# Socio-Economic Impact of the Outcomes Relating to the uMkhomazi-Mgeni Augmentation Scheme

# Final Report

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# 1 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 (eThekwini Municipality) and Pietermaritzburg (Msunduzi Local Municipality) 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 area, 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, and even the country. 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.

This study is informed by a number of developments that have taken place over the last fifteen years. The water resources available in the Mooi and Mgeni catchment to augment the Mgeni System will be fully utilised after the planned commissioning of Phase 2B of the Mooi-Mgeni Transfer Scheme (MMTS-2) occurs in 2015. A major development in the lower Mgeni System has been the undertaking of load-shifting exercises by the eThekwini Municipality. The Western Aqueduct project, expected to be fully commissioned in mid-2018, represents the most significant of these. The load-shifting activities will result in the full utilisation of the upper Mgeni resource by 2018. At this point current data suggests further augmentation of the Mgeni system will then be a necessity, since further water resource developments within the Mooi-Mgeni system are not considered to be beneficial after the full implementation of MMTS-2.

In addressing possible future water supply constraints, the Department of Water and Sanitation (DWS), and Umgeni Water identified water resource development on the uMkhomazi River as the best option for securing long-term water resources and commissioned a pre-feasibility study to investigate the various options for developing the uMkhomazi River's water resources for the purpose of augmentation. Thus the uMkhomazi Water Project was developed, and has been refined to its current two-phase scheme format.

The first phase of this project (uMWP-1) is the construction of Smithfield Dam as the primary impoundment. It will be constructed midway between Lundy's Hill Bridge and Deepdale. The second phase of the project is the construction of the Impendle Dam upstream of the Smithfield Dam, but downstream of the uMkhomazi River and Ngiza River confluence. This phase will only be implemented once the yield of Smithfield Dam has been fully utilised. This project is focussed specifically on the first phase of the project, the construction and operation of Smithfield Dam, and it's impact on the Mgeni River system and users. 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:

**1) Non-augmentation scenario**

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

**2) Augmentation scenario**

The uMkhomazi-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.

# 2 Scope of the Study

This study assesses the impact of augmentation and the impact of non-augmentation in the Umgeni System over the next 30 years. It serves to update previous studies and has strong links with various studies that consider the uMWP and that have taken place over the past 15 years, the most recent being the economic impact assessment report which forms part of the Technical Feasibility Study that is currently (as of November 2014) being carried out by the Department of Water Affairs and Sanitation. This study draws information from the Technical Feasibility Study and accompanying documents, the Umgeni Water 2014/15 – 2044/45 Infrastructure Master Plan, and other relevant documents.

## 2.1 Study Area Defined

The study area is defined as the total area that covers the uMkhomazi River catchment area as well as the Mgeni River supply area. The uMkomazi River catchment area includes the zone that borders the river, mostly in uMgungundlovu and Sisonke municipalities, but including a small section of eThekwini and Ugu municipalities near the river mouth. The Umgeni River supply area is the most of uMgungundlovu and iLembe municipalities, parts of Ugu Municipality and the whole of eThekwini Municipality.

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 uMkhomazi 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.

## 2.2 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 30 years i.e. 2014-2044, since this considered to be the time period over which the project will be financed.

## 2.3 Model Results

The model that is created as part of this study will estimate the impact of the two scenarios and their sensitivities on the customers of Umgeni Water. To this end, in addition to the impact on economic indicators as per the paragraph above, the supply impact of both scenarios will be shown.

# 3 The uMkhomazi Water Project

As previously mentioned, the uMkhomazi River Water Project (uMWP) will augment the Umgeni River system through two impoundment phases, initially the Smithfield Dam and then the Impendle Dam. Although this study will focus on the economic impact of the project over the next thirty years, and therefore is mostly concerned with the impact of the Smithfield Dam, the full project details are included for completeness and context.

The outline of the operation of the project is as follows:

- A tunnel through the catchment divide between the uMkhomazi and Mgeni catchments areas will transport raw water from Smithfield Dam into a balancing dam located in the Mlazi River catchment near Baynesfield.

- A new water treatment plant (WTP) will be constructed in the area to treat this raw water inflow.

- Potable water will be delivered under gravity, via a large diameter potable water pipeline into the '57 pipeline downstream of Umlaas Road Reservoir.

There is a separation in institutional responsibility at the WTP, with DWS responsible for infrastructure and supply up to the WTP and Umgeni Water responsible for infrastructure and supply from (and including) the WTP to the customer. Umgeni Water will purchase raw water from the DWS as per a revised water agreement and sell potable water to eThekwini, Msunduzi and uMgungundlovu municipalities, as per the existing bulk water supply agreements. The project will mainly service the eThekwini Municipal Area as well as the uMgungundlovu District Municipality to a lesser extent.

Detailed technical feasibility studies are being carried out this year (2014) by both DWS and Umgeni Water to assess the raw water feasibility, potable water feasibility, as well as the environmental impact. According to the Infrastructure Master Plan, the project would need to be implemented immediately to ensure a 99% level of assurance of supply to the Mgeni River system, however just phase 1 of the project can only be commissioned at the earliest in 2023. The total estimated cost of the project (for both phases) is estimated at R14.7 Billion in 2014 prices. The following able gives the breakdown of the major cost items for the uMkhomazi River Water Project. It can be seen that major cost items are the Smithfield Dam construction cost (1A), the tunnel construction cost (3A), the water treatment plant construction cost (7A), and the potable water pipeline cost (8A).

### Table 3-1 uMkhomazi Water Project Major Cost Items

| Item | Description | Detail | Amount |
|---|---|---|---|
| 1A | Smithfield Dam Construction Cost | Construction Period = 4 years (TBC) | R 1 330 504 760.00 |
| 1B | Smithfield Dam - Operation and Maintenance Cost per Year | - | R 5 092 066.10 |
| 2A | Langa Dam Construction Cost | Construction Period = 4 years (TBC) | R 783 719 862.00 |
| 2B | Langa Dam - Operation and Maintenance Cost per Year | - | R 2 853 001.80 |
| 3A | Tunnel Construction Cost | Construction Period = 4 years (TBC) | R 5 433 867 022.00 |
| 3B | Tunnel - Operation and Maintenance Cost per Year | - | R 20 848 764.40 |
| 3C | Tunnel - Refurbishment after the first 25 years of operation | Refurbishment Period = 1 year | R 409 445 176.00 |
| 3D | Tunnel - Refurbishment after the second 25 years of operation | Refurbishment Period = 1 year | R 409 445 176.00 |
| 4A | Raw Water Pipeline Construction Cost | Construction Period = | R 295 156 746.00 |

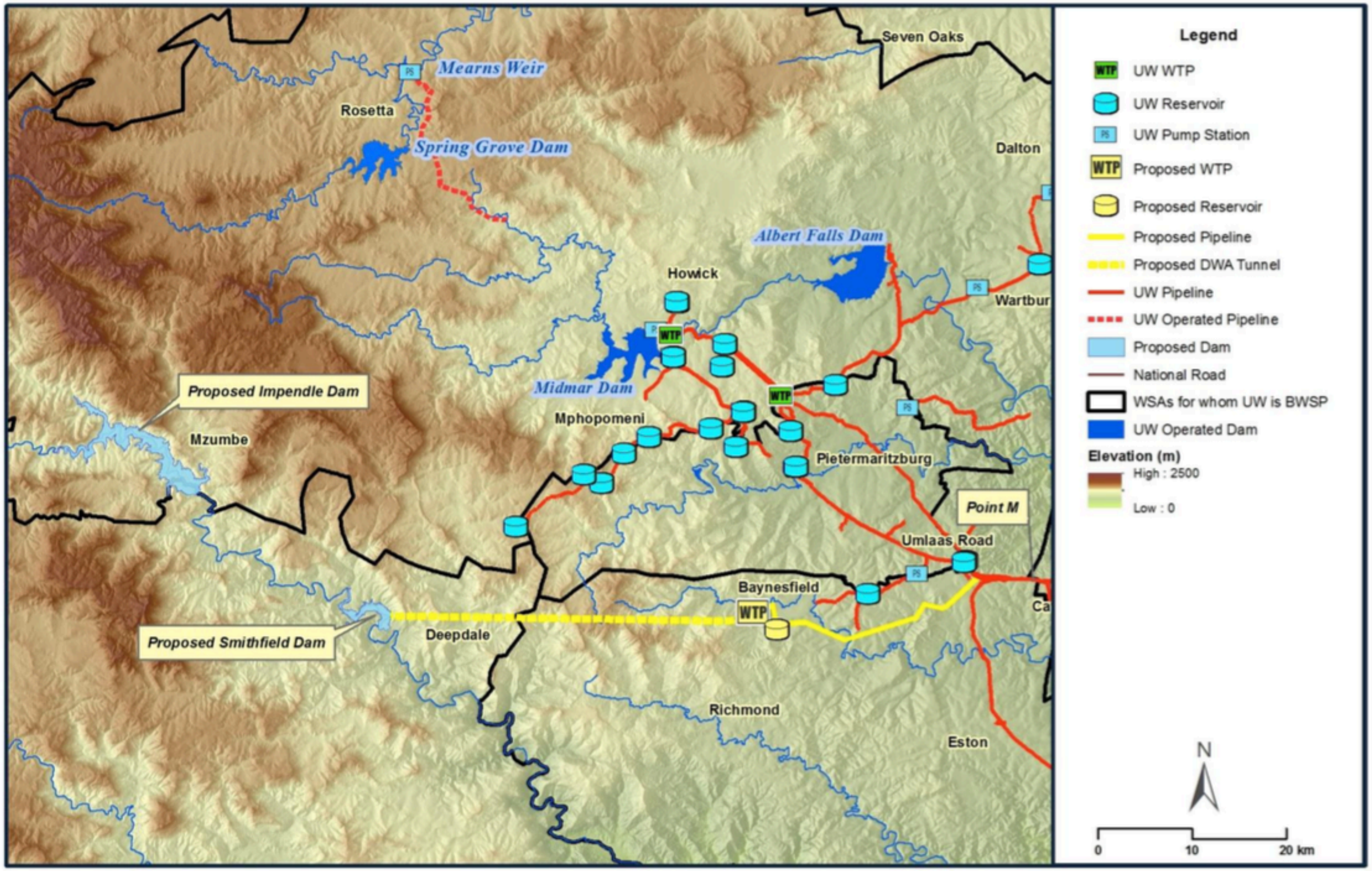
| Item | Description | Detail | Amount |
|---|---|---|---|
| | | 4 years (TBC) | |
| 4B | Raw Water Pipeline - Operation and Maintenance Cost per Year | - | R 1 429 201.80 |
| 4C | Raw Water Pipeline - Refurbishment after the first 25 years of operation | Refurbishment Period = 1 year | R 22 397 398.50 |
| 4D | Raw Water Pipeline - Refurbishment after the second 25 years of operation | Refurbishment Period = 1 year | R 22 397 398.50 |
| 5A | Bainsfield Hydro Power Plant Construction Cost | Construction Period = 4 years (TBC) | R 71 744 788.00 |
| 5B | Bainsfield Hydro Power Plant - Operation and Maintenance Cost per Year | - | R 859 601.80 |
| 5C | Bainsfield Hydro Power Plant - Refurbishment of Turbines after the first 10 year term of operation | Refurbishment Period = 1 year | R 8 527 199.25 |
| 5D | Bainsfield Hydro Power Plant - Refurbishment of Turbines after the second 10 year term of operation | Refurbishment Period = 1 year | R 8 527 199.25 |
| 5E | Hydro Power Plant - Refurbishment of Turbines after the third 10 year term of operation | Refurbishment Period = 1 year | R 8 527 199.25 |
| 5F | Hydro Power Plant - Refurbishment of Turbines after the Fourth 10 year term of operation | Refurbishment Period = 1 year | R 8 527 199.25 |
| 5G | Hydro Power Plant - Refurbishment of Turbines after the Fifth 10 year term of operation | Refurbishment Period = 1 year | R 8 527 199.25 |
| 6A | Access Roads Construction Cost | Construction Period = 4 years (TBC) | R 488 224 713.00 |
| 6B | Access Roads - Operation and Maintenance Cost per Year | - | R 2 039 851.80 |
| 7A | Water Treatment Plant Construction Cost | Construction Period = 4 years (TBC) | R 1 107 248 707.00 |
| 7B | Water Treatment Plant - Operation and Maintenance Cost per Year | - | R 4 424 305.86 |
| 7C | Water Treatment Plant - Refurbishment of Plant after the first 15 year term of operation | Refurbishment Period = 1 year | R 208 788 414.25 |
| 7D | Water Treatment Plant - Refurbishment of Plant after the second 15 year term of operation | Refurbishment Period = 1 year | R 208 788 414.25 |
| 7E | Water Treatment Plant - Refurbishment of Plant after the Third 15 year term of operation | Refurbishment Period = 1 year | R 208 788 414.25 |
| 8A | Potable Water Pipeline Construction Cost | Construction Period = 4 years (TBC) | R 2 900 824 024.00 |
| 8B | Potable Water Pipeline - Operation and Maintenance Cost per Year | - | R 10 984 116.57 |
| 8C | Potable Water Pipeline - Refurbishment after the first 25 years of operation | Refurbishment Period = 1 year | R 219 433 161.10 |
| 8D | Potable Water Pipeline - Refurbishment after the second 25 years of operation | Refurbishment Period = | R 219 433 161.10 |
| 9A | Gauging Weirs Construction Cost | Construction Period = 4 years (TBC) | R 90 887 982.00 |
| 9B | Gauging Weirs - Operation and Maintenance Cost per Year | - | R 887 101.80 |
| 10 | Waste Disposal Sites Cost | Operation Period = 4 years (TBC) | R 54 655 988.00 |
| 11A | Transmission Lines Construction Cost | Construction Period = 4 years (TBC) | R 194 303 164.00 |
| 11B | Transmission Lines - Operation and Maintenance Cost per Year | - | R 1 160 651.80 |
| 12 | Annual Energy Cost for 625 Ml/day WTP | - | R 9 398 750.00 |
| 13 | Annual Energy Income form Hydro Power | - | R 12 877 200.00 |
| 14 | Annual Volume of Water Supplied by the Scheme | - | - |

*Source: AECOM*

TBC = to be confirmed

A schematic layout of the proposed augmentation infrastructure is provided in Figure 4.1:

**Figure 3-1 uMkhomazi Water Project**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

The basic programme and life cycle over a period is presented in the table below:

## Table 3-2 uMkhomazi Water Project Basic Programme

**J01763: Umkomaas - Overview of Programme and Life Cycle over a Period of 60 years**

| Item | Description | Period (years) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 1A | Smithfield Dam Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1B | Smithfield Dam - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2A | Langa Dam Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2B | Langa Dam - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3A | Tunnel Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3B | Tunnel - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3C | Tunnel - Refurbishment after the first 25 years of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3D | Tunnel - Refurbishment after the second 25 years of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4A | Raw Water Pipeline Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4B | Raw Water Pipeline - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4C | Raw Water Pipeline - Refurbishment after the first 25 years of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4D | Raw Water Pipeline - Refurbishment after the second 25 years of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5A | Hydro Power Plant Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5B | Hydro Power Plant - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5C | Hydro Power Plant - Refurbishment of Turbines after the first 10 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5D | Hydro Power Plant - Refurbishment of Turbines after the Second 10 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5E | Hydro Power Plant - Refurbishment of Turbines after the third 10 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5F | Hydro Power Plant - Refurbishment of Turbines after the Fourth 10 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5G | Hydro Power Plant - Refurbishment of Turbines after the Fifth 10 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6A | Access Roads Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6B | Access Roads - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7A | Water Treatment Plant Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7B | Water Treatment Plant - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7C | Water Treatment Plant - Refurbishment of Plant after the first 15 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7D | Water Treatment Plant - Refurbishment of Plant after the second 15 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7E | Water Treatment Plant - Refurbishment of Plant after the Third 15 year term of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8A | Potable Water Pipeline Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8B | Potable Water Pipeline - Operation and Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8C | Potable Water Pipeline - Refurbishment after the first 25 years of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8D | Potable Water Pipeline - Refurbishment after the second 25 years of operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

*Source: AECOM*

# 4 Study Area Characteristics

The DWS study[1] gives a good baseline assessment of the characteristics of the study area. The uMkhomazi River catchment area has a total population of 203 912 in 2012, and 45 548 households. The Umgeni Water Supply Area meanwhile has a population of 6 326 419 and 1 614 087 households, and so is far a more dense area than the catchment area. The differences in the two are further highlighted by the fact that the population in uMkhomazi River catchment area is typically younger and less educated than that of the Umgeni River supply area.

Residents in the Umgeni River supply area mostly access water through piped water inside their dwelling or yard, whereas only 11.1% of uMkhomazi River catchment residents have piped water inside their dwelling, and mostly access water by community stand or dam/river/stream/spring. The most predominant household access to toilets in the Umgeni River supply area is a flush or chemical toilet, whilst for the uMkhomazi River catchment it is mostly pit latrine. This is partly due to the fact that the majority of the population in the uMkhomazi River catchment area live in traditional dwellings, compared to the Umgeni River supply area where most live in a house or brick structure on a separate stand or yard.

Employment profile can be examined by two labour force views:

- The labour force participation rate, which is the labour force as a percentage of the working age population, and

- The labour absorption rate, which is employed persons as a percentage of the working age population

There is 50.3% employment in the uMkhomazi River catchment area with 27.5% being unemployed and 22.2% being discouraged work seekers. There is 62.7% employment in the Umgeni River supply footprint with 27.8% unemployment and 9.6% being discouraged work seekers. The labour force participation rate in the uMkhomazi River catchment area is 44.3% against 60.4% in the Umgeni River supply area, which indicates fewer homemakers, full-time students, and other people in the working age-group that are not economically active in the Umgeni River supply area. The labour absorption rate in the uMkhomazi River catchment is 22.3% against 37.8% in the Umgeni River supply area, which indicates the uMkhomazi River catchment area has a large group that is dependant on income earners other than themselves (a high dependency ratio).

[1] P WMA 11/U10/00/3312/6 Economic Impact Assessment Report

The types of employment that dominate the uMkhomazi River catchment area are (in order of scale):

- Community, social, and personal services (19.9%),
- Wholesale and retail trade, catering and accommodation (18.5%),
- Agriculture forestry and fishing (12.9%), and
- Manufacturing (10.6%).

The types of employment that are predominant in the Umgeni River supply area are (in order of scale):

- Wholesale and retail trade, catering and accommodation (25.2%),
- Community, Social, and personal services (16.6%),
- Finance, insurance, real estate and business services (15.2%),
- General government (12.2%), and
- Manufacturing (11.4%)

In terms of economic gross value added (GVA), the study area is dominated by the Umgeni River supply area, which contributes 72.6% to provincial GVA. The uMkhomazi River catchment area contributes 1.9% of provincial GVA. Within the catchment area, agriculture forestry and fishing contributes 6.7% to this sectors provincial GVA, and is the only sector within the catchment area which contributes significantly above its average provincial contribution. In the Umgeni River supply area all sectors contribute significantly to the provincial GVA, which is unsurprising since the area contains eThekwini with the industrial and commercial centres of Durban and Pinetown, as well as Pietermaritzburg and the newer developments in the north of eThekwini and south of ILembe.

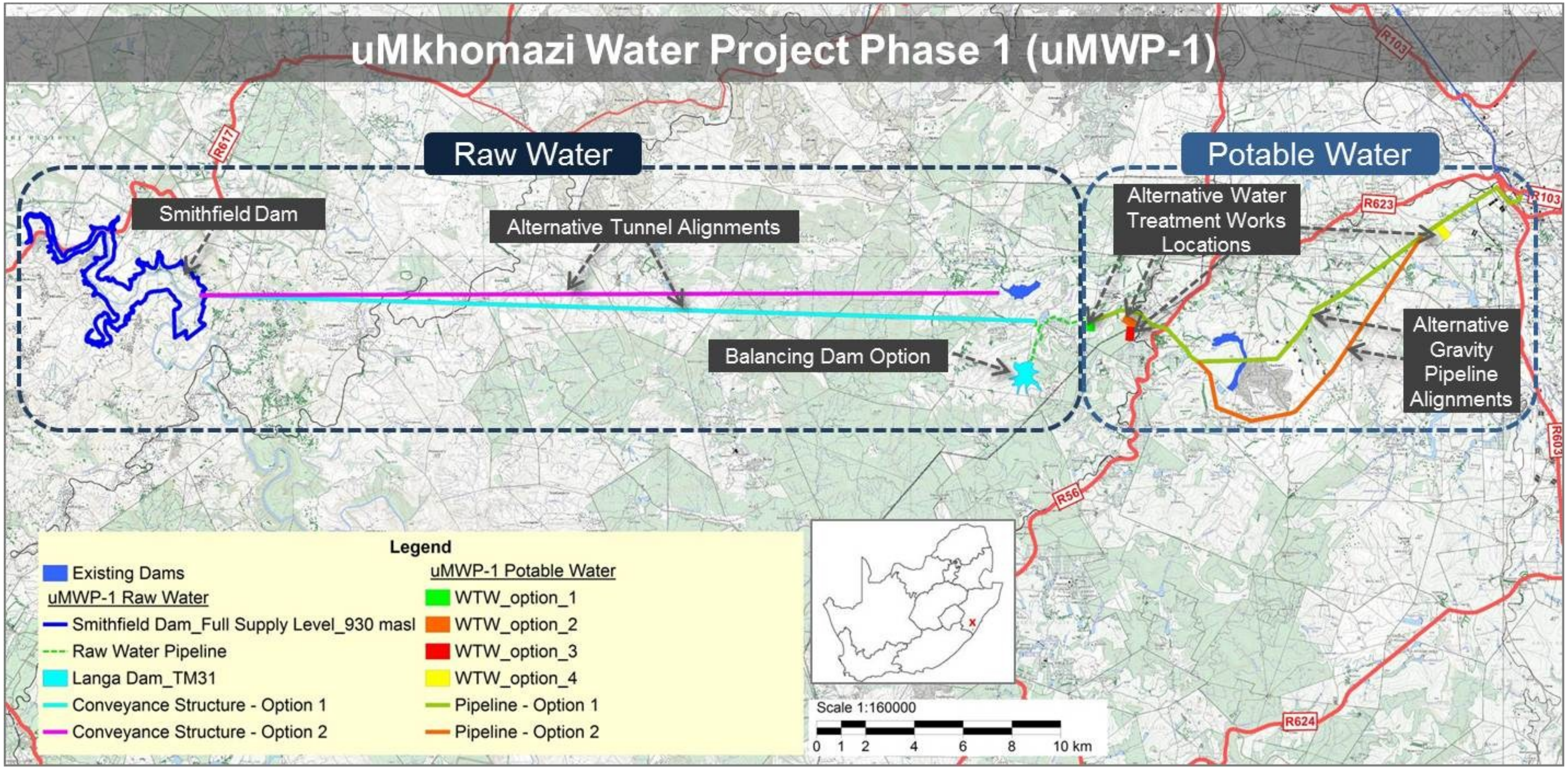
This trend is mirrored in the GVA *per capita* figures, with the Umgeni River supply area having a GVA *per capita* of R36,722 and the catchment area having a GVA *per capita* of R14,042. Finally, the household poverty threshold is measured at R400 per month or R4800 *per annum*. 19.8% of the uMkhomazi River catchment area lives below this poverty line; whilst for the Umgeni River supply area the figure is 20.1% of the population.

