FUNDING MODELS FOR THE FINANCING OF WATER INFRASTRUCTURE IN SOUTH AFRICA: A FRAMEWORK AND COMPARATIVE ANALYSIS OF ALTERNATIVES

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DECLARATION

I, Cornelius Ruiters, declare that this thesis is my own, unaided work. It is being submitted in partial fulfillment of requirements for the Masters Degree in Business Administration (MBA) in the University of South Africa, Pretoria. It has not been submitted before for any degree or examination in any other University.

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Executive Summary

Following two decades of under-investment, vital elements of South African water infrastructure is in serious disrepair, if not in a crisis. The government is challenged by the cumulative demands of sustained economic growth; as well as the new trade and investment opportunities in the post-financial crisis period. There is a serious backlog in water infrastructure investment, for the development and management of water resources and water services. This under-investment is estimated at more than R110 billion. The three spheres of government – national, provincial and local– which have served South Africa well in past decades now appear unable and ill-equipped to grapple with the present planning and delivery challenge.

Water infrastructure investment began to decline in the 1990s as the South African governments increased the share of public consumption expenditure in their budgets at the expense of public investment. Fiscal policies of budget surpluses and debt reduction have reinforced this decline. Government capital expenditure as a share of GDP, which was around 7.2 per cent in the early 1990s, has now fallen to a low of 3.6 per cent of GDP. Government has been the main provider of infrastructure in South Africa and remains so in the water sector. Government administration and institutional structures continue to shape and influence infrastructure investment. South Africa's constitutional system of government imposes unique complexities and constraints on infrastructure investment compared with many other countries. The national government (national treasury) traditionally had a pivotal role in shaping water infrastructure investment. The interplay of governments' fiscal policies of budget surplus/debt reduction and political considerations present an apparently insurmountable obstacle to overcoming the backlog in South Africa's infrastructure – and in putting in place fresh institutional structures and funding models for effective strategies leading to prompt water infrastructure provision.

This research project identified a number of funding models (14) for the financing of water infrastructure development projects. However, the classic public provision model of government planned, installed and financed infrastructure with pricing at marginal cost or on a loss–making basis – with returns recovered through the taxation system – continues to characterise much of South Africa's publicly provided water infrastructure. Nowadays, water infrastructure is split between fully public, and mixed ownership (water agencies and/or entities); Public-Private Partnerships (PPP) in the water sector is not yet a full reality. Further innovation in water infrastructure investment, including closing the circle between public and

private-sector capital, is required. Complex issues of pricing, access, public policy and regulation, risk–sharing, tendering processes, taxation and governance have arisen as key challenges that will influence whether private provision of water infrastructure can grow as a viable new model in South Africa. Sustainability has introduced a further new dimension into the calculus of water infrastructure provision. Thus, a framework that takes account of environmental and social aspects, as well as economic aspects, is now widely accepted as necessary.

Although water user tariffs of various types partially fund some of the water infrastructure, the link between cost and use is not well-established in the public's mind. Reinforcing this relationship could lead to conservation measures and would also make it much easier to create stable funding vehicles that do not depend solely on the national revenue fund/general tax revenues. In order to encourage funding vehicles that use private or non-government funds, the initiatives should be encouraged, i.e. investment banks, commercial banks, public water agencies and entities. The government should also create a stable investment environment through political commitment (but not interference), consistency, a regular and predictable flow of deals, and suitable framing legislation. This will ensures life cycle costing and the establishment of true user costs. A reasonable transfer of risk to the public sector should be a minimum government requirement of any partnership with the private sector. The well-established link between investment in public infrastructure and economic competitiveness means South Africa must act now if it is to avoid a widening water infrastructure gap.

Key Words

Department of Water Affairs
Funding models
Infrastructure deficit
Infrastructure development and rehabilitation
Infrastructure funding gap
Medium Term Expenditure Framework
National Revenue Fund
National Treasury
Operations and maintenance
Public Entities and Agencies
Public-Private Partnerships
Private sector markets
Raw Water Pricing Strategy
Return on Investment
Socio-economic growth and infrastructure
Water charges
Water tariffs
Water infrastructure

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GLOSSARY OF TERMS AND CONCEPTS

Backlog: generally refers to an accumulation over time of work waiting to be done or orders to be fulfilled.

Build-own-operate-transfer (**BOOT**) or **build-operate-transfer** (**BOT**): is a form of project financing, wherein a private entity receives a concession from the private or public sector to finance, design, construct, and operate a facility stated in the concession contract. This enables the project proponent to recover its investment, operating and maintenance expenses in the project. Due to the long-term nature of the arrangement, the fees are usually raised during the concession period. The rate of increase is often tied to a combination of internal and external variables, allowing the proponent to reach a satisfactory internal rate of return for its investment.

Brownfield development: is a term commonly used to describe problems needing the development and deployment of new systems in the immediate presence of existing (legacy) applications/systems. In contemporary civil engineering, Brownfield development means places where new infrastructure may need to be designed and erected considering the other structures and services already in place.

Conditional grants: means conditional allocations to provinces, local government or municipalities from the national government's share of revenue raised nationally, which are provided for and whose purpose is specified in the annual Division of Revenue Act referred to in section 214(1)(c) of the Constitution of the Republic of South Africa, 1996.

Cost-benefit analysis or BCA (Benefit-Cost Analysis): is a term that refers both to helping to appraise, or assess, the case for a project, programme or policy proposal; an approach to making economic decisions of any kind. Under both definitions the process involves, whether explicitly or implicitly, weighing the total expected costs against the total expected benefits of one or more actions in order to choose the best or most profitable option. Benefits and costs are often expressed in money terms, and are adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different points in time) are expressed on a common basis in terms of their "present value."

Catchment Management Agency: where water management is charge with the responsibility of coordinating the activities with water users, provinces, municipalities and other bodies.

Discounting: the rationale for adopting discounting in benefit-cost analysis is two fold. Firstly, it is assumed that we prefer consumption now rather than later and equally that we would prefer to put off making expenditures. Secondly, since the investment required for the project precludes those resources being invested elsewhere in the economy, it is obviously desirable not to undertake the project if those resources could generate a higher return if invested elsewhere in the economy.

Emerging markets: are nations with social or business activity in the process of rapid growth and industrialization. At 2010, more than 40 emerging markets in the world, with the economies of China and India considered to be the largest.

Economies of scale: are both pervasive and critical in water infrastructure management. Arise as a function of size, a single large plant, at least up to some point, having lower unit costs than many small plants providing the same throughput.

Economies of scope: That is, managing all aspects of water infrastructure management will result in a lower cost strategy than trying to manage each separately and in isolation. The second rationale, is that purely local solutions will be suboptimal from the perspective as a whole, so increasing total costs. This is not a claim that there are economies of scale but that local solutions will often simply shift the problem on to another place.

Estimation of costs: when developing a business plan for a new or existing company, product, or project, planners typically make cost estimates in order to assess whether revenues/benefits will cover costs (see cost-benefit analysis). This is done in both business and government. Costs are often underestimated resulting in cost overrun during implementation. Main causes of cost underestimation and overrun are optimism bias and strategic misrepresentation. Reference class forecasting was developed to curb optimism bias and strategic misrepresentation and arrive at more accurate cost estimates. Cost Plus, is where the Price = Cost plus or minus X%, where x is the percentage of built in overhead or profit margin.

Economic externalities: the positive or negative impact of one person's actions on another so as to either change the amount or value of resources available to that person or to change the enjoyment they gain from consumption.

Equitable share: local government's share of nationally raised revenue is allocated between municipalities using a formula that takes account of the different demographics and service levels in municipalities. The equitable share formula ensures that each municipality receives a share that allows it to meet its basic service obligations, taking account of both the operational costs of providing those services and administrative and governance costs incurred in running a municipality. Allocations are corrected to account for the varying ability of municipalities to raise their own revenues.

Equity: is the residual claim or interest of the most junior class of investors in assets, after all liabilities are paid. If valuations placed on assets do not exceed liabilities, negative equity exists. In an accounting context, represents the remaining interest in assets of a company, spread among individual shareholders of common or preferred stock.

Financial year: means the financial year commencing on 1 April in a particular calendar year and ending on 31 March of the following calendar year.

Greenfield investment: is the investment in a manufacturing, office, or other physical company-related structure or group of structures in an area where no previous facilities exist. Greenfield Investing is often mentioned in the context of Foreign Direct Investment. Green field investments occur when multinational corporations enter into developing countries to build new factories and/or stores.

Infrastructure: is the basic physical and organizational structures needed for the operation of a society or enterprise, or the services and facilities necessary for an economy to function. The term typically refers to the technical structures that support a society, such as roads, water supply, sewers, electrical grids, telecommunications, and so forth.

Infrastructure investment gap: capture all investment needs, in particular concerning capital replacement. If tariff revenues remain constant in real terms, utilities face a funding gap of the same magnitude. However, the funding gap would disappear if municipalities increased water and sanitation spending at a real rate of growth.

Marginal cost: costs are measured as the difference from the baseline, if there is no difference, there is no cost.

Off-budget: achieve self-funding by usually having funding through fees for services rendered. Some have the ability to raise revenue bonds. The public agency or entity issues tax-exempt industrial revenue bonds to finance public business ventures mainly to revitalize infrastructure development in depressed areas.

Opportunity cost: the cost of using a resource for some purpose is given by the value of that resource if used for the best alternative use.

Public–private partnership (**PPP**)**:** describes a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. These schemes are sometimes referred to as PPP, P3 or P^3. PPP involves a contract between a public-sector authority and a private party, in which the private party provides a public service or project and assumes substantial financial, technical and operational risk in the project.

Remaining Useful Life: is an engineering discipline focused on predicting the time at which a component will no longer perform a particular function. Lack of performance is most often component failure. The predicted time becomes then the remaining useful life (RUL). It is the analysis of failure modes, detection of early signs of wear and aging, and fault conditions.

Return on Investment (Assets): investors are assumed to wat to maximize investment return, generally agreed to be the total of income and capital gain over a particular period.

Risk: is commonly used in a number of different meanings: as a synonym for probability, as one for expected value (probability times outcome), or to refer to potentially harmful events of different kinds. Since a risk is always a "risk of", this mixed usage is almost inevitable, although 'risk' is only used in relation to undesirable events.

Uncertainty: is an ability to differentiate between a range, continuous or discrete, of different possibilities. Although risk and uncertainty appear similar in nature, uncertainty is fundamentally different from risk; the opposite of uncertainty is information which is formally defined as that which destroys uncertainty.

ABBREVIATIONS AND ACRONYMS

ADB:	Asian Development Bank
AfDB:	African Development Bank
AFP:	Alternative Finance and Procurement
AU:	African Union
BC:	British Columbia
BCA:	Benefit-cost analysis
BOOT:	Build-Own-Operate-Transfer
CMA:	Catchment Management Agency
CPI:	Consumer Price Index
CSIR:	Council for Scientific and Industrial Research
DCOGTA:	Department of Cooperative Governance and Traditional Affairs
DBSA:	Development Bank of Southern Africa
DEA:	Department of Environment Affairs
DoE:	Department of Energy
DPE:	Department of Public Enterprises
DPW:	Department of Public Works
DSRP:	Dam Safety Rehabilitation Programme
DTI:	Department of Trade and Industry
DWA:	Department of Water Affairs (after May 2009 and before April 1994)
DWAF:	Department of Water Affairs and Forestry (between April 1994 and May 2009)
EC:	Eastern Cape
GDP:	Gross Domestic Product
GNP:	Gross National Product
GWS:	Government Water Scheme
HDI:	Historically Disadvantaged Individual
ICT:	Information and Communication Technology
IDC:	Industrial Development Corporation
IFG:	Infrastructure Funding Gap
IIPF:	Infrastructure Investment Public Fund
IPAP 2:	Industrial Policy Action Plan 2
IWRM:	Integrated Water Resource Management
kl:	Kilolitre

KPI:	Key Performance Indicator
KZN:	KwaZulu-Natal
LED:	Local Economic Development
LHWP:	Lesotho Highlands Water Project
LM:	Local Municipality
KOBWA:	Komati Basin Water Authority
MDG:	Millennium Development Goals
MIIF:	Municipal Infrastructure Investment Framework
MIIU:	Municipal Infrastructure Investment Unit
MIG:	Municipal Infrastructure Grant
MTEF:	Medium Term Expenditure Framework
MTSF:	Medium Term Strategic Framework
NC:	Northern Cape
NDFA:	National Development Funding Agency
NGP:	New Growth Path
NSDP:	National Spatial Development Perspective
NRA:	National Roads Agency
NWA:	National Water Act, 1998 (Act No. 36 of 1998)
NWRI:	National Water Resources Infrastructure
NWRS:	National Water Resource Strategy
NT:	National Treasury
OECD:	Organisation for Economic Co-operation and Development
PFI:	Private Finance Initiative
PFMA:	Public Finance Management Act, 1999 (Act No. 1 of 1999)
PPP:	Public-Private Partnerships
RBIG:	Regional Bulk Infrastructure Grant
ROI:	Return On Investment
RPA:	Regional Planning Agency
RUL:	Remaining Useful Life
SADC:	Southern African Development Community
SAICE:	South African Institution of Civil Engineering
SALGA:	South African Local Government Association
SD:	Standard Deviation
SFWS:	Strategic Framework for Water Services
TCTA:	Trans-Caledon Tunnel Authority

UK:	United Kingdom
USAID:	United States Agency for International Development
VAT:	Value Added Tax
WB:	World Bank
WC:	Western Cape
WDCS:	Waste Discharge Charge System
WfGD:	Water for Growth and Development
WMA:	Water Management Area
WRC:	Water Research Commission
WRM:	Water Resources Management
WSDP:	Water Services Development Plans
WSP:	Water Services Provider
WTE:	Water Trading Entity
WTW:	Water Treatment works
WSA:	Water Services Act, 1997 (Act No. 107 of 1997)
WSAs:	Water Services Authorities
WSOS:	Water Services Operating Subsidy
WWTW:	Waste Water Treatment Works

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Increasingly, South African water is acknowledged as a strategic resource under threat, and requiring more astute management. This holds true for most nations and poses a challenge to governments, business and civil society on a global basis. A recent study by the 2030 Water Resources Group elaborated on this, stating (DWAF, 2008): "In the world of water resources, economic data is insufficient, management is often opaque, and stakeholders are insufficiently linked. As a result, many countries struggle to shape implementable, fact-based water policies. Water resources, therefore, face inefficient allocation and poor investment patterns because investors lack a consistent basis for economically rational decision making".

The Department of Water Affairs (DWA) is well aware of this challenge. Indeed, the Water for Growth and Development Framework (DWAF, 2008), states clearly that: "In an effort to elevate the status of water in terms of its value-add for growth and development and accentuating the fact that this is a scare and vulnerable resource, the Department acknowledges the importance of strengthening its regulatory role, providing support and guidance to the plethora of stakeholders, affecting and influencing the sector". The review of the pricing strategy, development of the related infrastructure funding model and the establishment of an economic water regulator will contribute to the realization of output 4 of outcome 6 (Infrastructure) as contained in the government programme of action: - 'create a competitive, responsive and cost effective economic infrastructure."

The Medium Term Strategic Framework (MTSF) and the government's Outcomes-based Programme articulate the importance of Infrastructure Development to support economic growth of the country. Water is a key natural resource and a reliable and affordable water supply underpins all economic and social development. Government's targets also highlight the need for Departments to address social development of poverty eradication, sustainable and equitable development and job creation. The supply of water is viewed as a critical input into the economy and the creation of opportunities for broad-based empowerment.

