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The uMkhomazi Water Project Phase 1: Module 1: Technical Feasibility Study: Raw Water

ECONOMIC IMPACT ASSESSMENT REPORT

FINAL

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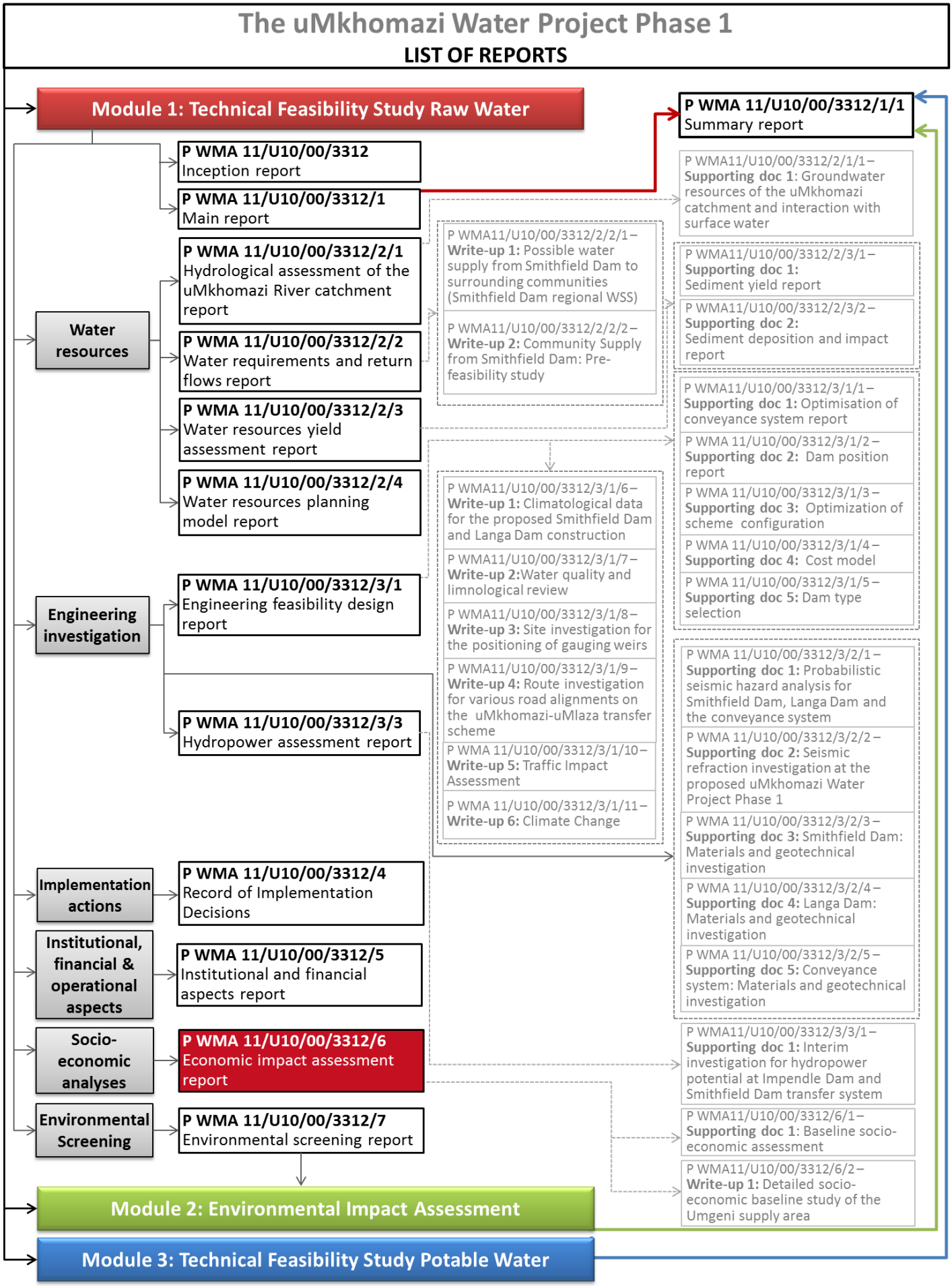
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Module 3: Technical Feasibility Study Potable Water

Executive summary

The socio-economic study reviews the locality, the drivers of water resource demand in the catchment areas and provides an overview of the anticipated impacts of the total development. Context is provided in terms of the long term development framework and legislative support for water provision in the study area.

SYNOPSIS OF THE SOCIO-ECONOMIC BASELINE

DEFINING THE CATCHMENTS

In the socio-economic baseline of the uMkhomazi Catchment and the Umgeni Water's (UW) supply area, the following demographic and economic trends for the region become evident: the uMkhomazi Catchment area (comprising of parts of eThekwini, Vulamehlo, Impendle, Mkhambathini, Richmond, Ingwe, KwaSani, and uBuhlebezwe municipalities), while geographically large, is very sparsely settled, with only 1.9% of the KwaZulu-Natal populous residing within the region. In contrast, the UW's supply area services 59% of all people in the province, 5.3 million people comprising of 1.6 million households.

UMKHOMAZI CATCHMENT

At present, the uMkhomazi Catchment has very low rates of economic activity, with 44.3% of the working age population economically active and with 22.3% of that sub-group employed. The majority of households are considered rural (60.3%), residing in traditional dwellings and the majority of all households in the catchment (66%) utilise pit latrines, only 21.6% have either flush or chemical toilet facilities, and 33.2% of households have access to piped water in yard or dwelling.

UMGENI WATER SUPPLY AREA

The UW's supply area has an economic active population of 60.4%, with 37.8% of that group employed. The majority of households (55.1%) use flush or chemical toilets; 78% households have access to piped water either inside their dwellings or inside their yard and the share of households with access to piped water on a community stand is 15% less than 200m from their dwelling, while 6.3% have access to piped water a distance greater than 200 m from their dwelling.

PROPOSED PROJECT DIMENSIONS

Economic impacts can be viewed in terms of their duration, or the stage of the lifecycle of the project that is being analysed.

Generally two phases are subjected to the economic impact assessment, the construction/development phase and the commercialisation/operational phase. The construction phase economic impact is of a more temporary duration, and has therefore a temporary effect. On the other hand, the operational phase of the project usually takes place over a long-term; hence, the impacts during this stage are of a sustainable nature. In this project, the construction phase is articulated in two clear components: the raw water infrastructure (to be owned by DWS) that comprise the development of the dams, raw water pipeline and tunnel and the potable water infrastructure (to be owned by UW) which includes the water treatment as well as potable water pipeline. Further to that, there are clearly defined refurbishment activities and common supportive activities like access roads and waste sites.

The total construction period is anticipated at 5 years, and operations are considered for the following 50 years; which includes the periods of refurbishment. Although it is anticipated that the asset lifespan exceeds 50 years; this period is used for modelling purposes.

ECONOMIC IMPACT ASSESSMENT

THE MODEL

The econometric model for the study was developed using the KZN Social Accounting Matrix (SAM) updated to 2014 figures. The SAM is a comprehensive, economy-wide database that contains information about the flow of resources between economic agents in the provincial economy. The socio-economic assessment developed considers three different types of economic impact, namely direct, indirect and induced. These levels of impact are defined as follows:

- *The **direct impact** occurs when the project creates jobs and procures goods and services resulting in increased employment, production, business sales, and household income. In the case of a mega project such as a dam and water system; many of these impacts occur directly in relation to the construction site;*
- *The **indirect impact** occurs when the suppliers of goods and services to the proposed project experience a larger markets and the potential to expand. Indirect impacts result in an increase in job creation, Gross Domestic Product (GDP) and household income.*

These impacts typically accrue to the first round of spend experienced by suppliers into the direct impact zone; and

- *The **induced impact** represents further shifts in spending on food, clothing, shelter and other consumer goods and services due to increased income in the directly and indirectly affected businesses. This leads to further business growth throughout the local economy. This level of impact can be best understood as the impact of additional wages entering the economy.*

MEASURING IMPACTS

The socio-economic impact of the project is measured according to the following indicators:

- *Production: Production is defined as the process in which labour and assets are used to transform inputs of goods and services into outputs of other goods and services. The impact assessment will measure the change in production expected to result from the project.*

- *Gross Domestic Product (GDP): Gross Domestic Product refers to the market value of all final goods and services produced within a country in a given period of time. The assessment therefore measures the impact of the proposed project on the South African economy.*

- *Employment created: An employment opportunity is defined as one person employed for one year. Seasonal work is therefore not counted as an individual employment opportunity but instead combined to calculate the number of total jobs created in one year.*

- *Income generated: The income generated by the project refers to the salaries and wages earned by those employed directly in the project and the suppliers of goods and services.*

MODELLED IMPACT OUTCOMES

The proposed uMWP will have an impact on the regional and local economies during the construction, operational and refurbishment phases. The impact during construction is considerable, yet it is not sustainable in the long-term as the construction will only last for approximately 60 months.

The operational phase is modelled on a 50 year period and therefore it is regarded as a more sustainable contribution to the domestic economy. The refurbishment phases will

contribute to the overall impact during the operational phase, these are identified as discrete expenditure undertaken in single year increments over the lifespan of the assets.

Employment opportunities are counted as annual opportunities (1 person employed for a year over 10 years equals 10 employment opportunities), thus the risk of double counting during operational phase is removed, as the scheme constantly, with exception of periods of refurbishment, generates constant employment opportunities. All measured benefits are in 2014 Rm.

- *Total additional production (new business sales)[1] anticipated to be generated by the project equates to R86 661m.*
- *Gross domestic product is anticipated to increase by R30 305m.*
- *Employment opportunities present in the form of 4 280 direct employment opportunities related to construction and site operation. Of these, 110 annual opportunities are created in a permanent manner for the operation of the scheme, which equates to 5 500 employment opportunities generated in the operational phase of 50 years, that total direct employment opportunities equates to 9 670 over both construction and operation . In total 123 846 employment opportunities are generated through* **direct, indirect and induced** *activities over the* **same period**.
- *Worker income is set to increase by R14bn over the modelled period. This is especially important for the uMkhomazi Catchment which has experienced high levels of migration, as population exodus in search of economic opportunity has impacted the rural economy. The uMWP provides employment opportunities and income in a region (uMkhomazi Catchment) that is facing severe economic constraint.*
- *The impact assessment showed that the construction, operation and refurbishment phases of the uMWP will result in numerous positive leverage effects in the study area. The sectors in which these leverage effects will be experienced the most are as follows:*
    - *During the construction phase in building and construction, manufacturing and real estate and business services*
    - *During the operational phase in water, manufacturing, transport and storage*

[1] *Production is defined as the process in which labour and assets are used to transform inputs of goods and services into outputs of other goods and services. The impact assessment will measure the change in production expected to result from the project.*

- *During the refurbishment phases in manufacturing, trade and accommodation, real estate and business services*

Economic Cost Benefit Analysis

In order to express all costs and benefits in the same monetary values, the financial analysis is undertaken over a 50 year period and held constant in 2014 Rand values. For the purposes of an Economic Cost Benefit Analysis (ECBA), land and existing infrastructure are not included and a discount rate was implemented to express future costs and benefits in current values.

The current prices were estimated using different inflators to indicate different positive and negative scenarios. The ECBA results for the costs of the scheme's development and current price analysis based on the provided water sales figures made available from uMkhomazi Water Project: Water requirement and return flows report, (P WMA 11/U10/00/3312/2/2). Economic Costs are provided as are the GDP benefits (as a proxy of benefit to society) and the anticipated revenues from future water sales from the scheme.

- *The scheme is anticipated to have a net benefit of R58 370m in 2014 Rand terms, and retains a positive discounted rate for net present value rates up to 25%.*

Opportunity Costs of the Scheme

Water is a critical input for all development, a key requirement for livelihoods as part of the social construct as well as an input to economic production processes. For the purpose of this assessment, the opportunity cost considered was the productive function of the supply area's economic activities as measured by economic output in gross value added terms. The assumption is that if the uMWP is not constructed then the opportunity to produce above a certain economic level will be foregone beyond that point in time that a constraint in supply is likely.

A 19 year review of economic production in KwaZulu-Natal and the supply area in specific indicates that the average economic growth rate achieved over the period equates to an approximate 3% annual increase in gross value-added year on year.

These growth rates have been projected forward, to provide a proxy for what economic production levels could be generated on an annual basis; should all other variables (including the access to water resources) remain constant.

- *If 2022 is used as the critical tipping point for water scarcity in the system, then the foregone economic production, i.e. the opportunity cost to the economy from 2022 until 2044 equates to R13.3bn in constant 2005 year Rands.*

- *This would have the consequence of foregone business sales for KZN province of R13 227 458 in 2005 Rand terms; a loss of R 1 222 866 in 2005 Rands of gross geographic production; an absolute loss of 376 055 employment opportunities over the 19 year period and a loss of income and wages of R1 717 103 in 2005 Rands.*

THE AFFORDABILITY OF WATER

Water affordability is a central element to water access, as noted in the socio-economic profile, 25% of the water supply from the Mgeni WSS is supplied to households that are considered to be below the poverty line. At present that approximately 60% of households in the uMkhomazi Catchment and 93% in the Umgeni WSS's footprint, receive water through a regional or local water scheme operated by their local municipality or another water service provider.

It is anticipated that with the increased economic activity through the uMWP investment will lead to an increase in worker income and as a result more people will be able to afford water, with supportive payment education, the creation of a willing mindset to pay for services received could be entrenched and cost recovery could be improved.

The study has shown that additional to the availability of portable water, the uMWP development will lead to numerous positive effects which will create various leverage effects throughout the uMkhomazi study area and increase the overall wellbeing of citizens.

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LIST OF ABBREVIATIONS

DWA	Department of Water Affairs
DWS	Department of Water and Sanitation, *legacy DWA*
BKS	BKS (Pty) Ltd
GDP	Gross Domestic Product
GVA	Gross Value Added
FTE	Full Time Equivalent
RSA	Republic of South Africa
D:NWRP	Directorate: National Water Resource Planning
uMWP	uMkhomazi Water Project
uMWP-1	uMkhomazi Water Project – Phase 1
uMWP-2	uMkhomazi Water Project – Phase 2
MMTS	Mooi Mgeni Transfer Scheme
KZN	KwaZulu-Natal
MAR	Mean annual run-off
LM	Local Municipality
DM	District Municipality
MMA	Mogoba Maphuthi and Associates

LIST OF UNITS

kℓ	Kilolitre
ℓ/c/d	litre per capita per day
m³	cubic meter

LIST OF DEFINITIONS

Household	A household is a group of persons who, at least for four nights per week, live together and provide themselves jointly with food and/or other essentials for living, or a single person.
Employment	A contract between two parties, one being the employer and the other being the employee certifying the employee with a fixed job; forming part of the working force. [Employment Opportunity – defined as one person in employment for one year, even if that person is employed in consecutive years]
Unemployment	A person is unemployed if he or she desires employment but cannot find a job. The unemployment rate is then obtained by expressing the number of unemployed persons as a percentage of the total number of people willing and able to work (the labour force). According to the official definition, the unemployed are those people within the economically active population who: a) did not work during the seven days prior to the interview, b) want to work and are available to start work within a week of the interview, and c) have taken active steps to look for work or to start some form of self-employment in the four weeks prior to the interview.
Potential Economically Active (PEA) Population	The potential economically active (PEA) population includes the formally employed, the unemployed and those persons active in the informal/unregistered sector. The terms supply of labour and the labour force are used as synonyms for the potential economically active population. The PEA population falls within the age categories of 15-64 years.
Disposable Income	Another measure of the region's welfare. It shows the average amount of income derived during a certain period. Since disposable income includes all income receipts by households and excludes all transfers, such as taxes and social contributions, it reflects the amount of money that the population has at its disposal to be spent on consumer products and services
Production (New Business Sales)	Production is defined as the process in which labour and assets are used to transform inputs of goods and services into outputs of other goods and services. The impact assessment will measure the change in production expected to result from the project.