### Table 4-1 Summary of Characteristics of Study Area

| Item | uMkhomazi River Catchment Area | Umgeni River Supply Area |
|---|---|---|
| **Population** | Small | Large |
| **Population Density** | Low Density | High Density |
| **Access to Water** | Low | High |
| **Access to Toilet** | Mostly pit latrine | Mostly flush or chemical toilet |
| **Unemployment** | 27.5% | 27.8% |
| **Contribution to Provincial GVA** | Minimal | Substantial |
| **Household Poverty** | 19.8% below poverty line | 20.1% below poverty line |

*Source: uMWP-1 Feasibility Study*

### Figure 4-1 uMkhomazi-Mgeni Transfer Scheme Phase 1 Layout




*Source: Umgeni Water*

# 5 Water Demand and Supply

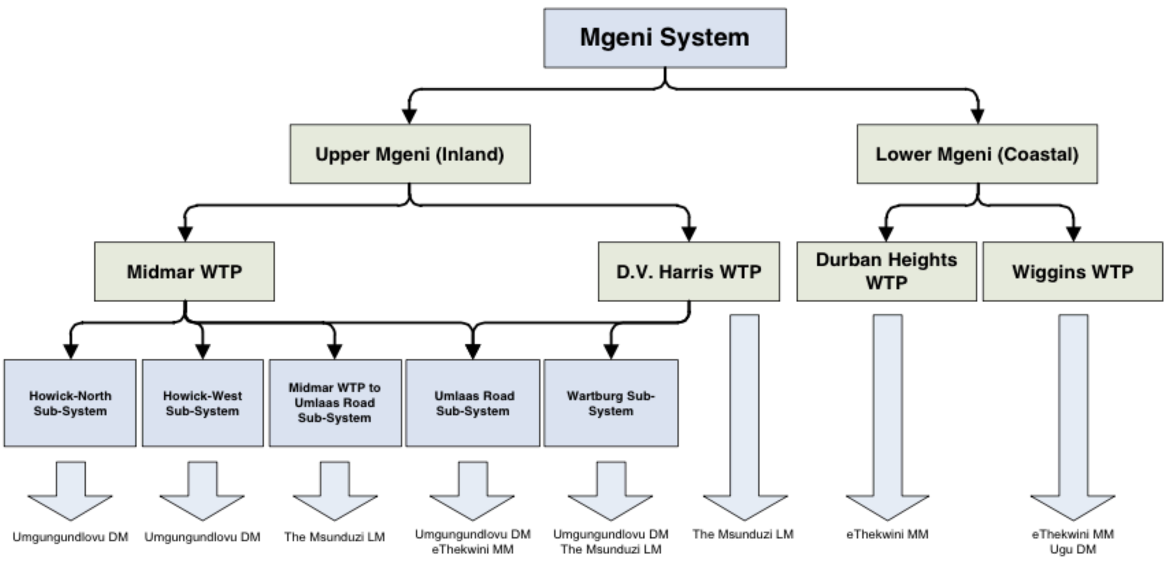
The diagram below, taken from the 2014 Infrastructure Master Plan, gives the layout of the primary, secondary, and sub-systems that contain all existing water resources and water infrastructure utilised by Umgeni Water. In most cases the systems are defined by the catchment that forms the original water source, with the exception of the smaller, adjacent catchments that provide the water to the South Coast system.

As can be seen in the diagram, the Mgeni system is responsible for the Msunduzi supply as well as most of eThekwini Municipality, and impacts upon the South Coast and Mdloti systems. Furthermore, the role of the Mooi and uMkhomazi systems as feeders to the Mgeni system can clearly be seen. The Mgeni system contains two major sub-systems:

- The Upper Mgeni system or Inland system, which serves
  - The Umgungundlovu District Municipality
  - Msunduzi Municipality
  - eThekwini Municipality Outer West area

- The Lower Mgeni systems which serves
  - The coastal areas and hinterland of the eThekwini Municipality
  - The northern coastal areas of Ugu District Municipality via the South Coast Augmentation Pipeline and the South Coast Pipeline

This is displayed in the following network chart:




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

## Figure 5-1 Umgeni Water Supply Primary Systems, Secondary Systems and Sub-Systems

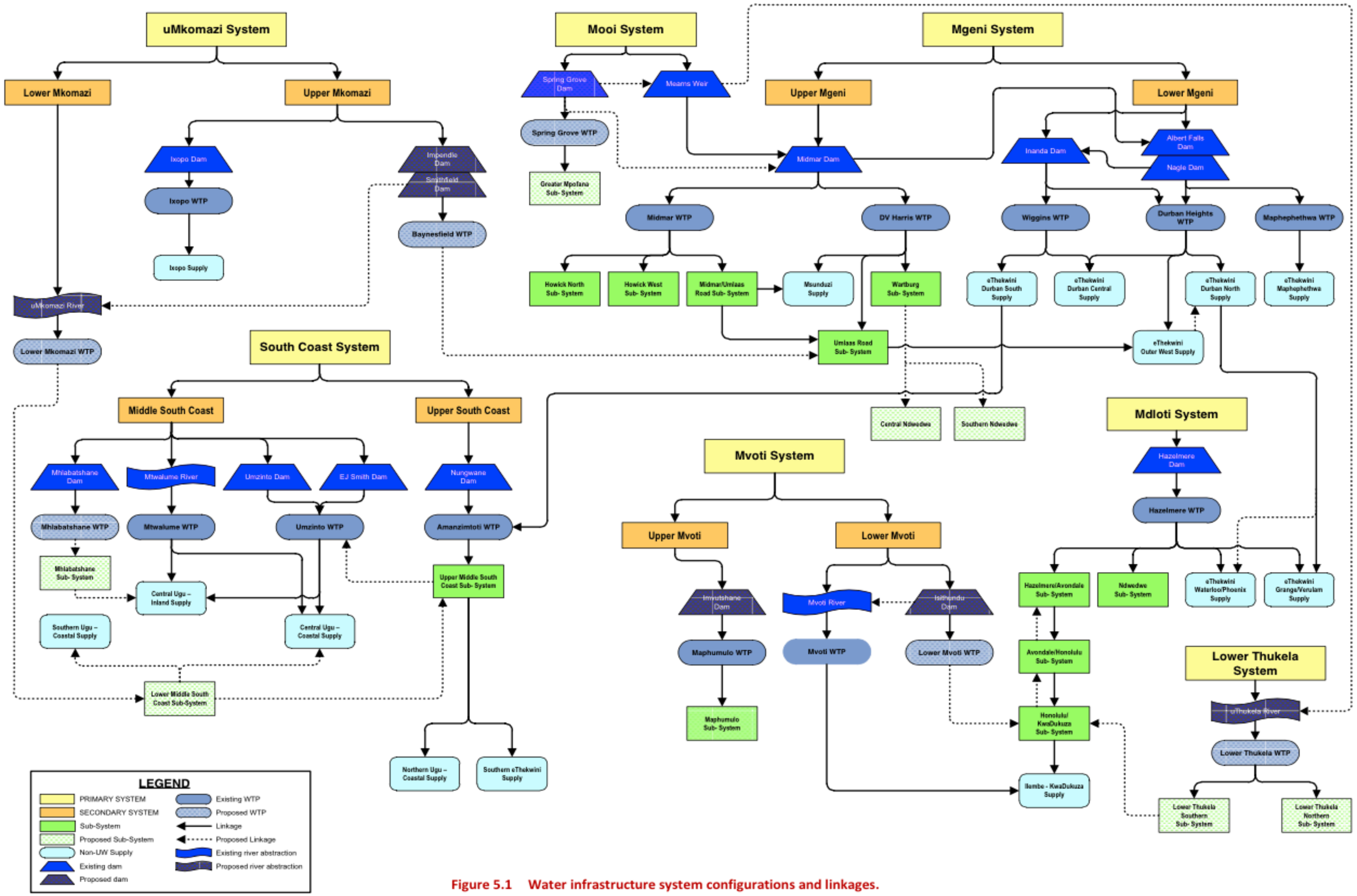



**Figure 5.1 Water infrastructure system configurations and linkages.**

*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

## 5.1 Water Supply

Given that the uMkhomazi River Water Project will impact the Mgeni River system, an analysis of this system is conducted below (including resultant impact on the South Coast system).

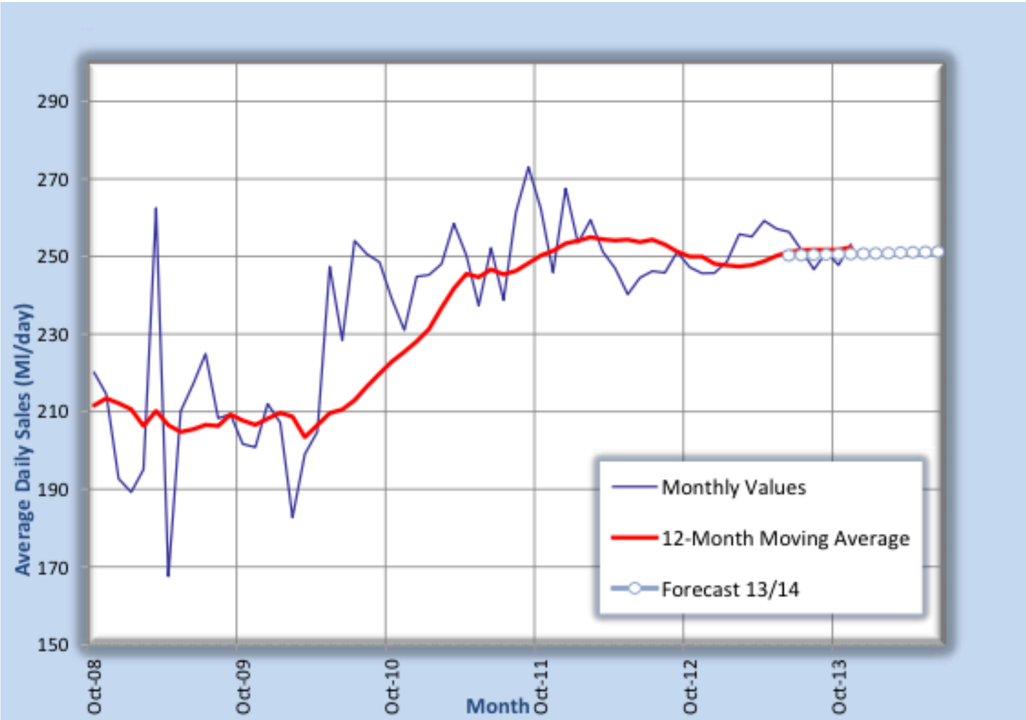
### 5.1.1 Upper Mgeni System

#### *Midmar Water Treatment Plant*

The Midmar WTP draws raw water from Midmar Dam, and has a design capacity of 250ML per day, which it can exceed during short peak demand periods. It supplies uMngeni Local Municipality, south and south western suburbs of Pietermaritzburg, Greater Edendale, Vulindlela, Thornville and the Umlaas Road node, as well as eThekwini Municipality's Outer West area. The Umlaas Road node is supplied primarily by the Midmar WTP, but can be supplemented by a potential 45 ML per day from the D.V, Harris WTP. The Midmar WTP's current utilisation is 220ML per day.

The figure below shows the demand place on the plant over the past few years, graphed against forecast sales, with the current production being 250 ML per day.

**Figure 5-2 Midmar WTP Demand**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

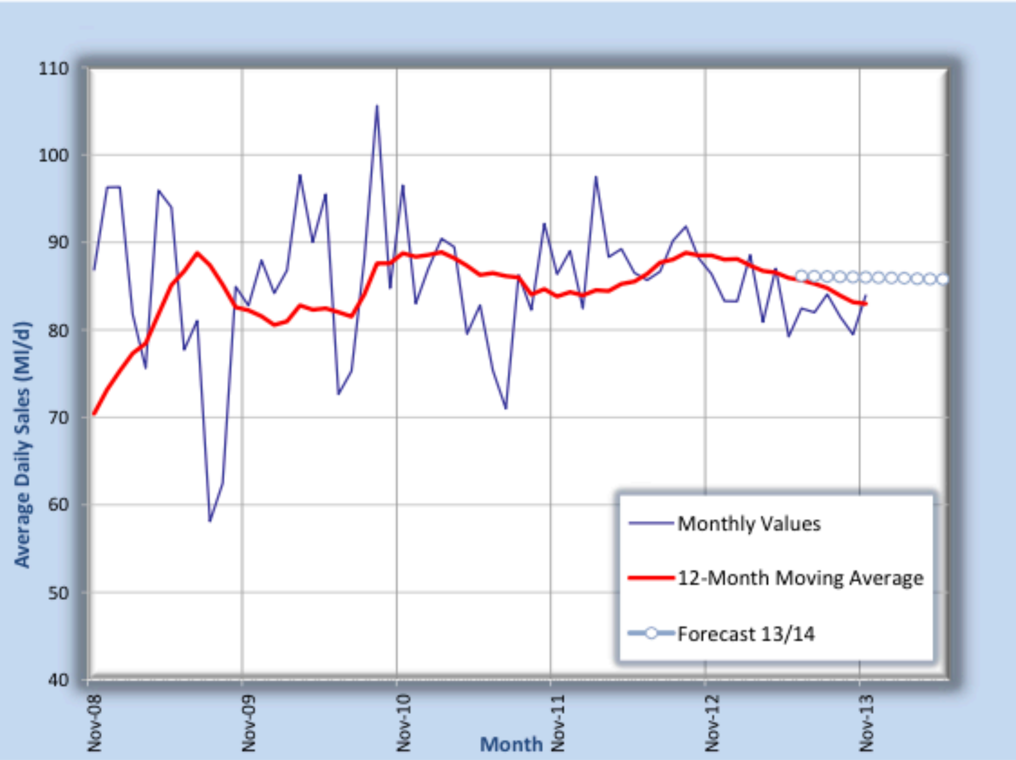
From November 2012 to October 2013 the WTP was operated above optimal operating capacity for 96% of the time, and above the design capacity 26% of the time, both up from the previous period. With the imminent load shift as a result of the Western Aqueduct, the upgrading of the capacity of the WTP is paramount, without which even a partial load shift will not be possible. The WTP can fortunately be upgraded to 375 ML per day without major civil construction.

### *D.V. Harris Water Treatment Plant*

D.V. Harris is fed raw water form Midmar Dam, and the WTP has a design capacity of 110 ML per day, having accommodated demands of up to 125 ML per day in peak times. It supplies he Clarendon and Claridge Reservoirs that feed the northern and eastern suburbs of Msunduzi Municipality, Greater Wartburg and the Table Mountain area. The WTP also supplies potable water to the Umlaas Road Reservoir in order to feed areas within Umgungundlovu District Municipality and eThekwini Municipality. The current utilisation of the D.V. Harris WTP is 89 ML per day.

The figure below shows the demand place on the plant over the past few years, graphed against forecast sales, with the current production being 92 ML per day.

**Figure 5-3 D.V. Harris WTP Demand**



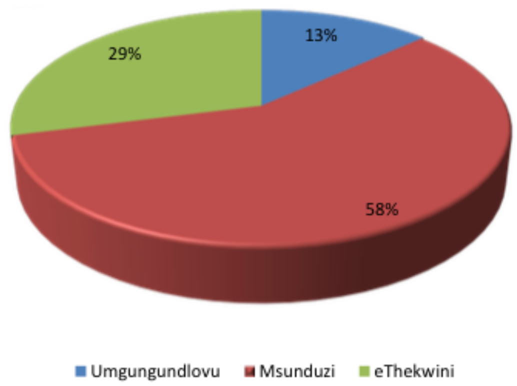

*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

As a result of the current and future projects (including uMWP), the D.V. Harris WTP will not need to be upgraded in this 30-year horizon. The amount of time the plant was operated above optimal operating capacity and design capacity in this period is lower than the previous period.

### *Current Supply Framework*

The Upper Mgeni system currently experiences a demand of 310 ML per day, which is illustrated in the following chart.

**Figure 5-4 Distribution of Demands in the Upper Mgeni System per WSAs (October 2013)**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

Although Umgeni Water has begun a process of transferring individual consumers over to the relevant water service authorities, Umgeni Water still owns and maintains the infrastructure and so has the responsibility of ensuring the infrastructure can meet demand. The eThekwini Municipality water service authority have put into place a number of optimisations of its distribution systems served by the Lower Mgeni system, which has lead to the implementation of new infrastructure, the chief of these being the load-shifting Western Aqueduct project. This project will be fully commissioned in mid-2018 and the intention is for those areas currently being served under pumping from the Lower Mgeni System (viz. from Durban Heights WTP) to be transferred onto the Upper Mgeni System, and served under gravity from Midmar WTP via the Western Aqueduct. It is also planned to link the Western Aqueduct into the municipality's Northern Aqueduct, which will extend the supply to the northern areas of the municipality, as far as the Dube Tradeport Development Zone. This will have the effect of shifting the supply load onto the Upper Mgeni System, freeing up additional capacity in the Lower Umgeni System. This load will particularly affect the Midmar WTP and the water resources available from Midmar Dam.

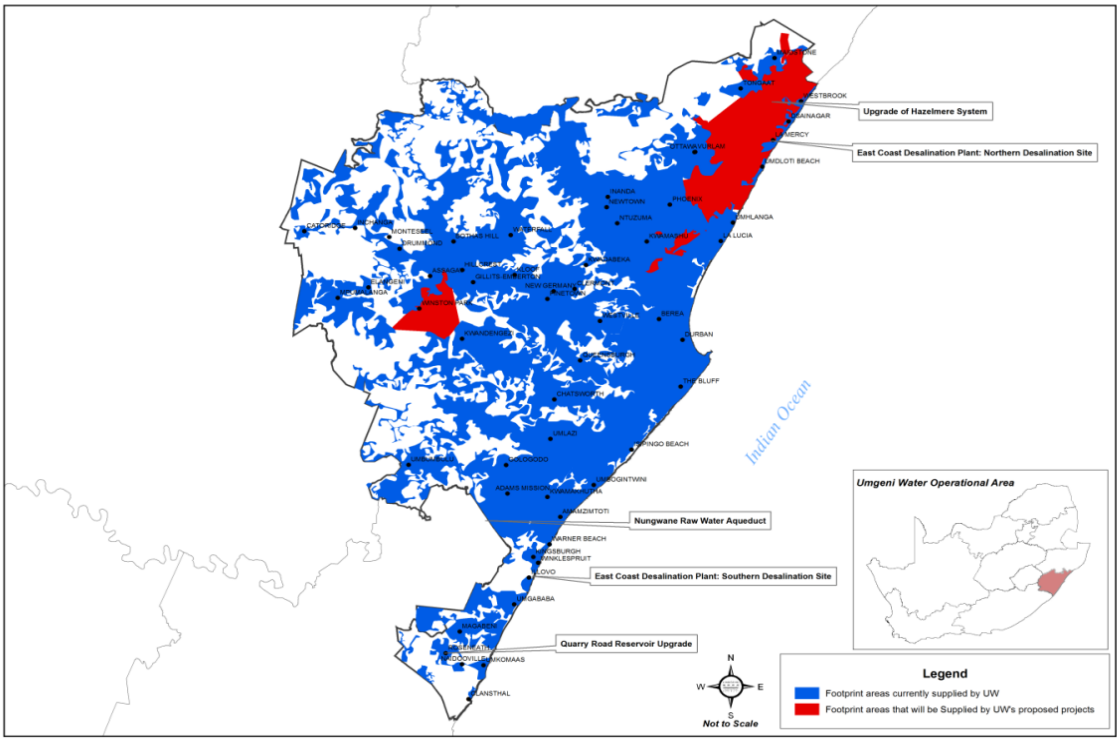
The commissioning of the Phase 2b of the Mooi-Mgeni Transfer Scheme (MMTS-2) in 2015 will increase the 99% assured yield of the Mgeni System at Midmar Dam from 322.5 ML per day to 476 ML per day. Demand in eThekwini Municipality is increasing to such an extent, however, that this increase yield will be insufficient to support to the proposed full Western

Aqueduct load shift for any significant period of time. The implementation of MMTS-2 will signify the final development on this scheme considered able to significantly increase the system's yield, after which additional supply must come from other proposed sources, the most significant being the uMkhomazi Water Project (MWP). The outline of this project is detailed in Chapter 3 of this report. After the completion of MMTS-2 (and Midmar's yield then being fixed) all future bulk distribution upgrades within the Upper Mgeni System will be limited to the water resources capacity that Midmar dam can support. It is estimated that there will be about 210 ML per day available for the Western Aqueduct Phase 2 load shift.

Until the uMWP is commissioned there is a limited amount of water available to meet demands downstream of Umlaas Road Reservoir. As the demands upstream of the reservoir increase over time, there will be less water available for eThekwini Municipality. This means until the uMWP is commissioned the full Western Aqueduct load shift requirement will not be able to be met. The anticipated load shift from the Lower to Upper Mgeni System has necessitated a number of infrastructure projects.

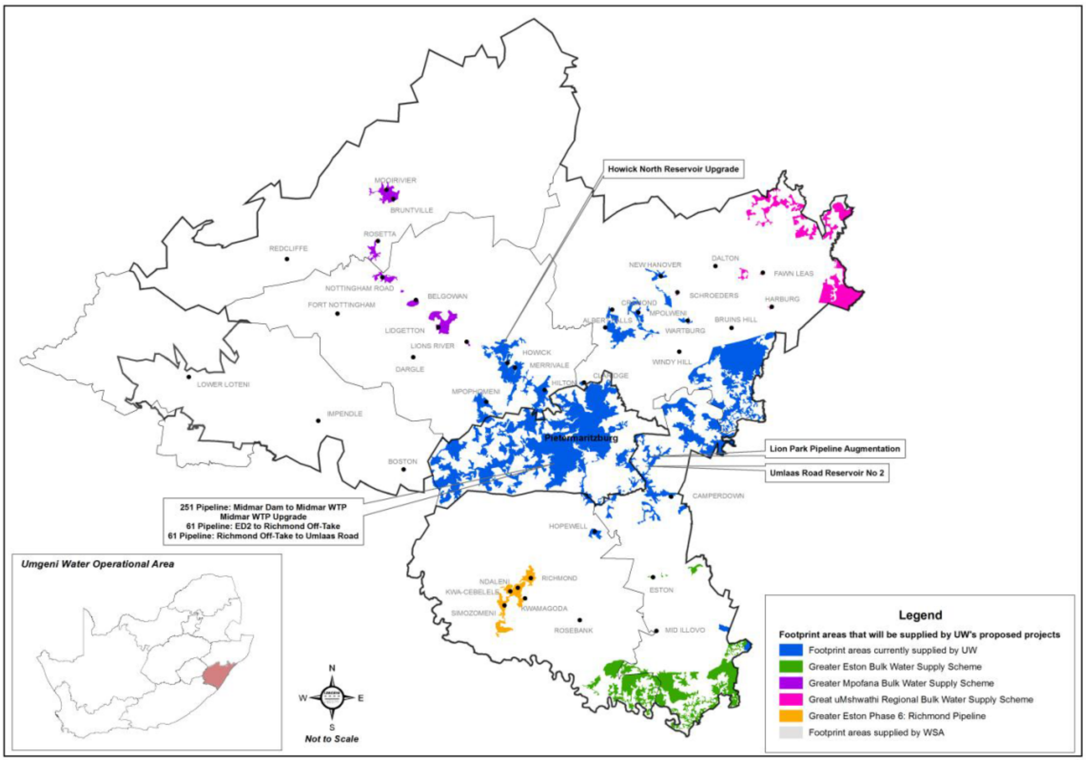
The following maps indicate footprint areas within uMgungundlovu and eThekwini municipalities that are supplied by Umgeni Water or are anticipated to be supplied by Umgeni Water's proposed projects.

**Figure 5-5 Umgeni Water eThekwini Municipality Supply Footprint**




*Source: Umgeni Water*

**Figure 5-6 Umgeni Water uMgungundlovu Municipality Supply Footprint**




*Source: Umgeni Water*

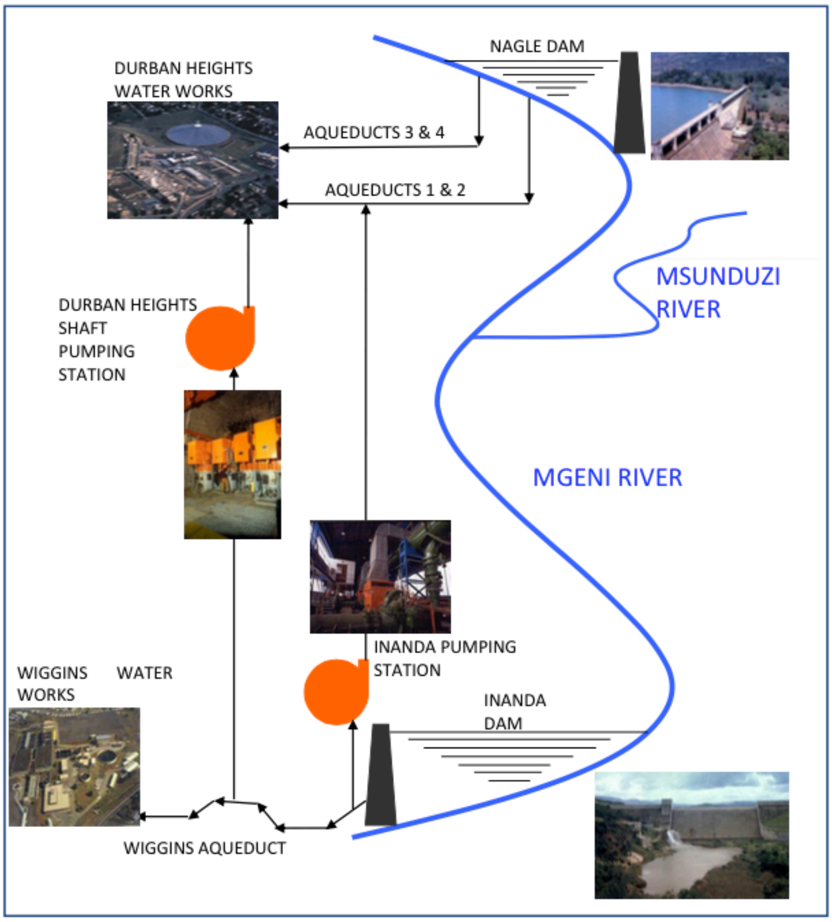
## 5.1.2 Lower Mgeni System

The Lower Mgeni system serves the greater eThekwini Municipal Area from lower Pinetown and KwaDabeka in the west, to Phoenix, Inanda and Verulam in the north, to the Durban seaboard in the east and to Amanzimtoti and KwaMakuta in the south. It also provides water to the northern coastal areas of Ugu District Municipality. The system derives its water resources from the uMgeni River, being fed from Nagle and Inanda Dams, which are supported by Albert Falls Dam, Midmar Dam and the MMTS.