With the promulgation of the National Water Act, 1998 (DWAF, 1998), there has also been new thinking around the way large water development projects will be developed, managed, operated and maintained and the option of establishing a national utility for this purpose has been investigated. Previously three options have been used for the development of large

scale water infrastructure (mainly dams and large raw water conduits such as tunnels and canals):

- DWA has undertaken this directly (by far the most important in the past);
- Water boards or large municipalities have provided their own facilities ; and
- Special purpose institutions have been established, the most notable being the Trans-Caledon Tunnel Authority (TCTA) which was established to develop the Lesotho Highlands water scheme, and Komati Basin Water Authority (KOBWA) for the development of the Driekoppies and Maguga dams.

1.2 The Problem in context

Water resources infrastructure development in South Africa is to ensure water security and availability within specific water management areas. It must be emphasised that South Africa is a water scarce country, subject to droughts and periodic floods. Future water availability (surface water) will be impacted by climate change and variability. Thus, water demand management and conservation (water use efficiency) must be an integral part of infrastructure planning and development.

The research will be presented in terms of the various performance areas, i.e.:

- Relationships between infrastructure and development;
- Water infrastructure development and management;
- Infrastructure condition and capacity, i.e. operations and maintenance.

Various studies have shown a relationship between the amount of infrastructure and economic strength of a country (Summers & Heston, 1991; Lang & Merino. 1993). It is estimated that capital expenditure is approximately 20% of the Gross National Product (GNP) represented expenditures by the public section (Goodman & Hastak, 2006). Furthermore, it is estimated that 5% of GNP is spent to maintain, replace, and add to the capital stock owned by governmental entities, and that about half of that amount is spent on the physical infrastructure for water resources and supply, wastewater treatment, capital costs, operation and maintenance (Goodman & Hastak, 2006).

Public infrastructure projects are planned in the following four broad categories:

- The development of new projects such as new water distribution system and a new dam; or the provision of additional capacity or capability to an existing project

because of increased demand through the raising of a dam wall, or expansion of a water treatment facility to accommodate new development;

- The rehabilitation, reconditioning, and/or reconstruction of an existing facility without changing the capacity or capability of the facility;
- The routine maintenance and operation of infrastructure systems such as the water supply; sewage and storm water, dams, and canals; including the preventive and demand maintenance; and
- The modification of the operation and management of an existing facility to improve its efficiency, extend its useful life, introduce alternative strategies, or incorporate new technologies to maximize the operational capacity of the facility.

A DWA assessment of the state of existing water infrastructure identified a number of inhibiting barriers (DWA, 2004):

- infrastructure maintenance is often one of the first spending cuts made in times of tight budgets;
- Capital investment in infrastructure continues to be viewed sceptically; and
- Constrained budgets at all levels of government seem to render even modest programmes and projects unaffordable.

The National Water Resources Strategy of South Africa (NWRS), Water for Growth and Development (WfGD) and Strategic Framework for Water Services (SFWS) (DWAF, 2003, 2004, 2009) identified water infrastructure as the key to development for the following objectives (1) efficiency, (2) reliability, (3) equity, (4) sustainability, (5) innovation, and (6) revenue diversification. The NWRS, WfGD and SFWS state that these objectives are complemented by two overarching goals - economic (productivity) growth and job creation. The National Water Resources Strategy acknowledges that more than half of the water management areas are in deficit, whilst a surplus still exists for the country as a whole, demonstrating the regional differences in the country. The strategy suggests the following to achieve a balance:

- *Development of surface water resources:* substantial potential for further development of surface water resources in some parts of the country, through construction of storage and transfer infrastructure

- *Inter-catchment transfers:* necessary in many cases in South Africa

- *Development of water services infrastructure:* water supply to domestic (urban and rural) and industrial sectors
- *Varying combinations of the above options*: suggested for potential water resources developments

1.3 Problem review

Water is a strategic natural resource and a reliable and affordable water supply underpins all economic and social development. Governmental targets highlight the need to focus on social development, poverty eradication, sustainability, equality and job creation. The supply of water is viewed as a critical input into the economy and the creation of opportunities for broad-based empowerment. These objectives require the DWA to refocus its Strategic Plan accordingly towards the planning, financing and implementation of mega water resources infrastructure development projects.

The purposes of doing this research are multiple and attempts to describe, explain, understand, predict (foresee), critique and/or analyse new and existing information on the funding (financing and economics) of water infrastructure projects. Based on research findings, this research paper will make recommendations around improved funding, management and governance.

1.4 Problem statement

1.4.1 Choosing the problem

The competition for the allocation of public financial resources for government priorities for the development of mega water infrastructure projects to ensure availability and security (sustainability) for socio-economic development necessitates research towards different funding (financial and economic) models. Furthermore, the sustainability of the "efficient" funding (business) models are needed for water infrastructure development in South Africa, given future changes such as: 1) changes in fiscal or treasury allocations; 2) impact of financial crisis or conditions on public sector budgets; and 3) the impact of the economic environment on private (corporate or financial) and public funding.

Critical reflective analysis of research data will be an integral part of the research topic, *Funding models for the financing of water infrastructure in South Africa: A framework and comparative analysis of alternatives*.

1.4.2 Problem overview

The DWA traditionally funded water infrastructure development projects in South Africa. These projects only favoured and benefited a privileged minority of the population in the pre-1994 political era. No appropriate and alternative analyses and models have since been suggested for the post–1994 period, with its growing demands on water infrastructure.. With limited financial resources, more pressure has been placed on DWA to develop alternative funding models for improved national water infrastructure management. Government has also been urged to seek advice and analysis on relevant funding models implemented from similar emerging economies in other parts of the world, e.g. Brazil, Mexico, Australia and India (Mayle *et al*., 2001; Matta & Ashkenas, 2003).

1.5 Research objectives

For the research project specific and proper objectives were set. These objectives for the research project were as follow:

- To describe the key sources of funding of water infrastructure
- To identify the funding (finance management and economic analyses) models for financing water infrastructure development projects
- To identify comparative funding models in other emerging or developmental economies, i.e. failures and successes, benchmarking, comparative analysis and best management practices, from other countries.
- To ensure using research analysis to make recommendations

For the develop and customize funding (project finance management and economic analyses) models for the financing of water infrastructure development projects in South Africa the research analysis would take into the following:

- The efficiency of different funding (business) models
- The impact of the South African regulatory environment and of national policies with an impact on the sources of funding of water infrastructure

- To benchmark and align the funding (project finance management and economic analyses) models for the financing of water infrastructure development projects in South Africa with international best practices and guidelines (i.e. World Bank, African Development Bank, Southern African Development Bank, Asian Development Bank, European Development Bank, European Directives, etc.)

1.6 Importance/benefits of the study

This research study and other various research methods and techniques will strengthen the DWA's position on infrastructure development:

- Upgrading water infrastructure development requirements, addressing water infrastructure backlogs in South Africa
- Improved water sector culture, professionalism and practices; aimed especially at the professional sector, providers, operators and advisors
- Funding and financing for improving water infrastructure development and systems
- A national water infrastructure situation and functional assessment framework
- Sustainable water infrastructure and asset management as part of the feasibility studies required for water infrastructure
- Ensure that the South Africa's economic infrastructure development targets are met in terms of the country's Medium Term Strategic Framework (MTSF)

1.7 Limitations and Delimitations

The study attempts to address a major financial constraint in general with regard the funding of infrastructure in South Africa and therefore the following limitations:

- All the public finance structural problems for the funding of public infrastructure (in particular water) will not be addressed in totality in the research project
- The scope of the research study will be limited to demand risk management, and the application of relevant or appropriate financial tools
- Unfinished work in the DWA concerning the revision of the Raw Water Pricing Strategy (DWAF, 2007) that must take into account the water tariff setting for the water resources management in South Africa; and

The scope of the research study covers both water resources infrastructure and water supply services (i.e. sanitation, waste water treatment works (WWTW), water treatment works

(WTW), and distribution networks). The delimitations of the research project will be as follow:

- It will provide a platform or the building blocks for the funding initiatives of all infrastructure development projects (i.e. energy, transportation, telecommunications, etc.), management and operations
- Comparative analysis and benchmarking appraisal with the funding models of water resources infrastructure in developing countries, where necessary; and
- Analysis of the financial structural problems that face the funding of (water resources) infrastructure development projects in South Africa.

The material for the research topic is presented in seven chapters. ***Chapter 1*** is devoted and gives details to the background, the problem in context, problem review, problem statement, research objectives, importance and benefits and limitations and delimitations of the research topic. ***Chapter 2*** deals with the problem analysis and theoretical considerations of the research topic. It concentrates in-depth on the problem analysis with the focus on the problem statement objectives, and problem review themes. However, the theoretical considerations concentrates on the current water infrastructure funding models with emphasis on financial and economic analyses and the development of the business case. ***Chapter 3*** is an important part of the thesis and gives the literature overview with the focus on identifying existing methodologies and theory base for the research project. ***Chapter 4*** is vital for the success of the thesis and considered the heart of the thesis. It focuses on the population and sample, data collection methods, and data analysis for the problem statement. ***Chapter 5*** includes the research results and/or findings based on the research design, data collection and data analysis. ***Chapter 6*** deals with the discussions from the research results and give direction in terms of the appropriate funding models that are needed for water infrastructure development projects in South Africa. ***Chapter 7*** includes the conclusions and recommendations for the research topic.

CHAPTER 2: PROBLEM ANALYSIS AND THEORETICAL CONSIDERATIONS

2.1 Introduction

Through the problem analysis and theoretical considerations of the problem statement objectives will be addressed or unpacked by means of a survey questionnaire, reports, interviews and focus workshops. This forms the business case for the relevance of the research project.

2.2 Problem analysis

The research topic, *Funding models for the financing of mega water infrastructure in South Africa: A framework and comparative analysis of alternatives* necessitates research for the development of mega water infrastructure projects to ensure water availability and security (sustainability). A number of organizations have attempted to delineate the extent of South Africa's water infrastructure deficit and requirements, with limited success; but taken together their efforts underscore the pressing need to address the following:

- a detailed inventory of both the extent and condition of public infrastructure which is tracked on a yearly basis in order to measure the amount of progress, if any, on reducing the infrastructure deficit; as it is not possible to develop a strong direction if there is no true understanding of the scope of the problem; and
- new funding models to supplement existing funding as existing funding techniques can no longer be relied upon to fully fund both the rehabilitation of existing public infrastructure and the expansion required to accommodate growth.

2.2.1 The extent of the problem

Much of South Africa's water infrastructure is at a crossroads. Following decades of under-investment, vital elements of the nations' infrastructure are in serious disrepair, if not in a crisis. South Africa's infrastructure – investment sunk in water infrastructure – is struggling to cope with the cumulative demands of South Africa's sustained period of economic growth and the vast new trade and investment opportunities emerging. There is a serious backlog in infrastructure investment, especially in water, estimated conservatively at R110 billion, which requires immediate attention. Institutional structures – those of public entities – which have served South Africa well in decades past now appear unable, and ill-equipped, to cope with the nation's present infrastructure planning and delivery challenge. Yet in South Africa's private sector, management skills and technical expertise in infrastructure

development and financing are world class. There is a mismatch between public- and private-sector capabilities. Fiscal policies of budget surpluses and debt reduction pursued over the last decade by governments in post-1994 South Africa have led to reduced public investment in infrastructure. Even with large increases in tax revenues and aggressive "surpluses" of government public entities, the water infrastructure investment required to meet South Africa's present and future needs has not materialised. Simultaneously, large capital resources are accumulating in the private sector, particularly in superannuation and managed funds, which could be increasingly tapped for infrastructure investment. Closing this circle – between infrastructure capital needs and private-sector capital availability – should be a priority.

2.2.2 The necessary investment in water infrastructure

Poor infrastructure (capital investment in water infrastructure) has been a long running sore for the South African economy alongside education and skills (human capital investment). However, competitive failings in these areas can be used to somewhat offset by competitive successes elsewhere. The erosion of competitive strength in these areas over recent years has once again highlighted the long running weaknesses elsewhere in the South Africa economy.

2.2.3 Economic growth and infrastructure

Efficient and productive infrastructure is a prerequisite for economic growth and competitiveness. The economic services provided by water infrastructure are essential inputs to production and are also in many cases final consumption goods and services. This government-led development model remained largely unchanged in South Africa until the 1980s (*cf.* Vawda *et al*., 2011).

The adequacy of water infrastructure and its timely implementation and financing – whether by public or private means – and its pricing are therefore essential questions for national economic growth and competitiveness. Although they are not traded goods themselves, infrastructure services are important inputs to all industries and hence to economic efficiency, productivity and competitiveness. Continued productivity growth – in which infrastructure plays a crucial role – will be particularly important in managing the emerging challenge of South Africa's growing population. Numerous studies have demonstrated the strong linkage between infrastructure investment and economic growth. There is strong evidence that investment in infrastructure has a positive and permanent effect on economic output, with a

1% increase in infrastructure spending increasing output by between 0.17 and 0.39%. Moreover, investment in infrastructure generates higher returns than investment in other sectors of the economy. Infrastructure investment impacts chiefly on the supply side of the economy by improving economic efficiency and resource allocation.

2.2.4 The decline in infrastructure investment

Infrastructure investment began to decline in the 1990s as governments increased the share of public consumption expenditure in their budgets at the expense of public investment. Fiscal policies of budget surpluses and debt reduction have reinforced this decline. Government capital expenditure as a share of GDP, which was around 7.2% in the 1970s and 1980s, has fallen to a low of 3.6% of GDP. Business leaders, politicians, professional economists, local governments, industry and community groups have increasingly expressed concern over the decline in South Africa's infrastructure investment and have stressed the need for action.

Professional evaluation led by the South African Institute of Civil Engineers has revealed the very serious problems now facing South Africa (SAICE, 2011). Rating on a scale of "A" to "D", revealed that the water infrastructure class received a D^-, however, indicating it was in serious condition and need urgent attention, although sufficient for South Africa's current and immediate future needs.

2.2.5 Government involvement

Government has been the main provider of water infrastructure in South Africa and remains so. Government administration and institutional structures continue to shape and influence infrastructure investment in spite of the trend to corporatisation, privatisation and increased private provision of infrastructure since post-1990s. Various proposals for the overhaul of financial relations continue to be advanced and discussed, but progress is unpromising. The interplay of governments' fiscal policies of budget surplus/debt reduction, vexatious financial relations, and political considerations present an apparently insurmountable obstacle to overcoming the backlog in South Africa's infrastructure – and in putting in place fresh institutional structures for effective strategies leading to prompt water infrastructure provision.

2.3 Problem statement objectives

The success of the research project will depend on the research findings to address the following objectives:

- To describe the key sources of funding of water infrastructure – for this research project the identification of the key sources for water infrastructure in the South Africa. This will be done through the identification of government levels (spheres), public entities and agencies, Public-Private Partnerships and/or private sector markets.
- To identify the funding (finance management and economic analyses) models for financing water infrastructure development projects – through this research project the most scientific funding models will be identified by survey a target population by means of survey questionnaire, interviews with a targeted population and focus workshops with relevant stakeholders to ensure the implementation of social and economic water infrastructure projects. These must be in line with the recently government approved MTSF, New Growth Path (NGP) and Industrial Policy Action Plan 2 (IPAP2).
- To identify comparative funding models – comparisons will be done concerning the usage or implementation of relevant funding models with other emerging or developmental economies, i.e. failures and successes, benchmarking, comparative analysis and best management practices, from other countries.
- To ensure using research analysis to make recommendations – will address challenges, achievements, lessons and recommendations of possible strategic and operational funding models following important research findings. It would be beneficial to recommend from the established research findings specialised technical and financial support mechanisms for water infrastructure development projects.