1 INTRODUCTION

The Department of Water Affairs (DWA) appointed **BKS (Pty) Ltd** in association with three sub-consultants **Africa Geo-Environmental Services (AGES), MM&A and Urban-Econ** with effect from 1 December 2011 to undertake the **uMkhomazi Water Project Phase 1: Module 1: Technical Feasibility Study Raw Water** study.

On 1 November 2012, BKS (Pty) Ltd was acquired by **AECOM Technology Corporation**. As a result of the change in name and ownership of the company during the study period, all the final study reports will be published under the AECOM name.

In 2010, the Department of Arts and Culture published a list of name changes in the Government Gazette (GG No 33584, 1 October 2010). In this list, the Mkomazi River's name was changed to the **uMkhomazi River***. The published spelling will thus be used throughout this technical feasibility study.*

1.1 BACKGROUND TO THE PROJECT

The current water resources of the Mgeni Water Supply System (WSS) are insufficient to meet the long-term water demands of the system. The Mgeni WSS is the main water source that supplies about six million people and industries in the eThekwini Municipality, uMgungundlovu District Municipality (DM) and Msunduzi Local Municipality (LM), all of which comprise the economic powerhouse of the KwaZulu-Natal (KZN) Province.

The Mgeni WSS comprises the Midmar, Albert Falls, Nagle and Inanda Dams in KZN, a water transfer scheme from the Mooi River and the newly constructed Spring Grove Dam. The current system (Midmar, Albert Falls, Nagle and Inanda dams and the Mooi-Mgeni Transfer Scheme Phase 1 (MMTS-1) has a stochastic yield of 334 million m^3/a (measured at Inanda Dam) at a 99% assurance of supply. The short-term augmentation measure, Phase 2 of the Mooi Mgeni Transfer Scheme (MMTS-2), i.e. the recently constructed Spring Grove Dam, will increase water supply from the Mgeni system by 60 million m^3/a. However, this will not be sufficient to meet the long-term requirements of the system.

Pre-feasibility investigations indicated that the development of the undeveloped uMkhomazi River, to transfer water to the existing Mgeni System, most likely will fulfil this requirement. The uMkhomazi River is the third-largest river in KZN in terms of mean annual runoff (MAR).

Eight alternative schemes were initially identified as possible alternatives, and the Impendle and Smithfield scheme configurations have emerged as suitable for further investigation. The pre-feasibility investigation, concluded in 1998, recommended that the Smithfield Scheme be taken to a detailed feasibility-level investigation as its transfer conveyances would be independent of the existing Mgeni System, thus reducing the risk of limited or non-supply to eThekwini and some areas of Pietermaritzburg, and providing a back-up to the Mgeni System.

The ***Mkomazi-Mgeni Transfer Pre-feasibility Study*** concluded that the first phase of the uMkhomazi Water Project (uMWP) would comprise a new dam at Smithfield on the uMkhomazi River near Richmond, a multi-level intake tower and pump station, a water transfer pipeline/tunnel to a balancing dam at Baynesfield Dam or a similar in-stream dam, a water treatment works at Baynesfield in the uMlaza River valley and a gravity pipeline to the Umgeni Water bulk distribution reservoir system, below the reservoir at Umlaas Road. From here, water will be distributed under gravity to eThekwini and possibly low-lying areas of Pietermaritzburg. Phase two of the uMWP may be implemented when needed, and could comprise the construction of a large dam at Impendle further upstream on the uMkhomazi River to release water to the downstream Smithfield Dam. Together, these developments have been identified as having a 99% assured stochastic yield of about 388 million m^3/a.

The DWA aims to have this scheme implemented by 2023.

1.2 OBJECTIVE OF THE STUDY

According to the Terms of Reference (TOR) (November 2010), the objective is to undertake a feasibility study to finalise the planning of the proposed uMWP at a very detailed level for the scheme to be accurately compared with other possible alternatives and be ready for implementation (detailed design and construction) on completion of the study.

The feasibility study has been divided into the following modules, which will run concurrently:

- Module 1: Technical Feasibility Raw Water (DWA) (*defined below*);
- Module 2: Environmental Impact Assessment (DWA); and
- Module 3: Technical Feasibility Potable Water (Umgeni Water) (*ranging from the Water Treatment Plant to the tie-in point with the eThekwini distribution system*).

The layout as per module is shown in **Figure 1.1**.

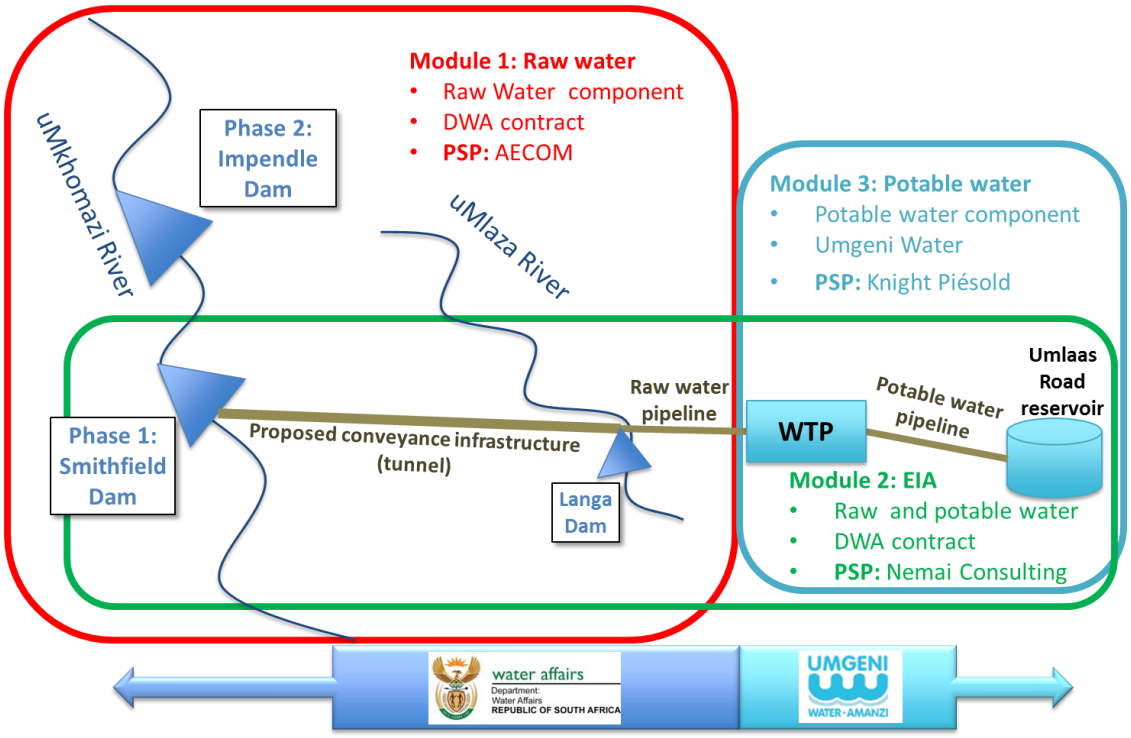


Figure 1.1: Feasibility layout

This module, the raw water technical feasibility study, considers water resources aspects, engineering investigations and project planning and scheduling and implementation tasks, as well as an environmental screening and assessment of socio-economic impacts of the proposed project.

Some specific objectives for this study, recommended in the *Mkomazi-Mgeni Transfer Scheme Pre-feasibility Study* are listed below:

- Smithfield Dam (Phase 1) to be investigated to a detailed feasibility level;
- Investigate the availability of water from Impendle Dam (Phase 2) as a future resource to release to Smithfield Dam, and refine the phasing of the selected schemes;

- Optimise the conveyance system between Smithfield Dam and the proposed Baynesfield Water Treatment Plant;
- Undertake a water resources assessment of the uMkhomazi River Catchment, including water availability to the lower uMkhomazi;
- Evaluate the use of Baynesfield Dam as a balancing dam; and
- Investigate the social and economic impact of the uMWP.

This study, being one of three modules, was undertaken in close collaboration with the DWA, Umgeni Water and the Professional Services Providers (PSPs) of the other modules.

1.3 STUDY AREA

The study focus and key objective is related to the feasibility investigation of the Smithfield Dam and related raw water conveyance infrastructure. However, this is a multi-disciplinary project with the study area defined as the uMkhomazi River catchment, stretching to the north to include the uMngeni River catchment, refer to **Figure 1.2**. The various tasks have specific focus areas, defined as:

- Water resources: uMkhomazi and Mgeni River catchments;
- Water requirements: water users in the Mgeni System and the uMkhomazi River catchment;
- Engineering investigations: proposed dams at Impendle (only for costing purposes) and Smithfield, and the raw water conveyance infrastructure corridor between Smithfield Dam and the proposed Water Treatment Plant of Umgeni Water;
- Environmental screening as input for the Environmental Impact Assessment for the project footprint; and
- Socio-economic impact assessment: regional, provincial (KZN) and national.

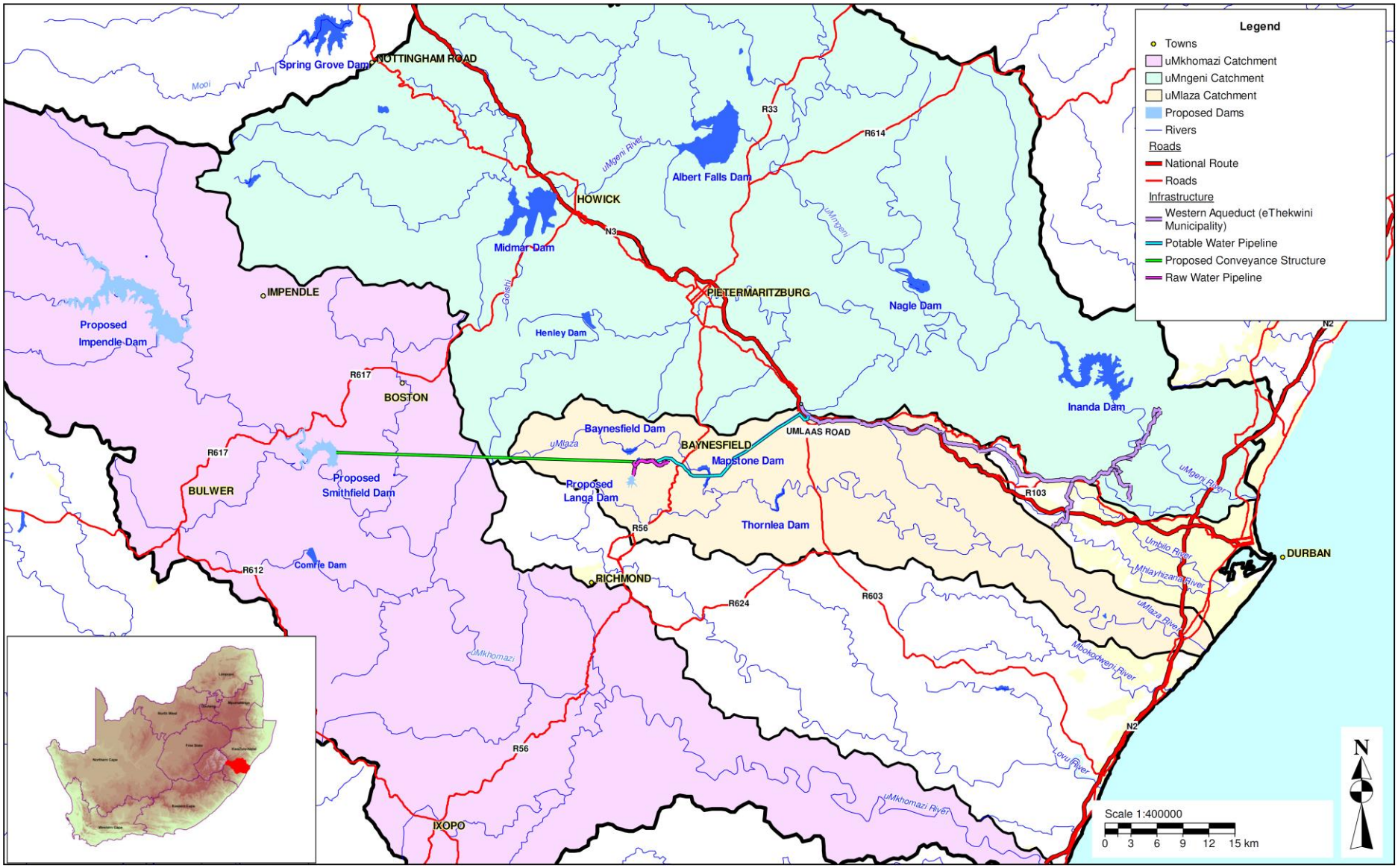


Figure 1.2: Locality map: study area of the uMkhomazi Water Project

1.4 SCOPE OF THIS REPORT

The purpose of this report is to provide a strategic economic assessment of the potential impacts of the proposed augmentation of the uMWP, including major development initiatives and spinoff development on the regional and national economy areas as defined in **section 1.3** above.

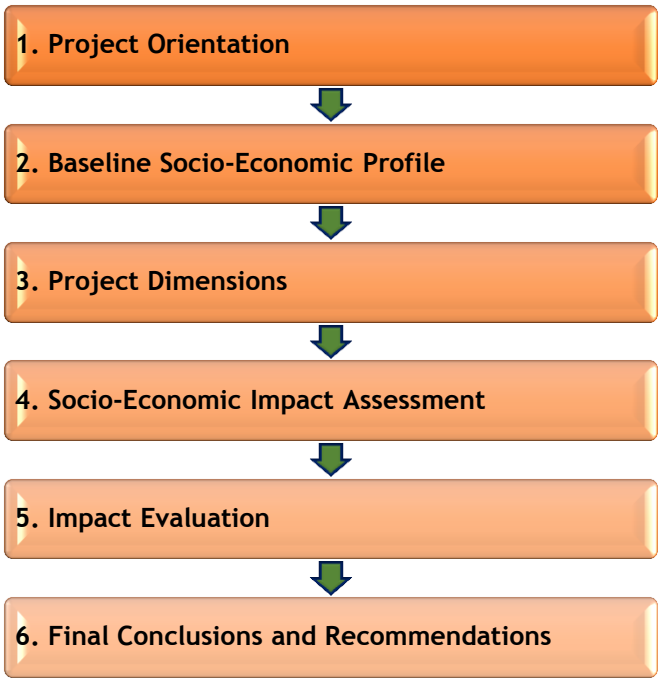


Figure 1.4: Methodological Approach

Figure 1.4 illustrates the methodological approach taken by Urban-Econ Development Economists in pursuit of the primary study goal of this socio-economic task.

For the purpose of this report, the most critical tasks completed in the socio-economic assessment included confirming the impact zones for both the catchment and supply areas. Obtaining the required primary and secondary socio-economic data. Acquiring the project-specific data for the relevant development phases. Lastly, a detailed impact assessment modelling process was undertaken to assist detail the social and economic consequences of the proposed uMWP augmentation and determining the positive and negative externalities anticipated to arise as a result of the uMWP augmentation.