There are three water treatment plants on the system, Durban Heights WTP, Wiggins WTP, and Maphephethwa WTP, and Umgeni Water sells water to the municipality "at the fence", and so does not own nor operate the bulk distribution pipelines downstream of these WTPs. Operational and infrastructural changes within the municipal system have profound influence on the WTPs operational and infrastructure requirements due to size of demand of the service area. Recently Umgeni Water has worked together with the municipality to optimise the overall efficiency of the distribution system, which has led to transferring demand from Durban Heights WTP to Wiggins WTP in recent years.

The figure below gives the layout of the Central Supply System

### Figure 5-7 Layout of the Central Supply System




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

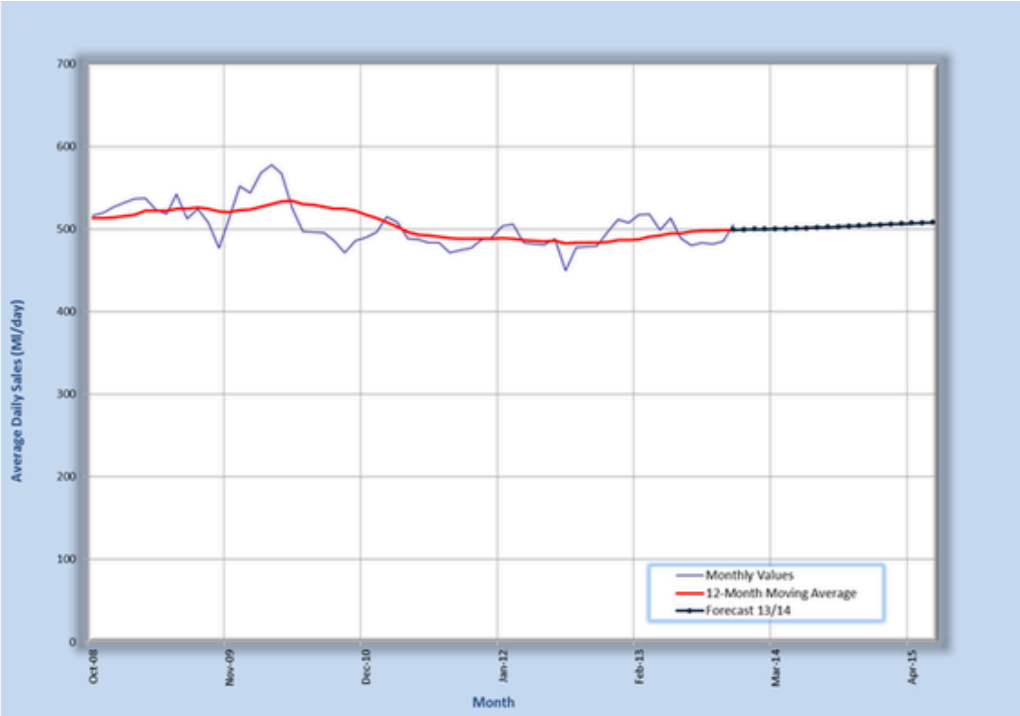
### *Durban Heights WTP*

The maximum design capacity of the Durban Heights WTP is 615 ML per day, and current utilisation is 490.84 ML per day.

The Durban Heights WTP serves the major growth area to the north of eThekwini Municipality, including the Northern Aqueduct, which currently conveys about 260 ML per day of the total volume sold to the municipality. Due to this high demand and to continue to provide adequate service, Umgeni Water has commissioned a number of infrastructure interventions on behalf of the municipality. The demand in the north is anticipated to accelerate considerably due to King Shaka International Airport and Dube Tradeport, and the municipality is making contingency plans to augment supply to the Northern Aqueduct. Due to urban development along the route of the aqueduct, however, additional infrastructure will be extremely difficult to implement. eThekwini Municipality plans to shift some of the demand off Durban Heights onto the Western Aqueduct that should free up about 70 ML per day, although this may very well be needed by the growing demand in the North.

The figure below gives the historical demand curve for the Durban Heights WTP, graphed against forecast sales.

**Figure 5-8 Durban Heights WTP Demand**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

For 67% if the time over the period November 2012 to October 2013 the WTP was operated above optimal operating capacity but never above design capacity, almost doubling from the previous period, indicative of an increasing demand.

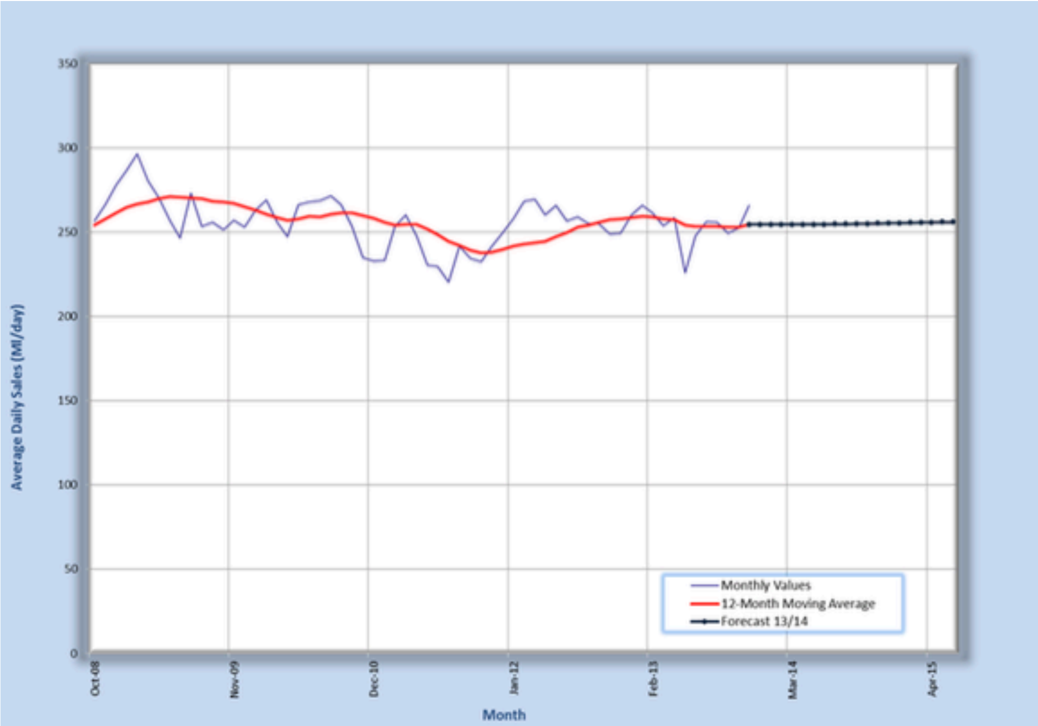
### *Wiggins WTP*

The maximum design capacity of the Wiggins WTP is 350 ML per day, and current utilisation is 238.03 ML per day.

Wiggins WTP supplies the Amanzimtoti and KwaMakuta areas located in the southern portion of eThekwini Municipality. Due to water resource constraints at Nugwane Dam and the limited capacity of Amanzimtoti WTP, it is necessary to augment the supply to areas downstream of the Amanzimtoti WTP with flows from Wiggins WTP via the South Coast Augmentation (SCA) Pipeline. This will be required until such time as a new regional bulk water supply system is developed on the lower reaches of the uMkhomazi River. Wiggins WTP sub-system should have sufficient treatment and distribution capacity to meet the short and medium-term demands of Amanzimtoti and the South Coast Pipeline (SCP).

The figure below gives the historical demand curve for the Wiggins WTP, graphed against forecast sales.

**Figure 5-9 Wiggins WTP Demand**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

For 15% if the time over the period November 2012 to October 2013 the WTP was operated above optimal operating capacity but never above design capacity, which is 5% less from the previous period, indicating a decreasing demand. This is a result of (amongst other factors) the load shedding off Wiggins WTP onto Durban Heights WTP along the Southern Aqueduct.

#### *eMaphephetheni WTP*

The maximum design capacity of the eMaphephetheni WTP is 5 ML per day, and current utilisation is 2.3 ML per day. It was commissioned as a rural scheme and is located in the Inanda Dam area.

### 5.1.3 South Coast System

The South Coast System is made up of three sub-regions:

- The Upper South Coast, which extends from Amanzimtoti to the uMkhomazi River

- The Middle South Coast, which extends from the uMkhomazi River to the Mtwalume River (just north of Hibberdene); and
- The Lower South Coast, which extends from the Mtwalume River to the Mtamvuna River (Port Edward).

Umgeni Water currently only operates in the Upper and Middle sub-regions, supplying bulk treated water to the southern parts of eThekwini Municipality and to the northern parts of Ugu District Municipality. These systems rely heavily on the Lower Mgeni system, which as mentioned above is already constrained. Potable water is supplied from Wiggins WTP via the South Coast Augmentation Pipeline to Amanzimtoti WTP. Treated Water is sold “at the fence” at Wiggins WTP, and there is a “buy-back” arrangement at Amanzimtoti WTP for the water required by Umgeni Water for the South Coast areas.

### *Amanzimtoti WTP*

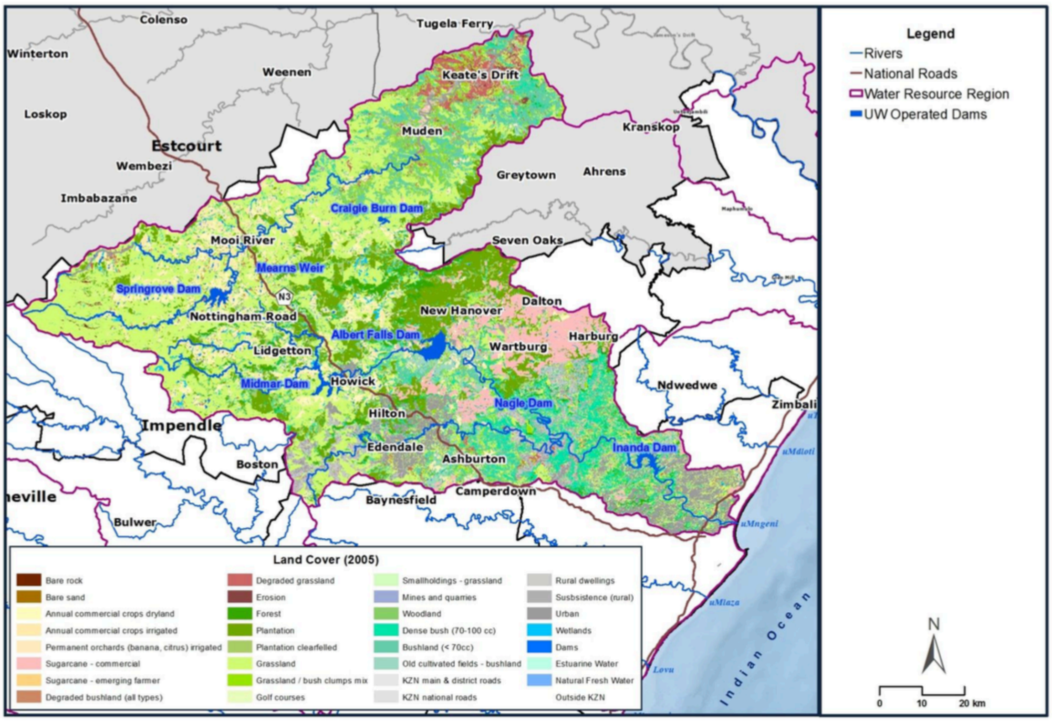
The maximum design capacity of the Wiggins WTP is 22 ML per day, and current utilisation is 19.97 ML per day. Sappi Saiccor takes water directly from the uMkhomazi River for use at their plant, and intend to construct the Ngwadini Dam jointly with Umgeni Water. They have also obtained an off-take form the South Coast Pipeline, which can only be used once the needs of eThekwini and Ugu municipalities have been met. The Nqwadini Dam will alleviate some of the pressure on the Lower Mgeni system, and is expected to accommodate future demands in the middle lower and upper South Coast areas.

Currently only 60 ML per day is available for all demand nodes along the South Coast area (SCA) Pipeline, which limits inflow to Amanzimtoti WTP to 24 ML per day. The current demand at Amanzimtoti WTP can peak at 68 ML per day. The SCA Pipeline is expected to read its design capacity of 97 ML per day by 2020, at which point no more than 65 ML per day will be available to the Amanzimtoti WTP. The Amanzimtoti WTP, with a design capacity of 22 Ml/day, will need to continue to operate together with the SCA Pipeline until a long-term solution is in place for supply of water to the area.

## 5.2 Water Resources

The water demands in the Mgeni catchment area currently exceed the available yield, which has led to the Mooi-Mgeni Transfer Scheme, and the proposed uMkhomazi Water Project. The Mgeni River has been fully developed with the construction of four major dams (Nagle, Midmar, Albert Falls and Inanda), and both the Mooi River and Mgeni River catchments are ‘closed’ catchments (no longer open to stream flow reduction activities such as afforestation, expansion of irrigated agriculture or the construction of storage dams).

### Figure 5-10 General layout of the Mooi River - Mgeni River Region




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

As previously mentioned, the Mooi-Mgeni Transfer Scheme is nearing completion (2015), having had a significant contribution to water resources and supply for the Mgeni system. The yield of the Mooi-Mgeni system has increased from 334 million $m^3$ *per annum* (915 ML per day), to 381 million $m^3$ *per annum* (1044 ML per day) as a result of the completion of Spring Grove Dam Phase 2A. The completion of the scheme will see this yield rise to 394 million $m^3$ *per annum* (1080 ML per day). There is currently a deficit of 25 million $m^3$ *per annum* (69 ML per day), and Umgeni Water has submitted a license application to DWS for 470 million $m^3$ *per annum* (1288 ML per day) in anticipation of the support from Spring Grove Dam.

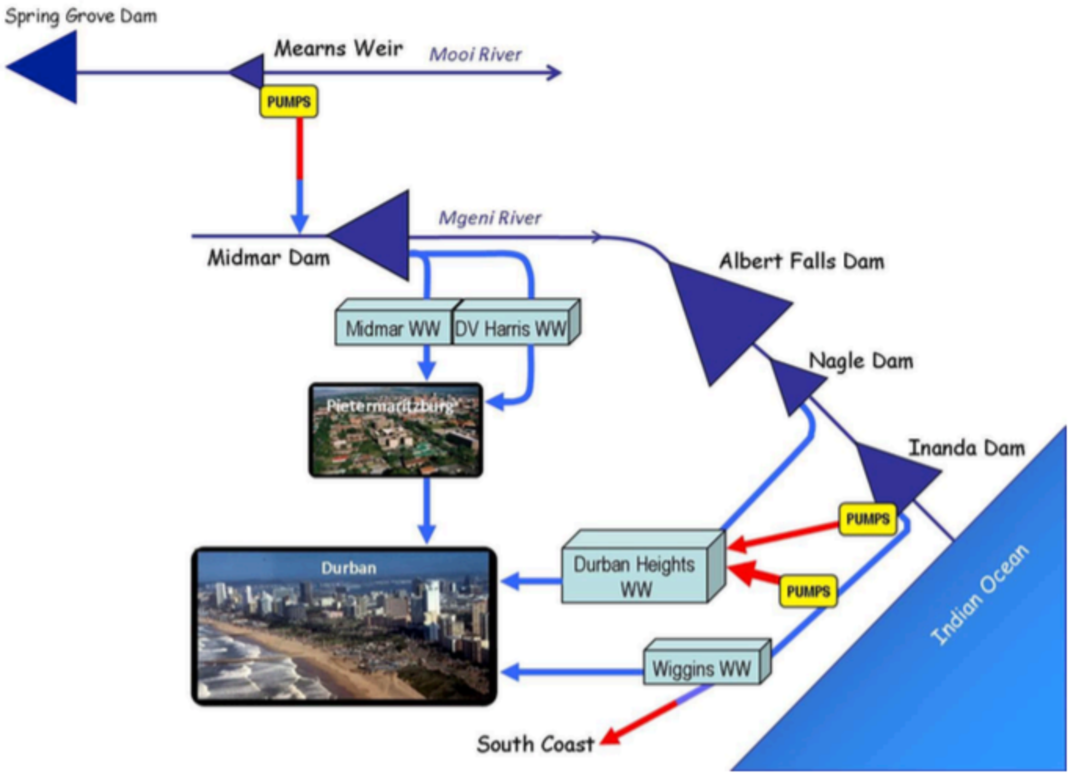
### Table 5-1 Existing Dams in the Mooi River - Mgeni River Region

| Impoundment | River | Capacity (million $m^3$) | Purpose |
|---|---|---|---|
| Spring Grove Dam | Mooi | 139.5 | Domestic |
| Craigie Burn Dam | Mnyamvubu | 23.5 | Irrigation |
| Mearns Weir | Mooi | 5.1 | Domestic |
| Midmar Dam | uMngeni | 235.4 | Domestic |
| Albert Falls Dam | uMngeni | 289.1 | Domestic |
| Nagle Dam | uMngeni | 23.2 | Domestic |
| Inanda Dam | uMngeni | 241.7 | Domestic |

*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

A schematic of the Mgeni System follows:

### Figure 5-11 Schematic of Mgeni River System




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

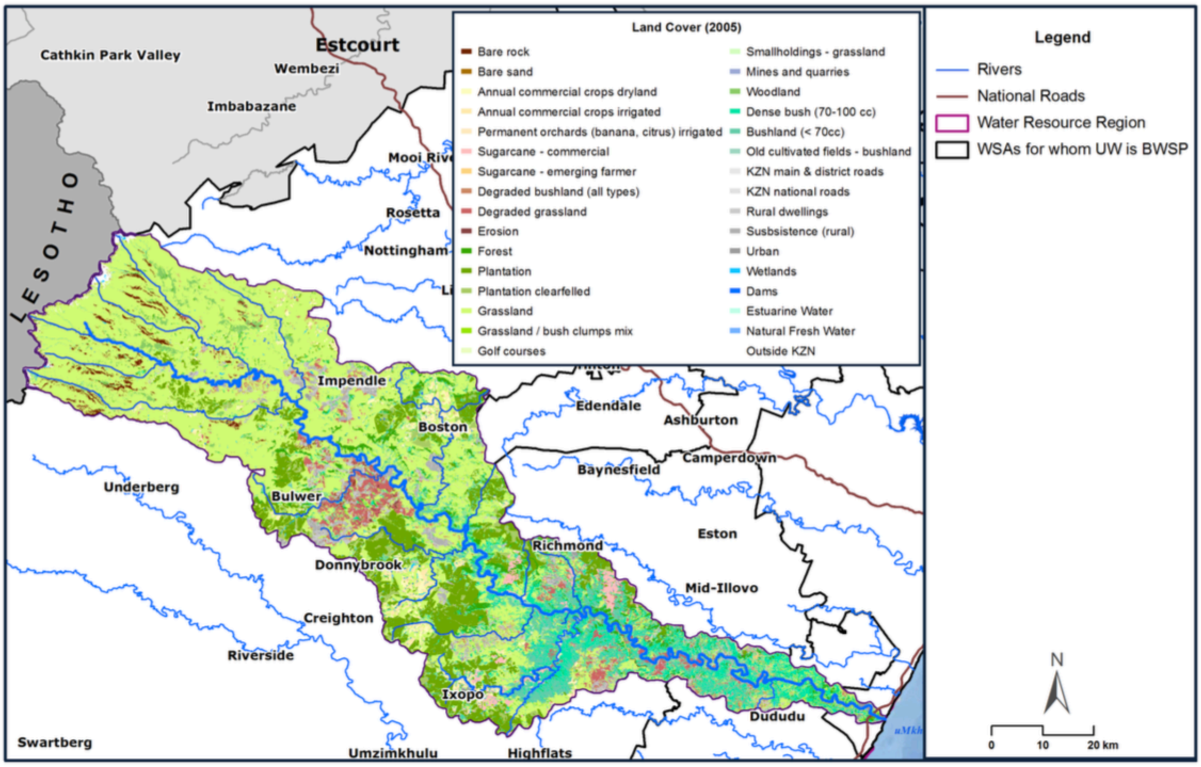
The system is under long-term water security threat due to rapidly increasing demand driven by development in eThekwini Municipality (as explained in the following section), which necessitates the immediate implementation of the MMTS-2B. However analysis indicates that even after this intervention further augmentation will be needed, and the options being considered for this augmentation include the uMkhomazi Water Project, the reuse of treated effluent, and seawater desalination.

### *The Mkomazi Region*

The Mkomazi catchment is fairly underdeveloped main land use activities being commercial forestry and and irrigated areas in the central catchment areas around the towns of Bulwer, Richmond, Ixopo and Impendle. There is a large industrial abstraction for Sappi Saiccor near the coastal town of Umkomaas.

Currently the region is unregulated and there is no major water resource infrastructure on the uMkhomazi River or any of its tributaries. The Ixopo System lies within the Mkhomazi catchment and is not connected to any of Umgeni Water's regional bulk systems. The uMkhomazi Water Project has long been seen as the solution to the deficit faced by the Umgeni System. The first phase (MWP-1) will result in the construction of Smithfield Dam and delivered by transfer tunnel and balancing dam at Baynesfield, wherefrom treated water will be transferred to an appropriate delivery node in the Mgeni catchment. DWS anticipates the MWP-1 will be implemented in 2023. Phase 2 of the project (MWP-2) comprises of the Impendle Dam, which will be built further upstream from Smithfield, with water being released from Impendle down the uMkhomazi River for abstraction and transfer at Smithfield. This phase will only be implemented at a future date when needed.

**Figure 5-12 General layout of the Mkomazi River Region**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

### *Wastewater Re-use*

Umgeni Water is involved in joint efforts by water authorities to further the study and use of wastewater as a channel of supply, as it improves the sustainability and security of supply. It currently owns an 18% share in the Durban Wastewater Recycling Plant, which treats water to near potable standards for industrial use. Projects that are currently being investigated are treating wastewater from the Darvill Wastewater Works and returning treated water into the distribution system at Umlaas Road. This water can then be used to augment the supply to the Western Aqueduct. This will have the effect of shedding load at Durban Heights WTP, but will add additional stress to the Upper Umgeni system that will lead to need for upgrading current infrastructure.