2.4 Problem review themes

To develop and customize funding (project finance management and economic analyses) models for the financing of water infrastructure development projects in South Africa will have the following themes:

- *Theme 1*: The efficiency of different funding (business) models.
- *Theme 2*: The sustainability of the "efficient" funding (business) models, given future changes such as: 1) changes in fiscal or treasury allocations; 2) impact of

financial crisis or conditions on public sector budgets; and 3) the impact of the economic environment on private (corporate or financial) and public funding.

- *Theme 3*: The impact of the South African regulatory environment and of national policies with an impact on the sources of funding of water infrastructure.
- *Theme 4*: Comparative funding models in other emerging and/or developing economies. However, the limitation is not a full extended analysis but a desk top analysis that will inform my adopted model(s) or new funding model(s).

In addition, the hypotheses to be tested for the funding models for the financing of water infrastructure in South Africa are:

- Current funding for the financing of water infrastructure is adequate and appropriate and therefore no need for substantial changes or alterations; and
- Government and its public agencies and entities do have adequate financial resources for the financing of water infrastructure.

2.3 Theoretical Considerations

2.3.1 Concept of the Current Water Infrastructure Funding Models

The post–1994 South Africa has placed more pressure on the National Treasury (NT) and DWA to develop alternative funding (financing and economic) analyses and models for the provision of improved national water infrastructure. Thus, government has sought advice and analysis on relevant funding models from similar emerging economies, e.g. Brazil, Mexico, Australia and India (*cf.* Mayle *et al*., 2001; Matta & Ashkenas, 2003).

Currently the DWA and DCOGTA, with NT, have implemented three programmes for the provision and management of water infrastructure in South Africa (NT, 2011a, b):

- Water Infrastructure Management Programme – the purpose is to ensure a reliable supply of water from bulk raw water resources infrastructure, with acceptable risk, to meet sustainable demand objectives for South Africa, including soliciting and sourcing of funding to implement, operate and maintain bulk raw water resources infrastructure in an efficient and effective manner by strategically managing risks and assets.
- Regional Implementation and Support Programme – the purpose is to co-ordinate effective implementation of the departmental strategic goals and objectives at the

regional level, including the establishment of water resource management institutions. Facilitate water conservation and demand management. Accelerate access to water infrastructure in communities.

- Infrastructure and Economic Development – the purpose to support provincial and local government programmes and systems for the promotion of economic and infrastructure development.

The main purpose of the above current water infrastructure funding is to act as a guideline for water infrastructure programme managers on how to formalize and source financing for the implementation and maintenance of water infrastructure. Funding models are not universal since the implementation environment of individual water infrastructure may differ thus, requiring adjustment to the models. However, conceptual funding models can become very important to water infrastructure development, since they can provide the water infrastructure programme manager with answers to such questions as:

- Where and how to seek out funds?
- Over what period will the funds be disbursed? and
- What are the effects of funding on pricing policies?

The answers to the above questions are even more significant to South Africa, other emerging and developing economies. This is true, since these nations are usually influenced by the negative effects of having very limited financial resources, poor capital markets and inadequate political governance structures (IIPF, 2001). Therefore, long term capital financing models for water infrastructure implementation as the potential of becoming an important tool for assisting water infrastructure programme managers of these nations in sourcing, structuring and formalizing funding for water infrastructure implementation.

2.3.2 Financial analyses

Financial analyses are needed for most public and private project that involves capital investments (*cf*. Park & Jackson, 1984; Hickling Corporation, 1991; Goodman & Hastak, 2006) (*cf*. Table 3). A financial analysis models for the research project may include (*cf.* Goodman & Hastak, 2006):

- Estimates of the investment (capital) cost and annual cost of the project in terms of monetary requirements;

- Schedule showing the breakdown of the investment cost by years, with separate accounts of expenditures for construction and for the other categories of costs needed to bring the project into operation;
- Estimates of portions of investment cost in domestic and foreign funds, especially when foreign currencies are in short supply;
- Plan for financing the costs of the project investment, including the sources of funds and the terms for repayment of each category of borrowing;
- Estimates of costs, revenues from the sale of products and services, and required subsidies, on a year-by-year basis extending from the completion of construction to the date when the repayment of all borrowed funds is completed, and beyond if appropriate;
- Plan for the required annual subsidies, if any, and for working funds to enable operation to commence and temporary cash flow requirements during the early years of operation; and
- Additional statements of a financial nature depending on the regulatory agencies and financial institutions involved in the project.

2.3.2.1 General principles for application of financial analyses

Some qualifications that are appropriate for financial analyses are briefly reviewed here.

i) Financial analyses for a social (municipal water supply) project

The selection of the recommended first phase of the project and the master plan IS normally based on their capacity to satisfy the expected future demands for water, and also to do so most economically as measured by investment cost, annual cost, and cost per unit of water supply. In addition to the basic cost analyses, detailed financial and economic analyses are carried out for all alternatives that appeared to be feasible from the standpoint of engineering construction

ii) Financial analyses for project with different sponsorships

Financial analyses can depend on the type of sponsor. The principal parameters are assumed to differ for three types of sponsors: (1) a municipal or other government agency; (2) an investor-owned public utility, (3) a private entrepreneur, or (4) an industrial or commercial user for their use.

iii) Financial analyses with multiple financing sources

The analyses can be patterned after an actual plan for a water supply in a European country (*cf.* Goodman & Hastak, 2006). However, the analyses are representative for a situation when multiple facilities and multiple sponsors of construction must be considered when developing a financing plan.

iv) Financial analyses of multi-unit and multi-purpose infrastructure programme

Although not included here, it is recommended that for (economic and) financial analyses of this type, account should be taken of periods when a project is not fully utilized. Low output may occur in the initial years of operation due to partial construction or inadequate market growth. The cost may also vary from year to year for at least two other reasons: (1) to reflect the terms of financing resulting in uneven annual capital charges and (2) due to variations in operation and maintenance costs (e.g., pumping cost varies with volume pumped) and inflation effects.

v) Cost allocations and subsidies

The cost allocations may depend on: (1) legislation specific to a project; (2) government agency policies applicable to certain types of projects; (3) legal requirements; (4) payment capacities and availability of money for subsidies; or (5) other policies concerning project beneficiaries.

vi) Financial analyses of commercial schemes

For a commercial scheme to be successful, it must have at least two practical ingredients: (1) an effective concessionary agreement between one or more government jurisdictions and one or more commercial partners; and (2) financial benefits to both government and commercial interests.

From the above methodologies available to evaluate the broader financial impacts of investments in public works projects, e.g. water infrastructure, the majority can create economic and physical conditions that induce additional economic growth. All the financial tools will be considered as important for water infrastructure project delivery. However, these models and tools will not be addressed in-depth in this research project.

2.3.3 Economic analysis

In addition to financial analysis, economic analyses are also needed for most public and private projects that involve capital investments, e.g. water infrastructure (*cf.* Park & Jackson, 1984; Hickling Corporation, 1991; Goodman & Hastak, 2006).

i) Local infrastructure costs as a consideration in economic analysis

An infrastructure project may include the growth of population and business in an area, e.g. the development of water infrastructure (water supply and sewage facilities) in urban and rural areas. The costs of these incremental infrastructure and services may not have been included in the estimates of the construction costs.

ii) Allocation of costs of multi-purpose projects

The infrastructure planner may often have to perform a benefit-cost analysis for a project or a group of projects with multiple purposes. He or she may also have to deal with facilities that serve more than one project. The ***separable cost-remaining benefits (SCRAB) method*** which allocates costs of projects can be used, e.g. a multipurpose water resources project often includes a reservoir serving several purposes and projects (U.S. Inter-Agency Committee on Water Resources, 1950, 1958).

iii) Models for estimating economic effects due to infrastructure development

- ***Microeconomic analyses*** - They deal largely with the evaluation of costs and benefits for physical infrastructure projects that, except for externalities if they are significant, affect individuals and organizations within a limited project area.
- ***Macroeconomic analyses*** - *Economic growth studies* are designed to capture the total economic effects of a project or programme and may be classified in certain cases as *macroeconomic analyses*.

From the various methodologies available to evaluate the broader economic impacts of investments in public works projects, e.g. water infrastructure, can create economic and physical conditions that can induce additional economic growth. The economic model benefit-cost analysis, with the levels of sample complexity, data requirements, cost,

reliability, etc. will be considered as important for water infrastructure project delivery. However, these models and tools will not be addressed in totality in this research project.

2.4 Informing the questionnaire and developing the business case

Research questions were used since enough is not known about the problem statement in South Africa (*cf.* Appendix 3). The research questions were formulated and used as precisely as possible what the research study will attempt to achieve or find out. Since it was difficult to work with research questions only with regard to the research topic additional secondary data were sourced in the form of review reports, documents, etc.

The research questions were formulated or set for testing or arguing the problem statement. Both, the testing and arguing, will allow the problem statement to retain advantages that the clear research topic offers, since they relate precisely to the research project. In addition, through the survey questionnaire (primary data collection) and the review reports, documents, etc. (secondary data collection) a business case for *The funding models for the financing of water infrastructure in South Africa* was formulated and thus be presented for implementation.

2.5 Conclusion

This chapter addressed the problem analysis and theoretical considerations of the research topic. The problem analysis gave a detail account of the extent of the problem with the indication that the necessary investment that is needed in water infrastructure since efficient and productive infrastructure is needed for economic growth. The decline in infrastructure since the 1990s government increased the share of public consumption expenditure in its budget and thus the recent involvement by government as main increased provider of water infrastructure funding is encouraging. The research themes identified efficiency, sustainability and the impact of regulatory environment on the water infrastructure delivery. The theoretical considerations gave the current water infrastructure funding models with their associated shortcomings and/or limitations. Furthermore, they outlined the probable type of financial and economic analyses that can be considered in the data collection and analysis to ensure the appropriate results for the selection of the most relevant and workable funding model(s). Lastly, the type of research questions formulated, as part of the surveys (questionnaire), has resulted in the development of the business case for the research topic.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

The purpose of the literature review is to convey to the reader what knowledge and ideas have been formulated for this particular research topic and the strength and weaknesses of them (Coldwell & Herbst, 2004; Lang, 2006). Literature review was based upon or defined by a guiding concept, i.e. research objective, the problem statement.

The literature review does not consist merely of a list of readings, but also contains literature or information that has been selected, as part of the planning, research and investigative processes (*cf.* Open University, 2001). Thus, it required an insightful evaluation, description and assessment of what is already known about the research problem or area, and relates to the aims and objectives of the research project (TerreBlance *et al.*, 2006; Open University, 2001).

The literature review was a re-iterative process whereby appropriate literature was selected, to inform the research process, including the data collection and analysis. Notes were made for reference and the formation of further themes. The literature search concentrated on a few key concepts, especially where empirical work was involved.

3.2 Literature review and identifying of methodologies

Through the review of related literature a number of methodologies were identified as having been employed by other researchers who studied similar problems. Therefore, the more a particular methodology has been tested and adjusted for use in studying the specific research problem. However, the research embraced any new and interesting methodologies developed. Several ways were explored to record the research process in a written format from the literature review, including:

- a **research project journal** to record ideas, hypotheses, observations, materials, etc. – all aspects of the inquiry processes.
- a **personal journal** to record information about the process, relationships, etc.
- a **formal report** that states the research process, from hypothesis to literature review, analysis, results and conclusions for presenting investigations.

Already the literature review has resulted in the research project being put into context by showing how it fit into a broader research field of infrastructure planning, development and financing (*cf.* Coldwell & Herbst, 2004; TerreBlance *et al*., 2006). Thus, it was used to gain and demonstrate skills in two areas (*cf.* Coldwell & Herbst, 2004):

- Information-seeking – the ability to scan literature efficiently
- Critical appraisal – ability to apply principles of analysis to identify unbiased and valid research studies

3.3 Theory Base of the Research Project

It is fundamental to understand the concept of water infrastructure, the inter-relationship of its components and the implementation environment before attempting to structure the economic issues associated with water infrastructure implementation. In partnership with all affected stakeholders, the issues must be identified and implement solutions for the various challenges experienced with the full funding of the water value chain (*cf.* Figures 3.1).

Healthy infrastructure is a necessary ingredient of a roust economy. Infrastructure systems are a part of the nation's economy through expenditures and infrastructure systems are also necessary to accommodate economic expansion and productivity. A positive correlation can be shown between the level of infrastructure development and economic productivity.

3.3.1 Perspective on funding of water infrastructure and development

Lang and Merino (1993) have estimated capital expenditures and found that the gross national product (close to the gross domestic product, or GDP) was over $6 trillion dollars per year in the early 1990s. Approximately 20% of the GNP was spent to maintain, expenditures by the public sector. They estimated that 5% of GNP was spent to maintain, replace, and add to the capital stock owned by governmental entities, and that about half of that amount was spend on the physical infrastructure. The infrastructure data covered the following types of infrastructure: high-ways, mass transit, rail, aviation, water transport, water resources, water supply, and wastewater treatment. Later reports have painted similar picture of overall spending, and the proportions for capital costs and for operation and maintenance (O&M).

A World Bank Development Report (World Bank,1994), which focused on infrastructure for development, studied investments in public utilities (power, piped gas, telecommunications, water supply, sanitation and sewerage, and solid waste collection and disposal), public works (major dam and canal works for irrigation, as well as roads), and other transportation sectors (railways, urban transport, ports and waterways and airports). The World Bank surveyed low-, middle-, and high-income countries. Infrastructure services represent a large share of the economy, accounting for value-added of roughly 7 to 11% of GDP, with transport comprising about 5 to 8% of total employment. Public infrastructure investment ranges form 2 to 8% (and averages 4%) of GDP. For developing countries, infrastructure typically represents about 20% of total investment and 40 to 60% of public investment. The report stated that even these shares understate the social and economic importance of infrastructure, which has strong links to growth, poverty reduction, and environmental sustainability.

The World Bank Report on Africa's Infrastructure (World Bank, 2010) indicated that Africa's infrastructure lags well behind that of other developing countries. Not only are Africa's infrastructure networks, i.e. water systems, power, etc., deficient in coverage, but the price of the services provided is also exceptionally high by globally standards. Sub-Sahara Africa has a combined infrastructure deficit for water and sanitation of estimated $93 billion annually, however, these estimated are a lower bound. Thus, meeting Africa's infrastructure needs calls for a very substantial program of infrastructure investment and maintenance. Some two-thirds of this total related to capital expenditure, and the remaining one-third to operation and maintenance requirements (Brineco-Garmendia *et al.*, 2008). The public sector remains the dominant source of finance for water infrastructure. Public investment is largely tax financed and executed through central government budgets, whereas the operating and maintenance expenditure is largely financed from user charges and executed through state-owned enterprises. Current levels of public finance are substantially higher to GDP, typically absorbing 5-6% of total GDP. Looking only at investment, one finds that official development assistance, private participation in infrastructure and non-OECD financiers together exceed domestically financed public investment (Brineco-Garmendia *et al.*, 2008). The private sector is by far the largest source, on a par with domestic public investment.