1.5 REPORT OUTLINE

The report is structured in chapters:

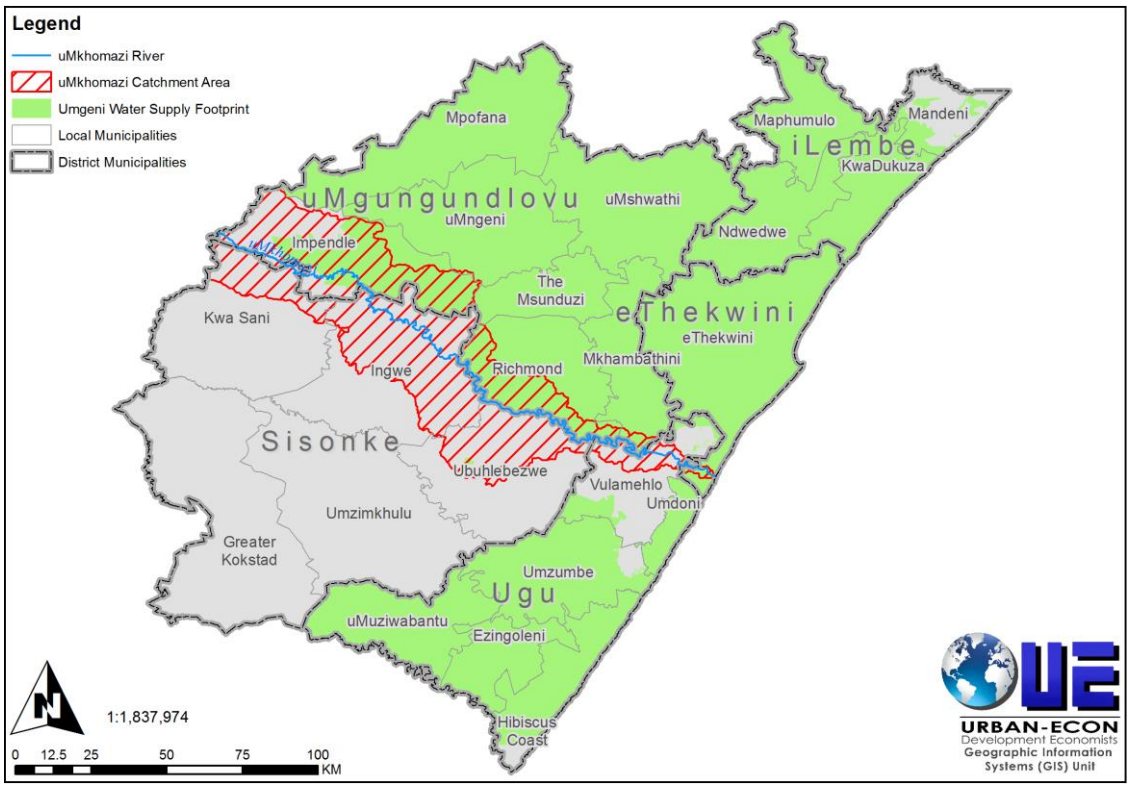
- The **introductory chapter** provides the background to the study and the project itself.
- The **second chapter** delivers an examination of key economic and socio-economic characteristics of the study area that assist in interpreting and evaluating macroeconomic impacts.
- The **third chapter** presents relevant legislation and policies that provide a backdrop for this project.
- The **fourth chapter** provides the input data regarding the project's dimensions, construction, operational and refurbishment phases, i.e. information used as an input into the modelling exercise.
- The **fifth chapter** gives an account of the primary quantified potential macroeconomic impacts of the uMWP.
- The **sixth chapter** presents opportunity costs associated with the uMWP.
- The **seventh chapter** presents the results of the economic cost-benefit assessment exercise.
- The **eighth chapter** presents the carbon implications of the proposed hydropower options on the uMWP.
- The **ninth chapter** presents the results of the regional and local socio-economic impact assessment and concludes the report.

2 BASELINE PROFILE AND LEGISLATIVE REVIEW

The purpose of this chapter is to provide an outline of the study area's salient features. This chapter then contextualises the proposed uMWP within the study area. The section further provides a legislative review of the policies pertaining to the development of the uMWP.

2.1 STUDY AREA DELINEATION

The study area consists of both the uMkhomazi Catchment as well as the UW's supply area. The delineation of these areas is highlighted in the following map.



Source: Urban-Econ GIS Unit (2014), Department of Water Affairs (2012), Umgeni Water (2011)

Figure 2.1: Delineation of the uMkhomazi Catchment and the Umgeni Water supply area

The socio-economic profile provides a high level analysis of the area supplied by UW, supplemented with water harvested from the uMkhomazi Catchment. As indicated in the mapping, the supply footprint includes the eThekwini Municipality, uMgungundlovu, iLembe and Ugu District Municipalities.

The supply area baseline as well as the catchment area baseline is included in this assessment so that the impact of the provision of additional water into the

supply area can be contextualised and, the associated opportunity costs of this water be better understood.

2.2 DEMOGRAPHIC PROFILE

The following table indicates the demographic profile of the uMkhomazi Catchment as well as the UW's supply area and includes the population total, household total and densities. All statistics figures used in this section are shown for base year 2013.

Table 2.1: Demographic profile (2013)

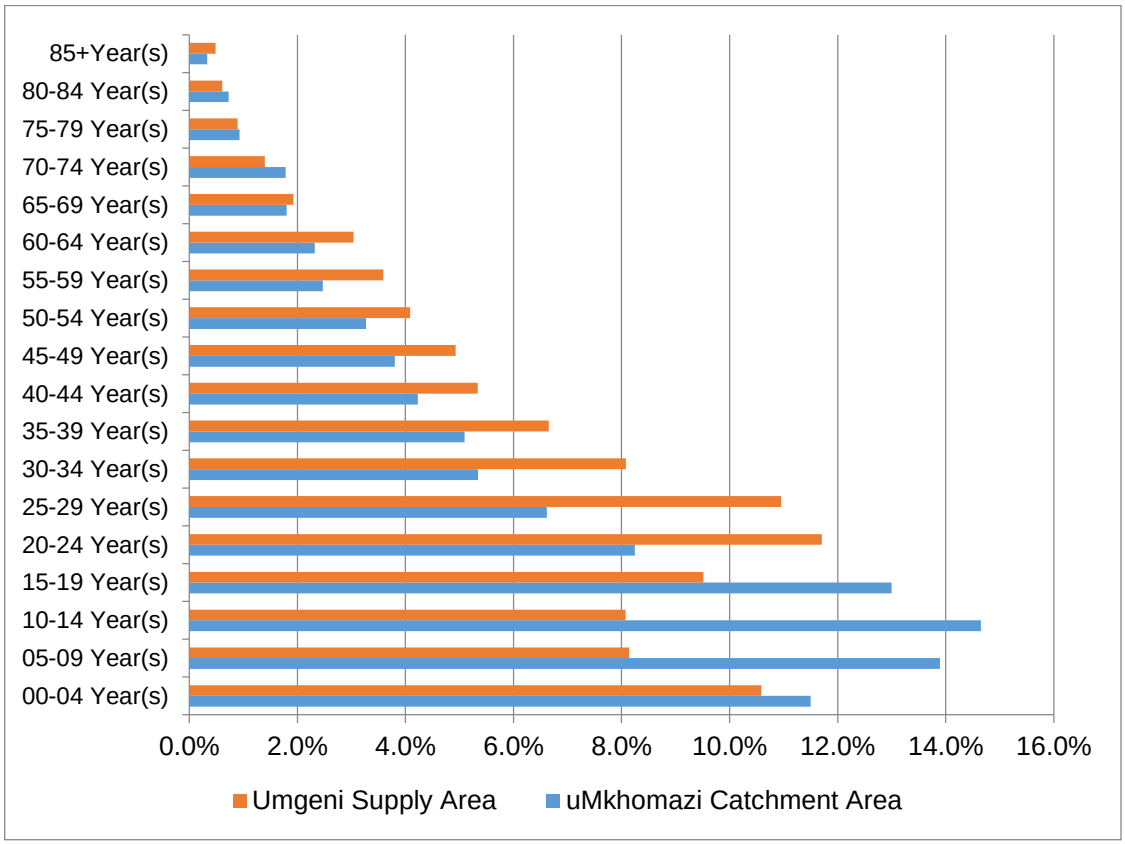
Demographic Profile*	uMkhomazi Catchment	Umgeni WSA footprint
Population total	203 912	6 326 419
Households total	45 548	1 614 087
Household size (average)	4.5	3.9
Population density (People per km^2)	24	4 962
Household density (Households per km^2)	5	1 211

** Demographics for eThekwini Municipality, Ugu, Umgungundlovu and iLembe District Municipalities*

Source: Quantec (2014)

There are 203 912 people in the catchment area and 6 326 419 people in the supply area, while there are 45 548 households in the catchment area and 1 614 087 households in the supply area. The rural nature of the catchment area is highlighted by the low population and household densities compared to the urban nature of the supply area with high population and household densities.

The figure below indicates the age profile for the uMkhomazi Catchment as well as the Umgeni Supply Area.



Source: Quantec (2014)

Figure 2.3: Age profile

From the above figure it is evident that the population in the uMkhomazi Catchment is generally younger than the population of the Umgeni WSS's area. This is largely attributed to the rural nature of the settlement in the uMkhomazi Catchment and the higher share of migration by job-seekers of working age outside of the area.

2.3 EDUCATION LEVELS

The following table shows the education levels of the population of both the uMkhomazi Catchment and the Umgeni WSS's area.

Table 2.2: Education levels

Education Profile	uMkhomazi Catchment	Umgeni WSS's footprint
No Schooling	31.1%	9.2%
Some Primary	25.3%	21.0%
Completed Primary	6.4%	4.9%
Some Secondary	23.7%	31.8%
Grade 12	10.2%	25.3%
Higher	3.4%	7.9%
Total	100%	100%

Source: Quantec (2014)

A significant share of the population (31.1%) in the uMkhomazi Catchment does not have any education, in comparison to a similar share of population (31.8%) in the Umgeni WSS's area which has some secondary education. There is a considerably higher percentage of people in the Umgeni WSS's area with a Grade 12 education or higher than in the uMkhomazi Catchment.

2.4 HOUSEHOLD ACCESS TO SERVICES

The following tables highlight the access that households have to services such as water, toilets and type of dwelling in the uMkhomazi Catchment and the Umgeni WSS's area.

Table 2.3: Household access to water

Access to Water	uMkhomazi Catchment	Umgeni WSS's footprint
Piped water inside dwelling	11.1%	49.8%
Piped water inside yard	22.1%	22.1%
Piped water on community stand: less than 200m	10.0%	15.0%
Piped water on community stand: greater than 200m	13.2%	6.3%
Borehole/rain-water tank/well	6.6%	0.9%
Dam/river/stream/spring	33.8%	3.1%
Water-carrier/tanker/Water vendor	0.6%	1.0%
Other/Unspecified	2.5%	1.7%

Source: Quantec (2014)

A significant share of the population (33.8%) of the uMkhomazi Catchment access water from dams, rivers or springs, while 49.8% of the population within the Umgeni Supply Area have piped water inside their dwelling.

Table 2.4: Household access to toilet

Access to Toilet	uMkhomazi Catchment	Umgeni WSS's footprint
Pit latrine	66.6%	27.4%
Bucket latrine	2.0%	2.3%
None of the above	9.8%	15.2%
Flush or chemical toilet	21.6%	55.1%

Source: Quantec (2014)

The population of the uMkhomazi Catchment mostly use pit latrines (66.6%) while the population of the Umgeni WSS's footprint area mostly have flush or chemical toilets (55.1%).

Table 2.4: Type of dwelling

Type of Dwelling	uMkhomazi Catchment	Umgeni WSS's footprint
House or brick structure on a separate stand or yard	28.2%	61.3%
Traditional dwelling/hut/structure made of traditional materials	60.3%	12.2%
Flat in a block of flats	2.9%	7.4%
Town/cluster/semi-detached house (simplex, duplex or triplex)	0.5%	3.7%
House/flat/room, in backyard	1.5%	1.7%
Informal dwelling/shack, in backyard	2.5%	3.4%
Informal dwelling/shack, NOT in backyard, e.g. in an informal/squatter settlement	3.3%	8.5%
Room/flatlet not in backyard but on a shared property	0.7%	0.6%
Other/unspecified/NA	0.2%	1.1%

Source: Quantec (2014)

The vast majority of people (60.3%) in the uMkhomazi Catchment live in traditional dwellings while the vast majority of people (61.3%) in the Umgeni Supply Area live in a house or brick structure on a separate stand.

2.5 EMPLOYMENT PROFILE

The employment profile is shown in the **Table 2.5**. It excludes the youth and the elderly and is based on the working-age population (portion of the population that are between the ages of 15 and 64).

Table 2.5: Employment profile

Employment Profile		uMkhomazi Catchment	Umgeni Water's supply area
Labour Force	Employed	50.3%	62.7%
	Unemployed	27.5%	27.8%
	Discouraged Work-Seeker	22.2%	9.6%
Labour force participation rate*		44.3%	60.4%
Labour absorption rate#		22.3%	37.8%

** Labour force participation rate: Labour force as a percentage of the working age population.*

 # Labour absorption rate: Employed persons as a percentage of the working age population.

Source: Quantec (2014)

From **Table 2.5** it is evident that a higher percentage of people are employed in the Umgeni Supply Area than the uMkhomazi Catchment, while there are significantly more discouraged work-seekers in the uMkhomazi Catchment. The labour force participation rate is higher in the Umgeni Supply Area meaning there are fewer people that are not economically active such as homemakers and full-time students. The labour absorption rate is low in the uMkhomazi Catchment meaning a large portion of the population is dependent on those earning an income from elsewhere, this is typical of the migrant worker employment pattern of KwaZulu-Natal and South Africa, with people often travelling into urban-areas (in this case eThekwini) for employment purposes.

The following table shows the percentage breakdown of employment per sector for each area.

Table 2.6: Employment per sector

Employment Per Sector	uMkhomazi Catchment	Umgeni WSS's footprint
Agriculture, forestry and fishing	12.9%	3.2%
Mining and quarrying	1.0%	0.7%
Manufacturing	10.6%	11.4%
Electricity, gas and water	0.1%	0.3%
Construction	9.1%	7.7%
Wholesale and retail trade, catering and accommodation	18.5%	25.2%
Transport, storage and communication	7.8%	7.4%
Finance, insurance, real estate and business services	10.3%	15.2%
Community, social and personal services	19.9%	16.6%
General government	9.8%	12.2%
Total	**100%**	**100%**

Source: Quantec (2014)

The sector that employs the highest percentage of people in the uMkhomazi Catchment is the community, social and personal services sector while the wholesale and retail trade, catering and accommodation sector employs the highest percentage of people in the UW's supply area.

2.6 ECONOMIC OVERVIEW

Table 2.6 indicates the percentage contribution that each sector makes to the provincial Gross Value Added (GVA). Gross Value Added refers to the total economic value of goods and services produced in an area, industry, sector or economy. **Table 2.7** below examines the GVA of the total KZN economy generated in each economic sector by rand value (2014 Rands) and identifies the share of each sector produced in both the uMkhomazi Catchment and UW's supply area.

Table 2.7: Percentage contribution to provincial GVA per sector

Employment Per Sector	KZN Provincial GVA in Rands (millions)	uMkhomazi Catchment % Share of KZN GVA	Umgeni Supply Footprint % Share of KZN GVA
Total GVA	480 382	1.9%	72.6%
Agriculture, forestry and fishing	21 170	6.7%	53.2%
Mining and quarrying	10 478	1.4%	45.4%
Manufacturing	75 268	1.8%	73.1%
Electricity, gas and water	14 457	0.7%	72.0%
Construction	16 614	2.3%	73.2%
Wholesale and retail trade, catering and accommodation	87 480	1.4%	71.4%
Transport, storage and communication	63 444	2.1%	76.4%
Finance, insurance, real estate and business services	90 454	1.4%	79.8%
Community, social and personal services	29 754	1.8%	70.5%
General government	71 262	1.5%	68.0%

Source: Quantec (2014)

The above table highlights the fact that the uMkhomazi Catchment only contributes a total of 1.9% to the total provincial GVA, while the Umgeni WSS's footprint area in contrast contributes a dominant 72.6% to the total provincial GVA, and is therefore noted as the economic hub of the KwaZulu-Natal.

The sector that makes the biggest contribution to the provincial GVA in the uMkhomazi Catchment is the agriculture, forestry and fishing sector that contributes 6.7% to the provincial total for that sector. The sector that makes the biggest contribution to the provincial GVA in the Umgeni WSS's footprint area is the finance, insurance, real estate and business services sector that contributes 79.8% to the provincial total for that sector.

The following table shows the GVA per capita as well as the disposable income per capita for each area.