### *Seawater Desalination*

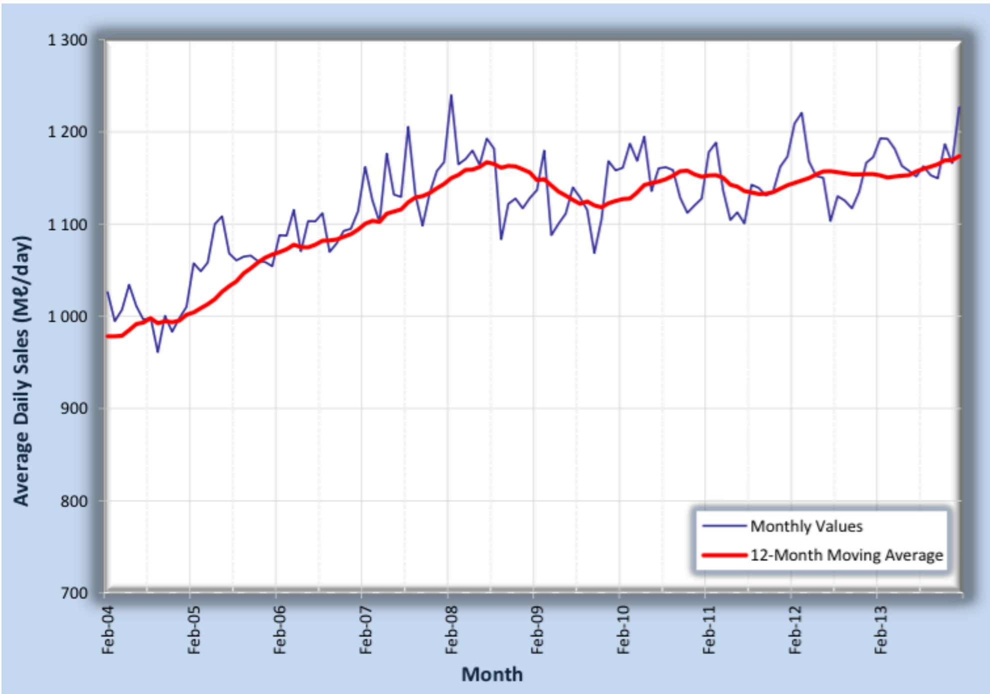
Recently Umgeni Water completed a desalination pre-feasibility study concerning the viability of constructing a large-scale desalination plant in the eThekwini area as a possible alternative to the proposed uMkhomazi Water Project. The ultimate capacity of the plant was set at 450 ML per day (164 million $m^3$ per annum). Due to infrastructure concerns, the original plan to have one big plant was adapted to now considering a 150 ML per day plant on both the north and south coast. This intervention would sufficiently augment supply to the Mgeni, South Coast, and North Coast Systems and an economic comparison at pre-feasibility level indicates no discernable difference when compared to the proposed uMkhomazi Water Project. Due to the ecological factors around east coast seawater, in-depth studies, including a pilot plant near Scottburgh on the KZN South Coast, are planned to assess viability of water quality. The pilot will operate for 12 months from the second half of 2014.

## 5.3 Water Demand

### 5.3.1 Short Term Demand

The total sales recorded for the 2012/13 financial year averaged 1 156 ML per day, 421 834 ML in total. This figure was 2.2% higher year-on-year than the 2011/12 financial year. Umgeni Water average daily bulk water sales over the past 10 years is provided in the figure below:

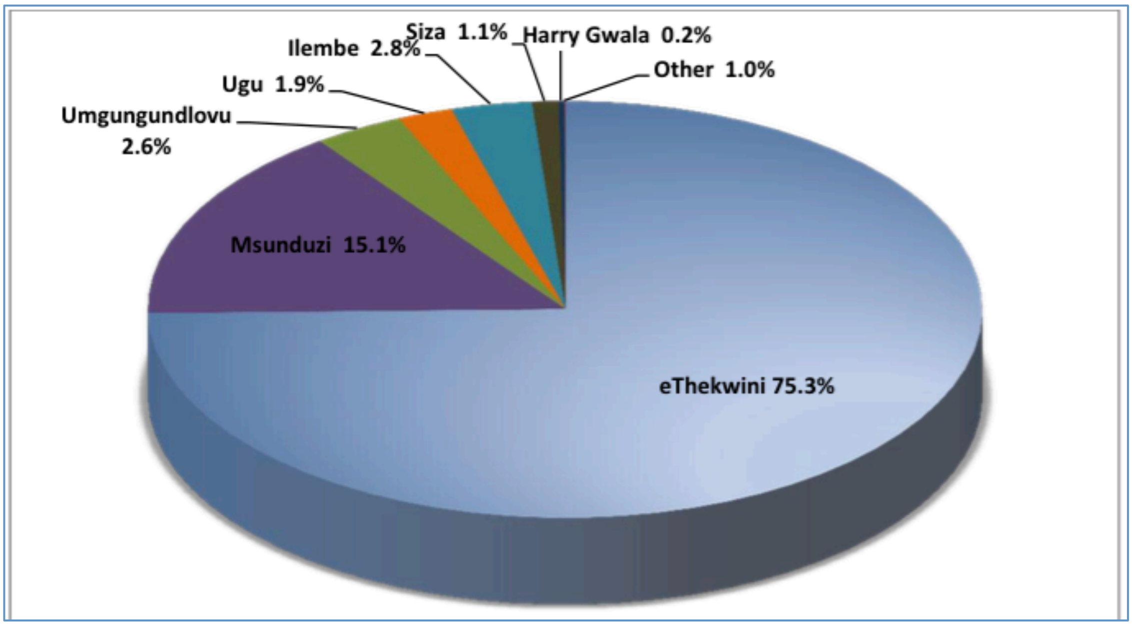
**Figure 5-13 Umgeni Water Total Average Daily Bulk Water Sales**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

eThekwini Municipality is the largest bulk water sales customer, accounting for 75.3% of Umgeni Water's total water sales in 2012/13, although increased demands from Ugu, iLembe and Msunduzi municipalities saw this figure drop from 77.1% in the previous period. Msunduzi Municipality is the second largest customer at 15.1% of sale. Umgeni Water's customer base in average daily sales distribution for the 2012/13 financial year is given in the graph below.

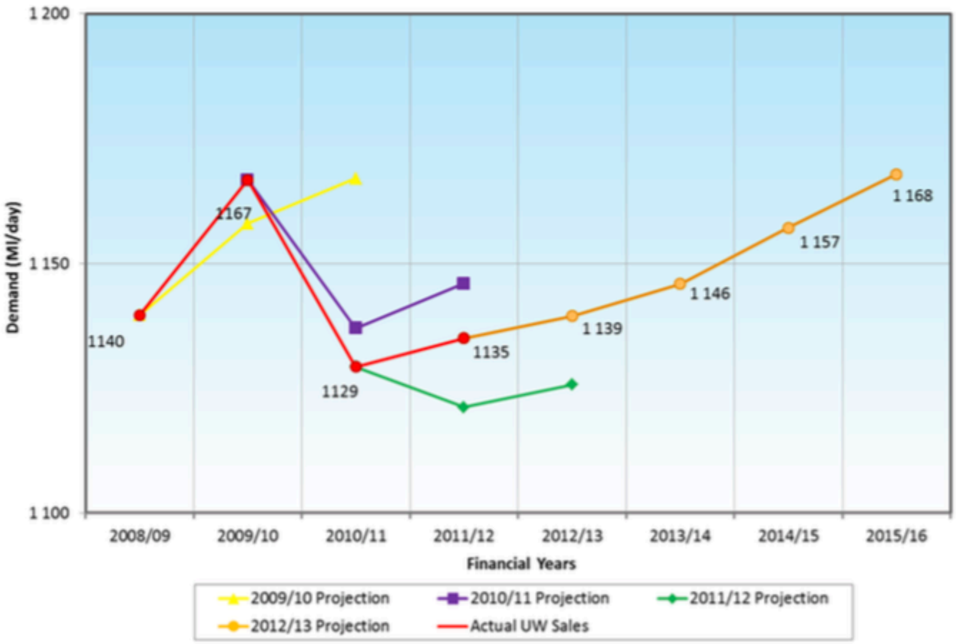
**Figure 5-14 Distribution of Sales Volumes by Municipality for 2012/2013**




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

The short-term bulk water sales are forecasted to increase 1.15% year-on-year, driven mainly by the forecast provided by eThekwini Municipality. The figure below gives this annual short-term sales forecast.

### Figure 5-15 Annual Short-term Sales Forecast




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

### *eThekwini Municipality*

It is predicted that substantial growth will still occur in the north of eThekwini Municipality, driven by the proposed formal housing projects and the industrial development of Dube Trade Port. Furthermore water demand management initiatives are not expected to further reduce sales. A load shift is expected from the Hazelmere WTP to the Durban Heights WTP as a result of proposed development on the KwaZulu-Natal North Coast. These factors are expected to drive sales from 868 ML per day in December 2013 to 889 ML per day in 2014/15.

### *Msunduzi Municipality*

There are no significant developments expected in the Msunduzi Municipality that will result in an increased in demand for water, and in addition an intensive water demand reduction programme is being implemented. These two factors have resulted in a negative demand forecast for Msunduzi in the short-term. It is expected this will result in the 2013/13 sales of 177 ML per day decreasing at a rate of 0.5%.

### *Umgungundlovu District Municipality*

It is expected demand will increase at a rate of 1% per year in the short-term in Umgungundlovu District Municipality, rising just above 40 ML per day by 2015.

### *iLembe District Municipality*

Significant factors in water demand in iLembe over the short-term will be sales to the coastal area of iLembe through Sembcorp Siza Water, sales to the coastal area of iLembe through iLembe District Municipality, and Sales to Ilembe District Municipality through schemes owned by the municipality and managed by Umgeni Water. It is predicted in the short-term that this area will experience initial growth of 5.5% in 2013/14 which equates to 38 ML per day, but thereafter the area will experience negative growth of -1.6% a year due to water demand managements initiatives and a restricted growth.

#### *Ugu District Municipality*

There has been some growth in Ugu water sales as a result of non-rural supply systems commissioned during the 2012/13 financial year. The completion of infrastructure implementation, such as the South Coast Pipeline (SCP-2a), will bring about further growth in sales. This growth would be driven by the municipality's proposed initiatives to reduce backlogs. The expected short-term sales growth rate is 2% in the 2014/15 financial year, driving sales to almost 27 ML per day.

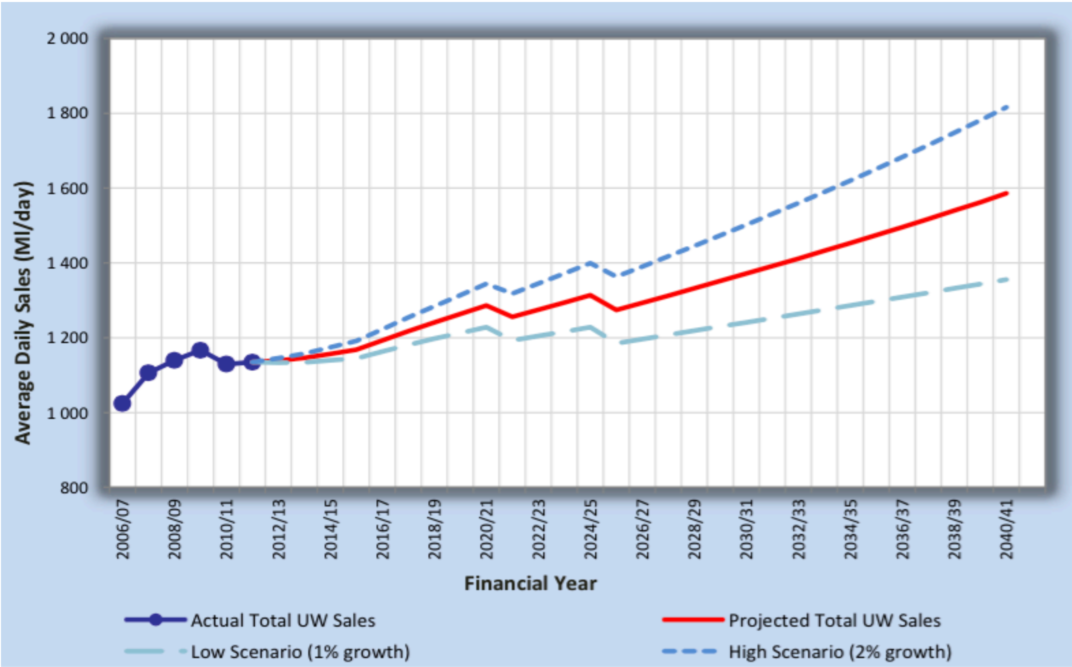
#### *Harry Gwala (Sisonke) District Municipality*

The Harry Gwala (Sisonke) District Municipality has had a recent reduction in sales that is attributed to leakage prevention through water demand management initiatives. It is forecasted that growth in sales will be 1% year-on-year for the short-term, rising to 2.5 ML per day by 2015.

### 5.3.2 Long-Term Demand

Umgeni Water bases it's 30-year long-term sales forecast on anticipated natural growth for its supply area, along with bulk sales from new supply infrastructure that will extend the supply area. The base projection is developed from the supply area's short-term forecasts and extended at a compounded 1.5% per annum growth rate until 2043/44. This has been deemed acceptable by major water users in the supply area and confirmed by the fact that it closely matches the forecast in an independent DWS study. The figure below presents this projection along with high and low scenarios. Two kinks are seen in the growth, first in 2020/21, and then in 2025/26, as a result of the anticipated commissioning of eThekwini Municipality's Northern and KwaMashu wastewater reuse plants.

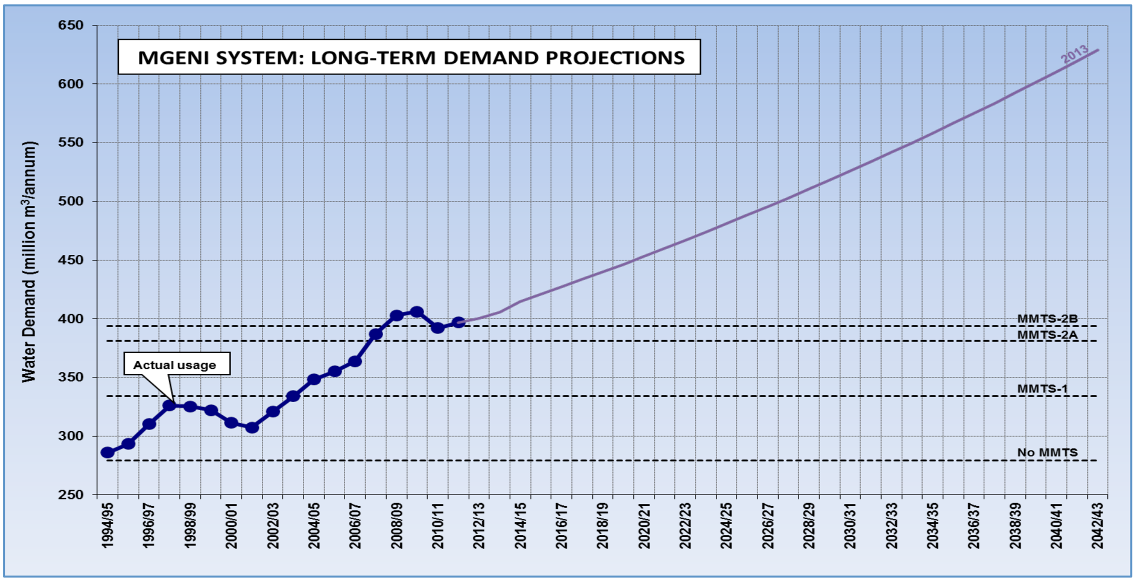
## Figure 5-16 Umgeni Water Long-Term Bulk Water Sales Forecast




*Source: Umgeni Water Infrastructure Master Plan 2014 2014/2015 - 2044/2045*

In March 2013 AECOM, who are responsible for the MWP-1 feasibility study, derived the flowing project long term-demand project for the Mgeni System. The graph below contains indicators for each level of supply from the Mooi-Mgeni Transfer Scheme, clearly displaying the need for additional water supply in the near future as demand exceeds MMTS-2B at just less than 400 million $m^3$ *per annum*, rising to 629 million $m^3$ *per annum* by 2042/43.

## Figure 5-17 Mgeni System Long-term Water Demand Projections




*Source: AECOM*

# 6 Socio-Economic Base Data

All socio-economic base-data is accessed via StatsSA and Quantec. Data for the study time period (2014/15 to 2044/2045) is projected based on existing trends and growth rates, using Umgeni Water infrastructure plan growth rates in the case of water demand and supply, and using a real growth rate in the case of economic data (inflation is removed from the data projections).

### *Gross Geographic Product*

Gross geographic product (GGP) is the measure of economic output measured by geographic region (gross domestic product by region).

### *Formal Employment*

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.

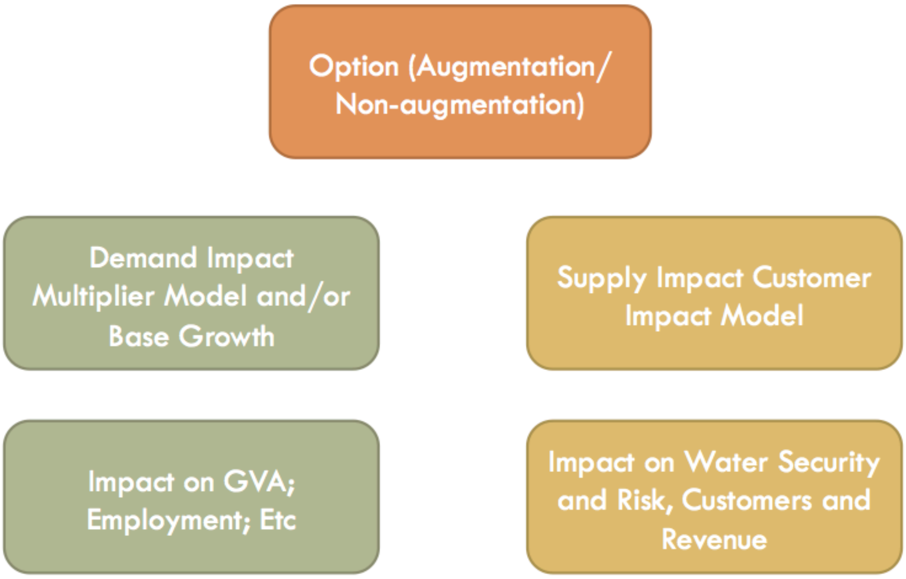
### *GGP and Employment Multipliers*

The GGP and employment multipliers used throughout this analysis were obtained from Quantec and are base year 2011. Both the GGP multipliers and the employment multipliers are specific to KwaZulu-Natal.

# 7 Economic Impact Model

The model created for this study assesses the impacts of augmentation and non-augmentation on the study area by calculating total economic impact of the existing system and projected growth, and comparing this to the total economic impact of the capital and operational spend needed to build and operate the first phase of the uMkhomazi Water Project. The demand implications under both scenarios are assessed in light of the breakdown of actual usage data in the regions supplied by the scheme. This enables the projection of the impact of both options on water end-users, and thus the impact on the customers of Umgeni Water.

**Figure 7-1 Economic Model Framework**




*Source: GMA*

## 7.1 General Methodology

Taking cost element inputs from the DWS Feasibility Study led by AECOM, the Umgeni Water economic impact model applies social accounting matrix (SAM) based economic multipliers to this data understand the full potential impact of the two proposed options on the study area. The results will been presented in a format which separates construction impact from operational impact, as it is important to assess construction spend separate from the operating of the water resources as this (construction impact) will be a limited term impact.

A SAM is a comprehensive, economy-wide database that contains information about the flow of resources that takes place between the different economic sectors that exist within an economy (that is sectors such as business enterprises, households, government) during a given period of time. In input-output model methodology, the static economic model analyses various industry sectors in the economy and provides the quantitative relationships between them. By identifying the monetary flows (expenditures and receipts) between various sectors in the economy, the input-output model depicts the economic relationships between the different components of an economy. The input-output model is demand driven and therefore relies on final demand data for it's functioning. The focus on inter-industry relationships at a detailed sectoral level allows a meaningful analysis of the national accounts, which yields an understanding of the inter-industry linkages and how each one of the economic sectors contributes, both directly and indirectly, to the economy as a whole.

The impact of a given sector on the economy as a whole, or alternatively the multiplier effect of that sector, is the relationship between the initial spending and the total effects generated by that spending. The input-output model translates final demand changes into total value of sectoral output. In order to ascertain the impacts of final demand spending on factors such as gross domestic product (GDP); imports; employment; household income, and personal income tax, multipliers are used. Multipliers are simply the inverse coefficients (value of production multipliers) produced by the input-output model, converted to relate to the factor they are measuring. In the case of a GDP multiplier, this indicates the additional GDP created throughout the entire economy due to an increase in demand for the products of a specific sector.

The economic impact of the proposed options is modelled over a 30-year period, from 2014/15 to 2044/45 using Quantec 2011 national multipliers. The regional economic analysis in Chapter 4 of this report provides the economic profile of the study area and its context regionally and nationally, including factors such as access to water and poverty.

Impact modelling assumptions are summarised in Appendix A.

## 7.2 Economic and Socio-economic Indicators

The analysis is carried out in terms of the following key economic indicators for KwaZulu-Natal and South Africa as a whole where possible, and phased according to the high-level feasibility plan:

- Employment
    - Skilled, semi-skilled, and unskilled employees and the informal sector
- Gross Value Added
- Household income
- Impact on investment
- Fiscal impacts

### 7.2.1 Levels of Impact

There are three levels of impact measured within the analysis:

- Direct (initial) impact: The direct impact is calculated from the macro-economic aggregates occurring as a direct result of activities within and related to the water resource.

- Indirect impacts (forward linkages): Indirect impact refers to suppliers that can be expected to sell increased volumes of goods and services as a result of activities within and related to the water resource.

- Induced impacts (backward linkages): The induced impacts are the multiplier impacts on goods and services demanded due to increased expenditure by households from additional income earned due to activities within and related to the water resource, representing the successive rounds of spending throughout the economy as a result of new water related activities.

Therefore the total economic impact of the option assessed is the sum of the Direct, Indirect and Induced impacts.

### 7.2.2 Phases of impact

The broad split generally found in the impact analysis of a potential investment is between the construction and operational phases of the project.

The construction phase is usually a defined time period in the life of a project and the direct construction related economic impact comes to an end as it finishes. The resultant effect this will have on the economic impact results will be to show a spike and then drop-off, as intensive construction picks up and then starts to curtail to be replaced by the economic activities it enabled. Its economic impact legacy is to put the structural environment in place that will enable economic production and service activities that will generate revenue and the resultant economic impact.

The assessment of the operational phase gives the potential economic impact of the core operation of the Umgeni Water, which is the impact of the water supply and related activities. It measures the sustainable economic potential of the investment over a set time period, and therefore is the critical barometer of the potential impact. Quantifying the operational activities is about analysing their scale and phasing.

# 8 Customer Model

## 8.1 Customer Usage Dataset

In order to further develop the understanding of water demand and usage, the project team contacted Umgeni Water Customers to insight into the breakdown of daily usage by water users. eThekwini Municipality was able to provide data which assisted in this analysis, supplying the project team with daily snapshot data (in kilolitres per day), which describes the total consumption in a day per individual site or household. This was a highly valuable exercise, since the municipality comprises of about 75% of Umgeni Water's supply and therefore customer's usage will give meaningful insight to the analysis. The full dataset consists of twenty-six individual consumption snapshots, starting from October 2011 and ending with the final dataset being September 2014. The table below summarises the datasets used.

**Table 8-1 eThekwini Municipality Customer Datasets**

| Dataset | Title | Comment |
|---|---|---|
| Oct-11 | C_20111003 | |
| Nov-11 | C_20111030 | |
| Dec-11 | C_20111211 | |
| Jan-12 | C_20120109 | Repeated |
| Feb-12 | C_20120205 | Repeated |
| Mar-12 | C_20120304 | Repeated |
| Apr-12 | C_20120402 | Repeated |
| May-12 | C_20120429 | Repeated |
| Jun-12 | C_20120527 | Repeated |
| Jul-12 | C_20120701 | Repeated |
| Aug-12 | C_20120729 | Repeated |
| Sep-12 | C_20120902 | Repeated |
| Oct-12 | AC20120930 | Repeated |
| Nov-12 | AC20121104 | |
| Dec-12 | | Missing |
| Jan-13 | | Missing |
| Feb-13 | | Missing |
| Mar-13 | | Missing |
| Apr-13 | | Missing |
| May-13 | | Missing |
| Jun-13 | | Missing |
| Jul-13 | | Missing |
| Aug-13 | | Missing |
| Sep-13 | AC20130929 | |
| Oct-13 | AC20131027 | |
| Nov-13 | AC20131202 | |
| Dec-13 | AC20140105 | |
| Jan-14 | AC20140203 | |
| Feb-14 | AC20140303 | |
| Mar-14 | AC20140331 | |
| Apr-14 | | Missing |

| Dataset | Title | Comment |
|---|---|---|
| May-14 | AC20140504 | |
| Jun-14 | AC20140601 | |
| Jul-14 | AC20140629 | |
| Aug-14 | ACS_201408 | |
| Sep-14 | ACS_201409 | |

*Source: eThekwini Municipality; GMA Model*

The following table represents the total consumption that can be extrapolated from the usage data compared to total monthly sales data from eThekwini. The table below illustrated that the relationships contained in the customer usage database are able to explain in the worse case 98.38% of total eThekwini Water Sales, and therefore these relationships can be analysed meaningfully.