The Asian Development Bank (ADB) (Sagar, 2006) indicated the challenges in infrastructure project financing. Emerging economies in Asia need billions of dollars in private funding to spark infrastructure investment. However, these economies have failed to attract a supply of private investment in infrastructure projects. This can be attributed to weak tariff regulation,

reluctance to honour commitments, poor governance practices, weak accounting and disclosure norms, etc. Thus, the ADB recognised for developing and implementing a new model to replace the traditional methodologies for infrastructure project financing as market players now desire bankable solutions for infrastructure project financing. In terms of the private-public local currency model, there has been an emerging need to review, on a sector-by-sector basis, the strengths and weaknesses of the processes that were used in the past to implement infrastructure projects. It was imperative to develop bankable versions of these models, ideally backed by the fundamental willingness and ability of customers to pay rather than relying on government guarantees or public sector assurances. In implementing this new model, local capital markets play an important role in providing infrastructure project finance. Thus, the role of government in promoting infrastructure investment has changed in character but not diminished.

Various other studies have also shown a relationship between the amount of infrastructure and economic strength. Summers and Heston (1991) have shown that increasing GDP per capita is associated with increasing levels of infrastructure. However, the studies were not conclusive as to whether more infrastructure creates more wealth, or whether infrastructure growth is a by-product of or follows economic growth. Furthermore, it is likely that the relative importance of the linkages of these effects varies from country to country. Thus, while infrastructure projects are often justified by governments and by international agencies as employment and economic generators in developing countries, most professional economists hold the view that they are not as efficient as other types of economic and social programmes for these objectives.

The concluding report from the U.S. Army Corps of Engineers (1995) stated that infrastructure studies identified the following public works goals as the primary objectives to guide the infrastructure development; (1) efficiency, (2) reliability, (3) equity, (4) sustainability, (5) innovation, and (6) revenue diversification. The report went on to state that within a broader context, the preceding objectives are complemented by two overarching goals that serve as national outcome-based performance indicators, i.e. productivity growth, and competitiveness and jobs. In assessing the state of the infrastructure, the U.S. Army Corps of Engineers (1995) identified a number of barriers that inhibit action on improving the infrastructure:

- Public works maintenance is often one of the first spending cuts made in times of tight budgets.

- Capital investment in public works continues to be viewed sceptically by many as "pork barrel" spending.
- Constrained budgets at all levels of government seem to render even modest programs and projects unaffordable.
- Significant advances in technology are prevalent, yet liability, regulatory, and contracting concerns have resulted in relatively few innovative public works applications.
- The accumulation of national (federal) and state regulations and mandates threatens to distort local budgets and priorities.
- The implementation of necessary environmental statutes has created a complex series of public works decision-making processes that often appears gridlocked.

Furthermore, through the U.S. Army Corps of Engineers (1995) number of studies of individual topics the following principles are needed or must be considered for federal agencies and for the state and local agencies involved in federal programs for the funding of infrastructure :

1. ***Cost-effective management and maintenance***. Adopt and encourage performance measurement and assessment process, as well as maintenance planning and reporting practices to reduce long-term costs through early identification of maintenance needs.
2. ***High-quality investments***. Obtain maximum benefits compared to costs from all federal infrastructure programs (directly provided, financially assisted, or regulated) through the use of investment analysis.
3. ***Budget-sensitive financing***. Federal infrastructure investments should be identified through the preparation of financial plans and affordability analyses early in the planning process, with full consideration of both traditional and non-traditional funding sources, including demand management options to ensure efficient use.
4. ***Innovative technologies***. Clear the path to the marketplace for new technologies through an explicit, singular federal research and development strategy that provides a strong link between the development and adoption processes, enhances the partnership between the federal research community and the private sector, and addresses the liability, regulatory, and contracting barriers to innovation diffusion.

3.3.2 Water infrastructure conditions in South Africa

3.3.2.1 Water infrastructure conditions

A number of recent studies have highlighted the poor condition of existing infrastructure and inadequate operational maintenance and management at municipal level. Some of these include:

- *DWAF and CSIR study: A* 2007/08 review of 500 rural projects to assess the quality and standard of (complete and incomplete) MIG funded infrastructure projects, the study indicated that rural water and sanitation projects were either: *partially non-compliant (B-rating) or non-compliant (C-rating). Many of the concern*s related to technical design flaws, poor quality, poor operation and maintenance and the need for rehabilitation. In addition, the lack of proper management around metering, billing and revenue collection were highlighted.
- *DWA 'Green Drop' report:* DWA found that 7.4% of all wastewater systems can be classified as excellently managed, but the reality remains that about 55% of the systems assessed scored between 0% and 49% meaning that drastic improvement is required in terms of management practices.
- *DWA 'Blue Drop' report:* DWA assessed 787 water supply systems in 2010 and found that 13% were in 'excellent' condition; 12% were 'very good'; 30% were 'good'; while 21% needed attention and 24% needed urgent attention. Overall these results, with 45% less than 'good', are concerning. However, DWA reports that this performance is better than it was in 2009.
- *SAICE's recent publication in 2011and its presentation to the World Bank in 2009* highlights some of the reasons behind failed or delayed infrastructure projects. In this case the survey reviewed MIG funded projects just after completion and was aimed at assessing design and construction performance. The findings suggested that while 52% of projects surveyed were completed "satisfactorily with minor niggles" the main challenges experienced relate to poor quality contracting (flawed procurement process), inadequate design and poor performance on the part of the contractor. This suggests that while civil engineering capacity is a constraint, a broader set of challenges face municipalities in successfully implementing infrastructure projects.

3.3.2.2 Water sector value chain and funding in South Africa

Water infrastructure is hierarchical (*cf.* Figures 3.1, 5.8 and 5.11), based on administrative and/or political boundaries (*cf.* Rajabifard, 2002; DWAF, 1997, 1998). The hierarchy ranges from a national level to a local level (Figure 3.1) with the responsibility for the implementation of each level varying from the government of the administrative boundaries to a combination of private sector and different aspects of the public sector. Thus, the questions which arise when designing funding models are:

- Are there different implementation strategies for the different levels of a water infrastructure or are they just subsets or smaller versions of the global implementation strategy? and;
- How does the answer to the above questions affect the funding policies?

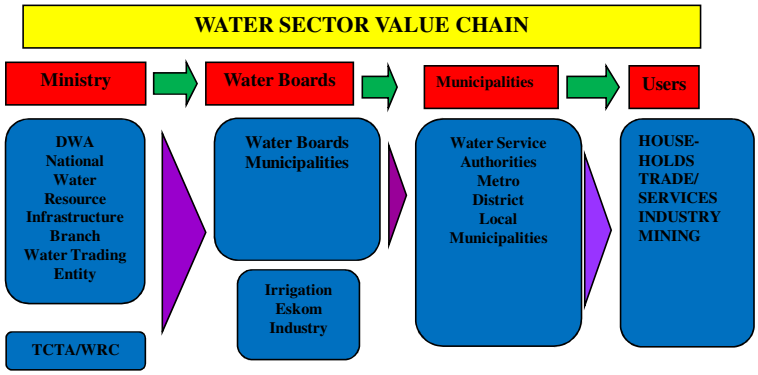


Figure 3.1: Water sector value in South Africa

3.3.3.2 The Economic Issues of Water Infrastructure Implementation

The economic issues involved in the implementation of the water sector value chain are covered by both strategic and operational management principles. Some of the more challenging management issues that must be addressed by the water sector include:

- The economic viability of a water infrastructure (Benefit-cost Analysis);
- Strategic Planning
- Funding Models
- Pricing Policies
- The role of a water infrastructure in the economy; and
- The economic issues associated with water infrastructure operations.

The first phase of implementing water infrastructure involves the determination of whether or not the water infrastructure is economically viable. This is usually achieved through a cost-benefit analysis or feasibility studies (*cf.* Rhind, 2000). A number of research studies have been carried out in this area to determine the value of water infrastructure (Kuiper, 1971; DWAF, 2004). However, researchers in general are still ignoring the next phase of the implementation (i.e. strategic planning) especially the funding aspect of this phase (Groot, 2001; Rhind, 2000). The first generation of water infrastructure was mainly financed in an *ad hoc* manner with no structured funding models for their implementation (DWAF, 2004, 2007). If the water sector community intends to improve on the implementation mechanism of the second generation of water infrastructure the following issues should urgently be raised:

- Are there current funding models in place for water infrastructure implementation?
- Can the current models (if they exist) finance the next generation of water infrastructure?
- Does each level/component of a water infrastructure require a different funding model for its implementation?
- Are funding models for water infrastructure implementation in developed world applicable in emerging nations? and
- If they are applicable, what kind of modification will be required of these models?

3.4 Conclusion

Through this literature review chapter there has been the identification of possible methodologies for the research problem. These have been identified through the appropriate research project journals and reports. The perspective on funding of water infrastructure and development, as part of the theoretical base, showed a positive correlation between the level of infrastructure development and economic development and the six studies analysed demonstrated this relationship and the type of funding model(s) used. These studies gave the fundamental theory base for the research topic to be taken into consideration, the type of analysis and the appropriate implementation solutions.

CHAPTER 4: RESEARCH METHODS

4.1 Introduction

The research design represents the master plan that specifies the methods and procedures for collecting and analysing the required data/information. It was used to structure the research, and to show how all the major parts of the research project – the samples or groups, measures, treatment or programmes, and methods – work together to try to address the central research question(s) (Cooper & Schindler, 2001; Coldwell & Herbst, 2004). The research design was to ensure the following:

- a time-based research plan;
- the research based on the questions;
- the selection of sources and types of information;
- specifying the relationship among the study's variables; and
- outline procedures for the research activities.

4.2 Population and sample

A representative sample (unit) was selected for measurement from a larger target population in such a way that it, in combination with other representative units, given an accurate picture of the problem statement being studied (Taylor, 2002; Coldwell & Herbst, 2004; Tustin *et al*., 2005). The method of choosing a representative sample was to take 'random' samples from the parent population.

The sample size for the study population of the research project was finite. Based on the sampling frame, the sample size (in this case, with a finite population) included the following:

- Interviews with representatives of financial institutions (commercial and development banks), i.e. World Bank (WB), Development Bank of Southern Africa (DBSA), African Development Bank (AfDB)
- Interviews with representatives of investment corporations, i.e. Industrial Development Corporation (IDC)
- Interviews with representatives of selected government departments (national and provincial), i.e. Department of Water Affairs (DWA), National Treasury (NT), Department of Cooperative Governance and Traditional Affairs (DCOGTA),

Department of Trade and Industry (DTI), Department of Public Works (DPW), Depart of Public Enterprises (DPE), and Department of Energy (DoE)

- Water institutions (entities) and/or agencies, i.e. Trans-Caledon Water Authority (TCTA), Water Boards (Rand Water, Umgeni Water, Sedibeng Water, etc.).
- Surveys with a representative sample of municipalities - The 2010 water services tariff survey information was from: 236 of 237 local authorities (municipal retail tariffs); 99.5% participation; 12 of 15 bulk water services providers / water boards (bulk water tariffs); 80% participation; 139 of 139 raw water schemes (raw water tariffs); 100% participation. Waste water tariffs were not measured as it was clear from the tariff types that a fair comparison of municipal wastewater tariffs was very difficult.

4.3 Data collection methods

Some basic quantitative and qualitative methods for the research topic for the analyses and models included: 1) surveys (questionnaires); 2) interviews; 3) documentation review (reports); 4) observations; 5) focus groups; and 6) case studies (*cf.* Cranston, 2004; Coldwell & Herbst, 2004). They have unique designs, contribution and value towards the research topic. They addressed the overall purpose, research objectives, and importance and benefits of the research (*cf.* Cranston, 2004; Coldwell & Herbst, 2004).

Thus, the research involved two types of data collection methods, i.e. primary and secondary data (Tustin *et al*. 2005):

i) ***Primary data*** - to address the research objective and if the value of secondary research is assessed as being inadequate for the research objectives (*cf.* Appendix 3). Research methods undertaken during the course of the study included interviews, surveys (questionnaires and checklists), and conducting a serious of workshops. Specifically, representatives were interviewed from local governments, state agencies, government finance experts, and individuals knowledgeable on issues pertaining to government bonding. National Treasury, Department of Water Affairs, local governments and state agencies were surveyed for relevant data on passage of funding models for water infrastructure. In addition, workshops and discussions were held focusing on funding options for water infrastructure with participants drawn from local government and other interested stakeholders, i.e. public and private agencies and entities.

ii) ***Secondary data*** - play a vital role in the research process because secondary data, by definition, are existing data, they have the benefit of being readily available. In addition, secondary data are generally far less time consuming than primary data. Secondary data was already available since it was collected for another purpose (other than the current research project). Finally, a list of options for funding water infrastructure has been developed to facilitate discussion by the DWA and other policy makers during their current and future deliberations of this important issue.

4.3.1 Primary data collection

An increasingly useful method of quantitative data collection in management research is to carry out a survey of a sample of a population in order to observe the relationship between a given set of variables (Taylor, 2002; Coldwell & Herbst, 2004). Surveys are most commonly carried out using questionnaires, which may be filled in by the questioner or the respondent.

The design of the questionnaire included the size and scale of the problem to be tackled by the survey (known as scoping) and what information will be required. Broad areas of questioning were identified (*cf.* Appendix 3).

The sample size (in this case, with a finite population) included the following:

- Twenty-five individual interviews, i.e. national departments, funding agencies, regulatory agencies, and local government representatives. To establish the new paradigm of funding models the questions of the questionnaire were used as guide to obtain the research data (*cf.* Appendix 3). They were used to explore new issues that were nt previously considered in existing funding models and/or to adapt existing funding models.
- Five (5) workshops and discussion focus groups, i.e. national and provincial workshops – consisted of an average of 46 people.
- Respondent Groups and national organizations, e.g. DWA, NT, DPE, DTI, DCOGTA, DoE, etc.
- Funding Agencies, i.e. Development Bank of Southern Africa (DBSA), African Development Bank (AfDB), Industrial Development Corporation (IDC), European Investment Bank, and World Bank.
- Regulatory Agencies, i.e. TCTA, Water Boards, Komati Basin Water Authority (KOBWA), and Catchment Management Agencies (CMA).

- Local Governments, i.e. South African Local Government Association (SALGA), municipalities (local, district and metropolitan municipalities).
- Technical Assistance Providers, i.e. European Union, World Bank, USAID

The questionnaire was forwarded to participants and/or stakeholders, including all local municipalities, via e-mail and fax and was followed up with individual interviews. The questionnaire requested from the municipalities and water boards the water tariffs per tariff type (Residential, Commercial, Industrial bulk raw water, Industrial-potable water and other/associated uses) in pre-defined blocks. For the 2010 financial year the survey captured tariff blocks in the format (number of blocks and actual volume ranges per block) as each municipality is applying it. The DWA is using web-pages and other electronic means to maintain the information sharing relationship with stakeholders. The tariffs were captured into an Excel spreadsheet and subsequently transferred to DWA's National Information System for effective sharing and evaluation of the information. This is now further being advanced through the establishment of a Governance System whereby DWA and municipalities will share core sector information via internet-based information sharing tools (*cf*. Figure 4.1).