Table 2.8: GVA per capita and disposable income per capita

Gross Value Add	uMkhomazi Catchment	Umgeni WSS's footprint
Disposable Income Per Capita	R 32 813	R 34 522
GVA Per Capita	R 14 042	R 36 722

Source: Quantec (2014)

The GVA per capita differs between the two areas with the GVA per capita more than double in the Umgeni WSS's footprint area than in the uMkhomazi Catchment. The disposable income only has a small difference between the two areas, this is largely due to higher levels of remittance income experienced in the uMkhomazi Catchment with the lower productivity evident as a lower GVA per capita.

Per capita poverty is measured at the income level of an individual earning under R443 per month or R5 316 per annum[2]. This translates into household income of R3 200 per month and below. Using this measure, 19.8% of the uMkhomazi Catchment and 20.1% of the UW's supply area are considered to be living below the poverty line, this has implications for recovery on infrastructure and provisioning costs, and identifies a need for some measure of support funding towards the provision of water infrastructure for these poor households.

2.7 SUMMARY

This section of the report provides a brief overview of the key socio economic characteristics of the catchment and supply areas. The former consisting of Harry Gwala (formerly known as Sisonke), Ugu, Ilembe, Umgungundlovu District Municipalities and eThekwini Metro. The supply area consists of eThekwini Municipality, the northern parts of Ugu (currently Vulamehlo LM) and parts of Umgungundlovu District.

The following findings can be highlighted:

- A total of 203 912 people (45 548 households) reside in the catchment area. This represents 1.9% of the total number of people in KwaZulu-Natal;
- A further 6 326 419 people (1 614 087 households) comprise the UW's supply area, and this approximately 59% of the population of KZN.
- The average household size in the uMkhomazi catchment area is 4.5 persons per household and 3.9 persons per household in the Umgeni Supply Footprint area.
- Only 44.3% of the working age population is economically active of which only 22.3% is employed in the uMkhomazi Catchment, in the Umgeni Supply Footprint the figures are 60.4% and 37.8% respectively.
- A significant share (19.9%) are employed within the community, social and personal services, a further 18.5% are employed in wholesale and retail trade

[2] *Statistics South Africa: Poverty Trends in South Africa 2006 – 2011, Report No. 03-10-06, March 2014*

white 12.9% are employed in agriculture, forestry and fishing in the uMkhomazi Catchment. This is not typical of rural areas within KwaZulu-Natal; as there are limited economic opportunities outside of government services and agriculture. In comparison, employment in the Umgeni WSS's footprint is concentrated in wholesale and retail, catering and accommodation (25.2%), community, social and personal services (16.6%), finance (15.2%), general government (12.2%) and manufacturing (11.4%).

- The majority of households (60.3%) reside in traditional dwellings or huts made of traditional materials in the uMkhomazi Catchment, in the Umgeni WSS's footprint, 61.3% of households are brick structures on a separate stand or yard.
- The majority of households (66.6%) use pit latrines. 2% of households use bucket latrines and a 21.6% of households have flush or chemical toilets.
- In the Umgeni WSS's footprint area, the majority of households (55.1%) use flush or chemical toilets. 27.4% use pit latrines and 2.3% use bucket latrines.
- A large portion of households (33.2%) have access to piped water either inside their dwellings or inside their yard in the uMkhomazi Catchment. The percentage of households with access to piped water on a community stand is 23.3% and 10.0% of all the households in the catchment area have access to piped water less than 200 m from their dwelling, while 13.2% have access to piped water a distance greater than 200 m from their dwelling. 22.2% of the households get their water either from a river/stream or from a dam/pool/stagnant water;
- The majority of households (77.9%) have access to piped water either inside their dwellings or inside their yard in the Umgeni WSS's footprint area. The percentage of households with access to piped water on a community stand is 15% less than 200m from their dwelling, while 6.3% have access to piped water a distance greater than 200 m from their dwelling. 3.1% of the households get their water either from a river/stream or from a dam/pool/stagnant water.

Nearly a third of the population of the uMkhomazi Catchment has no schooling. This average is below the provincial and national averages. Only 44.3% of the working age population is economically active, with an employment rate of this grouping at 22.3%. There is a pressing need for employment opportunities in the region. Employment as associated with construction that forms part of the proposed uMWP has the potential to up skill individuals through the provision of on-the-job training.

Only 33.2% of households in the uMkhomazi Catchment have access to piped water. This is line with expectations for the supply area as it is largely rural in nature which significantly limits the scope for provision of piped water. This in turn affects household access to water-borne sanitation services and creates backlogs for the respective local municipal authorities in terms of creating sustainable human settlements. 10.0% of all the households in the catchment area have access to piped water less than 200 m from their dwelling, while 13.2% have access to piped water a distance greater than 200 m from their dwelling. At present 22% of households acquire water from rivers or streams.

The catchment area has a relatively low level of social infrastructure given the dispersed settlement pattern. Within the total catchment area there are 16 health care facilities and 208 schools, with only 6 police stations. The non-provision or reduction of services has a detrimental impact on the efficiency of a region's economy and the wellbeing of a community. The provision of infrastructural services represents a precondition for improved economic growth, welfare, quality of life and productivity of people. By providing well-planned and managed infrastructure, economic opportunities and social wellbeing are created. Infrastructure such as the uMWP thus plays a dual role in the economic system, namely an improvement in economic activity and an improvement in living conditions. The development of the uMWP will create increased expenditure in the study area and as a result an opportunity to develop the area further.

Upon examining the income categories it was found that a large portion of the population, 19.8% in the uMkhomazi Catchment earns below the poverty line. A significant investment such as the proposed uMWP thus has the potential to significantly impact household incomes in the area through direct, indirect and induced channels. In the Umgeni WSS's footprint area, 20.1% of households (322 817) are considered poor and would likely not be able to pay for services received, making the provision of water resources in a cost effective manner critical in order to meet the municipal service delivery criteria a critical priority.

3 LEGISLATIVE REVIEW

The purpose of this section is to provide an outline of some of the pertinent and binding policies, plans and strategies that have a bearing on the proposed uMWP and its overall economic impact.

3.1 NATIONAL AND PROVINCIAL POLICY

3.1.1 New growth path

The New Growth Path is a statement of government's commitment to forging a developmental consensus. It is meant to lead the way by:

- Identifying areas where employment creation is possible on a large scale as a result of substantial changes in South African and global conditions.

Developing a policy package to facilitate employment creation in these areas, above all through:

- A comprehensive drive to enhance both social equity and competitiveness.
- Systemic changes to mobilise domestic investment around activities that can create sustainable employment.
- Strong social dialogue to focus all stakeholders on encouraging growth in employment-creating activities.

It contains policies that speak to industry; rural development; competition; education and skills development; enterprise development; BBBEE; labour and technology. These are to be expressed through job drivers in the form of spatial development, social capital, new economies and the main economic sectors.

3.1.2 National Development Plan (NDP)

The recently established National Planning Commission (NPC) has developed the NDP vision for 2030 for South Africa which is classified as a long term strategic framework for the country to work towards collectively. The Plan highlights 3 priorities: raising employment through faster economic growth, improving the quality of education, skills development and innovation and building the capability of the state to play a developmental, transformative role. These are seen as

essential to achieving higher rates of investment and competitiveness, and expanding production and exports.

The NDP acknowledges the need for increased investment in competitive infrastructure through improved governance to lessen the risk on international investment. This can be achieved by rising exports, attracting investment in competitive infrastructure, and lowering the cost of doing businesses through improving efficiencies in transport and logistics.

3.1.3 KwaZulu-Natal Provincial Growth and Development Strategy and Plan (PGDS AND PGDP)

The recently completed PGDS provides a high-level view of key issues, mechanisms and interventions necessary to achieve continued balance growth in the province for the 30 year time horizon. This PGDS provides KwaZulu-Natal with a reasoned strategic framework for accelerated and shared economic growth through catalytic and developmental interventions, within a coherent equitable spatial development architecture, putting people first, particularly the poor and vulnerable, and building sustainable communities, livelihoods and living environments.

The strategic focus of the PGDS is:

"*…to build on the smart province concept, through improving all growth sectors enhancing their employment generating potential, transformation of the economic sector in respect of representivity of our population, appropriate provision of economic and social infrastructure and building of sustainable communities in our Province, and contributing to this on a nation and Continental level*."

The Provincial Growth and Development Plan (PGDP), the implementation framework for the Provincial Growth and Development Strategy (PGDS), provides a number of interventions.

Attention is given to the provision of infrastructure and services, restoring the natural resources, public sector leadership, delivery and accountability, ensuring that these changes are responded to with resilience, innovation and adaptability. This will lay the foundations for attracting and instilling confidence from potential investors and developing social compacts that seek to address the inter-connectedness of the Provincial challenges in a holistic, sustainable manner, whilst nurturing a populous that is productive, healthy and socially cohesive.

The PGDS aligns itself to the Millennium Development Goals (MDGs), the New Growth Path (NGP), the National Development Plan (NDP), as well as various other national policies and strategies. It identifies seven strategic goals, all of which have a direct bearing on economic development. They are:

- Goal 1: Job Creation
- Goal 2: Human Resource Development
- Goal 3: Human & Community Development
- Goal 4: Strategic Infrastructure
- Goal 5: Environmental Sustainability
- Goal 6: Governance and Policy
- Goal 7: Spatial Equity

Strategic Goals 1, Job Creation, deals directly with economic investments, and is of particular importance to the purposes of the current analysis.

3.1.4 Provincial Spatial Economic Development Strategy (PSEDS)

The PSEDS provides a strategic framework, sectoral strategies and programmes aimed at a rapid improvement in the quality of life for the poorest people of the Province. It sets out to address the developmental challenges posed by these socio-economic contexts through a ten year development plan. The PSEDS specific programmatic interventions are built around the particular nature of inequality and poverty in the KZN.

The PSEDS is currently in the process of being reviewed by the Department of Economic Development and Tourism (DEDT). It must however be noted that as part of the revised PSEDS, the province seeks to identify the key driving commercial activity within the province and map this spatially. This will allow for a view of what economic concentration exists within the provincial context. The successful implementation of the PSEDS is dependent on the implementation at local level. The upgrade of key infrastructure, including water is seen a major unlocker for the affected study area.

3.1.5 Comprehensive Rural Development Programme (CRDP)

The CRDP is strategic priority no 3 within government's current Medium Term Strategic Framework and was established with the aim to eliminate rural poverty and food insecurity by maximising the use and management of natural resources to create vibrant, equitable and sustainable rural communities.

The programme focusses on:

- Agrarian transformation (production, food security, appropriate technologies and appropriate resource use)
- Land reform (redistribution processes and tenure reform) and
- Rural Development (physical and social infrastructure and support to human settlements in rural areas)

The implication of these above national and provincial informants is to be found in their prioritisation of projects such as the proposed uMWP. Provincial planning documents identify projects such as the proposed scheme as forming part of a set of critical infrastructure interventions, aimed at unlocking the province's development potential by assisting to secure water resources. Based on national and provincial informants, a project such as this is thus seen as having significant positive impacts on the broader region, beyond those impacts experienced solely within the study area's boundaries.

3.2 MUNICIPAL POLICY

3.2.1 eThekwini Integrated Development Plan (IDP)

An Integrated Development plan is the primary means of service delivery used by municipalities in identifying principle developmental needs and implementing actions to face these needs. The eThekwini IDP encompasses aspirations linked to economic, social, institutional and infrastructural goals within the metro. This is summed up neatly in the municipal vision: "*By 2030, eThekwini will enjoy the reputation of being Africa's most caring and liveable City, where all citizens live in harmony."*

The Vision for the municipality (more so the timeframe) has been amended to ensure that there is alignment with key strategic documents namely the National Planning Vision and The Provincial Growth and Development Strategy. Both these strategic documents have a 2030 timeframe. The City faces several key developmental challenges and ensuring adequate energy and water supply in the metro area is highlighted as a major focus of infrastructure planning. The unsustainable use of resources such as energy and water has major impacts on the environment, and will ultimately compromise the Municipality's energy security, as well as its ability to deliver water of adequate quality and quantity to its citizens. Unsustainable resource use is a direct consequence of overproduction and consumption. Demand side management is a critical part of

the approach to ensuring a more sustainable use of resources. In the case of water, whole catchment management (including areas that fall outside of the municipal area) as well as efficient nature conservation programmes will help to ensure that there is an adequate supply of clean water in the eThekwini Municipality.

3.2.2 uMgungundlovu Integrated Development Plan (IDP)

The municipal vision: "*UMgungundlovu DM will evolve into a dynamic metropolitan area, spreading its vibrant economic benefits to all its citizens and places and will, through concerted integrated development and service delivery realise improvement in the overall quality of life.*"

The Vision for the municipality aligns with key strategic documents at a provincial and national level. As such, it aligns itself with the seven goals of The Provincial Growth and Development Strategy and the National Infrastructure Plan. The district faces several key developmental challenges and ensuring adequate water supply, sanitation and environmental services in the metro area is highlighted as a major focus (or 'core business') of infrastructure planning and outputs for the next five years. The focus with regard to water is to improve quality and retain the blue drop status as well as to create an efficient infrastructure network by servicing aging infrastructure. As the Water services authority, water and sanitation backlogs also need to be eradicated as an outcome with spend identified into this sector over the next three years.

While the IDP cites good levels of existing water sources evident in the district it also states that demand side management is a critical part of the approach to ensuring a more sustainable use of resources. The DM has reached blue drop status in 2012 which is an indication of commitment to better service delivery and management of water resources.

3.2.3 Ugu Integrated Development Plan (IDP)

The IDP remains the strategic planning instrument to guide and inform the planning, budgeting, performance management and decision-making activities in the municipality. The Ugu IDP has been developed through a collaborative process with the communities of the Ugu District Municipality, sector departments both provincial and national, within the structures of the family of municipalities, as well as with surrounding District Municipalities. The vision, as stipulated in the 2013/14 review is as follows:

"A place where everyone benefits equally from socio-economic opportunities and services"

A number of development priorities are also identified in the IDP, which give rise to the strategic objectives of the IDP. These priorities and the strategic objectives are identified below:

- Infrastructure Investment (Roads, Water, Sanitation, Electricity, Housing)
- Economic and Sectoral Development (Job Creation, Employment, LED Projects, Tourism, Agriculture, Rural development)
- Financial Viability (Clean Audit, Corruption)
- Education and Skills development (Skills Development, Education)
- Institutional Integration and Coordination (Institutional development, review of Organogram, Workforce, Principles development)
- Centralised planning
- Reduce HIV & Aids
- Clean Environment
- Peace and Stability

3.2.4 Harry Gwala Integrated Development Plan (IDP)

The Harry Gwala IDP (2013-2014) identifies the following long term vision for the district: "*By 2030 Sisonke District Municipality will be a leading water services provider in the KZN Province with its communities benefiting from a vibrant agriculture and tourism sectors.*". Agriculture, community services, and retail trade were identified as main economic drivers of the district municipality. These sectors made contributions of 33.5 %, 33.3 %, and 12.8 % in 2011 respectively to the district municipality economy. Finance and construction are the fastest growing sectors of the local economy, yielding average growth rates of 8.1 %, 4.0 %, and 3.8 % respectively. Clearly community services and agriculture are the most significant sectors of the Sisonke District Municipality economy and together also contribute 60 % of the district's Gross Value Added (GVA). Other leading industries include the retail trade sector and the finance sector, with the manufacturing sector contributing no more than 6 % to total district GVA.

Bulk regional water supply schemes and localised rural sanitation plans are both identified as key service delivery areas.

4 PROJECT DIMENSIONS

The purpose of this section is to provide an overview of the proposed uMWP augmentation. The rationale is that a comprehensive understanding of the project's various elements (activities, phasing, scope, etc.) will allow a theoretically sound and practically robust assessment of economic impacts associated with it. Particular emphasis is placed on planned expenditure and employment, since this data encapsulates the primary input required to conduct a macroeconomic impact assessment. The input data utilised in this report is drawn from:

- **Report No. 108/114/12/R1 – Preliminary Pricing of Potable Water Module Options:** The purpose of this report was to provide preliminary capital costs for Module 3 to AECOM for their financial calculations for the overall scheme.