### Table 8-2 Verification of Customer Usage Data

| Year | Usage Data | eThekwini Sales Data | Difference | % |
|---|---|---|---|---|
| 2011* | 50 554 636.13 | 49 472 411.00 | -1 082 225.13 | -2.14% |
| 2012 | 204 247 116.52 | 204 714 612.00 | 467 495.48 | 0.23% |
| 2013 | 199 741 621.69 | 200 971 180.00 | 1 229 558.31 | 0.62% |
| 2014 | 206 331 318.69 | 206 627 076.00 | 295 757.31 | 0.14% |

*Source: GMA Model; * Not complete, only three months data*

Each instance (household or site) is categorised by Usage Type, Town and Suburb. Each dataset consists of about five hundred thousand rows, each line representing usage data per instance for a time period. The usage types and broad categories are as follows:

### Table 8-3 Usage Type

| Usage Code | Description | Category |
|---|---|---|
| A | Domestic | Residential |
| B | Flats | Residential |
| C | Domestic tank 200l | Residential |
| D | Commercial | Commercial |
| E | Commercial/flats | Commercial |
| F | Industrial | Industrial |
| G | [No observations] | [No observations] |
| H | Industrial standby | Industrial |
| I | Textile industry | Industrial |
| K | Hospital | Public |
| M | Hotel | Commercial |
| N | Education | Public |
| P | Recreational | Public |
| R | Temporary | Residential |
| U | Bulk metered units (domestic) | Residential |
| V | Ugu district meter (domestic) | Residential |

*Source: GMA Model*

Given that the "Town" category was complete (no missing categories) and due to the fact it was a better area descriptor, it was used as the second category in the analysis that was built on the dataset. The full index of towns in the dataset is as follows:

**Table 8-4 Towns**

| | | |
|---|---|---|
| Adams Rural | Hazelmere | Mount Moreland |
| Ak | Hillcrest | Mpumalanga |
| Alverstone | Ilanga | Mshazi |
| Amanzimtoti | Ilfracombe | New Germany |
| Assagay | Imbozamo | Ngonweni |
| Avoca | Inanda | Nkomokazi |
| Bhekulwandle | Inchanga | Nsulwana |
| Blackburn | Inkangala | Ntuzuma |
| Bothas Hill | Inthuthuko | Nungwane |
| Buffels Kloof | Inwabi | Ogunjini |
| Buffelsdraai | Isipingo | Osindisweni |
| Canelands | Kingsburgh | Ottawa |
| Cato Ridge | Klaarwater | Pinetown |
| Chesterville | Kloof | Qhodela |
| Clansthal | Kwadabeka | Queensburgh |
| Clermont | Kwamakhutha | Redcliffe |
| Cliffdale | Kwamashu | Riet River |
| Cornubia | Kwandengezi | Riet Vallei |
| Craigieburn | Kwanqetho | Salem |
| Crestholme | Kwantamntengayo | Senzokuhle |
| Danganya | Kwasondela | Shallcross |
| Dassenhoek | Kwenkwezi | Shongweni |
| Drummond | Lamontville | Summerveld |
| Duffs Road | Langefontein | Tongaat |
| Durban | Lindokuhle | Umbogintwini |
| Durban North | Lovu | Umbumbulu |
| Eastbury | Lower Illovo | Umdloti |
| Emachobeni | Lower Langefontein | Umgababa |
| Emansomini | Mabedlane | Umhlanga Rocks |
| Emona | Madundube | Umkomaas |
| Everton | Magabheni | Umlazi |
| Ezimbokodweni | Matabetule | Verulam |
| Folweni | Mgangeni | Waterfall |
| Fredville | Mgezanyoni | Waterloo |
| Georgedale | Mkholombe | Welbedagt |
| Gillitts | Mlahlanja | Westville |
| Golokodo | Mngcweni | Ximba |
| Hambanathi | Molweni | Yellowwood Park |
| Hammarsdale | Mophela | Zwelibomvu |
| Harrison | Mount Edgecombe | |

*Source: GMA Model*

## 8.2 Growth Rates and Assumptions

This dataset allows for the analysis of the trends that exist in water consumption over time broken down by usage type and area. This allows for a number of options in determining growth rates for forecast analysis, and therefore assumptions have to be made regarding which growth rates to use.

## 8.3 Tariff Data

In order to understand the revenue implications of the two scenarios, Umgeni Water provided a dataset for 1994 – 2014 with the following metrics:

- Bulk Water Tariffs per year and yearly growth in tariffs
- Cost of Sales per year
- Treated Water Volume Sold
- Capital Expenditure

This dataset is used to apply tariff and capital expenditure to the baseline and the various datasets drawn out of the customer data. From this dataset, the following (inflation adjusted) metrics were observed:

- Umgeni Water spend on average R216.84 million (real, 2012 rands) per year on capital expenditure
- Tariffs have grown at 15.675% a year between 1994 and 2014 in real terms (from 0.26c/kl in 1994 to R4.81/kl in 2014, real 2012 rands)
- Cost of Sales per kilolitre have grown at 18.388% a year between 1994 and 2014 in real terms
- Treated Water Volume has grown at 9.409% a year between 1994 and 2014 in real terms

The table below represents the forecasted baseline figures for tariffs, cost of sales, CAPEX, and treated water volume sold from 2014 to 2031, base on the historical dataset:

### Table 8-5 Umgeni Water Forecasted Baseline Figures, Real 2012 Rands

| | Bulk water Tariffs | Cost of sales | Treated water volume sold | Capital expenditure |
|---|---|---|---|---|
| | R/kl | R/kl | kl ('000s) | R ('000s) |
| **2014** | 4.23 | 2.35 | 439 542 404 | 1 010 599 395 |
| **2015** | 4.28 | 2.44 | 450 213 198 | 1 026 824 059 |
| **2016** | 4.33 | 2.53 | 461 143 047 | 1 043 309 201 |
| **2017** | 4.38 | 2.63 | 472 338 241 | 1 060 059 005 |
| **2018** | 4.43 | 2.73 | 483 805 221 | 1 077 077 718 |
| **2019** | 4.48 | 2.83 | 495 550 585 | 1 094 369 658 |
| **2020** | 4.54 | 2.93 | 507 581 093 | 1 111 939 211 |
| **2021** | 4.59 | 3.04 | 519 903 665 | 1 129 790 835 |
| **2022** | 4.64 | 3.16 | 532 525 394 | 1 147 929 057 |
| **2023** | 4.70 | 3.27 | 545 453 540 | 1 166 358 479 |
| **2024** | 4.76 | 3.40 | 558 695 544 | 1 185 083 777 |
| **2025** | 4.81 | 3.52 | 572 259 025 | 1 204 109 700 |
| **2026** | 4.87 | 3.65 | 586 151 787 | 1 223 441 074 |
| **2027** | 4.93 | 3.79 | 600 381 824 | 1 243 082 804 |
| **2028** | 4.99 | 3.93 | 614 957 325 | 1 263 039 872 |
| **2029** | 5.05 | 4.08 | 629 886 676 | 1 283 317 340 |
| **2030** | 5.11 | 4.23 | 645 178 468 | 1 303 920 353 |
| **2031** | 5.17 | 4.39 | 660 841 499 | 1 324 854 138 |

*Source: GMA Model*

### *eThekwini Municipality Tariff Data*

The table below gives the current eThekwini Tariff Data for each of the consumer types:

### Table 8-6 eThekwini Tariff Data

| Type of water supply | Roof tank | Domestic* | Domestic** | Industrial, commercial |
|---|---|---|---|---|
| | Semi-pressure system | Full pressure | Full pressure | and other users |
| **Monthly Consumption** | | | | |
| **Prices per kilolitre excluding VAT** | | | | |
| **0kl to 9kl** | nil | nil | R11,43 | R16,47 |
| **From 9kl to 25kl** | R9,20 | R13,51 | R13,51 | R16,47 |
| **From 25kl to 30kl** | R12,59 | R17,99 | R17,99 | R16,47 |
| **From 30kl to 45kl** | R27,74 | R27,74 | R27,74 | R16,47 |
| **More than 45kl** | R30,52 | R30,52 | R30,52 | R16,47 |

*Source: eThekwini Water and Sanitation; *for property rateable values less than R250 000; **for property rateable values greater than R250 000*

These rates are used in the tariff and revenue analysis, to understand the impact of both scenarios on Umgeni Water's largest customer. These rates have been forecasted over the period of analysis (until 2031) using historical rate information.

# 9 Scenario Analysis

## 9.1 Non Augmentation

Scenario one, the base case, is founded on the assumption that the proposed Mkomazi augmentation scheme does not occur. This scenario is tested for supply sensitivities (including tariff sensitivities) and the tipping point at which supply constraints have a negative impact on economic growth.

### *The Baseline Case*

Scenario one, the base case, is founded on the assumption that the proposed Mkomazi-Mgeni augmentation scheme does not occur. The commissioning of Phase 2b of the Mooi-Mgeni Transfer Scheme (MMTS-2) in 2015 and the commissioning of the Western Aqueduct in mid 2018 both occur in the baseline case, after which supply is unable to keep up with growth in demand. The current Mgeni System (Midmar, Albert Falls, Nagel and Inanda Dams and the MMTS-1) has a stochastic yield of 334 million $m^3$ per annum at a 99% assurance of supply. MMTS-2 will increase the water supply from the Mgeni System by 60 million $m^3$ per annum. Demand in eThekwini Municipality is increasing to such an extent, however, that this increase yield will be insufficient to support to the proposed full Western Aqueduct load shift for any significant period of time.

The implementation of MMTS-2 will signify the final development on this scheme considered able to significantly increase the system's yield. After the completion of MMTS-2 (and Midmar's yield then being fixed) all future bulk distribution upgrades within the Upper Mgeni System will be limited to the water resources capacity that Midmar dam can support.

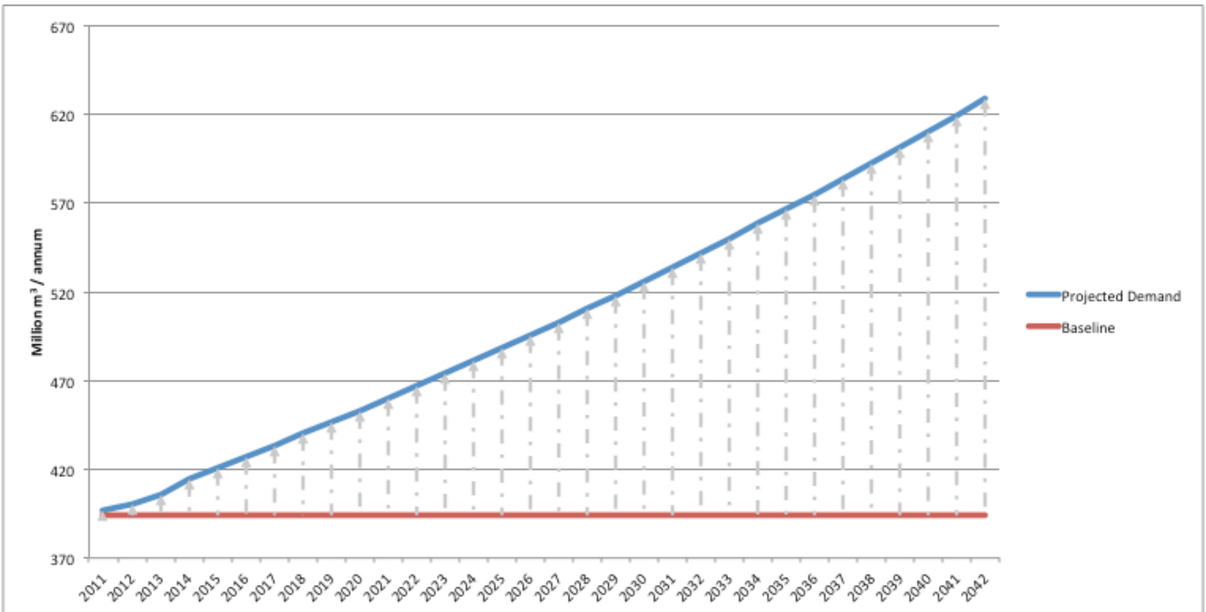
Under this baseline (a maximum of 394 million $m^3$ per annum) the Mgeni system is considered at capacity from 2014, and as such is constrained and unable to meet demand. The following graph represents the projected demand versus baseline supply:

### *eThekwini in the Baseline Scenario*

Although eThekwini uses requires 58% of the upper Mgeni system, it is assumed to make up 75.3% of the demand on the system for the forecast, consistent with its proportion of Umgeni Water sales in 2012/13.

It is assumed, under the baseline scenario, that Umgeni Water continues it's capital (CAPEX) and operational (OPEX) expenditure in the same trend as it has historically.

### Figure 9-1 Baseline vs. Projected Demand




*Source: AECOM, Umgeni Water*

## 9.2 Augmentation

Scenario two, the augmentation scenario, is founded on the assumption that the proposed Mkomazi-Mgeni augmentation scheme does occur. This second (augmentation) scenario follows the base case scenario in respect of demand and supply up to the year 2023, where after phase one of the Mkomazi transfer scheme becomes operational.

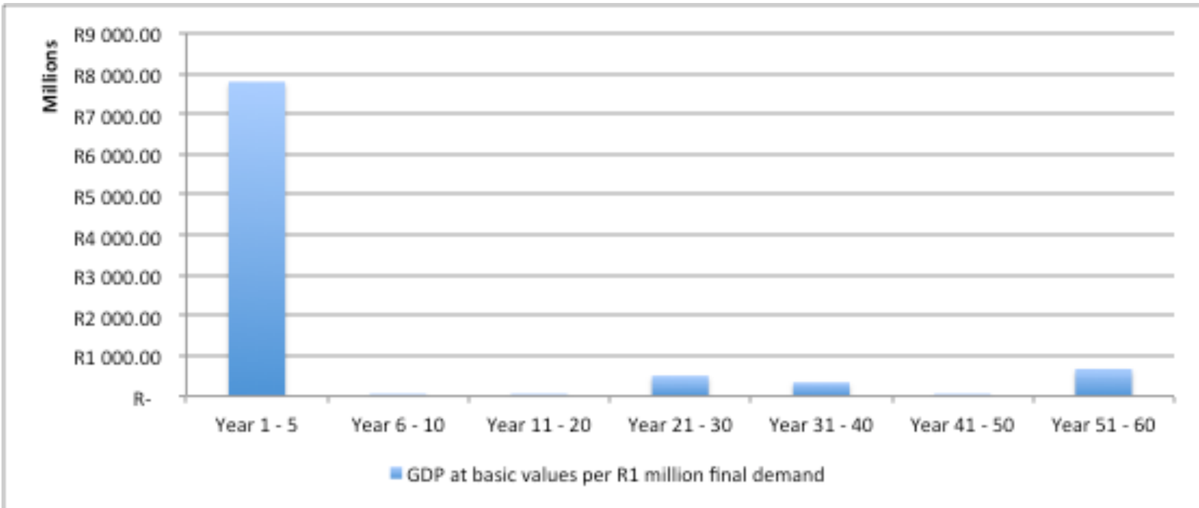
The structure of the augmentation analysis is divided into three components. Firstly, the economic impact, in terms of GGP and employment, of the capital expenditure on construction of the scheme is assessed. Secondly, the economic impact of operational expenditure is assessed, and thirdly the accommodating 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.

# 10 Impact Model Results

The results presented below summarise the socio-economic impact of carrying out the full extent of the uMWP within the current time, financial and technical parameters.

## 10.1 Economic Impacts of the uMkhomazi Water Project

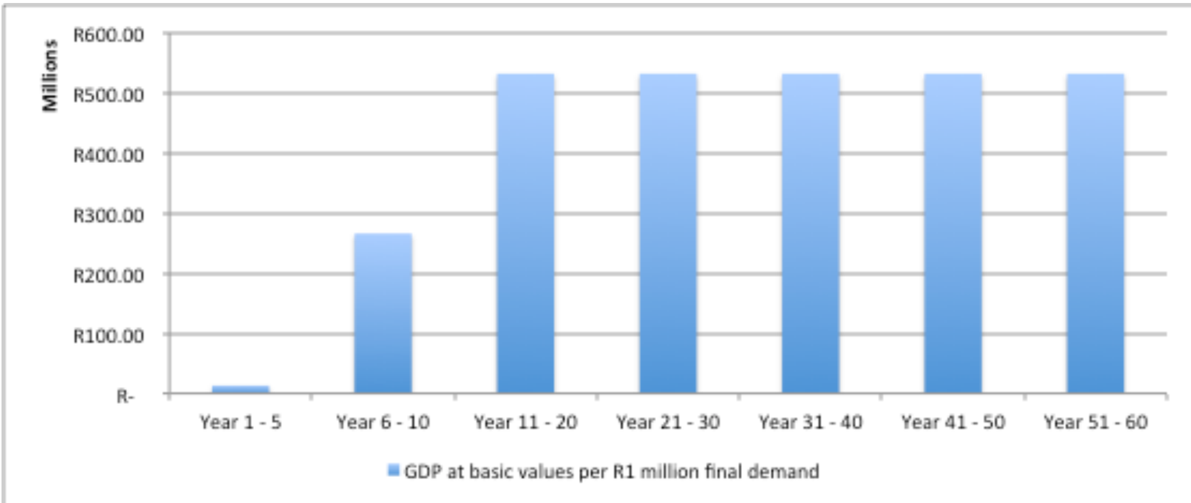
**Figure 10-1 uMkhomazi Water Project Total Economy-Wide Value Added to Economy from Investment (CAPEX) Over 60 Years**




*Source: GMA Model*

The figure above shows the distribution of economy-wide value addition over sixty years from the capital investment of the uMWP. Construction mostly takes place in the first 5 years. Thereafter capital spend in limited mainly to planned refurbishment of built assets.

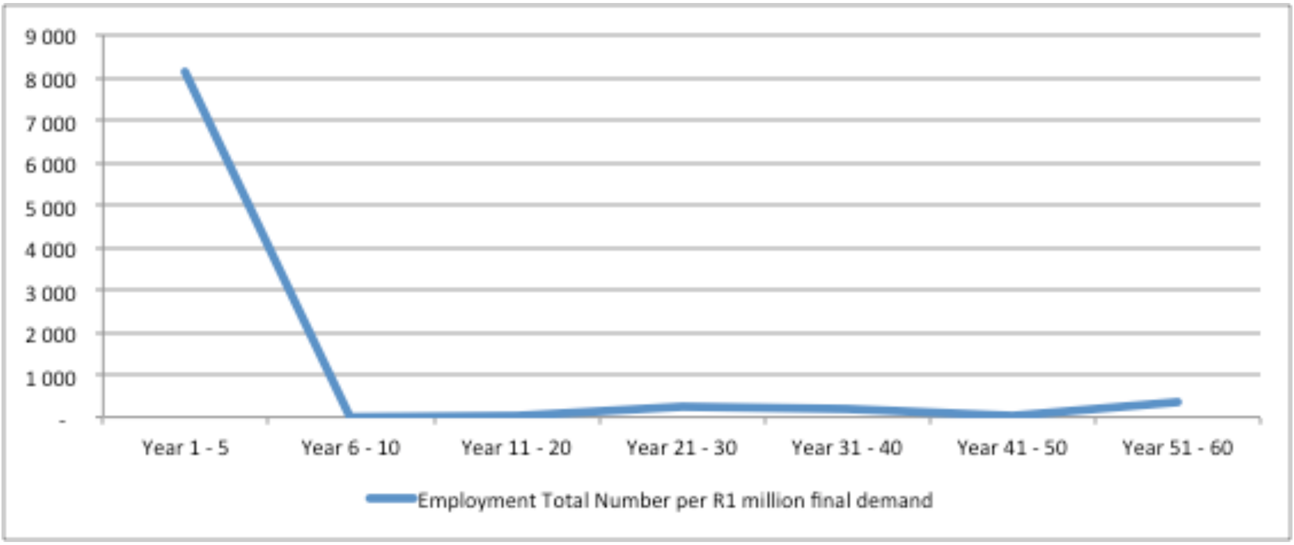
**Figure 10-2 uMkhomazi Water Project Total Economy-Wide Value Added to Economy from Investment (OPEX) Over 60 Years**




*Source: GMA Model*

The figure above shows the distribution of economy-wide value addition over sixty years from the sustainable operations of the uMWP created by the phase 1 construction. After the first fiver years during which construction is taking place, there is little sustainable value addition, however as operation ramps up from year 6 operational value is created, and by year 10 the investment reaches its full potential sustainable addition at R53.2 million a year.

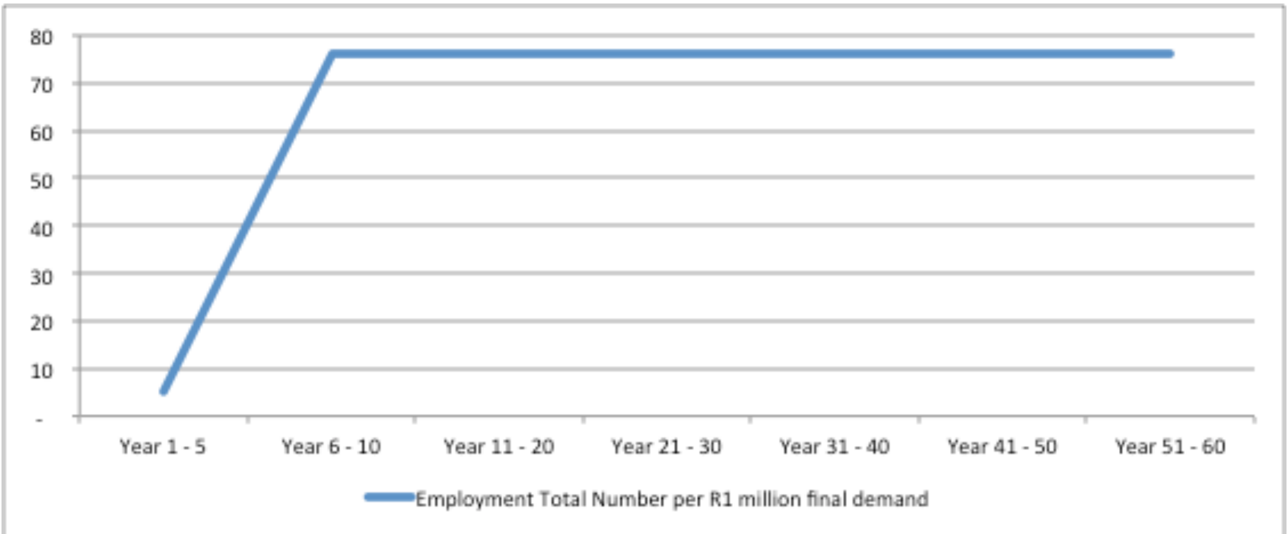
**Figure 10-3 uMkhomazi Water Project Total Economy-Wide Employment Created From Investment (CAPEX) Over 60 Years**




*Source: GMA Model*

The figures above and below show the distribution of economy-wide employment over sixty years. Construction mostly takes place in the first 5 years, during which 8 127 jobs are created temporarily (for the construction). In next 5 years, the activities of operational entities pick up and construction drops off. Finally total sustainable employment is reached during years 6-10, at 76 sustainable jobs created.

**Figure 10-4 uMkhomazi Water Project Total Economy-Wide Employment Created From Investment (OPEX) Over 60 Years**




*Source: GMA Model*

## 10.2 Contribution to Gross Geographic Product

The average direct impact of the operations of the uMWP per year over the 60-year period is a Gross Value Add (GVA) of R38.33 million per year. Including the indirect and induced effect of the investment and activities, this increases to an average total gross value added from operations to R53.24 million per year. To put this into context, the average direct impact (which could be expected to mostly occur in the KwaZulu-Natal) is 0.008% of the 2014 GDP of the Eastern Cape in 2014. The total economy wide impact of R53.24 million per year is 0.002% of the South African GDP.

### *Impact from Construction*

As can be seen from the table below, the estimated GDP impact across the country from construction in the uMkhomazi Water Project is R7.8 billion in years 1 to 5, which reduces to R2.71 million in years 6 to 10, and then to R10.8 million in years 11 to 20. Thereafter intermittent refurbishment drives further construction impact of R505.6 million in years 21-30, R341.4 million in years 31-40, R10.8 million in years 41-50, and R674.72 million in years 51-60. This value added is based on economic activity that is project and time based and therefore has distinct periods of investment.

