	183	171	160	149	139	130	121	114	109	104	100	5,447
EMPLOYMENT OPPORTUNITIES ATTRIBUTABLE TO OPERATION OF AUGMENTATION SCHEME	1,542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22,572
PROJECTED EMPLOYMENT AFTER AUGMENTATION	4,954,900	5,101,757	5,254,488	5,411,795	5,573,814	5,740,685	5,912,554	5,912,541	5,912,528	5,912,516	5,912,504	5,912,493	5,912,482	5,912,472	5,912,463	5,912,454	5,912,447	5,912,442	5,912,437	5,912,433	191,230,176