- **Report No. 108/114/12/R2 – Revised Mgeni System Operating Rules During uMkhomazi Raw Water Tunnel Shutdowns:** The purpose of this report was to investigate whether the existing Mgeni system water supply infrastructure could accommodate a three week shutdown of the uMkhomazi system for planned maintenance purposes.

- **Report No. 108/114/12/R3 – Water Demand Projections and Phasing of Infrastructure:** This report documents the water demand projection exercise undertaken for the uMkhomazi scheme supply area. These water demands were used for both the Module 1 and Module 3 studies.

- **Report No. 108/114/12/R4 – Pipeline Design Report:** This report provides details of the potable water investigations including WTW locations, pipeline routes and hydraulics as well as detailed cost estimates. The raw water pipeline, although forming part of Module 1, has been included in this report. This report is presented in four volumes.

- **Report No. 108/114/12/R5 – Water Treatment Works Conceptual Design Report:** This report provides details of the WTW design and treatment technology proposed.

- **Report No. 108/114/12/R6 – Geotechnical Investigations:** This report documents the outcomes of the geotechnical investigations for the raw and potable water pipeline routes and the proposed WTW site. This report is

presented in three volumes covering separately, the raw water pipeline route, potable water pipeline route and WTW site geotechnical investigations.

- **Report No. 108/114/12/R7 – Environmental Impact Assessment:** This report documents the Environmental Impact Assessment (EIA) process.
- **Report No. 108/114/12/R8 – Land Survey and Landowner Details:** This report provides details of the engineering survey carried out for the proposed pipeline routes and WTW site. It also provides landowner contact details and information on all affected properties.
- **Report No. 108/114/12/R9 – Executive Summary Report:** The Executive Summary Report summarises the main findings of the Module 3 study. This report is presented in two volumes.

4.1 PROJECT PHASES

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

In this project, the construction phase is articulated in two clear components: the raw water infrastructure comprising the development of the dams and tunnel and the second which includes the raw water pipeline, hydropower plant and the potable water infrastructure, comprising the water treatment as well as potable water pipeline. Further to that, there are clearly defined refurbishment activities

4.1.1 Construction phases

For the development of the uMWP it is necessary to understand the total development programme which comprises the following major construction components is broken into two clear components as described below.

The raw water component, or raw water component, includes the ***construction*** of:

- Smithfield Dam and associated infrastructure;
- Gauging Weirs Construction
- Langa Dam and associated infrastructure;
- Tunnel and associated infrastructure;
- Access/construction roads and deviation of existing road;
- Raw Water Pipeline
- Waste Disposal Sites
- Access Roads

The potable water ***construction*** component, or bulk potable water component, comprises of:

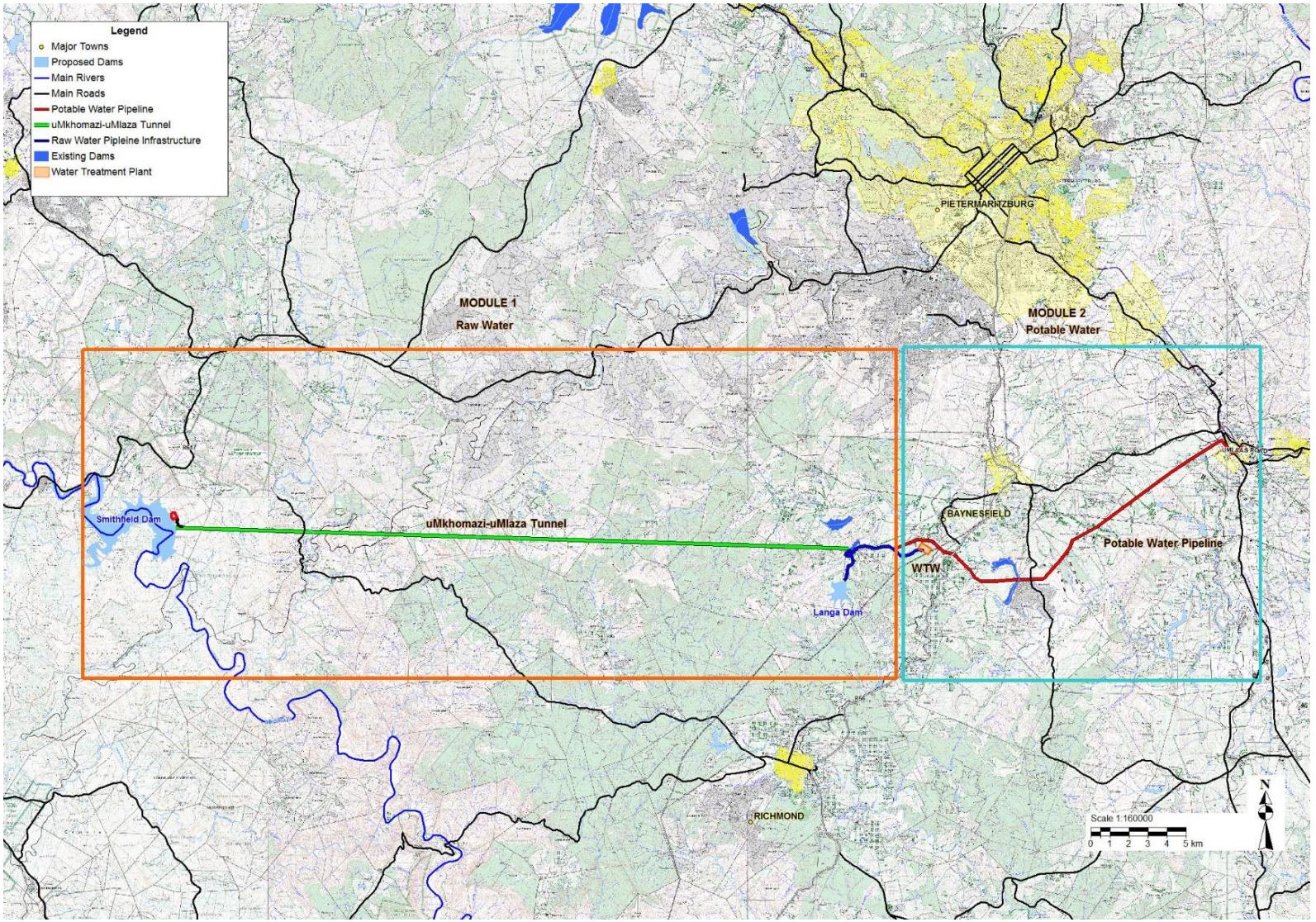
- Water Treatment Plant and associated infrastructure;
- Potable Water Pipeline and associated infrastructure; and
- Transmission Lines.

4.1.2 Refurbishment phases

Additional to the construction phases of the uMWP there are specific identified refurbishment phases, each major capital component has a different rate refurbishment required these are bulleted below.

It should be noted that the operational and refurbishment phases will physically last beyond 2060 but for the purposes of the economic impact assessment the operational phase was modelled for an assumed economic life of 50 years.

Component:	Required refurbishment period:
Smithfield Dam	after the first 25 years of operation
Langa Dam	after the first 25 years of operation
Tunnel	after every 25 years of operation
Raw Water Pipeline	after every 25 years of operation
Gauging Weirs	after the first 25 years of operation
Water Treatment Plant	of Plant 15 years of operation, three times during the analysis period
Potable Water Pipeline	after the first 25 years of operation



Source: AECOM

Figure 4.1: uMWP capital programme spatially represented

4.1.3 Operational phase

The operational phase which includes operation and maintenance for the following components:

- Smithfield Dam
- Langa Dam
- Tunnel
- Raw Water Pipeline
- Access Roads
- Water Treatment Plant
- Potable Water Pipeline
- Gauging Weirs
- Transmission Lines

4.2 CAPITAL EXPENDITURE[3]

4.2.1 Raw water component construction

The construction costs for each of the identified components below includes the excavation, clearing and concrete works. Required on-shore (domestic) purchases of mechanical items, necessary landscaping, and preliminary works. Accommodation and transport for skilled core staff and the cost of hire for local staffing for the total period.

Included in the capex costs are the costs of capital refurbishment, which occurs in discrete single year spends at different points of the assets' lifespan, as indicated in the section above.

Table 4.1: Raw water component: Total construction and refurbishment costs (exclusive of VAT, 2014 Rands)

Item	Total capital cost (R million)	Construction period
Raw water system		
Smithfield Dam	2 018	4
Langa Dam	439	3
Tunnel	3 901	5

[3] *All figures in this section are in 2014 Rands, excl VAT as provided by the Construction Cash Flow from the Feasibility Design Report*

Item	Total capital cost (R million)	Construction period
Raw water pipeline	365	3
Access roads	232	2
Gauging weirs	30	3
Waste disposal sites	15	1
Transmission lines	5	2
Sub-total: Raw water system	**7 006***	

** Capital only, excluding Ps & Gs, Professional fees, Environmental, land acquisition, financial cost*

Source: P WMA 11/U10/00/3312/3/1, Engineering feasibility design report

In terms of labour content, the bulk raw water component construction will generate 4 170 direct on-site employment opportunities (an employment opportunity is the equivalent of employment for a person for a year on the project site), of which, 3 670 employment opportunities are set aside for local labour over the 5 year construction period; additional employment will be generated in the discrete periods of refurbishment.

4.2.2 Bulk potable water component construction

The construction costs for each of the identified components below includes the excavation, clearing and concrete works. Required on-shore (domestic) purchases of mechanical items, necessary landscaping, and preliminary works.

Accommodation and transport for skilled core staff and the cost of hire for local staffing for the total three year period.

Table 4.2: Bulk potable water component total construction and refurbishment costs (exclusive of VAT, 2014 Rands)

Item	Total capital cost (R million)	Construction period
Potable water system		
Water Treatment Works	795	3
Potable water pipeline	1 143	3
Sub-total: Potable water system	**1 938**	

** Capital only, excluding Ps & Gs, Professional fees, Environmental, land acquisition, financial cost*

Source: 108/114/12/R9, Potable Water Executive Summary

In terms of labour content, the bulk potable water component will generate 1 778 direct employment opportunities (an employment opportunity is the equivalent of employment for a person for a year on the project site), of which, 1 565 opportunities are set aside for local labour over the 3 year construction period.

4.3 OPERATIONAL EXPENDITURE PHASES

The operational phase expenditure is reflected as the per annum expenditure required to operate each component of the uMWP. As the various components come on stream at different times, the total system's expenditure is mapped over the 50 year planned expenditure.

Table 4.3: Operational expenditure (exclusive of VAT, 2014 Rands)

Item	Total annual operational cost (R million)
Raw water system	
Smithfield Dam	5.4
Langa Dam	1.2
Tunnel	9.8
Raw water pipeline	0.9
Access roads	0.6
Gauging weirs	0.1
Waste disposal sites	0.03
Transmission lines	0.03
Sub-total: Raw water system	**18**
Potable water system	
Water Treatment Works	429.2
Potable water pipeline	4.6
Sub-total: Potable water system	**433.8**

Source: P WMA 11/U10/00/3312/3/1, Engineering feasibility design report

The employment generated by the operation of the uMWP equates to 110 permanent employment opportunities, this equates to total employment opportunities created over the operational period of 5 500. These opportunities are to be created within the uMkhomazi Catchment for the operation of the system.

4.4 SUMMARY

As is reflected in **Figure 4.1** below, the anticipated annual expenditure associated with the uMWP is shown for the a 55 year time horizon of the project, from initial construction period of 5 years and including the first 50 years of water delivery.

The uMWP consist of the construction of both the raw water and bulk potable water components as well as a refurbishment programme and an annual

operational programme. These components form the basis of the economic impact assessment. The uMWP construction period is anticipated over a 5 year period. The refurbishment programme has multiple phases, which occur at different discrete intervals based on asset refurbishment requirements. The uMWP impact assessment is based on an operational phase stretched out over a 50 year period.

During each of the identified phases, on average, 87% of employment will be sourced locally. Only 13 % of employment will be towards core skilled people from outside of the study area. During the infrastructure construction phase pipes will be manufactured within South Africa, but not necessarily in the study area. Heavy earth moving and special equipment will also be sourced in South Africa but not necessarily in the study area. All the other construction materials will be obtained from the local region, provided that the area can supply the required materials, otherwise some materials may have to be source from elsewhere in the province or country. The tunnel boring machinery (TBM) required to create the tunnel components are anticipated to be wholly imported, and expenditure has been removed from the impact modelling that follows. Local procurement will increase the positive impact associated with the proposed uMWP.