### *Impact from uMkhomazi Water Project Operations*

The estimated value added across the country from operational activities is R13.17 million in years 1 to 5, rising to 266.21 million in years 6 to 10, then to R532.42 million in years 11 to 20, at which point operations reach their full economic potential according to the phase 3 plan. This impact can be seen as sustainable, as it is based on economic activity that supports the sustainable activities of water supply.

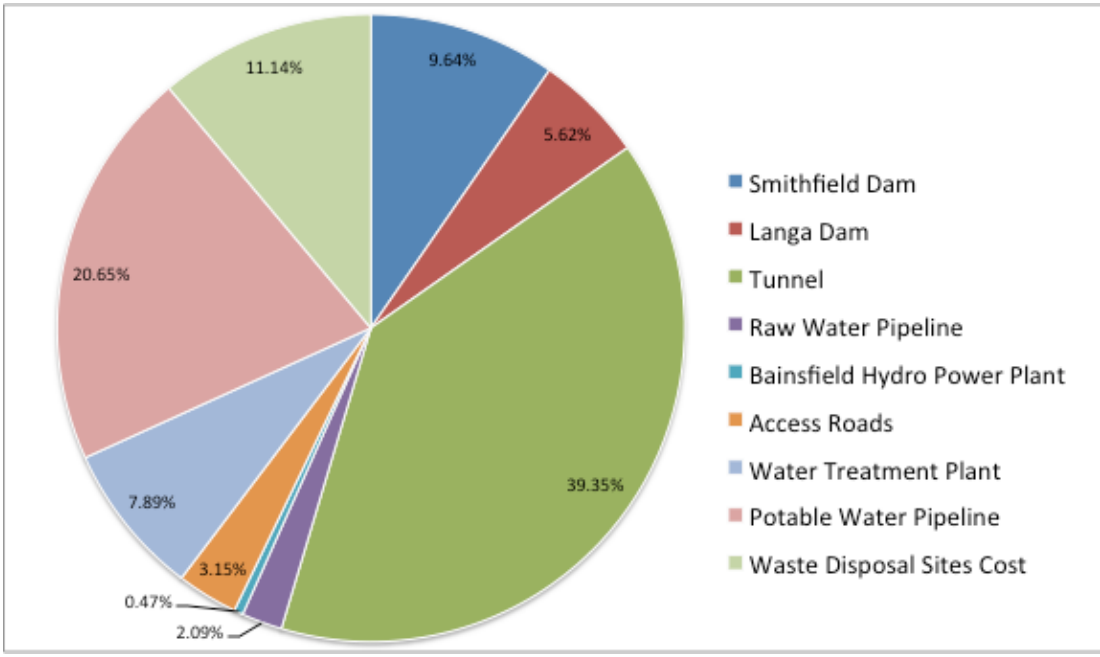
**Table 10-1 Value Added from uMkhomazi Water Project**

The total estimated contribution to GDP are shown in the table below:

| GVA In Rand Millions | Year 1 - 5 | Year 6 - 10 | Year 11 - 20 | Year 21 - 30 | Year 31 - 40 | Year 41 - 50 | Year 51 - 60 |
|---|---|---|---|---|---|---|---|
| **CAPEX Summary (Total)** | | | | | | | |
| *Direct Impact* | R4 827.56 | R1.55 | R7.07 | R310.53 | R209.80 | R7.07 | R414.28 |
| *Indirect Effect* | R1 319.67 | R0.22 | R1.55 | R87.15 | R58.80 | R1.55 | R116.47 |
| *Induced Impact* | R1 650.00 | R0.40 | R2.18 | R107.86 | R72.76 | R2.18 | R143.96 |
| *Economy-wide Impact* | R7 797.23 | R2.17 | R10.80 | R505.55 | R341.35 | R10.80 | R674.72 |
| **OPEX Summary (Total)** | | | | | | | |
| *Direct Impact* | R8.99 | R191.65 | R383.31 | R383.31 | R383.31 | R383.31 | R383.31 |
| *Indirect Effect* | R2.05 | R27.76 | R55.52 | R55.52 | R55.52 | R55.52 | R55.52 |
| *Induced Impact* | R2.13 | R46.79 | R93.58 | R93.58 | R93.58 | R93.58 | R93.58 |
| *Economy-wide Impact* | R13.17 | R266.21 | R532.42 | R532.42 | R532.42 | R532.42 | R532.42 |
| **CAPEX Summary (Average)** | | | | | | | |
| *Direct Impact* | R965.51 | R0.31 | R0.71 | R31.05 | R20.98 | R0.71 | R41.43 |
| *Indirect Effect* | R263.93 | R0.04 | R0.16 | R8.72 | R5.88 | R0.16 | R11.65 |
| *Induced Impact* | R330.00 | R0.08 | R0.22 | R10.79 | R7.28 | R0.22 | R14.40 |
| *Economy-wide Impact* | R1 559.45 | R0.43 | R1.08 | R50.55 | R34.14 | R1.08 | R67.47 |
| **OPEX Summary (Average)** | | | | | | | |
| *Direct Impact* | R1.80 | R38.33 | R38.33 | R38.33 | R38.33 | R38.33 | R38.33 |
| *Indirect Effect* | R0.41 | R5.55 | R5.55 | R5.55 | R5.55 | R5.55 | R5.55 |
| *Induced Impact* | R0.43 | R9.36 | R9.36 | R9.36 | R9.36 | R9.36 | R9.36 |
| *Economy-wide Impact* | R2.63 | R53.24 | R53.24 | R53.24 | R53.24 | R53.24 | R53.24 |

*Source: GMA Model*

### Table 10-2 Programme Contributions to GVA




*Source: GMA Model*

The figure above shows the economic wide impact from the individual uMkhomazi Water Project programmes after construction has ended; in other words, the portion of total sustainable impact each programme is responsible for is responsible for. The Tunnel (39.35%) and Potable Water Pipeline (20.65%) together are over half the contribution, with the Waste Disposal Site and Smithfield Dam being the next largest contributions at 11.14% and 9.64% respectively.

## 10.3 Levels of Investment

The total capital investment of the uMWP is R 11.67 billion, which yields a total direct construction value add impact return of R5.78 Billion over 60 years, and a total direct operational value add impact return of R2.18 Billion over 60 years, together making a direct impact of R7.9 billion gross value added. When the economy-wide impact is considered, the impacts on GDP from construction and operation investment is R9.3 billion and R2.9 billion respectively, together combined to make an economy wide impact on GDP of R12.3 billion over 60 year. In other words, the investment of the uMWP will create value to the extent that it covers the cost of investment over 60 years. This means the payback period in a Gross Value Added sense is 54 years.

## 10.4 Impact on the Current Account

The cost of the investment of the uMWP will worsen current account deficit in the short term. However the economic activity that occurs as a result of securing the water supply to economically active entities will have a long-term effect reducing the risk of dometic industry shutting down and even potentially allow the creation of new economic activity. In the long-term the uMWP will help to stabilise and even potentially reduce the current account deficit. Given the vital status of water as a necessity good, it will secure the eventual reduction of the current account deficit by far more than the initial investment extends the deficit.

## 10.5 Contribution to Output, Intermediate Imports, and Gross Operating Surplus

The economy wide contribution of the uMWP to Output, Intermediate Imports, and Gross Operating Surplus is presented in the table below.

**Contribution from uMkhomazi Water Project (Average per Year, R Millions)**

| | Year 1 - 5 | Year 6 - 10 | Year 11 - 20 | Year 21 - 30 | Year 31 - 40 | Year 41 - 50 | Year 51 - 60 |
|---|---|---|---|---|---|---|---|
| **Output** | | | | | | | |
| *Construction* | R21 462.5 | R4.7 | R27.4 | R1 407.4 | R949.5 | R27.4 | R1 879.4 |
| *Operation* | R6.2 | R116.2 | R116.2 | R116.2 | R116.2 | R116.2 | R116.2 |
| **Intermediate Imports** | | | | | | | |
| *Construction* | R2 309.5 | R0.3 | R2.5 | R152.8 | R102.8 | R2.5 | R204.1 |
| *Operation* | R0.4 | R7.1 | R7.1 | R7.1 | R7.1 | R7.1 | R7.1 |
| **Gross Operating Surplus** | | | | | | | |
| *Construction* | R4 544.9 | R1.4 | R6.6 | R293.2 | R198.1 | R6.6 | R391.2 |
| *Operation* | R1.8 | R35.2 | R35.2 | R35.2 | R35.2 | R35.2 | R35.2 |

*Source: GMA Model*

## 10.6 Employment

### *Employment Opportunities from Construction*

The potential sustainable employment impact in the country as a result of the uMkhomazi Water Project is 8127 jobs per year from construction activities and 76 jobs per year from operational activities. This translates to 29 direct jobs per year once the project is operating at full capacity. As can be seen from the table below, the estimated employment across the country from construction in the uMkhomazi Water Project is 8 127 jobs in years 1 to 5, which reduce to 1 in years 6 to 10, and then to 4 jobs in years 11 to 20.

**Table 10-3 Employment Impact of uMkhomazi Water Project**

The total estimated jobs created by the project are shown in the table below:

| Jobs | Year 1 - 5 | Year 6 - 10 | Year 11 - 20 | Year 21 - 30 | Year 31 - 40 | Year 41 - 50 | Year 51 - 60 |
|---|---|---|---|---|---|---|---|
| **CAPEX Summary (Total FTEs)** | | | | | | | |
| *Direct Impact* | 27 469 | 1 | 25 | 1 779 | 1 198 | 25 | 2 380 |
| *Indirect Effect* | 5 533 | 1 | 6 | 365 | 246 | 6 | 488 |
| *Induced Impact* | 7 636 | 2 | 10 | 499 | 337 | 10 | 666 |
| *Economy-wide Impact* | 40 637 | 4 | 41 | 2 643 | 1 781 | 41 | 3 535 |
| **OPEX Summary (Total FTEs)** | | | | | | | |
| *Direct Impact* | 12 | 146 | 293 | 293 | 293 | 293 | 293 |
| *Indirect Effect* | 4 | 60 | 119 | 119 | 119 | 119 | 119 |
| *Induced Impact* | 10 | 174 | 347 | 347 | 347 | 347 | 347 |
| *Economy-wide Impact* | 26 | 380 | 759 | 759 | 759 | 759 | 759 |
| **CAPEX Summary (Real Jobs)** | | | | | | | |
| *Direct Impact* | 5 494 | 0 | 3 | 178 | 120 | 3 | 238 |
| *Indirect Effect* | 1 107 | 0 | 1 | 37 | 25 | 1 | 49 |
| *Induced Impact* | 1 527 | 0 | 1 | 50 | 34 | 1 | 67 |
| *Economy-wide Impact* | 8 127 | 1 | 4 | 264 | 178 | 4 | 353 |
| **OPEX Summary (Real Jobs)** | | | | | | | |
| *Direct Impact* | 2 | 29 | 29 | 29 | 29 | 29 | 29 |
| *Indirect Effect* | 1 | 12 | 12 | 12 | 12 | 12 | 12 |
| *Induced Impact* | 2 | 35 | 35 | 35 | 35 | 35 | 35 |
| *Economy-wide Impact* | 5 | 76 | 76 | 76 | 76 | 76 | 76 |

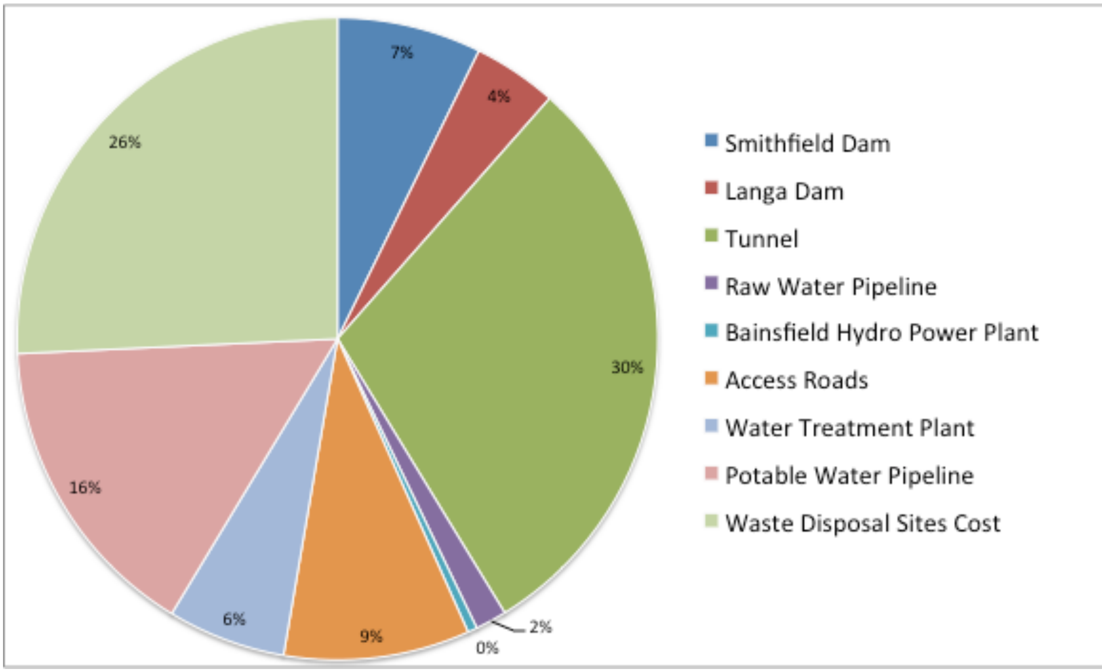
*Source: GMA Model*

Thereafter intermittent refurbishment drives further construction impact of 264 jobs in years 21-30, 178 jobs in years 31-40, 4 jobs in years 41-50, and 353 jobs in years 51-60. This value added is based on economic activity that is project and time based and therefore has distinct periods of investment.

### *Employment Opportunities from uMWP Operations*

The estimated employment added across the country from operational activities is 5 jobs in years 1 to 5, rising to 76 jobs in years 6 to 10 at which point operations reach their full economic potential according to the phase 3 plan. This impact can be seen as sustainable, as it is based on economic activity that supports the sustainable activities of water supply.

**Table 10-4 Programme Contributions to Employment**




*Source: GMA Model*

The figure above shows the economic wide impact from the individual uMkhomazi Water Project programmes after construction has ended; in other words, the portion of total sustainable jobs each programme is responsible for is responsible for. The Tunnel (30%) and Waste Disposal Sites (26%) together are over half the contribution, with Potable Water Pipeline and Access Roads being the next largest contributions at 16% and 9% respectively.

## 10.7 Contribution to Labour Remuneration

The economy wide contribution of the uMWP to labour remuneration is presented in the table overleaf.

**Contribution from uMkhomazi Water Project (Average per Year, R Millions)**

| | Year 1 - 5 | Year 6 - 10 | Year 11 - 20 | Year 21 - 30 | Year 31 - 40 | Year 41 - 50 | Year 51 - 60 |
|---|---|---|---|---|---|---|---|
| **Labour Remuneration** | | | | | | | |
| *Construction* | R3 148.0 | R0.8 | R4.1 | R205.8 | R138.8 | R4.1 | R274.6 |
| *Operation* | R0.8 | R18.2 | R18.2 | R18.2 | R18.2 | R18.2 | R18.2 |

*Source: GMA Model*

## 10.8 Baseline Impact Analysis

The results below are the result of running the baseline scenario through the economic impact model. They represent the impact that the baseline CAPEX and OPEX would have in the absence of the uMWP, given the historical trends remain constant. This establishes the baseline for the impact of the uMWP to be compared against. The baseline model analysis is carried out over the initial thirty-year period, from 2015 to 2030. This timeframe is chosen because this is the critical period over which supply capacity needs to be provided; after this time any trends (such as the negative gap between the baseline and augmentation) will only worsen. In addition, the analysis attempts to provide as accurate a view as possible, since forecasting gets less accurate the further it moves form the start year.

### 10.8.1 Contribution to Gross Geographic Product

The normal operation of Umgeni Water only carries through to 2015, after which supply constraints mean that capital and operational spending even out.

**Table 10-5 Impact of Baseline on Gross Value Added (Total Over Period)**

| | Year 1 - 10 | Year 11 - 20 | Year 21 - 30 |
|---|---|---|---|
| **CAPEX Summary (Total)** | | | |
| ***Economy-wide Impact*** | R8 120.19 | R8 133.05 | R8 133.05 |
| | | | |
| **OPEX Summary (Total)** | | | |
| ***Economy-wide Impact*** | R17 421.14 | R17 482.66 | R17 482.66 |

*Source: GMA Model*

At the Baseline Umgeni Water adds R8.1 billion from CAPEX and R17.42 billion from OPEX to the economy over the first ten years, and R8.13 billion from CAPEX and R17.48 billion from OPEX every ten years thereafter.

### 10.8.2 Contribution to Employment

At the Baseline Umgeni Water adds 4 606 jobs from CAPEX and 2 516 jobs from OPEX to the economy over the first ten years, and 4 613 from CAPEX and 2 516 from OPEX every ten years thereafter.

**Table 10-6 Impact of Baseline on Employment (Jobs)**

| | Year 1 - 10 | Year 11 - 20 | Year 21 - 30 |
|---|---|---|---|
| **CAPEX Summary (Average)** | | | |
| ***Economy-wide Impact*** | 4 606 | 4 613 | 4 613 |
| | | | |
| **OPEX Summary (Average)** | | | |
| ***Economy-wide Impact*** | 2 508 | 2 516 | 2 516 |

*Source: GMA Model*

## 10.9 Scenario Comparison

In order to build the augmentation scenario, the results from the uMWP above are added to a baseline were there is no restriction on growth, to get the derived operation of Umgeni Water with full ability to meet demand.

### 10.9.1 Adjustment to Augmentation Analysis

**Table 10-7 Impact of Augmentation on Gross Value Added (Total Over Period)**

| | Year 1 - 10 | Year 11 - 20 | Year 21 - 30 |
|---|---|---|---|
| **CAPEX Summary (Total)** | | | |
| ***Economy-wide Impact*** | R16 407.69 | R10 105.36 | R12 342.97 |
| | | | |
| **OPEX Summary (Total)** | | | |
| ***Economy-wide Impact*** | R20 202.83 | R29 040.26 | R41 323.40 |

*Source: GMA Model*

Under Augmentation Umgeni Water adds R16.4 billion from CAPEX and R20.2 billion from OPEX to the economy over the first ten years, R10.1 billion from CAPEX and R29 billion from OPEX to the economy over the second ten years, and R12.3 billion from CAPEX and R41.3 billion from OPEX to the economy over the third ten years.

**Table 10-8 Impact of Augmentation on Employment (Jobs)**

| | Year 1 - 10 | Year 11 - 20 | Year 21 - 30 |
|---|---|---|---|
| **CAPEX Summary (Average)** | | | |
| ***Economy-wide Impact*** | 8 947 | 5 730 | 6 979 |
| | | | |
| **OPEX Summary (Average)** | | | |
| ***Economy-wide Impact*** | 2 908 | 4 179 | 5 947 |

*Source: GMA Model*

Under Augmentation Umgeni Water adds 8 497 job from CAPEX and R2 908 jobs from OPEX to the economy over the first ten years, 5 730 jobs from CAPEX and 4 179 jobs from OPEX to the economy over the second ten years, and 6 979 jobs from CAPEX and 5 947 jobs from OPEX to the economy over the third ten years.

### 10.9.2 Non-Augmentation Impacts vs. Augmentation Impacts

When the two scenarios are compared, the following results:

*Impact on Gross Value Added*

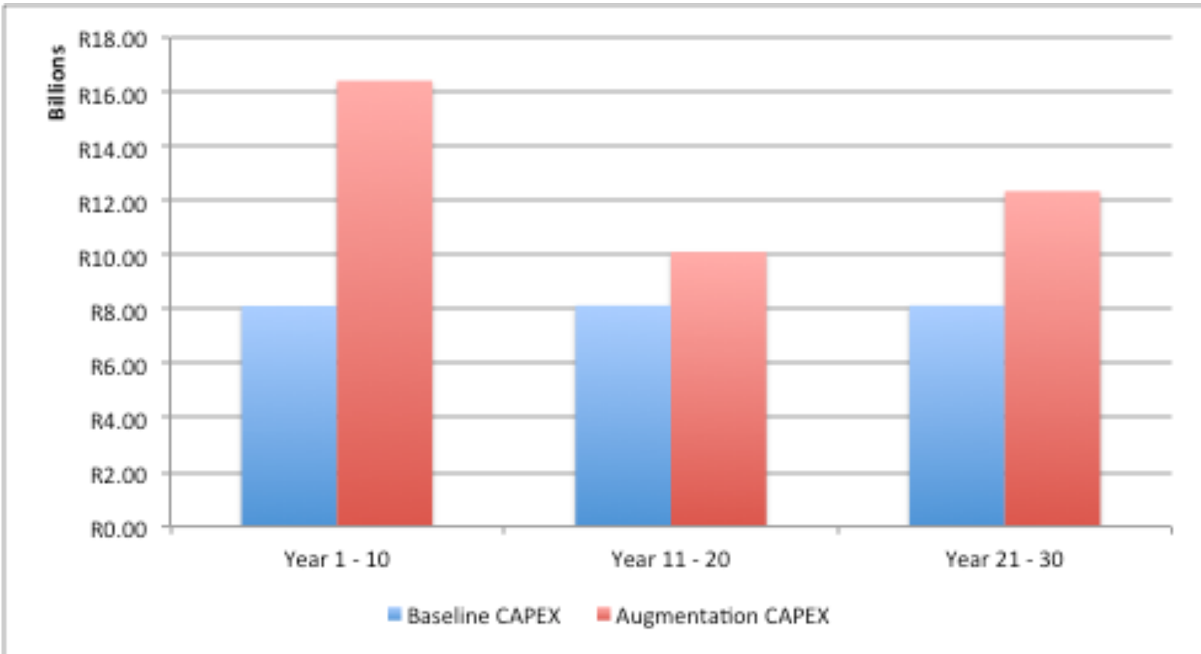
**Table 10-9 Gap; Gross Value Added (Total Over Period)**

| | Year 1 - 10 | Year 11 - 20 | Year 21 - 30 |
|---|---|---|---|
| **CAPEX Summary (Total)** | | | |
| ***Economy-wide Impact*** | R8 287.50 | R1 972.31 | R4 209.92 |
| | | | |
| **OPEX Summary (Total)** | | | |
| ***Economy-wide Impact*** | R2 781.70 | R11 557.60 | R23 840.73 |

*Source: GMA Model*

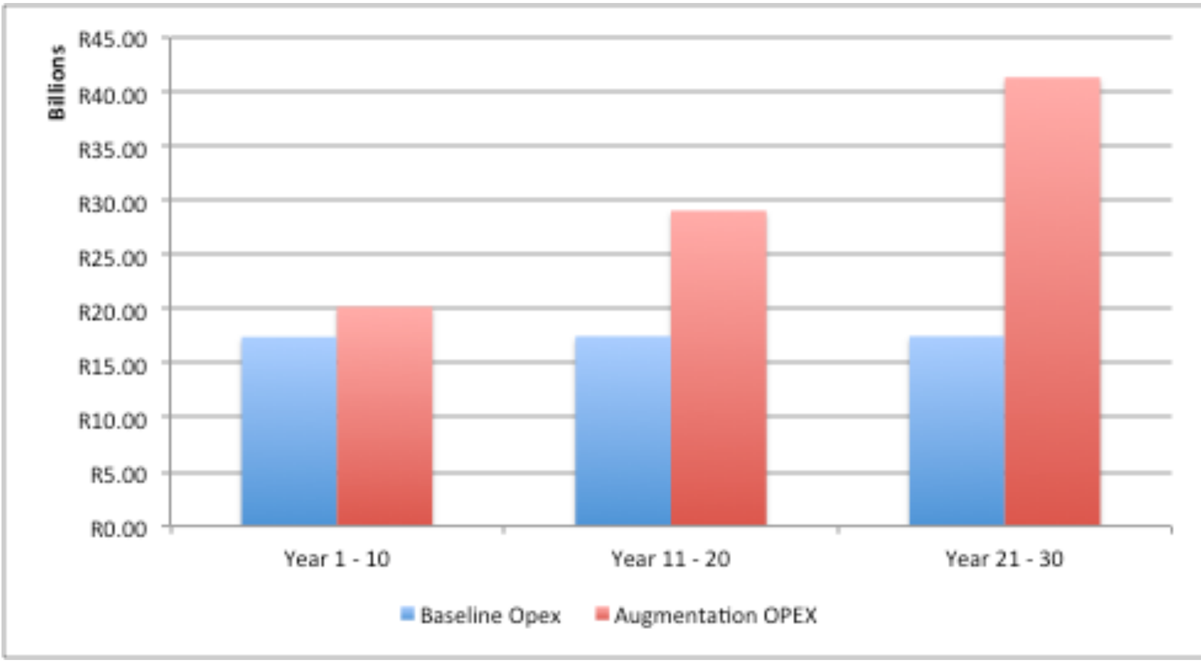
The GAP amounts to R8.3 billion from CAPEX and R2.8 billion from OPEX to the economy over the first ten years, R1.97 billion from CAPEX and R11.56 billion from OPEX to the economy over the second ten years, and R4.2 billion from CAPEX and R21.8 billion from OPEX to the economy over the third ten years.