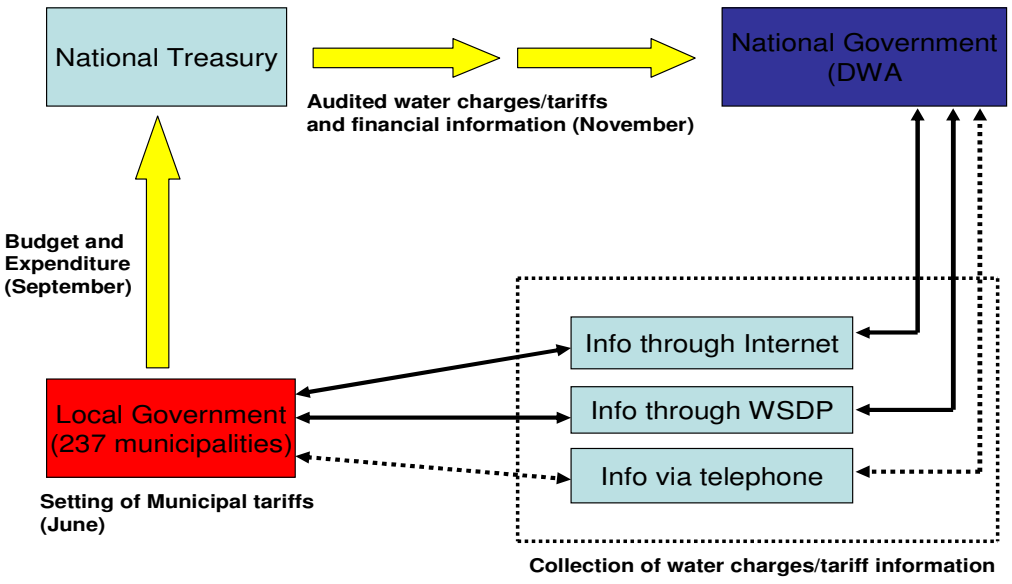


Figure 4.1: Financial (funding) information management process water charges/tariffs.

It is important for water service providers (WSP, i.e. water boards) and water service authorities (municipalities) to know the amount of raw water resource charges in its areas so that these can be incorporated in the setting of their municipal tariffs. The following process was followed to generate average costs for the various local authorities throughout the country:

- Obtained the latest / applicable DWA raw water charges
- The supply areas for each scheme
- Possible link of communities to raw water charges.
- Combine raw water charges within a LM to derive applicable charges for each

The survey collated bulk water supply tariffs from all water boards and from two selected bulk water service providers which are not water boards. The biggest challenge was to ascertain which local authorities were being served by the water boards and the other bulk water service providers.

4.3.2 Secondary data collection

Reviewed prior reports, reports relative to infrastructure needs and funding; and researched infrastructure funding activities in other countries have been studied. The compiled data has illustrating current expenditures and revenue patterns of DWA (NT, 2011a), DCOGTA (NT, 2011b) state agencies and utilities, Metropolitan Municipalities, municipalities (district and local) (NT, 2011c), and private sector for water infrastructure. Revenue streams, local debt, expenditure restrictions, and other information relative to funding water infrastructure were reviewed. Summaries of this compiled data and review of revenue sources are presented in the study findings.

The DWA together with the Water Research Commission (WRC) undertook various studies that are relevant to this research project. The research project considered the various studies undertaken by the DWA and WRC. A representative sample of some of the relevant studies is listed below.

4.3.3 Data types

Four levels of data types in quantitative data analysis were considered and used where appropriate (*cf.* Taylor, 2002; Coldwell & Herbst, 2004; Tustin *et al.*, 2005): i) Nominal

(categorical) data (scales); ii).Ordinal (ranked) data; iii) Interval and ratio (scaling) data; and iv) Ratio (scaling) data.

Table 4.1: Representative sample of secondary studies and/or reports used in the research.

TOPIC	AUTHOR	WRC REPORT NO.
Economic regulation of water services in SA	Palmer Development Group	1383/1/04
Supply pricing of urban water in SA	R Eberhard	678/1/99
Development of models for economic evaluation of the integrated management of the quantity and quality of irrigation water within river catchments	B Grove	1043/1/04
Retail Water and Sanitation Guidelines	DWA	
Guidelines for bulk potable water tariffs	DWA	
Development of an integrated regulatory framework for the water sector	Khanyisile Consulting Services CC	
Assessment of the ultimate potential and future marginal cost of water resources in South Africa	MS Basson	DWA Rep. no. P RSA 000/00/12610
Research impact assessment of the water administration system	D Winter	TT 447/09
Cost and tariff model for rural water supply schemes	D Still	886/1/03
Cost benefit analysis in SA for water resource development	Conningarth Economists	TT177/02
Estimation of residential price elasticity of demand for water by means of a contingent valuation approach	GA Veck	790/1/00
Supply pricing of urban water in SA	R Eberhard	678/2/99
Corporatisation of municipal services providers	Palmer Development group	TT 199/02
Proposed tariffs for the use of DWAF	M Vawda	

TOPIC	AUTHOR	WRC REPORT NO.
water resources for small scale hydropower generation with a capacity of not greater than 20 MW		
Cost recovery for water schemes to developing urban communities	D Hazelton	521/1/98
Identifying examples of successful cost recovery approaches in low income, urban and peri-urban areas	L Marah	1131/1/03
Incorporating economic considerations into quantification, allocation and management of the environmental water reserve	M Mander	978/1/02
Development of a hydrological economic agricultural model based on case studies in the upper Mvoti Catchment	G Creemers	890/1/02
Researching, developing & testing of payment strategies for the lower income groups at four selected communities in order to manage charges for water use	DS van Vuuren	202/1/03
Payment strategies & price elasticity of demand for water for different income groups in three selected urban areas	DS van Vuuren	1296/1/04
The development of an activity based costing model to quantify the real costs of delivering water services in rural areas	W Matthews	1614/1/09
Supply pricing of urban water in South Africa	R Eberhard	678/1/99
Effective cost recovery in a changing institutional and policy environment:	L Marah	1384/1/04

TOPIC	AUTHOR	WRC REPORT NO.
Municipal demarcation, the "free basic water" policy and financially sustainable service delivery		
Investigating the mechanism and processes used in setting water services tariffs	P Hosking	K5/1871/3
An investigation into the water infrastructure development financial allocation pathways in municipalities	B Hollingworth	K5-1844
Water supply services model manual	Palmer development group	KV109/98
Guidelines for economic regulation of water services in SA	Palmer development group	TT229/04
The review of industrial effluent tariff structures in SA	Des Kerdachi	854/1/02
Guidelines for setting water tariffs with a focus on industrial, commercial & other non-residential consumers	Palmer Development group	992/1/00

4.3.4 Data validation

To ensure that the data contained in the storage and retrieval system can be used for decision making, each data quality needs were defined, i.e. the required accuracy and precision (Chapman, 1992; Taylor, 2002; Coldwell & Herbst, 2004; Tustin *et al*., 2005). It must be noted that all phases of the data collection process, i.e. planning, collection, analysis and data storage, contribute to the quality of the data.

Of particular importance was the care and checking of the original coding entry of data (Chapman, 1992; Taylor, 2002; Coldwell & Herbst, 2004; Tustin *et al*., 2005). Other careful design of data codes and entry systems minimised input errors. Experience also showed that major mistakes can be made in transferring data to databases, even when using standardized data forms. It was absolutely essential that there was a high level of confidence in the validity of the data to be analyzed and interpreted. Without such confidence, further data

manipulation is fruitless. If invalid data are subsequently combined with valid data, the integrity of the latter is also impaired.

4.4 Reliability and validity issues

4.4.1 Reliability

Reliability refers to whether you as a researcher has measured or recorded something accurately and whether if another person repeats the same exercise would he/she obtain the same result (Lewis, 2001). Therefore the evidence t collected was sufficient, authentic and valid to ensure reliability of my problem statement.

Furthermore, to test the particular hypotheses to see whether or not it sustains the test, it was subjected to exactly the same test to which it was subjected before (Coldwell & Herbst, 2004). Thus, consistency was the hallmark of my reliability and several ways of measuring were delineated. For reliability, the test-retest reliability technique was used.

4.4.2 Validity including threats to validity/improving validity

This refers to whether the evidence can demonstrate it worth or relevance (validity) for the selected research problem. Validity or valid evidence was central to the way in which research was conducted. Two fundamental kinds of validity in relation to research designs (*cf*. Denscombe, 2003; Coldwell & Herbst, 2004) were of importance:

- ***Internal validity*** – findings followed in a direct and unproblematic manner/way from its methods and therefore it 'sustains' its findings or conclusions.
- ***External validity*** – findings or conclusions can be generalised beyond the confines of the design and the study setting.

Both types of validity, internal and external, were important and desirable attributes of the research design. There was little point in having results that are coherent, and which were sustained completely by the research procedure one has utilised, if they were merely self-referring. Similarly, there was no point in conducting research that paid great attention to external validity if the design was flawed and lead to spurious results.

Thus, in the context of gathering valid evidence (validity) and to address any uncertainty, the approach(es) or method(s) for my research project were:

- To use more than on method when investigating the research topic (cf. data collection)
- Recognise the value of using multi-methods for the corroboration of findings and for enhancing the validity of data
- Recognise that the notion of a single financial and/or technical notion is controversial, and therefore adopt a cautious approach and/or position which avoids any controversies
- Appreciate that different methods might point in a similar direction but unlikely to meet at some precise, unequivocal point of reality
- Avoid the presumption that use of certain methodological and systematic models can prove that data or analyses are absolutely correct.
- Statistical methods and analysis

4.5 Data analysis

The types of data collected for the research topic were many and varied. Data analysis and presentation, together with interpretation of the results and report writing, normally form the last step in the research project process. It is this phase that shows how successful the activities have been in attaining the objectives of the problem statement. It is also the step that provides the information needed for decision making, such as choosing the most appropriate solution to the problem statement, assessing the state of the topic or refining process itself.

Statistical methods and analysis and funding (financial and economic) models were used to test the data sets (*cf.* Gilbert, 1987; Chapman, 1992, Hounslow, 1995). Descriptive statistics were used to summarise data sets into simpler and more understandable forms, such as the mean, median and standard deviation (SD). When these and other questions are re-stated in the form of hypotheses then inductive (inferential) statistics were performed. Funding (financial and economic models) will be described for the capital investment priorities for water resources infrastructure development in South Africa.

4.5.1 Descriptive and Inferential statistics

4.5.1.1 Descriptive statistics

These are the most commonly used, and form the basis for more advanced (mathematical) statistical techniques. The statistics used included number, i.e. groups, percentages, and frequencies, measures of central tendency, i.e. mean, and measures of variation, i.e. range, standard error and/or standard deviation (Coldwell & Herbst, 2004; Tustin *et. al*., 2005).

4.5.1.2 Inferential Statistical Analysis

Inferential statistics go beyond describing of data, i.e. they were used to answer such questions as whether two or more groups differ on a given attribute, or whether a relationship exists between variable *x* and *y* (Taylor, 2002; Coldwell & Herbst, 2004; Tustin *et. al*., 2005). Their purpose was to enable inferences to be made about the population from which particular samples were drawn (Taylor, 2002; Coldwell & Herbst, 2004). However, since data were based on samples, they are subjected to *sampling error.* Inferential statistics were used to determine the level of uncertainty with which the findings should be treated. The techniques used were ANOVA and F-tests. For the significance tests the parametric *two-tailed F-test*.

The statistical analysis for the research topic included the completeness of the survey and helps to identify any information gaps or data inaccuracies. For statistical analysis and national reporting, the various block structures were normalized into the most-common and standard structure. The study also applied modelling techniques to gain a deeper understanding of the social and financial impact of the tariffs, including, i.e. the mathematical average adds the tariffs of all municipalities within each block and then divides the sum by the total number of municipalities (returns); the population-weighted average considers the number of people affected within each municipality and by each tariff block; and the volume-weighted average considers people and their service levels, thus representing the average value of 1kl of water used in each of the blocks.

4.6 Conclusion

The population and sample, data collection and data analysis formed the spine or nucleus for the adequate funding model formulation described in the theory and how it can be applied.

Thus, the substantial primary data, through surveys (questionnaires), and secondary data, documents and reports, collection were used to develop the model(s) described in the results in Chapter 5. It suggests that from the theory information, data collection method and data analysis showed that the data/information collected on water infrastructure investment and funding, viz. development projects and operation and maintenance, were adequate and sufficient.

CHAPTER 5: RESEARCH RESULTS

5.1 Introduction

The results for the problem statement are discussed based on the research findings obtained through the various data collection methods. These are based on the following research objectives:

- To describe the key sources of funding of water infrastructure
- To identify the funding (finance management and economic analyses) models for financing water infrastructure development projects
- To identify comparative funding models in other emerging or developmental economies, i.e. failures and successes, benchmarking, comparative analysis and best management practices, from other countries.
- To ensure using research analysis to make recommendations

The hypotheses to be tested for the funding models for the financing of water infrastructure in South Africa are:

- Current funding for the financing of water infrastructure is adequate and appropriate and therefore no need for substantial changes or alterations
- Government and its entities do have adequate financial resources for the financing of water infrastructure

The results and main findings from the primary (questionnaires, surveys, etc.) and the secondary data collection are presented in the following sections. This will demonstrate whether the objectives and hypotheses set were addressed in the research project.

5.2 Principles for the funding models

The framework for water sector infrastructure funding models was designed to meet the challenges presented by the current and growing imbalances which exist between the supply of and demand for water in South Africa (*cf.* Figure 5.1). To this end, the project was guided by the principles of achieving the key themes.

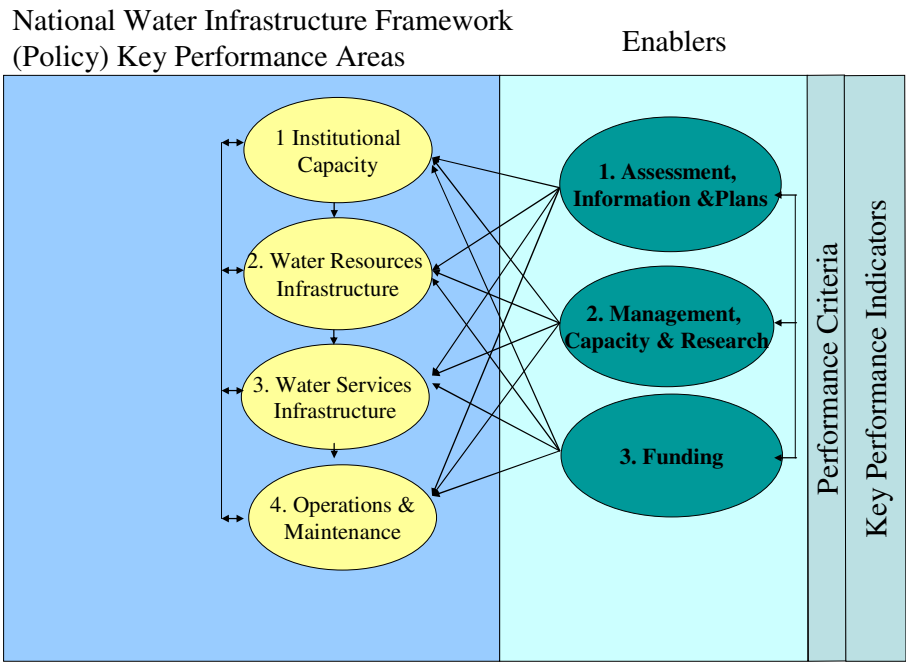


Figure 5.1: National water infrastructure framework policy with key performance indicators for water infrastructure in South Africa.