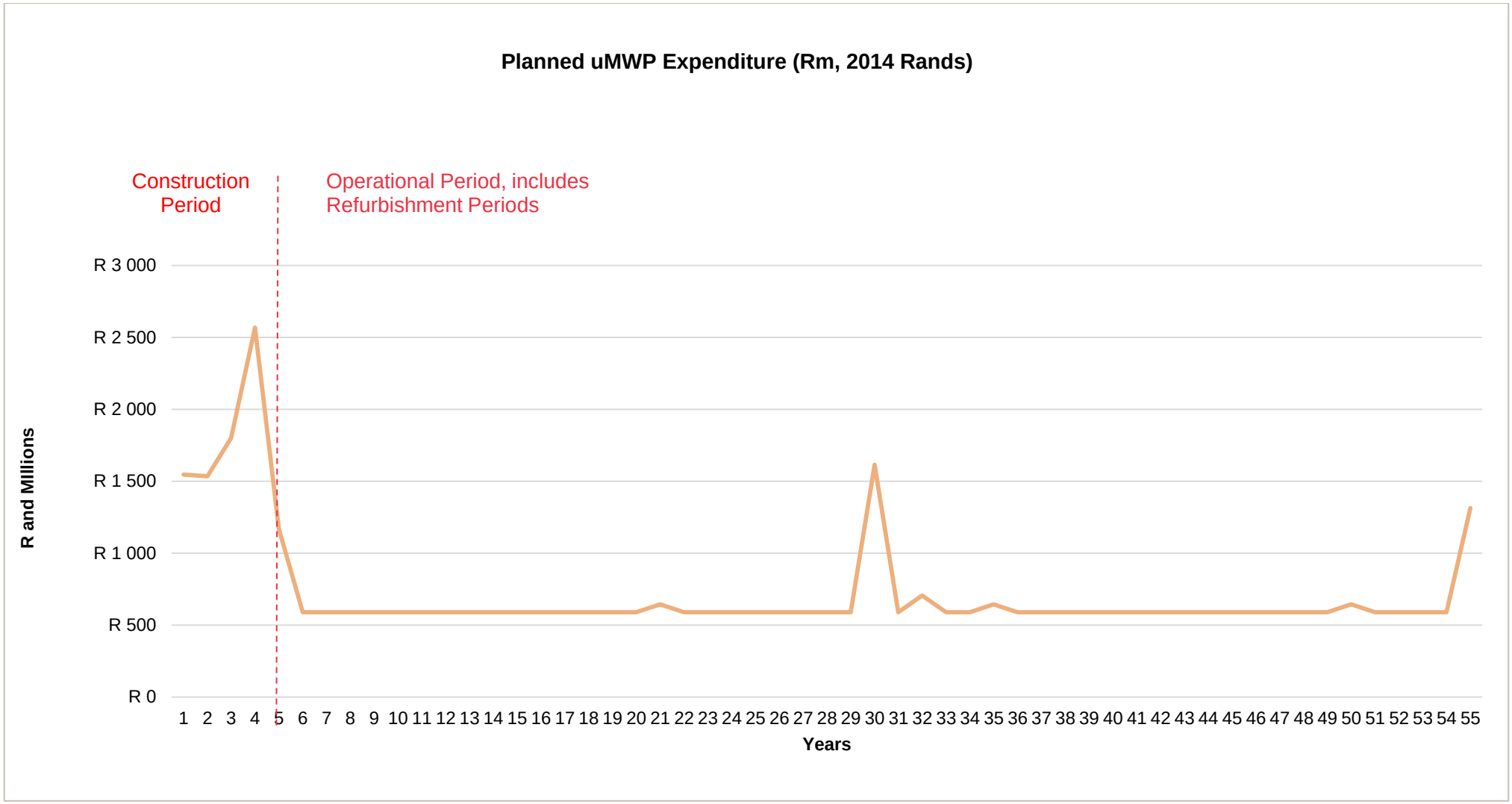


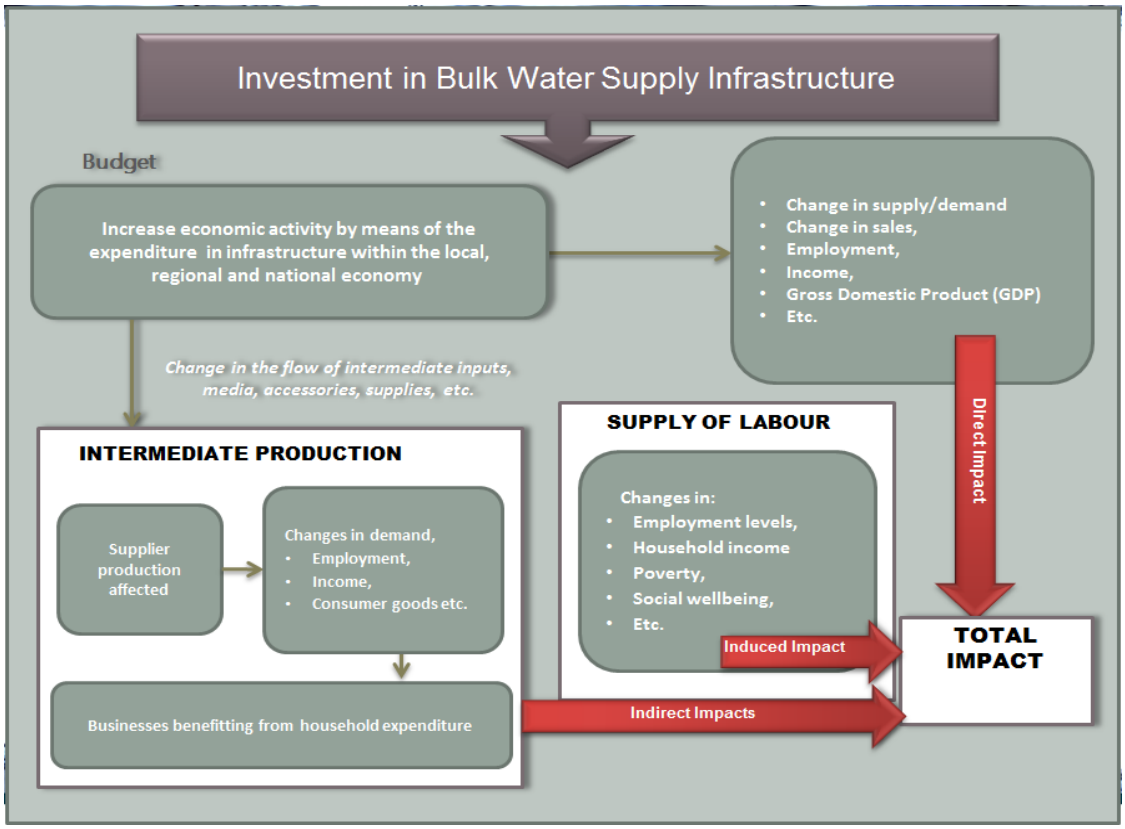
Figure 4.1: Annual planned uMWP expenditure in Rm (based on 2014 rand pricing provided by AECOM)

5 ECONOMIC IMPACT ASSESSMENT

5.1 BACKGROUND TO THE ECONOMIC IMPACT ASSESSMENT

The assessment analysis the potential changes in economic production, Gross Domestic Product (GDP), employment creation, and income during project implementation.

The socio-economic impact assessment examines the effects of a proposed project on the level of economic activity and the welfare of households in the local, regional and national economies. The assessment considers not only the direct impact of the intervention but also the indirect and induced impacts relating to wider economic growth and development. The relationship between capital and operational expenditure and the direct, indirect and induced impacts of this expenditure is illustrated in **Figure 5.1** below.



Source: Urban-Econ Development Economists (2014)

Figure 5.1: Impact of capital investment and expenditure

5.1.1 Measuring economic impacts

The socio-economic assessment considers three different types of economic impact, namely direct, indirect and induced. These levels of impact are defined as follows:

The **direct impact** occurs when the project creates jobs and procures goods and services resulting in increased employment, production, business sales, and household income.

The **indirect impact** occurs when the suppliers of goods and services to the proposed project experience a larger markets and the potential to expand. Indirect impacts result in an increase in job creation, Gross Domestic Product (GDP) and household income.

The **induced impact** represents further shifts in spending on food, clothing, shelter and other consumer goods and services due to increased income in the directly and indirectly affected businesses. This leads to further business growth throughout the local economy.

The socio-economic impact of the project is measured according to the following indicators:

- **Production:** Production is defined as the process in which labour and assets are used to transform inputs of goods and services into outputs of other goods and services. The impact assessment will measure the change in production expected to result from the project.
- **Gross Domestic Product (GDP):** Gross Domestic Product refers to the market value of all final goods and services produced within a country in a given period of time. The assessment therefore measures the impact of the proposed project on the South African economy.
- **Employment created:** An employment opportunity is defined as one person employed for one year. Seasonal work is therefore not counted as an individual employment opportunity but instead combined to calculate the number of total jobs created in one year
- **Income generated:** The income generated by the project refers to the salaries and wages earned by those employed directly in the project and the suppliers of goods and services.

The econometric model for the study was developed using the KZN Social Accounting Matrix (SAM) updated to 2014 figures. The SAM is a comprehensive,

economy-wide database that contains information about the flow of resources between economic agents in the provincial economy.

5.1.2 Assumptions

Based on the input data provided in the previous section, the following assumptions were made:

- All expenditure figures reflect the real situation accurately enough for the purpose of the impact assessment.
- Machinery and equipment as well as imported tooling and equipment were valued at 2014 book values.
- Buildings and infrastructure (i.e. roads, electricity, and water) were valued at 2014 book values.
- Cost of services rendered/goods produced have been re-categorised from commodity to categories of economic sectors to accommodate the modelling process.
- The technical coefficients of the SAM model remain constant for the period over which forecast projection is made, i.e. no structural changes in the economy are experienced.
- Operational capacity will not require new buildings and infrastructure.
- For construction activities, expenditure on labour was based on industry standards.

5.2 QUANTIFIED CAPITAL EXPENDITURE IMPACT

Table 5.1 indicates the direct, indirect, induced and total production, GDP, employment and income associated with the total construction and refurbishment of capital assets of the uMWP.

Table 5.1: Macroeconomic effect of the uMWP construction and refurbishment programme

CAPITAL AND REFURBISHMENT IMPACT				
Indicator	**Direct**	**Indirect**	**Induced**	**Total**
Production	R 10 738	R 12 193	R 5 733	R 28 665
GDP	R 994	R 4 245	R 2 194	R 7 433
Employment (person years)	4170	31089	12131	47390
Worker Income	R 1 396	R 1 898	R 878	R 4 172

Note: R' million, 2014 prices – unless otherwise stated: Urban-Econ Calculations

From the table above it becomes apparent that the contribution to the total production in the economy of the study area during the construction phase, will amount to approximately R 28 665 million over the five year construction period and discrete refurbishment periods as per the provided time programme.

The construction component will generate a total of approximately R7 433 million in GDP during construction. The total GDP contribution will be as a result of the direct expenditure plus that of industries supplying the project with inputs and industries that supply consumer goods and services.

The construction process will require approximately 4170 new direct employees over 5 years, of which 3628 will in all probability be local people from the study area and 542 core skilled people from outside the region. Higher production in industries supplying inputs will create an additional 4 245 employment opportunities, while approximately 12 131 new employment opportunities will be generated as a result of an increased demand for consumer goods and services. In total, approximately 47 390 employment opportunities will be created by the construction and refurbishment of the uMWP.

The development of the proposed facilities will result in a total increase of R 4 172 million in income over the construction and refurbishment periods.

5.3 QUANTIFIED OPERATIONAL PHASE IMPACT

Table 5.2 indicates the direct, indirect, induced and total production, GDP, employment and income associated with the operational phase of the uMWP. The impact is provided as the total impact of 50 operational years.

Table 5.2: Macro-economic effect of the operational phase indicated as annual impact

OPERATIONAL IMPACT PER YEAR				
Indicator	**Direct**	**Indirect**	**Induced**	**Total**
Production	R 452	R 469	R 239	R 1 160
GDP	R 136	R 202	R 119	R 457
Employment	110	764	655	1529
Worker Income	R 77	R 81	R 48	R 206

Note: R' million, 2014 prices, impacts are annual, Urban-Econ Calculations

The total operational direct spend, will as indicated in **Table 5.2** resulting from the direct investment into the catchment area and the uMWP scheme, cause increased productivity in other sectors of the economy. In total, the operational phase will raise the level of production by approximately R 452 million directly, and by R708 million if indirect and induced impacts are included. This is anticipated annual impact on production in the economy.

Raised production levels are accompanied by increased GDP. The direct impact of the operational phase is an increase of R 136 million in GDP per annum, with a total increase in the level of GDP of approximately R 457 million.

Regarding employment, the system's operations will generate permanent employment of 110 persons per year once the system is fully established, and this manpower requirement remains constant. Increased production in industries supplying the operational inputs and industries supplying consumer goods and services implies the creation of new employment opportunities in these industries. The (indirect) impact on employment in supplying industries will manifest in the creation of approximately 764 employment opportunities, while the impact on industries supplying consumer goods and services (i.e. the induced impact) will be the creation of approximately 655 employment opportunities. In total, the operational phase will generate 1529 employment opportunities that are considered sustainable over the 50 period of the uMWP. **Thus the scheme will generate 5 500 employment opportunities over the 50 year operational timeline.**

In return for providing a service, employees receive an income. It is estimated that a total cumulated income of R 77 million per annum, which over the timeline of operation (50 years) equates to R 3850 million in new wages into the uMkhomazi Catchment , will be generated through the operation of uMWP.

The total impacts for the joint 5 year construction and 50 year operational period modelled are described in the summary section below.

5.4 SUMMARY

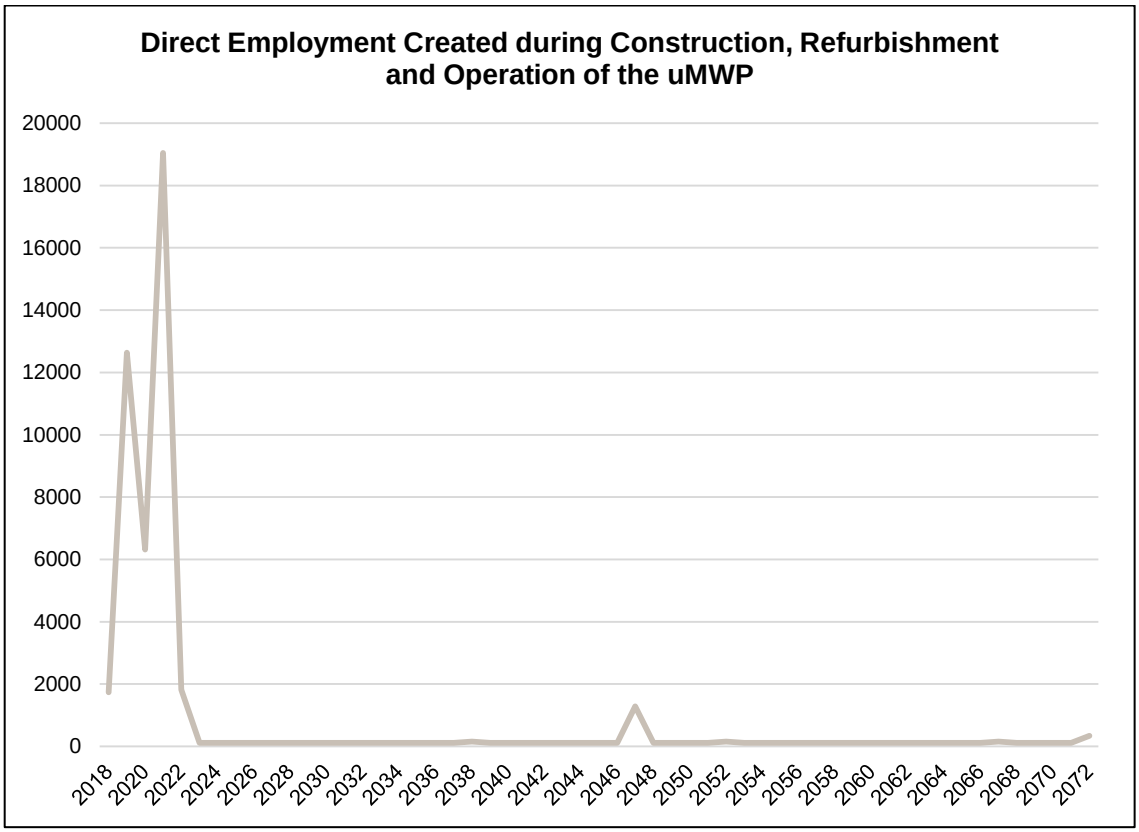
The proposed uMWP will have an impact on the regional and local economies during the construction, operational and refurbishment phases. The impact during construction is considerable, yet it is not sustainable in the long-term as the construction will only last for approximately 60 months. The operational phase, is modelled on a 50 year period and therefore it is regarded as a more sustainable contribution to the domestic economy. The refurbishment phases will contribute to the overall impact during the operational phase, these are identified as discrete expenditure undertaken in single year increments over the lifespan of the assets.

Employment opportunities are reflected as annualised job opportunities, thus the total impact of the operational annual figures shown above in **Table 5.2** are multiplied out over the period measured and added to the construction and refurbishment employment opportunities to provide a total scheme impact for the duration of the 55 year period modelled**,** **Table 5.3** provides a summary of the various impact assessments associated with the proposed development.

Table 5.3: uMWP impact assessment summary

TOTAL IMPACT (Capex and Opex modelled for Lifespan)				
Indicator	**Direct**	**Indirect**	**Induced**	**Total**
Production	R 33 333	R 35 644	R 17 685	R 86 661
GDP	R 7 807	R 14 355	R 8 143	R 30 305
Employment opportunities	9 670	69 311	44 866	123 846
Worker Income	R 5 271	R 5 935	R 3 260	R 14 466

The graph below illustrates the total employment creation of the uMWP between 2018 and 2072. The start year of 2018 is illustrative, and assumes that all planning permissions and finance requirements are in place for the project.



**One person employed for one year*

Figure 5.2: Total job* creation during the construction, operational and refurbishment phases of uMWP

To summarise, it is important to note that the development of the uMWP is expected to increase the size of the economy of the local area within the uMkhomazi Catchment. Also, note that the 2nd phase of the uMWP, the construction of Impendle Dam and double up of other the other infrastructure, is not included in this graph, but, uMWP-2 is planned to supply water by 2043.

5.5 FINAL CONCLUSION

The analysis has shown that the uMWP development in the uMkhomazi Catchment has the potential to generate high levels of production, employment creation as well as household income. This will stimulate business and human capital development and assist in raising living standards.

The current economic profile (**Section Two**) was established as a point of departure to evaluate the anticipated effects. The effect of changes in the economic reality resulting from the proposed development was discussed and concluded to be positive. Through the employment opportunities created it is estimated that a total of 47 390 opportunities will be created through the construction and refurbishment activities of the scheme, of which 4 280 will be

directly on the scheme site. This will result in an increase in worker income within each household affected, with 88% of local labour content planned for those on-site employment opportunities. The operational phase will positively generate 1 529 annual employment opportunities over the 50 year time period.

Regarding the affordability of water the income profile indicated that there is a significant portion of the population that are at risk of not being able to afford the water that will be provided through the uMWP. At present, 19% of the households within the uMkhomazi Catchment and 20.1% of the Umgeni WSS's footprint are considered to be living in poverty. This is reflected in the share of households in these areas with a household income of R3 200 per month and below.