**Figure 10-5 Baseline CAPEX Against Augmentation CAPEX**



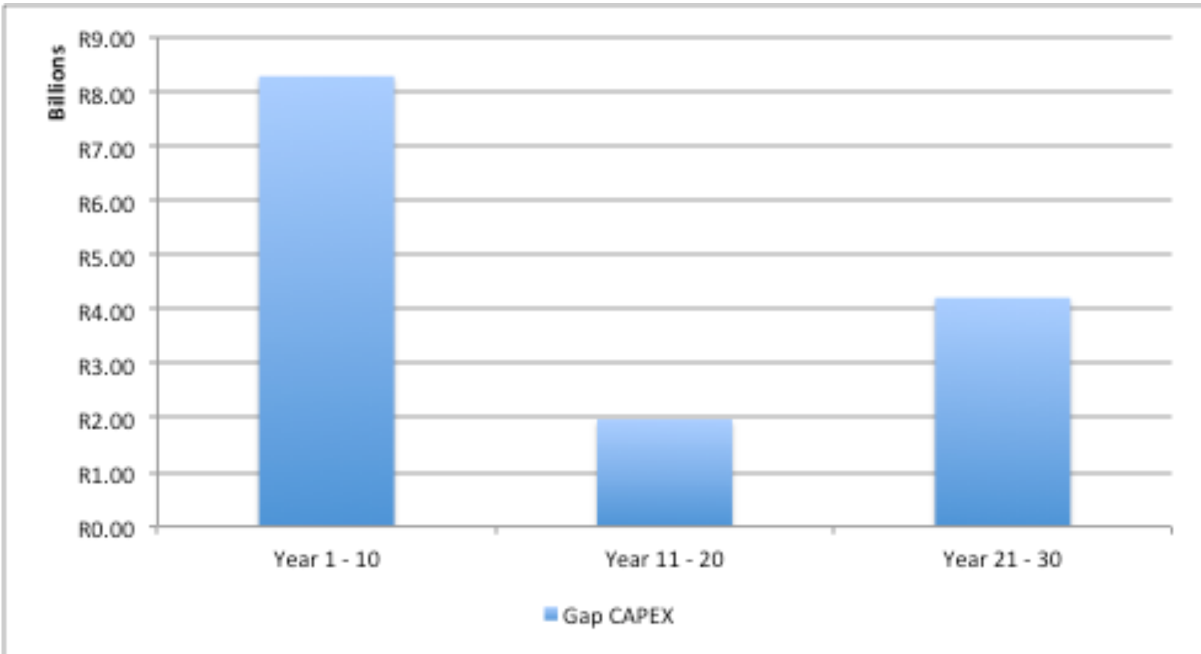

*Source: GMA Model*

### Figure 10-6 Baseline OPEX Against Augmentation OPEX



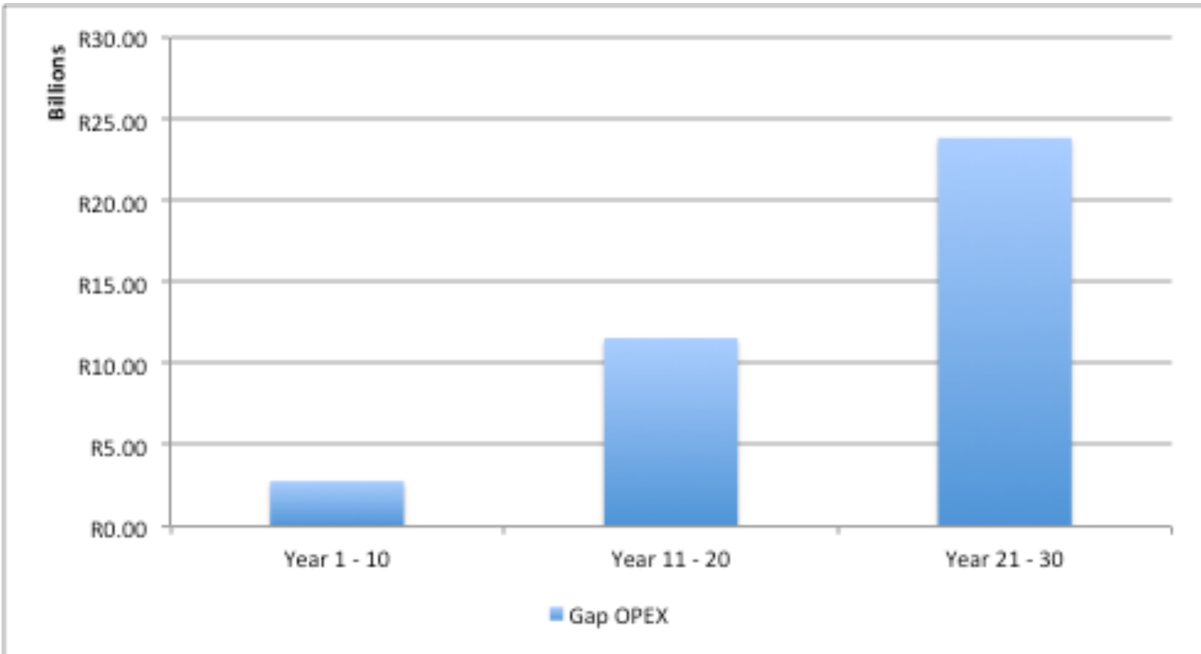

*Source: GMA Model*

### Figure 10-7 Gap CAPEX




*Source: GMA Model*

### Figure 10-8 Gap OPEX




*Source: GMA Model*

### *Impact on Employment*

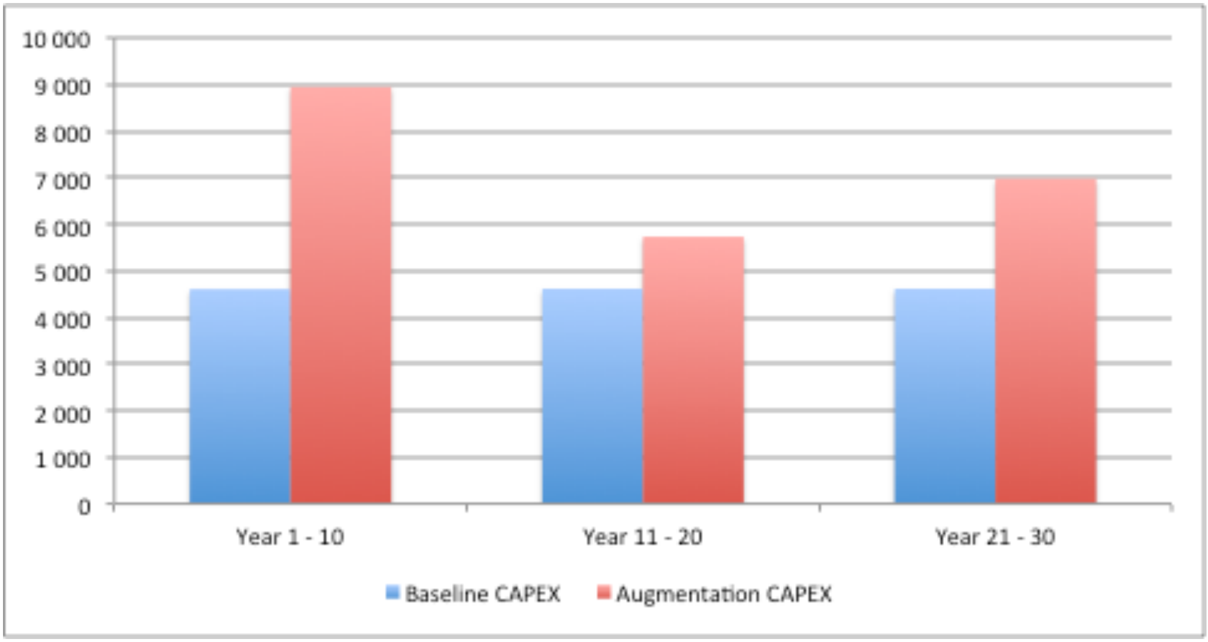
### Table 10-10 Gap; Employment (Jobs)

| | Year 1 - 10 | Year 11 - 20 | Year 21 - 30 |
|---|---|---|---|
| **CAPEX Summary (Average)** | | | |
| ***Economy-wide Impact*** | 4 341 | 1 117 | 2 366 |
| | | | |
| **OPEX Summary (Average)** | | | |
| ***Economy-wide Impact*** | 401 | 1 663 | 3 431 |

*Source: GMA Model*

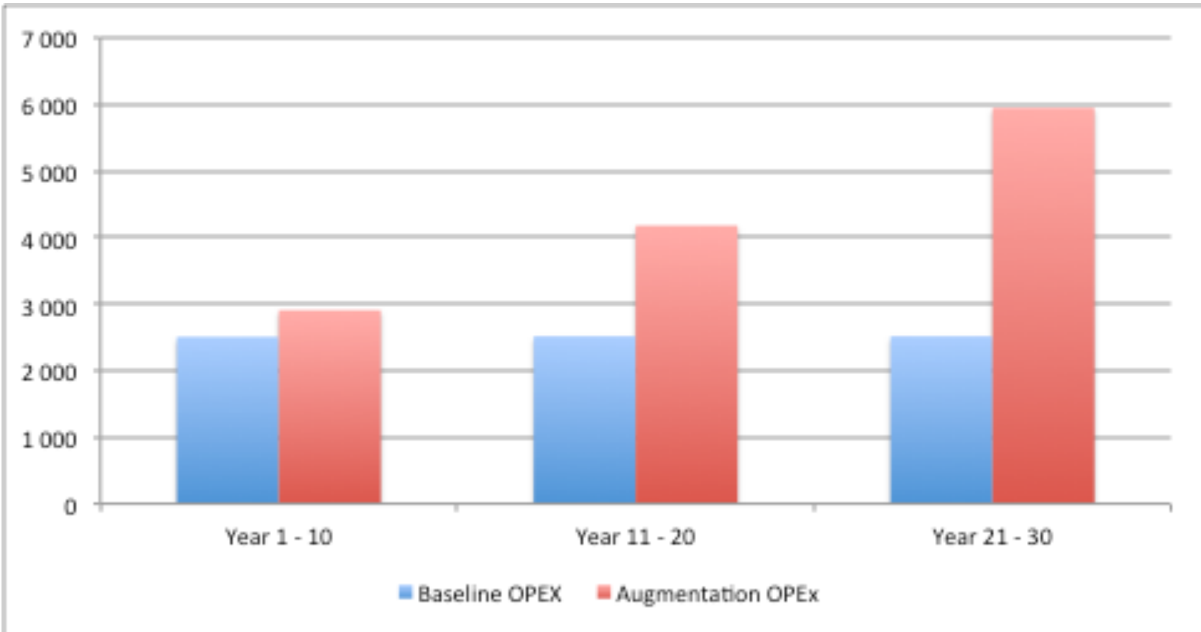
The GAP amounts to 4 341 jobs from CAPEX and 401 jobs from OPEX to the economy over the first ten years, 1 117 jobs from CAPEX and 1 663 jobs from OPEX to the economy over the second ten years, and 2 366 jobs from CAPEX and 3 431 jobs from OPEX to the economy over the third ten years.

## Figure 10-9 Baseline CAPEX Against Augmentation CAPEX



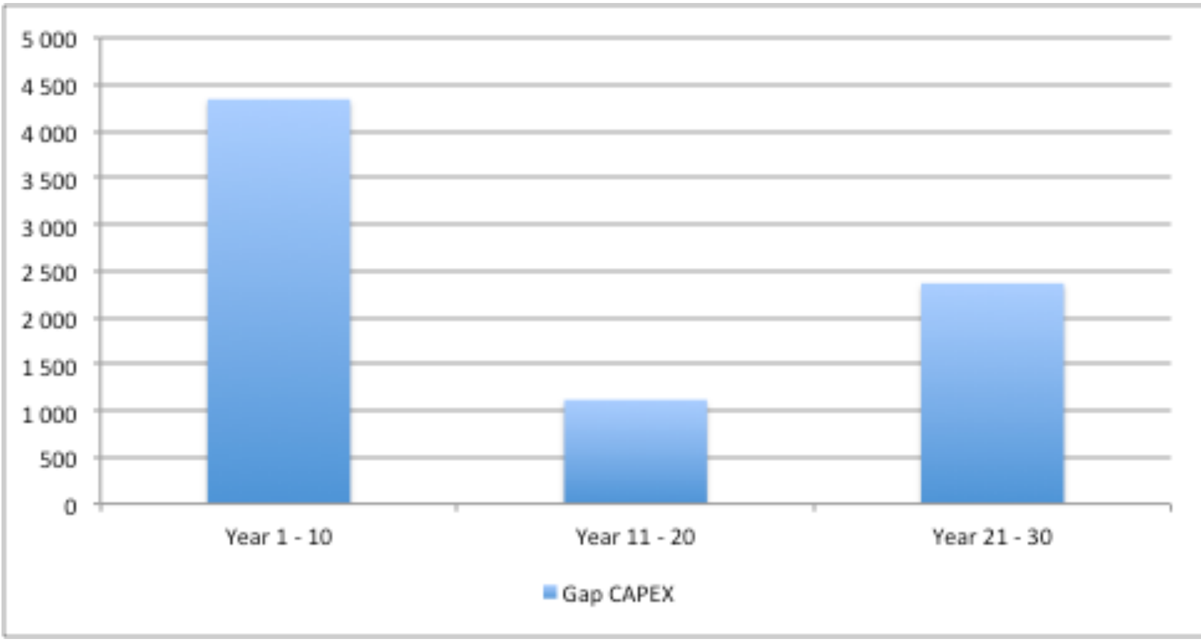

*Source: GMA Model*

## Figure 10-10 Baseline OPEX Against Augmentation OPEX



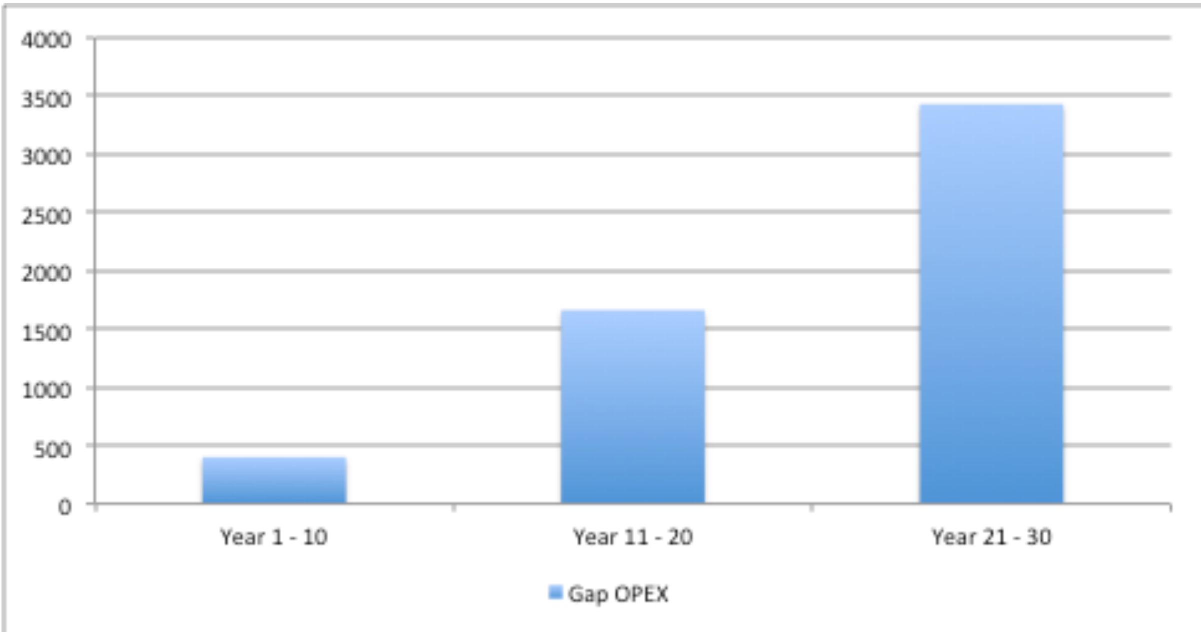

*Source: GMA Model*

## Figure 10-11 Gap CAPEX




*Source: GMA Model*

## Figure 10-12 Gap OPEX




*Source: GMA Model*

# 11 eThekwini Customer Data Analysis

The eThekwini Municipality water customer database was been cleaned and collated for the analysis. The most useful grouping was to summarise the data by usage type by town, which resulted in 499 groupings that were used to forecast customer water usage. Using the historical data explained in Chapter 8, these groupings were extrapolated from 2014 to 2031. Therefore the final model dataset was a database of usage summary by type and town, from 2011 to 2031.

### *Growth Rates*

In order to forecast growth rates were chosen that, as accurately as possible, reflect the growth in usage in the context of eThekwini Municipality and its socio-economic profile and potential future growth across areas and usage types. Where possible the intrinsic growth rate is used, but where this growth is unrealistic, the model reverts to the growth rate of the usage type as a whole, and finally to the town's usage growth rate where appropriate.

### *Summary of the Dataset*

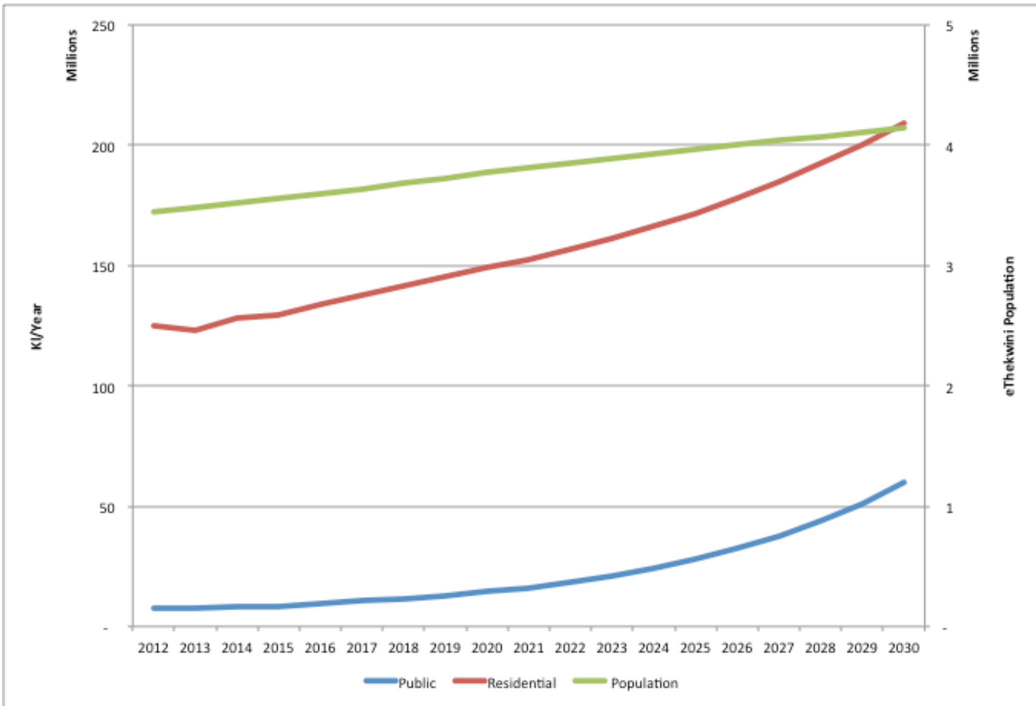
**Table 11-1 eThekwini Water Usage Summary**

| | None | Commercial | Industrial | Public | Residential | Total | UW Total* |
|---|---|---|---|---|---|---|---|
| **2012** | 1 244 | 51 720 251 | 20 327 312 | 7 511 142 | 124 687 167 | 204 247 117 | |
| **2013** | 1 448 | 50 304 224 | 18 917 541 | 7 495 962 | 123 022 446 | 199 741 622 | |
| **2014** | 1 339 | 51 606 661 | 18 629 584 | 8 157 286 | 127 936 449 | 206 331 319 | 294 288 682 |
| **2015** | 1 413 | 51 691 960 | 18 623 421 | 8 505 210 | 129 269 922 | 208 091 926 | 296 799 822 |
| **2016** | 1 426 | 53 031 703 | 18 804 732 | 9 627 302 | 133 941 214 | 215 406 377 | 307 232 364 |
| **2017** | 1 436 | 54 098 234 | 18 779 549 | 10 682 510 | 137 834 398 | 221 396 126 | 315 775 494 |
| **2018** | 1 451 | 55 223 037 | 18 581 380 | 11 613 763 | 141 782 540 | 227 202 171 | 324 056 609 |
| **2019** | 1 473 | 56 117 332 | 18 394 204 | 12 802 926 | 145 437 731 | 232 753 666 | 331 974 661 |
| **2020** | 1 508 | 56 885 086 | 18 265 662 | 14 328 729 | 149 177 708 | 238 658 693 | 340 396 953 |
| **2021** | 1 544 | 57 485 151 | 18 051 601 | 16 099 946 | 152 492 543 | 244 130 784 | 348 201 753 |
| **2022** | 1 596 | 58 372 071 | 17 901 333 | 18 280 611 | 156 621 189 | 251 176 799 | 358 251 426 |
| **2023** | 1 665 | 59 384 772 | 17 764 050 | 20 895 589 | 161 191 171 | 259 237 246 | 369 747 976 |
| **2024** | 1 762 | 60 683 945 | 17 687 629 | 24 082 041 | 166 688 816 | 269 144 193 | 383 878 174 |
| **2025** | 1 882 | 61 773 856 | 17 526 266 | 27 742 365 | 171 805 542 | 278 849 911 | 397 721 360 |
| **2026** | 2 053 | 63 147 785 | 17 424 950 | 32 170 151 | 177 938 460 | 290 683 400 | 414 599 369 |
| **2027** | 2 288 | 64 641 969 | 17 334 951 | 37 429 921 | 184 690 747 | 304 099 875 | 433 735 179 |
| **2028** | 2 618 | 66 438 141 | 17 303 405 | 43 785 270 | 192 640 714 | 320 170 148 | 456 656 078 |
| **2029** | 3 061 | 67 999 820 | 17 188 097 | 51 077 322 | 200 300 638 | 336 568 938 | 480 045 539 |
| **2030** | 3 685 | 69 870 300 | 17 130 985 | 59 857 358 | 209 301 287 | 356 163 615 | 507 993 268 |

*Source: GMA Model; *Derived from the historical ratio of eThekwini Sales to Umgeni Water Purchases*

The following high-level analysis shows consumption (existing and forecast) in eThekwini against various economic measures.