From the research results of the data collection, 10 principle drivers have been identified for the funding (financing) of water infrastructure development:

- Financing and investment framework/model - Alternative funding models for public water infrastructure, i.e. Water resources (dams, pipelines, canals, Information on gauging stations, etc.), water services (reticulation, water treatment works, waste water treatment works, etc.), including the application of Public Private Partnerships (PPPs) should be pursued where possible in order to encourage innovation and reduce taxpayer exposure.
- Sustainable asset management - Sustainable water infrastructure needs to consider the life time cost of funding water infrastructure and the contribution to the capital and operation expenditure cost of that infrastructure by the user.
- Viability and acceptability of real costs - Strategic issues for financing and management tools and value chain accounting for water resources and services – primary, secondary and tertiary principles (social and economic).
- Economics of water – economic criteria for water infrastructure; unpacking of New Growth Plan (NGP) and Industrial Policy Action Plan 2 (IPAP2) - meet the challenges in growth of demand.

- Hierarchical impact - Improved accountability for water security, availability and quality; and better management of supply and demand of water.
- Impact by development - Strategic positioning and importance of water; nett value of water (social and economic value).
- Financial management water - Barriers to investment in water infrastructure are removed by adopting a streamlined approach to legislation and the consultation process and how to manage and sustain a secure business (operational side).
- Trading of water entitlements (rights) - Greater weight should be placed on the jurisprudence set down by the Water Tribunal under the National Water Act when determining both public and private changes and resource consent applications in order to address poor quality outcomes.
- Return on investment - funding methodology to ensure maximum return on investment for new infrastructure development.
- Value of reliability, quality and sustainability, and financial and ecological sustainability of water resources and services and water infrastructure development.
- Governance structure – Consolidation and modernisation of water infrastructure consultation would provide a greater degree of certainty to the funders and developers that build and own water infrastructure.

In addition, the following principles were taken into consideration in the funding models design or formulation from the research results:

i. Improve economic inclusion and ability to provide affordable services and to cross-subsidise;
ii. Integrated risk management;
iii. Ability to leverage finance for commercial projects;
iv. It should lead to economies of scale;
v. Whatever model is chosen should not compete with local government but should complement local government constitutional mandate-improve service delivery;
vi. There must be ability to attract and retain necessary skills to operate and maintain infrastructure;

    The reforms should enable the DWA to take charge of the entire water value chain whilst recognizing legislative mandates of others; and
vii. Differentiated approach

5.3 Identifying the Funding Models for Water Infrastructure

The research results identified the specific funding models in existence and others that are needed for the development of future water infrastructure projects in South Africa. This could take the form of one or a combination of the following funding models:-

1. Funding by the National Revenue Fund (on-budget)
2. Funding through grants (MIG, RBIG, Conditional Grants, etc.) from the National Revenue Fund (on-budget)
3. Funding through the development of a tariff model (via balance sheet)
4. Funding through the raising of funds on the financial markets (off-budget)
5. Funding through Private-Public-Partnerships (Hybrid model – on-and off-budget)
6. Funding through the private sector markets – e.g. private sector investment in the form of Build Own Operate Transfer (BOOT) scheme (*cf.* Appendix 4 for different generic range of non-traditional service delivery initiatives)
7. Demand (market) risk funding model for water infrastructure
8. Innovative financing models
9. Establishment of special banks or financial institutions - to underwrite low interest loans for the investment in water infrastructure
10. Issuing of medium and long-term tax-free bonds
11. Creation of water infrastructure as a service entity, bureau or consortium (using of shares on the stock exchange or through private subscriptions)
12. Accessing of capital markets (revolving loans and other similar debt and equity structures)
13. Application of incentives (matching ratios to stimulate investment).
14. Alternative funding models in respect of government guarantee, a new paradigm shift.

In some cases depending on the implementation environment the models proposed above might fall short of raising the complete capital investment required for a particular water infrastructure development project therefore considering a combination of them would be more advisable.

5.3.1 Funding by the National Revenue Fund (on-budget) – Water Resources Infrastructure

The Department of Water Affairs is primarily responsible for infrastructure development. Spending grew from R4.8 billion in 2007/08 to R8.2 billion in 2010/11, at a mean annual rate of 16.3% (SD±3.5%), and over the MTEF period (2011/12 – 2013/14), spending will increase from R8.2 billion to R10.9 billion, at a mean annual rate of 8.8% (SD±7.7%). However, much of the financing (through augmentation from the Main Account), construction, implementation and commissioning of the bulk raw water infrastructure is done by the Water Trading Entity (*cf*. Figure 5.2). However, the regional bulk infrastructure is mainly developed by water service authorities and water boards. The Department of Water Affairs oversees and manages a total of 151 water and waste water infrastructure projects at various levels of government throughout South Africa. The total estimated cost of these projects is R70.9 billion. The projects are at different stages of completion and include those projects where new infrastructure is being built, or existing infrastructure is being refurbished, rehabilitated, upgraded or maintained. Infrastructure spending includes direct expenditure on national water resources infrastructure projects by the department through its public entities and indirect expenditure on regional bulk water and waste water infrastructure projects through transfers to water services authorities and water boards. Between 2007/08 and 2009/10, approximately R5.1 billion was spent on water and waste water infrastructure projects and in 2010/11 approximately R2.7 billion. Over the MTEF period, expenditure is expected to increase to R13.6 billion.

The *National Water Resources Infrastructure* programme consists of two components:

- *Infrastructure Development and Rehabilitation* provides for the design, construction and commissioning of new water resource infrastructure as well as the rehabilitation of existing infrastructure to ensure the safety and functionality of departmental dams and related infrastructure. It has a budget of R2.4 million in 2011/12 and R7.2 billion over the medium term, the bulk of which will be used for infrastructure development and related projects. In 2010/11, R1.9 billion was transferred to the water trading entity (WTE) to continue developments of and refurbishments to existing infrastructure such as dams, pipelines, reservoirs and canals.

- *Operations of Water Resources* provides for the augmentation of the Water Trading Entity to ensure the effective management of water resources and the sustainable operation and management of bulk raw water infrastructure. Over the MTEF R890

million will be spent, and an additional expenditure of R962.7 million would be allocated to the dam safety rehabilitation project. No other form of funding is available for water resources infrastructure operations and maintenance due to the fact that these water infrastructure assets are under the ownership of the national government.

The *National Water Resources Infrastructure* programme's sole responsibility is to provide transfer payments to the Water Trading Entity. The entity manages the development and rehabilitation of infrastructure as well as the operation of infrastructure on behalf of the Department. *Infrastructure, Development and Rehabilitation* expenditure increased from R1.2 million in 2007/08 to R3.04 billion in 2013/14, at a mean annual rate of 14.1% (SD±9.7%. The significant growth in the programme is as a result of additional allocations for water resources development projects. These allocations are disbursed as transfers to the Water Trading Entity (WTE). Over the medium term the Department will continue to transfer R7.227 billion for the construction of water augmentation and other projects. Over the MTEF period alone, expenditure in this programme is expected to grow marginally at a mean annual rate of 9.5% (SD±6.7%), from R2.2 billion in 2010/11 to R3 billion in 2013/14.

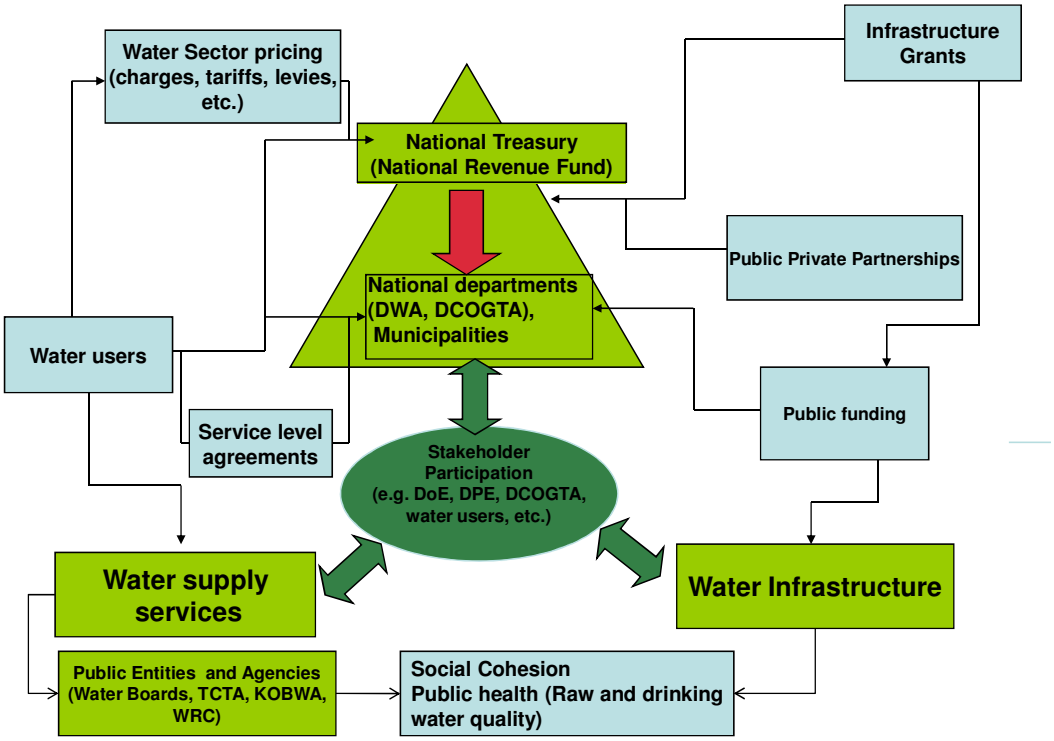


Figure 5.2: Main funding flows for water infrastructure in South Africa.

5.3.2 Funding through grants (MIG, RBIG, Equitable Share; Conditional Grants) from the National Revenue Fund (on-budget) - Water Services Infrastructure

5.3.2.1 Municipal Infrastructure Grant (MIG)

The Municipal Infrastructure Grant transfer to municipalities has grown significantly from R 5.938 billion in 2006/07 to R 12.529 billion in financial year (2010/11) and is further projected to grow to R 18.322 billion by 2012/13 – this represents a significant growth of more than triple the budget of 6 years ago. Spending has continued to consistently improve in the last few years.

While there are various backlog figures used, all sources show the extent to which many households lack basic services. Water services and sanitation (waste water) are the biggest concern in terms of backlogs in three provinces, i.e. Eastern Cape, KwaZulu-Natal and Limpopo (Table 5.1). Thus, for these backlogs to be addressed or eradicated alternative or a combination of funding models are needed.

Table 5.1: Current Levels of Access to Basic Services

Municipal Backlogs per Province	**Backlog (% with service below adequate)**			
	Electricity	**Piped Water**	**Sanitation**	**Refuse Removal**
Western Cape	6.0%	1.1%	6.6%	8.9%
Free State	13.4%	2.5%	30.6%	23.9%
Gauteng	16.5%	2.1%	12.2%	13.8%
North West	17.7%	10.1%	18.4%	45.2%
Mpumalanga	18.3%	8.7%	46.1%	58.5%
Limpopo	19.0%	16.4%	69.2%	81.3%
KwaZulu Natal	28.5%	20.6%	36.1%	48.1%
Northern Cape	12.7%	5.2%	45.5%	27.9%
Eastern Cape	34.5%	29.6%	51.1%	60.0%
South Africa	20%	11.4%	32.4%	38.4%

5.3.2.1.1 Municipal infrastructure delivery and management failure

The results from the primary data collected, from the DWA, DCOGTA, provinces and municipalities all indicated a concern over poor planning and adherence to a municipal financial framework model as required (*cf.* Figure 5.3). Ideally, the financial planning should include high level planning for all infrastructure, drawing from the detailed sector infrastructure plans (tying these together cohesively), and providing a sense of what is possible within financial and institutional constraints. Currently this is lacking.

The Municipal Infrastructure Investment Framework (MIIF) which aimed at assessing the required levels of capital and operating expenditure to meet 2014 service targets against the available finance to cover this expenditure indicate a serious shortfall in capital (*cf.* Figure 5.4). The estimated requirement for 2010 alone is some R 91 billion compared to the current budget (including ESKOM and Water Boards) of R 47 billion (*cf.* Figure 5.5). This shortfall partly relates to insufficient transfers, but the raising of revenue through rates and tariffs is an equally big concern. In assessing the options for closing this funding gap, the MIIF indicates the following:

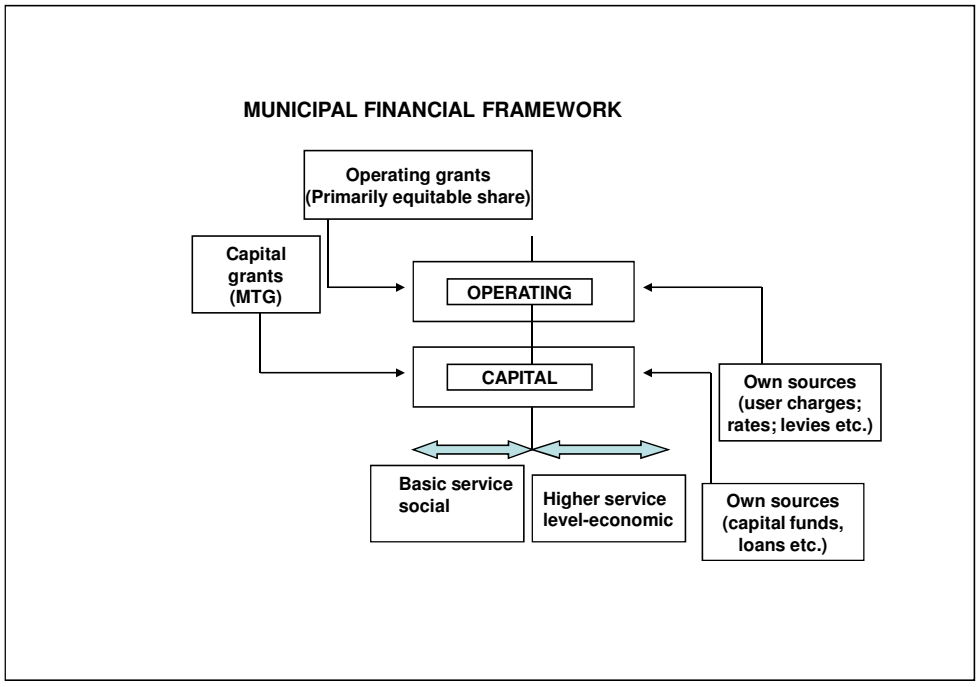


Figure 5.3: Municipal financial framework for water infrastructure at local government.

- Increased borrowing and funding from developer charges in A and B1 municipalities. B1 municipalities will still be finance constrained and will need to improve their credit worthiness to be able to access loan financing.
- In the case of B2 and B3 municipalities, the situation is highly variable and much depends on how strong their local economies are. Some will be able to borrow but not what is required in total. These will require higher levels of grant funding to deliver infrastructure effectively to meet growth and backlog eradication targets while at the same time provide for proper rehabilitation.
- In the case of B4 municipalities, their capital constraints are most severe and they only have approximately 40% of what is needed. This situation may only be rescued through much higher levels of capital grants or an acceptance of dramatically reduced service levels.