With time, increased economic activity through uMWP investments will lead to an increase in worker income and as a result more people will be able to afford water. It can therefore be said that to make water available and affordable grant funding will be required.

During each of the identified phases, on average, 87% of the direct employment will be sourced in South Africa. Only 13 % of all employment will be towards core skilled personal from outside the study area. During the infrastructure construction phase pipes will be manufactured within South Africa, but not necessarily in the study area. Cranes and special equipment will also be sourced in South Africa but not necessarily in the study area. Imported tunnel boring machinery will be required. All the other construction materials will be obtained from the local region, provided that the area can supply the required materials, otherwise some materials will have to be sources from elsewhere in the country. Local procurement will increase the positive impact associated with the proposed uMWP and the following is recommended to maximise the positive economic impacts of the project:

- Use local labour and inputs as far as possible.
- Require that companies that bid for tenders within the development (especially the construction phases), have a skills development plan in order, which will result in impacts that will have a long-lasting nature.

In addition to the economic impacts associated with the capital, operation and refurbishment expenditures of the proposed uMWP, the development is important from a national strategic perspective. The national, provincial and local legislation policy environment prioritises projects such as the proposed uMWP.

The developments are sizable developments, which will result in numerous positive leverage effects into the receiving economies. It is recommended that the developments must be supported to realise the positive socio-economic effects illustrated in the investment scenario.

6 ECONOMIC COST-BENEFIT ANALYSIS

This section undertakes an Economic Cost-Benefit Analysis (ECBA) in the aim of evaluating the economic costs of various interventions and the resulting benefits to determine the effectiveness of resource allocation. A fundamental principal of an ECBA will be to provide the decision-makers with the quantitative comparison of options and supporting information for which costs and benefits can be quantified against. Only when all costs and benefits are listed in current monetary values, the costs and benefits of implementing the project can be weighed against each other. The difference between costs and benefits of a particular project is the net effect. When the net effect is positive, the cost of implementation is less than the benefits; it can be seen as a profitable project; therefore, by implementing the project there has been greater benefits than costs. If the net effect is negative, the costs are more than the benefits and thus it can be seen as a non-profitable project; implementing the particular project would cost more than the potential benefits. Included in this section is a review of the economic opportunity costs anticipated if the uMWP is not undertaken.

6.1 ASSUMPTIONS

In order to express all costs and benefits in the same monetary values, the following assumptions were identified:

- The financial analysis is undertaken over a 50 year period;
- The financial analysis is done in constant 2014 Rand values;
- Financing cost is not included;
- For the purposes of an ECBA, land and existing infrastructure are not included;
- The table below illustrates the water cost assumptions that the scenarios were based on; and
- A discount rate should be implemented to express future costs and benefits in current values.

Given the above consideration and the parameters set in the scenario, it was possible to create an ECBA for the project. The total cost of development was supplied by AECOM and the benefit of the scheme is indicated by the changes made to GDP and the financial returns from the sale of water.

GDP is frequently used as a measure of welfare to a society. GDP shows the size of the economy or the total income and expenditure of the economy and households are expected to have higher well-being or welfare when they are able to purchase more goods and services. Although GDP is not a perfect measure of welfare, it is still the most effective measure available. Therefore, any positive changes in GDP will be an indication of the benefits of the scheme.

There are however other unquantifiable costs and benefits not included in this ECBA, due to the difficulty to place a market value on these costs and benefits. These costs and benefits could potentially include changes in food security, changes in agricultural production, changes in land values, changes in social cohesion or changes in political and civil stability. In this study it is assumed that these effects will be constant.

The discount rates represented in the ECBA indicate the future costs and benefits at current value. The Discounted Cash-Flow (DCF) analysis sees the annual nominal cost of a project as the Net Present Value (NPV) of its future cash flows. Cash flows are nominal forecasts over the life of the project and then adjusted to a common reference date. The sum of the discounted cash flows for the full-term of the project gives its Net Present Value (NPV) a Rand figure. The NPV is a useful measure because it is easily interpreted and readily comparable to other projects or bids modelled in the same way for the same reference date. Discounted cash flows take into account the time value of money, making the NPVs comparable.

6.2 ECBA RESULTS

The following table gives the net effect in NPV of the scheme representing the values of water. All monetary values are given in millions in 2014 Rand values. The results for the ECBA is presented at current prices. The current prices were estimated using different inflators to indicate different positive and negative scenarios. In **Table 6.1** the CBA results for the costs of the scheme's development and current price analysis based on the provided water sales figures made available from AECOM. Economic Costs are provided in the table, as we the GDP benefits and the anticipated revenues from future water sales from the scheme.

Table 6.1: CBA Current Water Values (2014 R-Values in millions) at NPV 8%

	Totals (Rm)	
Sub-total Construction Cost	R	27 014
Sub-total Operation Cost	R	29 448
Total Construction and Operation	**R**	**56 462**
Sub-total Water Sales Revenue Benefit	R	68 693
Sub-total Construction GDP Benefit	R	22 757
Sub-total Operation GDP Benefit	R	23 380
Total Construction and Operation GDP Benefit & Water Sales Revenue Benefit	**R**	**114 833**
Net Benefit (Benefit – Cost)	**R**	**58 370***

* *The net effect is positive (cost of implementation is less than the benefits), therefore it can be seen as a profitable project*

6.3 THE ECONOMIC OPPORTUNITY COST OF THE UMKHOMAZI WATER PROJECT

Water is fundamental to economic growth and development, social development and progress in a region. This section aims to place an economic proxy value on the opportunity cost of water provided by the uMWP to the regional economy.

Water resources, like most natural resources, are scarce relative to the purpose to which they could be used.

"The Dublin Statement of the International Conference on Water and the Environment, states that "water has an economic value in all its competing uses and should be recognized as an economic good". But there is little agreement on what this actually means, either in theory or in practice." World Bank, 1996[4]

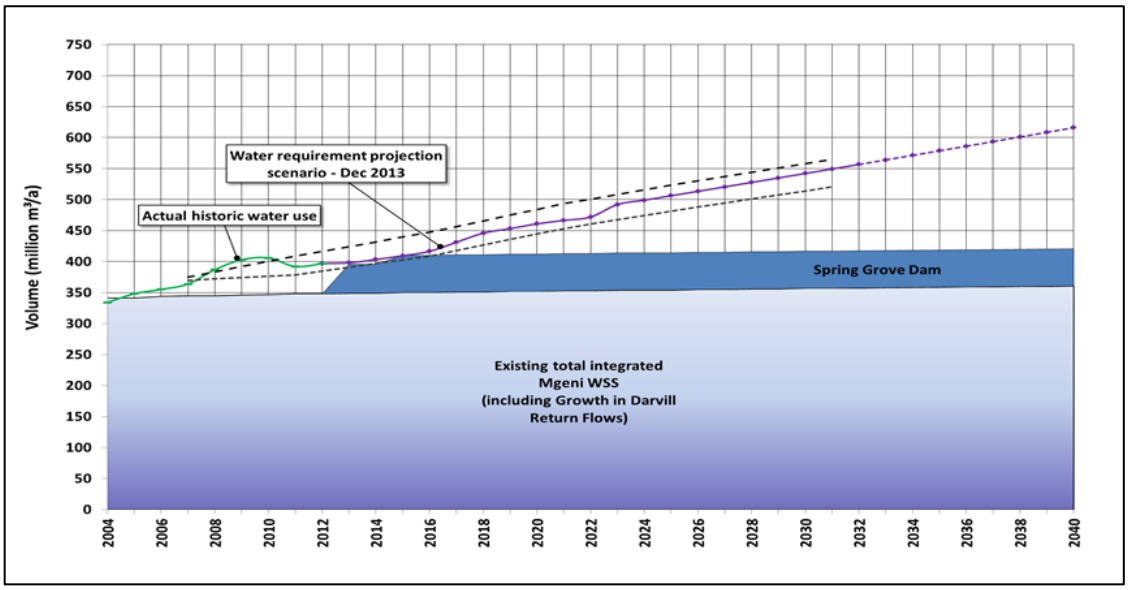
This paper provides a simple framework for unbundling the different components of water as an economic resource, provides some data on critical variables, and discusses the policy implications. As a result, choices have to be made about how best to use these resources. This basic economic problem is thus frequently referred to as 'scarcity and choice'. Scarcity introduces the necessity of choice and choice implies rejected as well as selected alternatives[5]. From this definition, the opportunity cost is the evaluation placed on the most highly valued of rejected alternatives. It is that value that is given up or sacrificed in order to secure a higher value that selection of the chosen object embodies[6].

[4] *Briscoe, J (1996) Water as an economic good: the idea and what that means in practice.*
[5] *Lippman, S.A. and Rumelt, R.P. (2003). Precis of the payment perspective micro-foundation of resource analysis. Strategic Management Journal, Vol.1, No.24*
[6] *Buchanan, James M. (1987). "Opportunity cost. The New Palgrave: A Dictionary of Economic Theory and Doctrine, Vol. 3. Macmillan, London*

6.4 OPPORTUNITY COST OF WATER PROVISION

The opportunity cost of a resource is normally understood as the value in its next best alternative. As an example, suppose a farmer cuts down a forest to expand his cropland. If the consequent loss of timber, firewood and water purification function is the next best use of the land, then the value of timber, firewood and water purification is the opportunity cost of the expanded cropland. Thus, opportunity costs are not restricted to monetary or financial costs.

It is anticipated that any future water scarcity will be much more permanent than past shortages, and the techniques that have previously been used in responding to past disturbances may not be enough, this water deficit is detailed in the figure below. All industry from agriculture, electric power and industrial manufacturing to beverage, apparel, and tourism relies on water resources in some form to grow and ultimately sustain their business.



Source: AECOM

Figure 6.1: Water Deficit Graph

The uMWP Phase 1 has been designed to meet the water demand anticipated from up until 2044, and is set to commence in 2022.

Thus the opportunity cost measured in this section relates to the productive function the supply area's economic activities as measured by economic output in gross value added terms if this water provision is not undertaken.

6.5 MEASURING ECONOMIC OPPORTUNITY COST OF WATER CONSTRAINTS

A 19 year review of economic production in KwaZulu-Natal and the supply area in specific indicates that the average economic growth rate achieved over the period equates to an approximate 3% annual increase in gross value-added year on year. Obviously, the economic cycle over this period includes troughs as well as years of higher production, but the compounded annual growth rate reflects a rate of between 3.31% for KZN in its totality, 3.48% in Ugu District, 2.73% in uMgungundlovu District, 2.85% in iLembe District and 3.10% in eThekwini.

Table 6.2: Economic Production Levels in Supply Area (Rm, 2005 Rands)

Measurement	Average Annual Growth Rate	Level of Economic Production				Potential foregone production
Year	**1995-2013**	**2014**	**2024**	**2034**	**2044**	**2022 - 2044**
KZN	**3.31%**	**302 451**	**419 013**	**580 497**	**804 216**	**13 227 458**
Ugu	3.48%	13 349	15 842	18 800	22 312	431 346
uMgungundlovu	2.73%	34 826	39 841	45 579	52 143	1 048 865
iLembe	2.85%	11 582	13 331	15 343	17 660	352 890
eThekwini	3.10%	159 332	185 636	216 283	251 989	4 969 341

Source: Quantec Standardised Regional Dataset, Urban-Econ Calculations

These growth rates have been projected forward, to provide a proxy for what economic production levels could be generated on an annual basis; should all other variables (including the access to water resources) remain constant. If 2022 is used as the critical tipping point for water scarcity in the system, then the foregone economic production, i.e. the opportunity cost to the economy from 2022 until 2044 equates to R13.3bn in constant 2005 year Rands.

In terms of economic impacts, this translates into foregone economic benefits to the regional economy related to the inability of the economy to produce at the average level of economic growth; these are estimated to be the following scale as shown in the table below.

Table 6.3: Forgone Economic Benefits Calculated for the Period 2022 – 2044

	Production	Gross Geographic Product	Employment Opportunities	Income/Wages
KZN	13 227 458	1 222 866	376 055	1 717 103
Ugu	431 346	39 878	12 263	55 995
uMgungundlovu	1 048 865	96 967	29 819	136 157
iLembe	352 890	32 624	10 033	45 810
eThekwini	4 969 341	459 411	141 278	645 088

As a developing nation, with substantial levels of existing unemployment evident in the catchment areas; forgoing future economic growth is not a preferred outcome for the province nor the country.

7 CARBON IMPLICATIONS OF THE UMKHOMAZI WATER PROJECT

7.1 SOUTH AFRICA'S ENERGY AND IMPLICATIONS

South Africa's current energy mix is dominated by finite, non-renewable resources, predominantly coal and to a lesser extent natural gas. Due to the negative environmental and economic consequences of fossil-fuel intensive technologies, there is a greater interest in and need of renewable energy sources to restrain environmental and economic degradation. One of the possible positive spin-offs of the uMkhomazi Water Project is the installation of hydro-electric generation capabilities. Two alternatives exist namely the Baynesfield Hydropower Plant and the Smithfield Dam Hydropower Plant (HPP). It is expected that the former will generate at its peak 21.9 GWh of electricity annually while the latter will generate 17.52 GWh annually. **Table 7.1** below includes the generation capacity and annual income over the expected lifetime of the two alternatives.

Table 7.1: Hydropower – Potential energy and income per year

Year	Baynesfield HPP alternative 1: Power wheeled into national grid for use at WTW		Smithfield Dam HPP alternative 2: Power wheeled into national grid for operation of dam (2.6 MW)	
	Annual power generation (kWh/year)	Annual income (R/year)	Annual power generation (kWh/year)*	Annual income (R million/year)
2023	4 380 000	1 984 000	17 520 000	8 130 000
2024	13 140 000	6 082 000	17 520 000	8 130 000
2025	13 578 000	6 286 000	17 520 000	8 130 000
2026	14 016 000	6 491 000	17 520 000	8 130 000
2027	14 454 000	6 696 000	17 520 000	8 130 000
2028	14 892 000	6 901 000	17 520 000	8 130 000
2029	15 330 000	7 106 000	17 520 000	8 130 000
2030	15 768 000	7 311 000	17 520 000	8 130 000
2031	16 206 000	7 516 000	17 520 000	8 130 000
2032	16 644 000	7 721 000	17 520 000	8 130 000
2033	17 082 000	7 926 000	17 520 000	8 130 000
2034	17 520 000	8 130 000	17 520 000	8 130 000
2035	17 958 000	8 335 000	17 520 000	8 130 000
2036	18 396 000	8 540 000	17 520 000	8 130 000
2037	18 834 000	8 745 000	17 520 000	8 130 000
2038	19 272 000	8 950 000	17 520 000	8 130 000

Year	Baynesfield HPP alternative 1: Power wheeled into national grid for use at WTW		Smithfield Dam HPP alternative 2: Power wheeled into national grid for operation of dam (2.6 MW)	
	Annual power generation (kWh/year)	Annual income (R/year)	Annual power generation (kWh/year)*	Annual income (R million/year)
2039	19 710 000	9 155 000	17 520 000	8 130 000
2040	20 148 000	9 360 000	17 520 000	8 130 000
2041	20 586 000	9 565 000	17 520 000	8 130 000
2042	21 024 000	9 770 000	17 520 000	8 130 000
2043	21 462 000	9 975 000	17 520 000	8 130 000
2044	21 900 000	10 179 000	17 520 000	8 130 000
2045	21 900 000	10 179 000	17 520 000	8 130 000
2046	21 900 000	10 179 000	17 520 000	8 130 000
2047	21 900 000	10 179 000	17 520 000	8 130 000
2048	21 900 000	10 179 000	17 520 000	8 130 000
2049	21 900 000	10 179 000	17 520 000	8 130 000
2050	21 900 000	10 179 000	17 520 000	8 130 000
2051	21 900 000	10 179 000	17 520 000	8 130 000
2052	21 900 000	10 179 000	17 520 000	8 130 000

* *Assumed that Average, but values will decrease due to decreases in dam levels over time*

The finite nature of fossil-fuel resources requires that South Africa starts investigating the feasibility and future potential of alternate sources of electricity generation. The Renewable Energy Independent Power Producer Procurement Programme (REIPPP) is a realisation of this fact, where it is noted that substantial renewable energy potential exists in South Africa in the form of solar, wind and hydro power. More specifically, hydropower has an important role to play in generating electricity that is renewable and does not pollute. For instance, the Ingula Pumped Storage Scheme scheduled for completion in late 2015, is a 1 332 MWh plant nestled between the Free State and KwaZulu-Natal, and is the third such pumped storage scheme in the country. Hydropower plants are one of the cleanest ways of generating electricity. **Table 7.2** below includes the greenhouse gas emissions per different electricity generation technology.