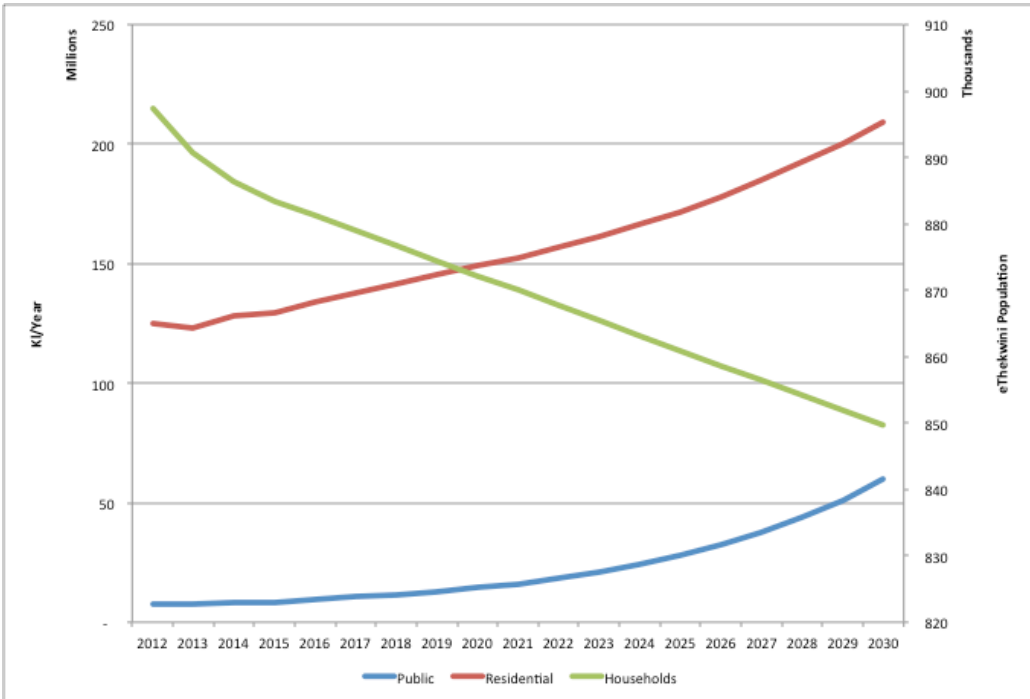
**Figure 11-1 Residential and Public Consumption Tracked Against eThekwini Population**




*Source: GMA Model*

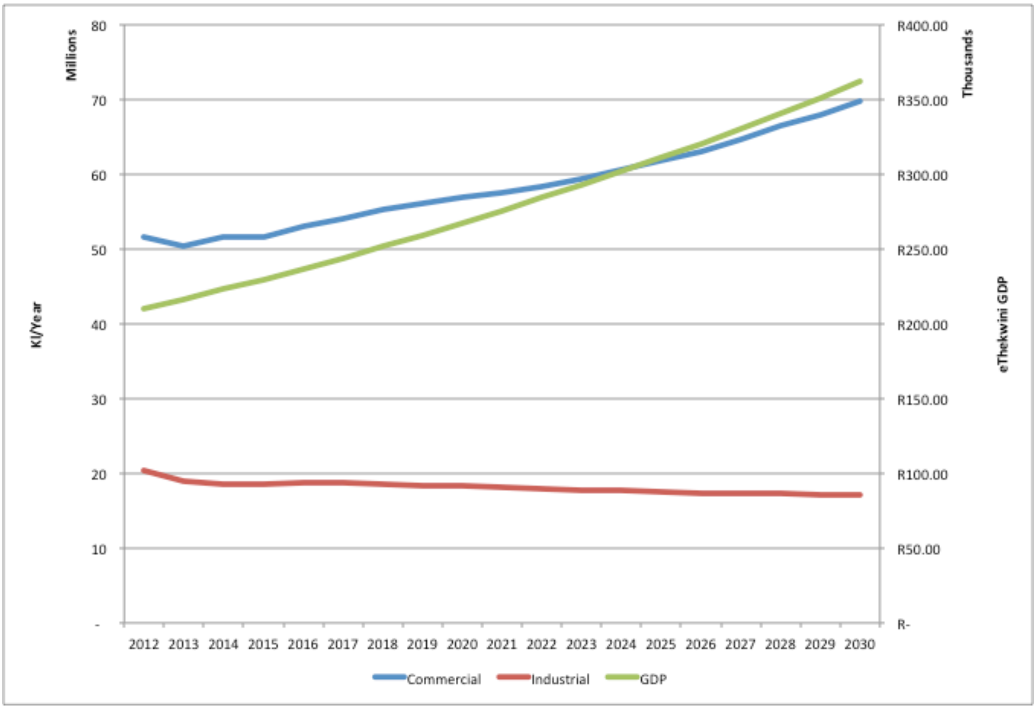
Some interesting factors to note in the three graphs is the reducing household numbers against population in eThekwini, and the correlation between population size and domestic consumption.

**Figure 11-2 Residential and Public Consumption Tracked Against eThekwini Households**




*Source: GMA Model*

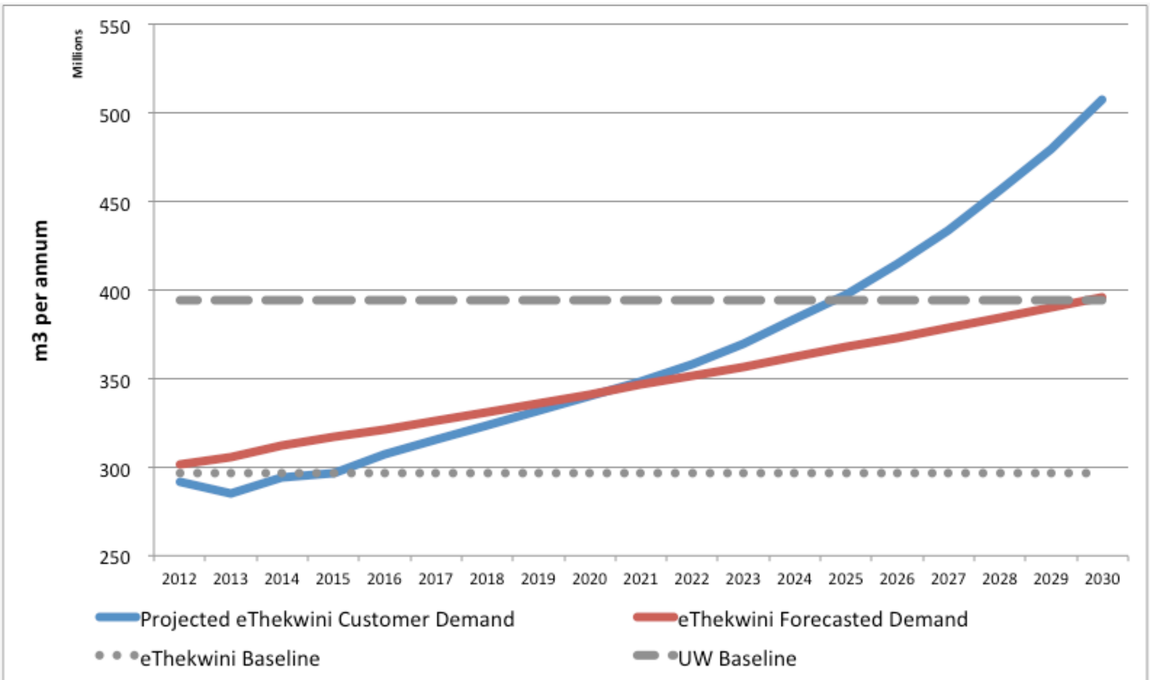
## Figure 11-3 Commercial and Industrial Tracked Against eThekwini GDP




*Source: GMA Model*

Projected eThekwini Customer Demand surpasses the eThekwini Baseline in 2015 at 296.79 million $m^3$ per annum. It surpasses the eThekwini Forecasted Demand in 2021 at 348.2 million $m^3$ per annum. Finally, it surpasses the Full Umgeni Water Baseline in 2025 at 397.72 million $m^3$ per annum.

## Figure 11-4 Projected eThekwini Customer Demand




*Source: GMA Model*

## 11.1 Revenue Analysis

Forecasted Umgeni Water tariff rates are applied to the eThekwini Usage Model to forecast the impact of the uMWP on Umgeni Revenue.

**Table 11-2 Forecasted Revenue by Usage Type Per Year, Rand Millions (2014 – 2030)**

| | UW Tariff | None | Commercial | Industrial | Public | Residential | Total |
|---|---|---|---|---|---|---|---|
| **2014** | 4.23 | R0.01 | R310.99 | R112.26 | R49.16 | R770.96 | R1 243.37 |
| **2015** | 4.28 | R0.01 | R315.21 | R113.56 | R51.86 | R788.27 | R1 268.92 |
| **2016** | 4.33 | R0.01 | R327.23 | R116.03 | R59.41 | R826.48 | R1 329.16 |
| **2017** | 4.38 | R0.01 | R337.79 | R117.26 | R66.70 | R860.64 | R1 382.40 |
| **2018** | 4.43 | R0.01 | R348.92 | R117.40 | R73.38 | R895.83 | R1 435.55 |
| **2019** | 4.48 | R0.01 | R358.79 | R117.61 | R81.86 | R929.88 | R1 488.14 |
| **2020** | 4.54 | R0.01 | R368.03 | R118.18 | R92.70 | R965.15 | R1 544.07 |
| **2021** | 4.59 | R0.01 | R376.35 | R118.18 | R105.40 | R998.35 | R1 598.29 |
| **2022** | 4.64 | R0.01 | R386.71 | R118.59 | R121.11 | R1 037.59 | R1 664.01 |
| **2023** | 4.70 | R0.01 | R398.10 | R119.09 | R140.08 | R1 080.59 | R1 737.86 |
| **2024** | 4.76 | R0.01 | R411.66 | R119.99 | R163.36 | R1 130.75 | R1 825.77 |
| **2025** | 4.81 | R0.01 | R424.04 | R120.31 | R190.43 | R1 179.34 | R1 914.14 |
| **2026** | 4.87 | R0.01 | R438.64 | R121.04 | R223.46 | R1 235.99 | R2 019.14 |
| **2027** | 4.93 | R0.02 | R454.36 | R121.85 | R263.09 | R1 298.17 | R2 137.49 |
| **2028** | 4.99 | R0.02 | R472.55 | R123.07 | R311.43 | R1 370.18 | R2 277.25 |
| **2029** | 5.05 | R0.02 | R489.42 | R123.71 | R367.62 | R1 441.64 | R2 422.41 |
| **2030** | 5.11 | R0.03 | R508.87 | R124.77 | R435.95 | R1 524.36 | R2 593.97 |
| | | R0.22 | R6 727.65 | R2 022.89 | R2 797.00 | R18 334.17 | R29 881.93 |

The impact of the uMWP on Umgeni Water in terms of eThekwini as a customer is to secure R29.89 billion rand of revenue over the next 16 years.

## 11.2 Sensitivity Analysis

### *Delays in Timing*

The final part of this analysis comprises two sensitivity analyses. The first examines the impact that water losses will have on augmentation timing. eThekwini Municipality have put in considerable infrastructure to prevent water loss over the past fifteen years, however water losses would prevent a potential risk to Umgeni Water's operations and so the degree of this sensitivity is vital. The consequence of water losses being reduced by lesser amounts in high, medium and low scenarios is assessed. 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 Water Project.

### *Impact of One Year of Delay*

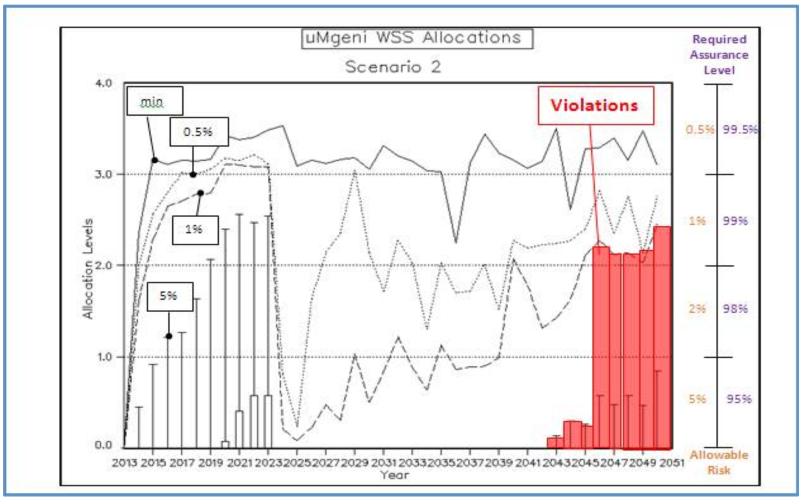
The impact of augmentation, apart from the direct uMWP Impact, will be to add on average 420 jobs and R3.7 billion of gross value added to the South African economy every year over 60 years. Each year of delay will cost the South African economy to this extent, before the economic impacts of restrictions are taken into account.

### *Water Loss*

The second sensitivity looks at the effect of changes to the timing of the Mkomazi Water Project 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. A sub-class of this sensitivity is the impact of drought on the system under both scenarios, and this will be estimated within this analysis.

The current risk profile of the Umgeni System with the first phase of the uMkhomazi Water Project is presented in the following figure. As can be seen from the data, under the current supply risk of curtailment increases at a rapid rate, resulting in violations from 2042.

**Figure 11-5 Umgeni System Risk and Potential Violations**




*Source: Umgeni Water*

The table below gives the risk of curtailment criteria for each priority of water user classes. These can be seen in the above figure, with violations to the low and medium low priority water users from 2042.

### Table 11-3 Risk of Curtailment Criteria

| Priority Water user classes | Curtailment level range | Risk of curtailment not to be exceeded |
|---|---|---|
| Low | 0-1 | 5% |
| Medium Low | 1-2 | 2% |
| Medium High | 2–3 | 1% |
| High | 3–4 | 0.50% |

*Source: Umgeni Water*

Drought restriction for the above priority water user classes are displayed for the Mgeni River in the table below. These measures will be incorporated into the model sensitivity analysis in the water loss sensitivity testing.

### Table 11-4 Priority classifications and risk criteria of drought restrictions for the Mgeni River System

| | User Priority Classification | | | |
|---|---|---|---|---|
| **User Group** | **High (1:200)** | **Medium High (1:100)** | **Medium Low (1:50)** | **Low (1:20)** |
| Durban Heights, Wiggins demand | 63% | 13% | 12% | 12% |
| Midmar, DV Harris demand | 63% | 13% | 12% | 12% |
| Mgeni compensation releases | 50% | 25% | - | 25% |
| Return flows | 70% | 20% | - | 10% |
| Irrigation from the Mgeni River | 5% | 25% | - | 70% |

*Source: Umgeni Water*

### *Impact of Water Restrictions*

Commercial and Industrial eThekwini Usage account for R6.7 billion and 2 billion in Umgeni Water revenue over the next fifteen years. R6.1 billion in commercial driven revenue and R1.8 billion in industrial revenue will be at risk and most likely unattainable under the water restrictions that would be imposed by not carrying out uMWP.

# 12 Summary and Conclusion

The impact of non-augmentation, apart from the direct uMWP Impact, will be a loss of (on average) 420 jobs and R3.7 billion of gross value to the South African economy every year over 60 years. Each year of delay will cost the South African economy to this extent, before the economic impacts of restrictions are taken into account.

## 12.1 Augmentation vs. Non-Augmentation

The GAP is calculation of impact on both economic value-added and employment between augmentation and non-augmentation, and so if viewed in the context of non-augmentation, represent the extent of the cost of not augmenting.

The GAP amounts to R8.3 billion from CAPEX and R2.8 billion from OPEX to the economy over the first ten years, R1.97 billion from CAPEX and R11.56 billion from OPEX to the economy over the second ten years, and R4.2 billion from CAPEX and R21.8 billion from OPEX to the economy over the third ten years.

The GAP amounts to 4 341 jobs from CAPEX and 401 jobs from OPEX to the economy over the first ten years, 1 117 jobs from CAPEX and 1 663 jobs from OPEX to the economy over the second ten years, and 2 366 jobs from CAPEX and 3 431 jobs from OPEX to the economy over the third ten years.

The impact of the uMWP on Umgeni Water in terms of eThekwini as a customer is to secure R29.89 billion rand of revenue over the next 16 years.

## 12.2 Risks

Commercial and Industrial eThekwini Usage account for R6.7 billion and R2 billion in Umgeni Water revenue over the next fifteen years. R6.1 billion in commercial driven revenue and R1.8 billion in industrial revenue will be unattainable under the water restrictions that would be imposed by not carrying out uMWP.

**The impact of augmentation, apart from the direct uMWP Impact, will be to add approximately 420 jobs and R3.7 billion (2014 Rands) of gross value added to the South African economy every year.** Each year of delay will cost the South African economy to this extent, before the economic impacts of restrictions are taken into account.

# Appendix A: Variation Orders - Granular Impact Analysis

## Introduction

One of the key challenges associated with macroeconomic impact analysis is it's top down nature. Because the anaylsis is modelled with national relationships from the system of national accounts, and then applied to local context and data, one often finds a distortion in the results, and the inablility to meaningfully dive into more granular analysis, as well as in South Africa other regions adopting a Gauteng-centric framework as the country's economic heart has a strong influence on the relationships in the analysis.

This makes it very difficult, for example, to accurately predict where in the region of anlaysis jobs will be lost, or which industry they will be lost in, or what the granular socio-economic and polictical knock-on impacts will be. This is undesirable in most studies, especailly so one realting to an essential good such as water supply, but is the necessary evil of being able to forecast and analyse impact as in most cases the data needed for bottom up analyses is too expensive or just doesn't exist.

During the course of the intial phases of the project, the study team became aware that it may be possible to use the eThekwini Municipality consumption data as a basis for a more granular analysis of the impact on non-augmentation and restrictions (based on various scenarios and risk profiles) on socio-economic factors, and potentially extend this analysis to the whole supply area should Ugu and Msunduzi be able to provide similar point data that had both time and geoloction within the dataset. This led to the creation of two variation orders to extend the scope of the study beyond the update of the macroeconomic modelling of the impact on non-implemetnation of the uMkhomazi-Mgeni Augmentation Scheme.

## Variation Order Methodologies

The purpose of the two Variation Orders therefore was to explore the potential of impact of restrictions on socio-economic factors, including value chain analysis, and investigate the feasiblity of building a dynamic data tool prototype (web application) to allow for a 'living' analysis that allowed for more engagement and interation by users than a static paper based report.

The methodology therefore was to:

- Engage with eThekwini, Ugu and Msunduzi Municipalities to ascertain whether the correct data exists and would be able to be used in the study;

- Engage with Umneni Water, their partners working in similar studies (such as AECOM), and the department of water to understand what value chain data would be able to be used in a granular analysis;
- Collect, clean and collate the data that was shared by partners, and build the analytical framework for the extention;
- Model the data according to the research aims above; and
- Build the prototype data tool (on a free, opensource framework to use as a proof case).

The study team also presented the existing analysis at a meeting with the team from DWS, AECOM, and Urban Econ that were carrying out a similar study on the supply area to explore synergies in the two projects, and buidlig a deeper collaboration with the AECOM team, including alignment meetings in Gauteng and Durban, and presenting report and conclusions at the Support to the Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coastal Metropolitan Area: Phase 2 - SSC Meeting 8 held at the Jewish Club in Durban in September 2015.

## Project Narrative

The aim of the variation orders was to present the raw data, analysis and results in a web-driven dynamic data tool rather than a written report, and more on this is included below. However this appendix in the final report serves to complete the requirement for a written deliverable for this process.

One of the key challenges experienced by the project team in this study (although this is a common experience in the current public research sector) was access to raw data, as there is still a misunderstanding of sharing data and the risks attached to this within government, as well as a lack of capacity and in some cases, skill, to enable the release of very important data that could aid planning and impact forecasting at a granular level. There is also a fear attached to releasing data, due to the many misconcpetions about the value of the data and the risks associated with sharing it within government and many other institutions.

Another key challenge that was experienced during the original study was access to the key stakeholders within Ugu and Msunduzi to allow for complete analysis of the supply area, whereas eThekwini Municipality proved to be both able to share data in terms of capacity and skill, and open to meeting about the project and discussing how the data could be accessed and used, and where the pressure point and points of interest lay for the municipality. It was therefore agreed for the variation orders that Umgeni Water would manage setting up interactions with the various water authorities and national and local government departments, as this may lead to more success in meaningful interactions.

This proved to be the case with DWS and their partners (mainly AECOM), and Msunduzi municipality, but not with Ugu Department of Water, and after repeated attempts (mostly weekly) bu Umgeni Water to organise an interaction, it was finally decided that due to scope and timelines this area would have to be excluded from the analysis.

The project team held a number of successful meetings with Msunduzi concerning the data needed for the low-level analysis. The ultimate outcome of these interactions was that Msunduzi is almost at a level required for this analysis, but that currently there would have to be too intensive and resource-heavy a process to transform the data, as this was out of scope of the project and certianly out of the timeframe. However, given the extent of the work being carried out on linking billing data and geotagging data points within the municipality, it will not be long until this data will be highly useful for this type of analysis.

The interactions with Department of Water and Sanitation and AECOM were valuable and a lot of data was collected that can now be found on the data repository on the project website. From these, it is clear that creating data systems with more granular, real-time consumption and demand analysis will allow for much more sensitive supply planning response, deeper and more transparent analysis to prove or disprove justification for projects such as uMWP, and more realistic and accurate prediction of the risks and impacts of restrictions in the system. Some of this analysis can be found in the final output on the project website.

Once these interactions, engagements and data explorations had been carried out, the project team could finalise the analysis framework and focus on linking scenario driven restictions forecasts to impact on households and economy in the supply area. Given the above, the analysis was once again restricted to eThekwini Municipal Supply Area as only here was the data good enough to be used. However the purpose of the variation orders were to prototype an approach to analysis that can most definitely be extended and made more useful by investment and resources, as well as over time as cleaner, more granular and appropriate data is created or becomes more readily available within the smaller municipalities.

## Project Website

As mentioned above, one of the aims of the Variation Orders was not only to innovate on granular, bottom-up data analysis, but to innovate in the delivery of data, analysis and results. To this end, the project team developed an analysis website prototype to deliver a living, interactive analytical tool, rather than a static report. Therefore the project team developed a dynamic, interactive data tool for the final output of this project, rather than a static report. The website can be found at:

https://sites.google.com/a/gmainnovations.com/umgeniwater/

The project site was built on free, open source software using the google apps framework and google sites as a container, as there was no budget allocated to development and maintenance due to the prototype nature of the output (if it had not been appopriate, the project team would have had to recreate the whole project within a word document. Due to the fact that some of the data used in the study is not able to shared with the genreal public, the site requires a login. To get access to the site, contact te project team at Graham Muller Associates or one of the Umgeni Water project managers on this project.

All of the analysis and results, as well as raw data, from the Variation Order process can be found on the project site.

# Appendix B: Impact Model Assumptions

## Model Methodology

The various inputs for the model are drawn from the technical and financial assessments of the uMkhomazi Water Project. This model gives, through the use of multipliers, the forecasted effect that the investment will have on the country over the next thirty years.

The multipliers are given to show two effects, firstly the forecasted direct impact of the investment, and secondly the forecasted indirect impact of the investment. The direct impact pertains to the initial impact of the investment (value directly added due to investment) added to the impact of the first round suppliers (those industries that deliver goods and services directly to the industry in question). The indirect impact used in the study is the impact of the indirect suppliers (those industries that, on their part, deliver goods and services to the first round suppliers). The indirect impact also captures additional induced effects of household income generation through payments for labour services and the associated private consumption expenditure on goods produced by the various sectors. This results in larger multiplier effects.

## Application of Employment Multipliers

The multipliers show the effect of a R1.00 increase in final demand for the specific sector's product on GDP, except in the case of the employment multiplier which measures the number of jobs created by an additional R1 million increase in final demand. For the employment multiplier a price adjustment has to be made in the case where the impact of a project is to be determined in a year other than the base year for which the multipliers have been calculated for. As financial information is reported at current prices and employment is regarded as a "stock" concept (real values), a price adjustment has to be made on the financial information by means of a price deflator[2].

For this study, prices are expressed in 2013 Rands and 2011 multipliers are used, so a price deflator is used to adjust the data from the developer to match the employment multipliers.

The economic impact model in this report was built using input data from the developer, and input-output table and multipliers from Quantec Research (Pty) Ltd. The assumptions that apply to this analysis are laid out below:

[2] *Input-Output Analysis Sectoral Multipliers For South Africa In 1993 Technical Series (TS3/97), Gerhard Kuhn and Rentia Jansen, 1997, IDC of SA Ltd*

## Basic Assumptions in the Input-Output Model

The assumptions are very important and should be kept in mind in the application of input-output analysis. Basic assumptions for these models are for instance the following:

- It is possible to group the different production activities in homogeneous industries;
- The demand for intermediates by a particular sector will change in direct proportions to the specific sectors change in output;
- No substitution of intermediates is possible due to price changes;
- No technological change takes place; and
- That each sector produces only one primary product.
- All spending stays within South Africa

There is also no quantitative estimation of the impact of the knowledge transfer as a result of the uMkhomazi Water Project, which is likely to add to the current calculations. Given the above assumptions, this can therefore be seen as a conservative estimation of the impact.

**END OF REPORT**