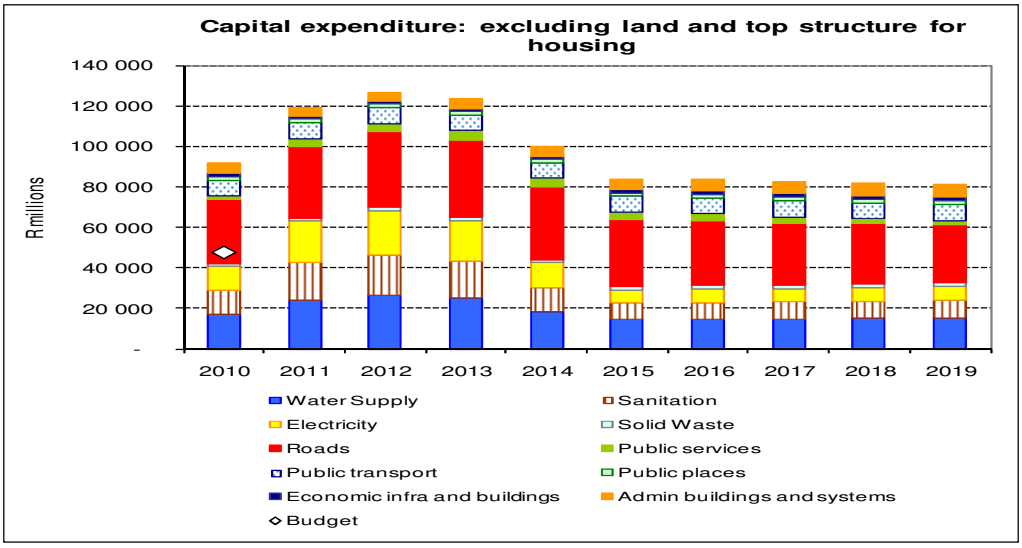


Figure 5.4: Capital expenditure per infrastructure class at municipal level.

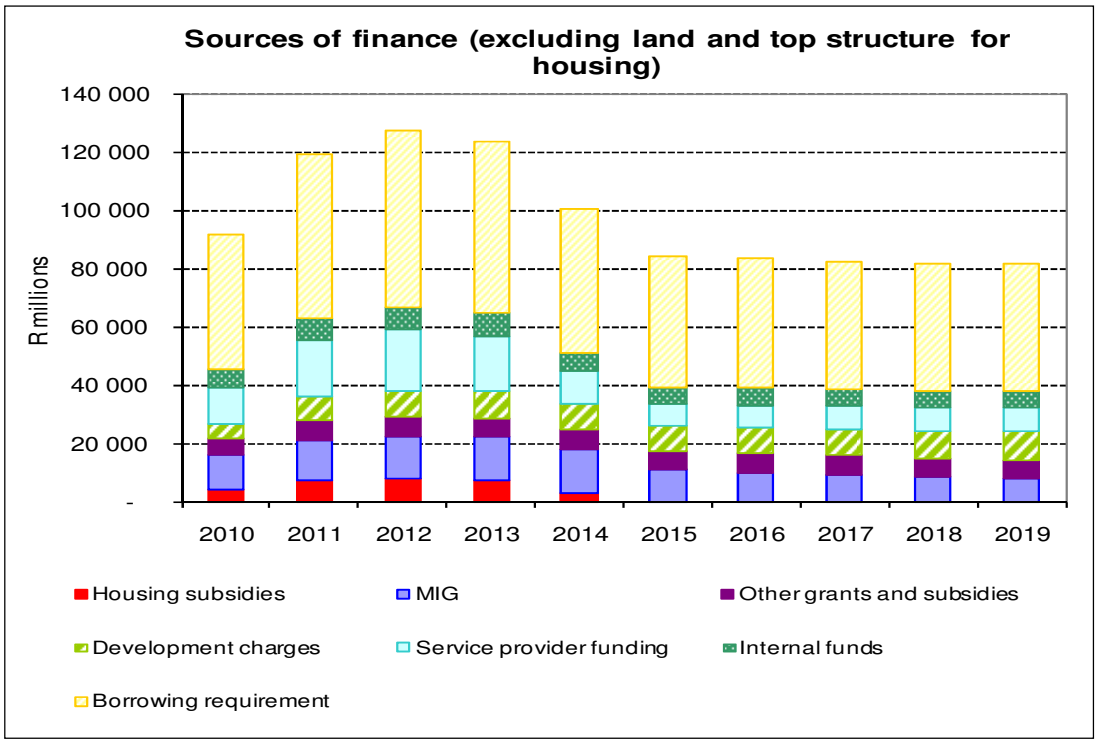
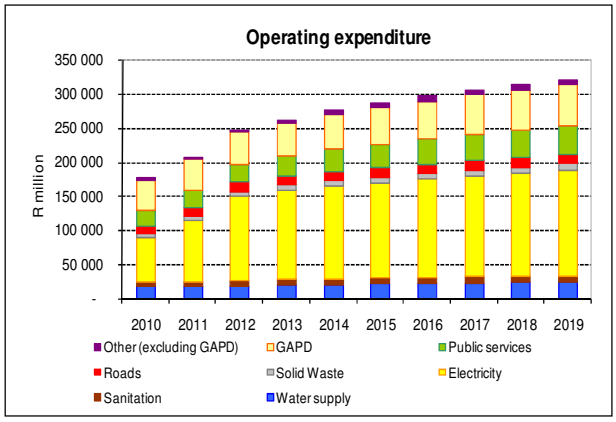


Figure 5.5: Required Capital Expenditure versus Available Funding.

The Figures 5.6 and 5.7 show the trend in terms of the viability (surplus or deficit) of municipalities overall and by each service.

The interpretation of the operating account results in total (for all municipalities in aggregate) are not strictly speaking correct as the situation is so variable across the categories of municipalities due to their vastly different income-raising capacity and infrastructure backlogs (*cf.* Figures 5.6 and 5.7). On average, if municipalities operate fully functional metering, billing and revenue collection systems (which is a rather significant assumption); they may be able to meet their operating requirements. But for economically weaker municipalities, the trend is rapidly downwards as they roll out services to mostly poor people. This downward trend can only be resolved by substantially higher funding or transfers for these poorer municipalities.



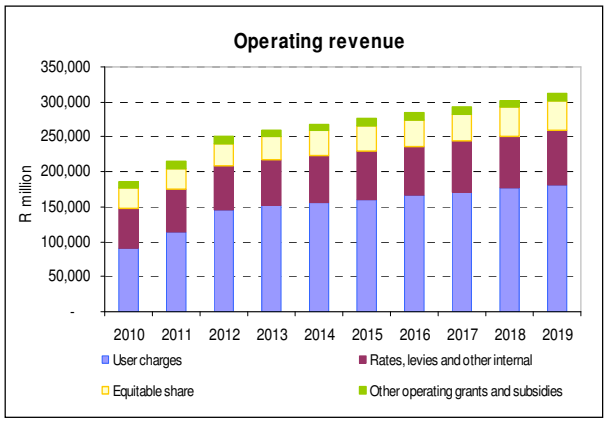
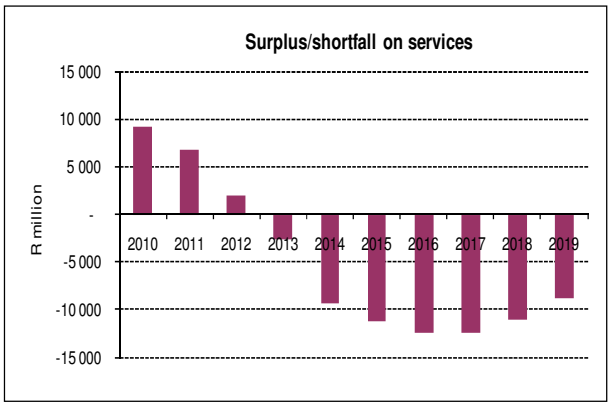


Figure 5.6: **Estimated operating balances overall and per municipal services**



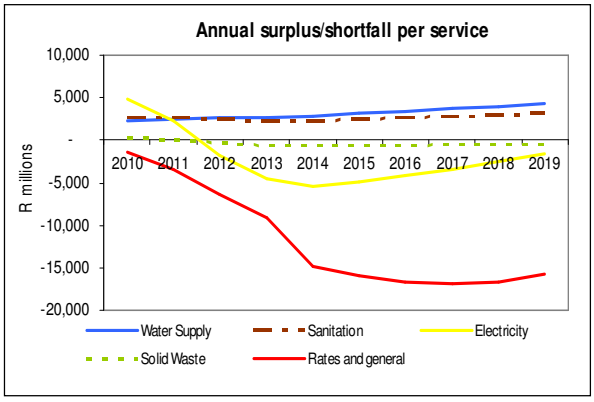


Figure 5.7: Funding Surplus/Shortfall overall and per municipal service.

5.3.2.1.2 Required Expenditure by Infrastructure type

Using the Municipal Infrastructure Investment Framework (MIIF) models it was possible to quantify funding requirements for the different services for the above municipal categories (high, medium and low capacity). This provides a sense of the differentiated funding requirements for each category.

5.3.2.1.2.1 Capital requirements

The total capital required to meet current backlogs and projected future demand as well as undertake required rehabilitation for all municipal services in all municipalities to be R970 billion over 10 years (including provision for escalation). These figures include the capital investment required by external service providers (Water Boards). The requirement in Year 1 to meet this 10 year target would be R91 billion. Of this R91 billion, R66 billion is required for the 'Big 5' municipal services (water, sanitation, roads, electricity and solid waste). The distribution of this investment by municipal category for Year 1 is shown below (*cf.* Table 5.2; Figures 5.6 and 5.7).

The data (using Year 1 for the purposes of this analysis) shows that:

- Low capacity municipalities require substantial capital for water infrastructure rehabilitation than for new infrastructure in total (this is mainly the backlog).
- At the other end of the spectrum, high capacity municipalities require a focus on new infrastructure (mainly economic infrastructure, e.g. urban transport systems and public places and water services) as well as rehabilitation (mainly roads and water supply systems).

Table 5.2: Capital Requirements (Rand billions) of high, medium, low capacity municipalities

Infrastructure by sector	Municipal category by capacity							
	Low capacity		Medium Capacity		High capacity		Total	
	New	*Rehab*	*New*	*Rehab*	*New*	*Rehab*	*New*	*Rehab*
Water	1,051	903	1,409	1,348	4,897	3,793	7,358	6,044
Sanitation	981	624	1,164	843	3,620	2,181	5,765	3,648
Electricity	1,720	749	1,343	968	2,887	2,234	5,951	3,950
Solid waste	70	-	284	0	1,013	40	1,367	40
Roads	837	13,131	1,834	7,937	2,882	5,670	5,553	26,737
All other	1,575	264	2,167	497	10,419	2,086	14,161	2,848
Total	6,235	15,670	8,202	11,593	25,719	16,004	40,156	43,268

5.3.2.1.2.2 Operating requirements

Operating expenditure is calculated in the MIIF as the amount required to adequately manage each municipal service (*cf.* Table 5.3). The total required operating expenditure for all services in all municipalities was calculated to be R2 726 billion over 10 years and R177 billion for Year 1. Of this R177 billion for Year 1, R108 billion is for operating the 'Big 5' municipal services, with water infrastructure requirements of R16 Billion. Municipal budgets target a total income of more than R24 billion of which R19.5 billion is collected for water supply and R4.6 billion from sanitation services. Water services generated a net surplus of about R4.1 billion which will be used to cross-subsidise other services or, if approved, could be used for recapitalisation of water services assets. About 55% of the operating expenditure (R12 billion) is used in the six metros and of the remainder, *ca.* R7 billions, is used by local municipalities and about R2 billion by district municipalities.

The data (using Year 1 for the purposes of this analysis) shows that (*cf.* Table 5.3):

- High capacity municipalities require a significantly higher annual operating amount than any other category.
- The operating requirements for low and medium capacity municipalities are similar in focus and magnitude.

Table 5.3: Operating Requirements (Rand billions) of high, medium, low capacity municipalities.

Infrastructure by sector	Municipal category by capacity			
	Low Capacity	**Medium Capacity**	**High Capacity**	**Total**
Water	2,239	3,426	10,915	16,580
Sanitation	865	1,653	4,831	7,350
Electricity	7,066	15,032	44,426	66,524
Solid waste	329	1,469	3,855	5,653
Roads	4,115	3,330	4,980	12,424
All other	4,715	13,181	50,107	68,002
Total	19,329	38,091	119,114	176,534

Current Infrastructure Budgets

Notwithstanding these estimated financing requirements, the current MTEF budgets are shown in Table 5.4 against the required funding levels.

The MIG MTEF allocations provide for: R12.529 billion in 2010/11; R15.069 billion in 2011/12 and R18.323 billion in 2012/13. The equitable share transfers projected over the MTEF period are: R30.168 billion in 2010/11; R33.940 billion in 2011/12 and R37.234 billion in 2012/13.

5.3.2.2 Regional Bulk Infrastructure Grant (RBIG)

The focus of the Water Services Regional Bulk Infrastructure fund is on regional and local bulk water supply and sanitation services. This includes "enabling infrastructure" required to connect water resources over vast distances with bulk and reticulation systems. An overview of all bulk infrastructure requirements in the country is ongoing and it is estimated that the total funding required is R112 billion.

Table 5.4: Funding Requirements against Current Budget Allocations per category (in Rand billions)

Municipal Infrastructure Grant Allocations	**Municipal category by capacity**			
	Low Capacity	**Medium Capacity**	**High Capacity**	**Total**
Capital Requirements (Year 1) against MIG Allocations (2010/11)				
Total MIG	4,286	4,175	4,068	12,529
MIIF round 7 total estimated capital budgets	8,504	9,457	26,639	44,600
Total Capital Requirements	21,905	19,795	41,723	83,424
% MIG contribution to Capital Requirements	*20%*	*21%*	*10%*	*15%*
% Estimated capital budgets vs Capital Requirements	*39%*	*48%*	*64%*	*53%*
Operating Requirements (Year 1) against Equitable Share Transfers (2010/11)				
Equitable Share	8,630	10,136	11,402	31,168
MIIF estimated operating revenue	21,515	38,375	123,411	183,301
Total Operating Requirements	19,329	38,091	119,114	176,534
% ES contribution to Capital Requirements	*45%*	*27%*	*10%*	*18%*
% Estimated operating revenue vs operating requirements	*111%*	*99%*	*97%*	*104%*

Regional Bulk Infrastructure Programme develops regional bulk infrastructure for water supply and water treatment works and supplements regional bulk sanitation collector systems as well as regional wastewater treatment works. Regional bulk infrastructure is required to connect the water resource, on a macro or sub-regional scale (over vast distances), with internal bulk and reticulation systems or any bulk supply infrastructure. The activities consist of connecting water from a water source to a municipal reticulation system.

Accelerated Community Infrastructure Programme implements an intervention to expedite service delivery through community infrastructure programme to achieve the target for universal access to water supply. For the 2010/11 financial year, a budget of R259 million was allocated. From the inception of the programme (2009/10 financial year), the funding is

utilised for the construction of new water services infrastructure projects (amongst which are wastewater treatment refurbishment, community water supply infrastructure).

The Regional Implementation and Support Programme finances regional infrastructure through transfers from the Department to provinces and municipalities. Expenditure in the programme grew at a mean annual rate of 16.5% (SD±2.9%), from R2.5 billion in 2007/08 to R4.3 billion in 2010/11. Over the medium term period (2011/12 to 2013/2014), the programme's budget increases at a mean annual rate of 11.4% (SD±9.1%) from R4.4 billion to R6.1 billion. This strong growth is mainly due to additional transfers to local government for the construction of water supply and distribution infrastructure. Between 2007/08 and 2010/11, transfers to municipalities increased from R733.2 million to R1.04 billion, at a mean annual rate of 9.8% (SD±18.1%), and over the medium term period, the transfers will decrease from R1.04 to R422 million, at a mean annual rate of -34.5% (SD±79.3%).