Table 7.2: Approximate lifecycle GHG emission rate ranges by fuel type for electricity generation technology

Technology	GHG Emission Rates (kg co_2 eqt/MWh)
Hydroelectric facility (run of river or non-tropical reservoir)	0.5 – 152
Hydroelectric facility (newly flooded reservoir only, boreal)	160 – 250
Hydroelectric facility (tropical reservoirs)	1300 – 3000
Natural gas-fired power plant	400 – 500

Technology	GHG Emission Rates (kg co_2 eqt/MWh)
Oil-fired power plant	790 – 900
Coal-fired power plant	900 – 1200

Source: (Steinhurst, et al., 2012)

As included above, hydroelectric generation technologies are relatively more environmentally friendly than other generation technologies. Further, different types of hydroelectric generation technologies have different GHG emission outcomes. The hydroelectric facility using the existing run of river (gravitational) is more efficient than, for instance, hydroelectric facilities based on new reservoirs, uMWP is considered to provide the conditions of a hydroelectric facility (run of river of non-tropical reservoir).

The little GHG emissions that are created by the hydropower plant depend to a varying degree on the type of hydropower technology used (as noted above). In addition, the majority of GHG emissions are caused by initial construction of the infrastructure along with the biomass decomposition of the area being flooded by the new dam/reservoir (Steinhurst, et al., 2012). However, the resultant GHG emissions are still relatively better than other technologies.

The argument for hydroelectric generation is clear namely; without a strategy in place to curb GHG emissions, especially in the electricity generation sector where the majority of GHG emissions emanate, South Africa, along with its Southern African neighbours, are in a precarious position. A 3-4 degree Celsius rise in temperature could lead to a 15% reduction in crop yields. Such an outcome can tip the balance in what is already a tight situation.

In an economic sense, the natural environment is considered a ‘public good’, having the characteristics of non-excludability and non-rivalry. The former entails that individuals cannot be excluded from using or consuming the natural environment, videlicet air, water, or land. The latter entails that one individual’s consumption or use of a good does not reduce or constrain another individual from using the same good. More recently, the natural environment, particularly air and water, have come to be considered as ‘global public goods’, as the use of these goods in one area of the world has implications for other areas. The uMkhomazi Water Project that involves both water and air elements, can have an important impact on the surrounding environment.

The potential savings in terms of expected GHG emissions can be estimated using existing industry figures.

Table 7.3: List of variables and estimates used in carbon calculation

Variable	Estimate
HPP (kg of Co2 eqt/KWh) [7]	0.250
Coal (kg of Co2 eqt/KWh) [8]	0.993
Rand cost/kg of Co2 eqt. [9]	R250 (2020-2040); R750 (2040-2050)

Using this formula:

$$\alpha = (\beta * \gamma) * \delta$$

Where:

α: Total Savings of Carbon (in Rands)

β: Total Annual Electricity Generated (KWh)

γ: Kg of Co2 eqt/Kwh

δ: Rand cost/kg of Co2 eqt.

It was possible to determine the net impact of the HPP alternatives. The figures below illustrate the difference between HPP power and coal generated power in Rands.

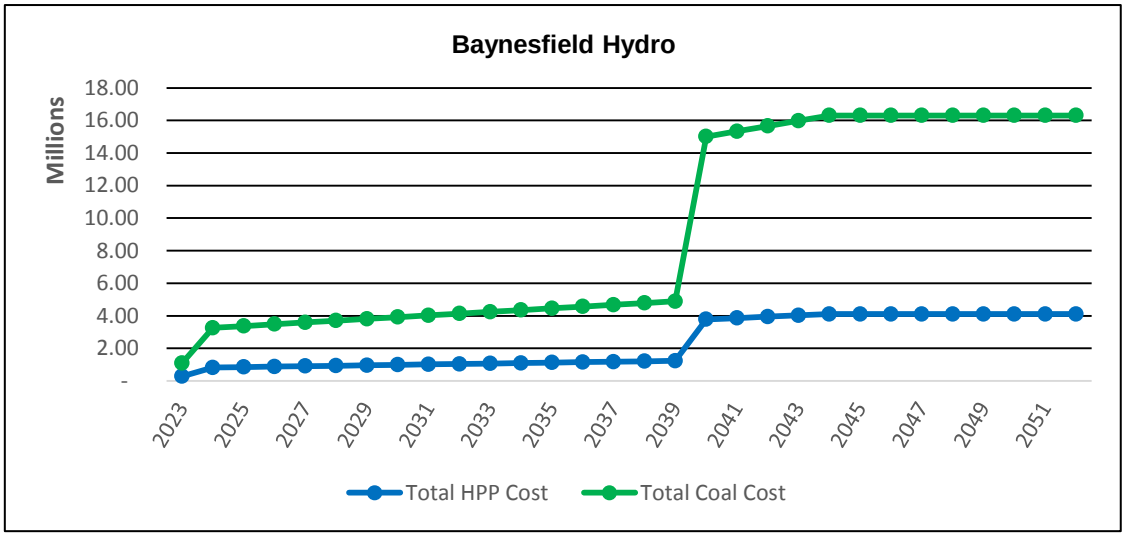


Figure 7.1: Difference between hydropower and coal carbon production in Rands

[7] *(Steinhurst, et al., 2012)*

[8] *(Letete, et al., n.d.)*

[9] *(Department of National Treasury, 2010)*

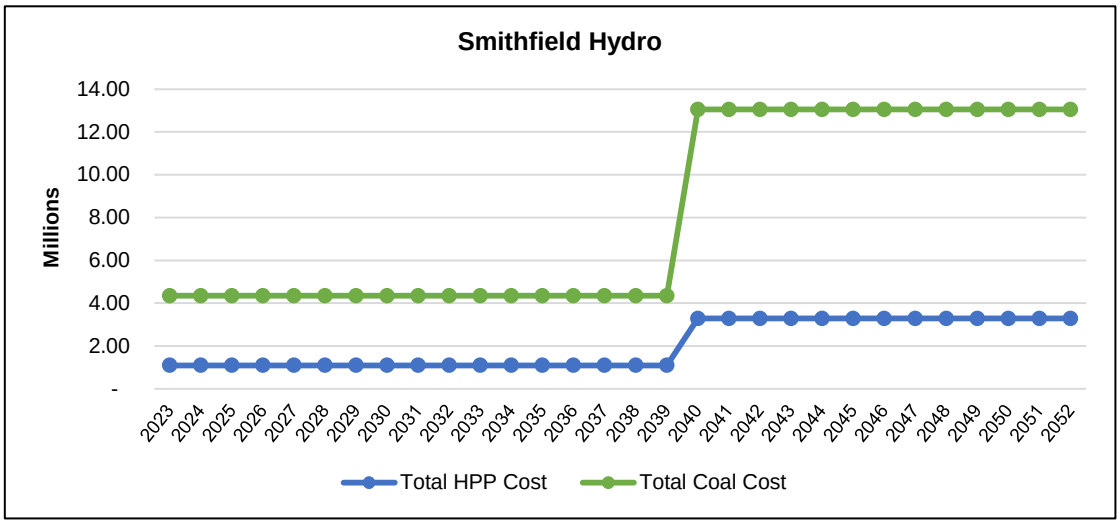


Figure 7.2: Difference between hydropower and coal carbon production in Rands

Both figures above indicate the large difference between the total cost of carbon emissions from either the uMkhomazi HPP alternatives or coal-generated electricity. In both cases, there is a 75% saving in the amount of GHG emissions that are created. From the above illustrations and calculations, it can be concluded that the uMkhomazi Water Project HPP will have positive net benefits for the surrounding economy and environment. Although there will be a small GHG emission component for this new project, it is believed that it is substantially smaller than the equivalent of coal-generated electricity. Further, depending on the particular environment, construction methods, and type of technology used, it can be expected that the GHG emissions of the project could potentially be lower, thus increasing the positive environmental benefits of the project.

8 SUMMARY OF ANTICIPATED SOCIO-ECONOMIC IMPACT ANALYSIS

It is evident from the previous section that the construction, operation and refurbishment phases of the uMWP will have a positive effect on the economies of the uMkhomazi Catchment and Umgeni Water supply area as well as the broader environment. The current economic profile (**Section 2**) was established as a point of departure to evaluate the anticipated effects. The effect of changes in the economic profile of the study area as a result of the proposed development is discussed in this section of the report.

8.1 IMPACT EVALUATION WITHIN THE SOCIO-ECONOMIC ENVIRONMENT

8.1.1 Population

The uMkhomazi Catchment has experienced high levels of migration, as population exodus in search of economic opportunity has impacted the rural economy. The Umgeni Water supply area, has in comparison grown substantially over the same period, attracting inward additional people seeking economic and social opportunities. The proposed investments will provide employment opportunities and income for a portion of the growing population, which will ensure that living standards do not decline. It is imperative that the state and market is able to provide in the needs of the population through interventions such as the uMWP.

8.1.2 Employment, skills development and worker income

The investment into uMWP will generate 4170 direct employment opportunities during construction and refurbishment processes, and a further 5 500 direct employment opportunities during operation. During construction and refurbishment it is anticipated *87% of the direct employment will be sourced locally. Local procurement will increase the positive impact associated with the proposed uMWP.* Local employment will further create skills development opportunities through on-the-job training. Skills development will assist employees in future employment and contribute to the development of the uMkhomazi Catchment. Specifically skills developed and experience accumulated during the time of employment. In this respect, for example, a construction project engenders a positive impact that is lasting in nature.

The leverage effect that will be created through the employment and training of unskilled people is immense and will have a lasting effect throughout the study area, affecting not only the lives of the employees but their entire households. Through the employment opportunities created it is estimated that a total of 47 390 employment opportunities will be created from the construction activities of the scheme. This will result in an increase in worker income within each household affected. The operational phase combined with the refurbishment phases will create 76 456 employment opportunities over a 50 year time period. In total, 123 846 job opportunities.

In addition, an increase in employment will be accompanied by an increase in individual and household income, which will translate into an increase in the demand for goods and services. This then provides an opportunity for the expansion of business productivity and/or the start-up of new businesses. *There is a significant portion of the population that are at risk of not being able to afford the water that will be provided through the uMWP. Increased economic activity through investments such as the uMWP will lead to an increase in worker income and as a result more people will be able to afford water.*

8.1.3 Services and infrastructure development

The proposed project offers the opportunity to provide a greater number of impoverished households with potable water services through the significant increase in available raw water into the system. For the current 20% of households living below the poverty line in both the uMkhomazi Catchment and the Umgeni Water supply area this scheme provides the best opportunity for improved service delivery to these households by ensuring that adequate supply is available to the total population. In addition, improved access to water in the region will have multiple and significant impacts on the quality of life experienced by these households. The proposed uMWP will also unlock economic opportunities through facilitating or making feasible the provision of potable water for communities in the uMkhomazi Catchment as well as supporting the Umgeni Water supply area.

The continuing population densification trends evident in the Umgeni Water supply area, have in many of the peri-urban and urban nodes exerted adverse effects on public infrastructure and services, such as roads and public transport. Additional to the benefit of clean and sufficient water, the uMWP will generate revenue for the government in the form of taxes, which may assist the government by providing (a portion of) funds to maintain and/or upgrade

infrastructure and services that come under pressure as a result of demographic trends. It would also further assist government in providing much needed facilities as schools, social amenities and health facilities throughout the uMkhomazi Catchment and Umgeni Water supply area.

The non-provision or reduction of services in an area has a detrimental impact on the efficiency of the economy and the well-being of a community. The provision of infrastructural services represents a precondition for improved economic growth, welfare, quality of life and productivity of people. By providing well-planned and managed infrastructure, economic opportunities and social well-being are created. Infrastructure such as the uMWP thus plays a dual role in the economic system, namely an improvement in economic activity and an improvement in living conditions.

The provision of infrastructural services will also play an important role in the direct improvement of the welfare of households within the uMkhomazi Catchment, an area that has long experienced high outward migration of skills and very low employment levels.

8.1.4 Economic impact profile

The impact assessment showed that the construction, operation and refurbishment phases of the uMWP will result in numerous positive leverage effects in the study area. The sectors in which these leverage effects will be experienced the most are as follows:

- During the construction phase:
  - building and construction
  - manufacturing
  - real estate and business services
- During the operational phase:
  - water
  - manufacturing
  - transport and storage

- During the refurbishment phases:
  - manufacturing
  - trade and accommodation
  - real estate and business services

It can be concluded that the proposed investments will be a positive injection into sectors other than the dominating community and social services (government services). This will assist in the diversification of the local economy. A diverse economy ensures better sustainability through economic activities in all the sectors of the economy.

8.2 THE AFFORDABILITY OF WATER

Water affordability is a central element to water access, as noted in the socio-economic profile, 25% of the water supply from the Mgeni WSS is supplied to households that are considered to be below the poverty line. Thus, while water affordability is typically measured by the annual cost of water bills as a percentage of median household income. Households paying an amount for water that exceeds an affordability threshold are considered to be paying a cost that is unaffordable and a “high burden.” Affordability of services and housing is also directly linked to what people are willing to pay for the services they receive. However, if households simply do not have the resources to pay, the traditional measurements that consider willingness to pay for a resource are mooted.

At present that approximately 60% of households in the uMkhomazi Catchment compared to 93% in the Umgeni Water supply area, receive water through a regional or local water scheme operated by their local municipality or another water service provider. A significant share of households (33.8%) in the uMkhomazi Catchment acquires water from rivers or streams. As noted, the high level of impoverished households in the supply and catchment areas make likely that in order to provide services to these households subsidisation will be required.

With time, increased economic activity through the uMWP investment will lead to an increase in worker income and as a result more people will be able to afford water, with supportive payment education, the creation of a willing mind-set to pay for services received could be entrenched. The study has shown that additional to the availability of portable water, the uMWP development will lead to

numerous positive effects which will create various leverage effects throughout the uMkhomazi study area and increase the overall wellbeing of citizens.

8.3 SUMMARY: THE ECONOMIC OUTCOME SCENARIO

The investment scenario represents the effect of the establishment and operation of the uMWP on the local, provincial and national economy. The outcome of the investment scenario is summarised below.

Table 8.1: uMWP total impact

TOTAL IMPACT (Capex and Opex Impacts Calculated for Lifespan)				
Indicator	**Direct**	**Indirect**	**Induced**	**Total**
Production	R 33 333	R 35 644	R 17 685	R 86 661
GDP	R 7 807	R 14 355	R 8 143	R 30 305
Employment	9670	69311	44866	123846
Worker Income	R 5 271	R 5 935	R 3 260	R 14 466

From the above, it can be concluded that the uMWP investment will lead to numerous positive leverage effects in the economy of the study area as well as the broader environment. The key impacts of the uMWP Investment Scenario are the following:

- More production, business development opportunity and growth.
- New job opportunities and skills development potential on local, regional and national levels.
- Increase in worker income, changing spending patterns, demand for retail and business space, housing, urban infrastructure, entrepreneurial development and growth.
- People benefitted as a result of increased income on local, regional and national level, which results in poverty alleviation and a better quality of life.

If the uMWP should not be developed, the two key effects will entail the following:

- The most obvious implication of not developing the uMWP is the loss of the positive economic impacts (the topic of this report) associated with the construction, operation and refurbishment expenditures and employment.
- Water provision in the study area will remain the same and the benefits associated with adequate and reliant potable water provision will be loss.

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