5.3.2.3 Equitable Share and Conditional Grants

Each province's and municipality's share of government's equitable share of revenue is raised nationally in respect of a particular the financial year. An envisaged division between provinces and municipalities of revenue anticipated are also raised nationally in respect of the next financial years, and which is subject to the provisions of the annual Division of Revenue Acts for those financial years. Each province and municipality equitable share is transferred to the primary bank account of the province and municipality, in accordance with a payment schedule determined by the National Treasury.

Conditional grants means conditional allocations to provinces, local government or municipalities from the national government's share of revenue raised nationally, which are provided for and whose purpose is specified in the annual Division of Revenue Act (DORA; NT, 2011c). Conditional allocations specifying the following:

- allocations to municipalities to supplement the funding of functions funded from municipal budgets;
- specifying specific-purpose allocations to municipalities;
- specifying allocations-in-kind to municipalities for designated special programmes;
- specifying incentives to municipalities to meet targets with regard to priority government programmes; and

- specifying funds that are currently not allocated to specific municipalities, that may be released to local government or municipalities to fund disaster response, i.e. damage to water infrastructure from floods, etc.

This had been implemented through the Water Services Operating Subsidy (WSOS) grant which has two components: Direct Transfers to local government and an Indirect Grant which provides for the refurbishment of water and waste water schemes which are not transferred to municipalities but are still with the DWA. In 2009/10, the WSOS grant had a total budget of R1.1 billion of which R871.2 million was for the direct grant and R209.5 million for the Indirect Grant. In 2010/11 the budget decreased to R845 million of which R670.1million was for the Direct Grant and R175 million for the Indirect Grant.

5.3.2.4 Infrastructure Operations and Maintenance Grants

This is needed in South Africa at national, regional (provincial) and local government level for reducing impacts to water resources and directly affecting water use sectors. It can be preventative measure for the further deterioration of water infrastructure. This grant could be a welcoming addition in the need for augmenting funding for water infrastructure operations and maintenance since there is currently no financial/funding reserves available for this function. This can be introduced in a phased approach similar to the current funding for the dam safety rehabilitation (DSRP) and regional bulk infrastructure grant (RBIG) programmes both currently being implemented and managed under the auspices of the DWA.

5.3.3 Funding through the development of a tariff model (via balance sheet) - Public Entities and other Agencies

5.3.3.1 Pricing Strategy for Water Use Charges

The current pricing strategy was gazetted in Government Gazette No. 29696 on 16 March 2007 (DWAF, 2007). The Pricing Strategy is seen as a process that evolves over time and is aimed at achieving the efficient and cost effective allocation of water (*cf.* Table 5.5; Figures 5.8 - 5.12). It was also meant to ensure the long term sustainability of water related infrastructure and the natural environment. The current pricing strategy makes provision for the cushioning of the effect of the periodic technical revaluation of the national water resources infrastructure (NWRI) assets and offers tariff capping and exemptions which mainly benefits the irrigation sector.

Current legislation (National Water Act, 1998 and Water Services Act, 1997) provides for a 3-tier pricing of water supply services, including (*cf.* Table 5.5; Figures 5.8, 5.9 and 5.11):

- Tier-1: raw water use from the water source or supplied from a government waterworks
- Tier-2: water supplied in bulk by public entities and agencies, i.e. water boards, TCTA, KOBWA
- Tier-3: water distributed to households (by water services authorities)

The Pricing Strategy contains the objectives, methodology and implementation strategy for setting water use charges as follows:

- ***Funding water resource management:*** Activities such as planning and implementing catchment strategies, monitoring and assessing water resource availability and use, water allocation, water quantity management, including flood and drought management, water distribution, control over abstraction, storage and stream flow reduction activities, water resource protection, resource quality management and water pollution control, water conservation and demand management and institutional development and enabling the public to participate in water resource management and decision-making.
- ***Funding water resource development and use of waterworks:*** The costs of investigation, planning, design, construction, operation and maintenance of government waterworks, as well as the pre-financing of development, a return on investment (assets) and the costs of water distribution.
- ***Achieving the equitable and efficient allocation of water:*** Economic incentives to encourage more efficient use of water, water conservation and a shift from lower to higher value uses.

Resource management and resource development charges are financial charges, which are directly related to the costs of managing water resources and supplying water from schemes and systems. Charges have be phased in progressively over time, and the target of achieving full cost recovery will therefore be achieved at different times for different water use sectors.

Similar provision is made for sanitation services, including (*cf.* Table 5.5; Figure 5.8):

- Wastewater collection charge (including the treatment costs)
- Bulk wastewater tariff (treatment costs)
- Waste Discharge Charge Tariff (polluter-pays principle) - aimed at internalising costs associated with waste and to encourage the reduction in waste load, thereby minimising the detrimental impacts on water resources.

According to the Water Pricing Strategy, any economic use of water is charged at the full cost of supplying water to the users over a 20-year term. It requires the payment of a capital unit charge (CUC) to repay the off-budget loan funding. This CUC is normally payable on a take or pay basis from the water infrastructure development projects when commissioned on the full licensed volume of each off-taker. The users agreed to pay on their license volume and not actual demand for water, to increase the bankability of the revenue stream. A systems tariff will apply where all commercial users will pay the same tariff. If the project's full funding is provided by National Treasury without refinancing the National Treasury for the commercial potion, the economic cost of water for the scheme to be paid back to government could be interest free and will then reduce substantially.

Appropriate pricing or tariffs for water has become an important issue for South Africa and have substantial impacts on demand and supply. Different water tariffs are employed in South Africa to ensure enough funds are collected to maintain and expand the supply infrastructure (*cf.* Figures 5.9 and 5.12).

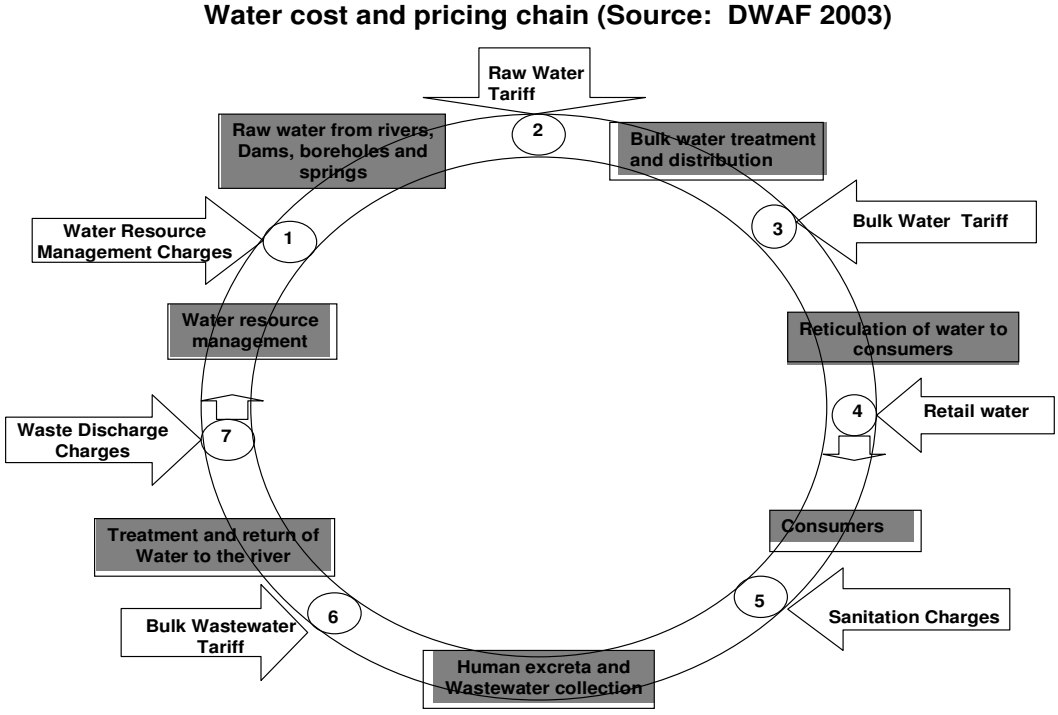


Figure 5.8: The water cost and pricing for water supply and water infrastructure in South Africa.

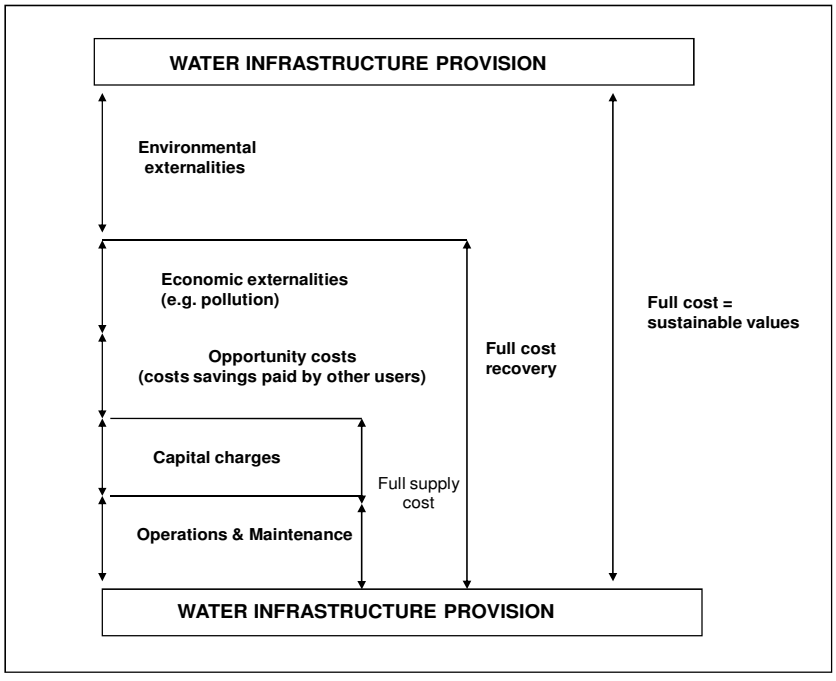


Figure 5.9: Funding and cost recovery for water infrastructure in South Africa.

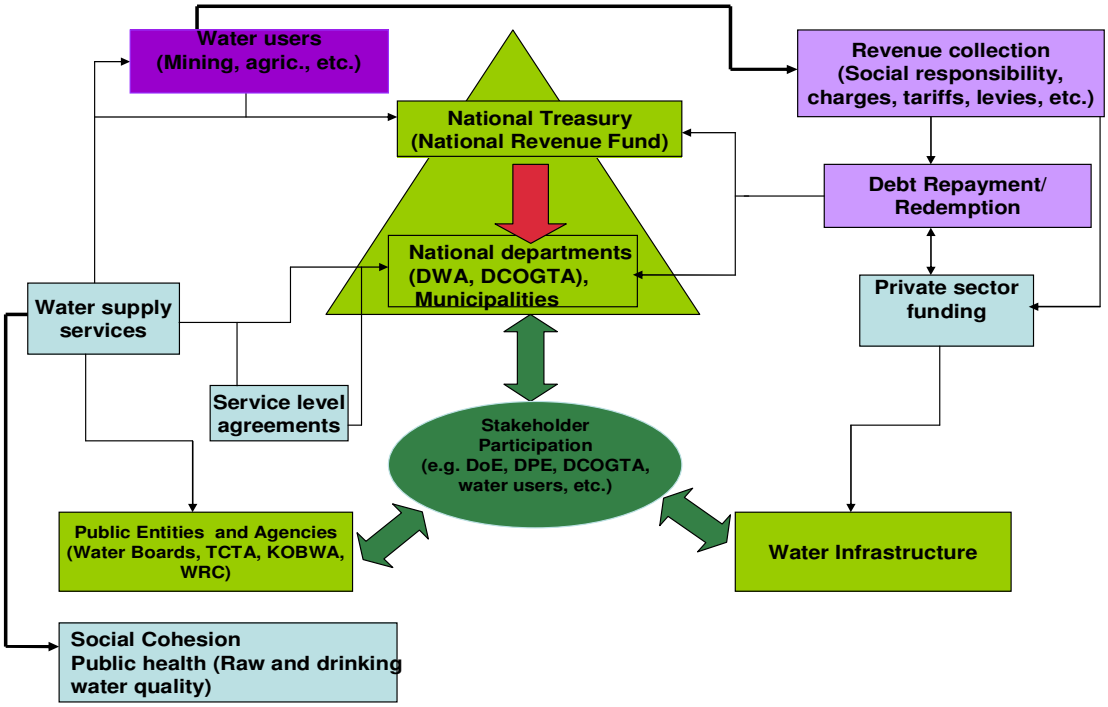


Figure 5.10: Funding of water infrastructure through the balance sheet (tariff model and private sector markets, if needed) in South Africa.

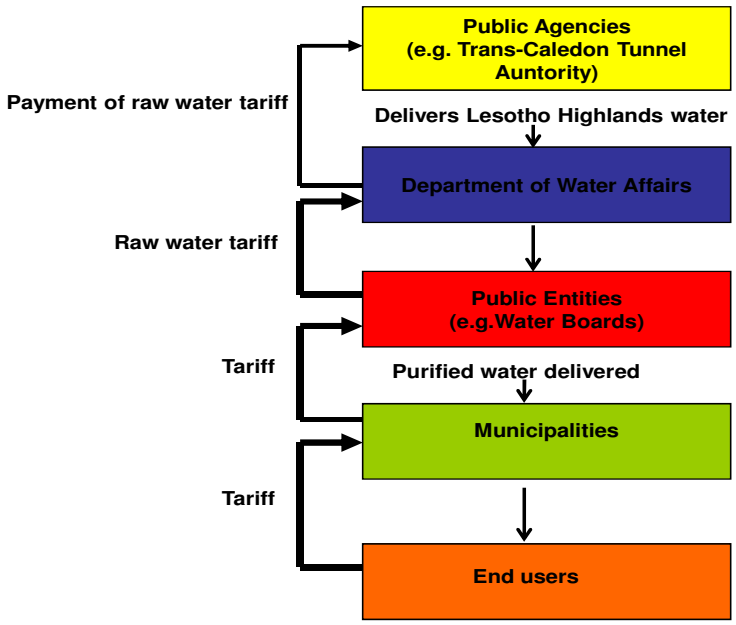


Figure 5.11: Different tariff structures for water using different water infrastructure

Table 5.5: User Fees for Water Infrastructure Facilities

Type of Infrastructure	**Possible User Fees**
Water supply	Metered water use (stepped block tariff system) Full costing for connections Seasonal pricing
Raw water usage charges (tariffs)	Depreciation costs (tariff) Water resources management charge Return of Investment (ROI) Operations and Maintenance (Capital costs) charge
Waste Discharge Charge System: Wastewater treatment Industrial wastewater treatment	Industrial and commercial effluent charge
Recreation	Access to water resources infrastructure and utilization of facilities Seasonal pricing Special district property taxes

Source: Raw Water Pricing Strategy of South Africa (DWAF, 1998; DWAF, 2007)

5.3.3.2 Marginal Cost of Water

Marginal cost is the change in total cost that arises when the quantity produced changes by a unit (*cf.* Table 5.6; Appendix 5). That is, it is the cost of producing an additional unit of a good. If the item being produced is divisible, the size of the marginal cost will change with an additional volume produced. The reason for this is that there will always be fixed cost which will remain the same with a variance in quantity, until such time when additional demand will required expansion of the production capacity.

In general terms, marginal cost at each level of production includes any additional costs required to produce the next unit. If making additional water available requires the building of a new dam, the marginal cost of this extra water will includes the cost of the new dam.

Table 5.6: Using a hypothetical example one could work out the marginal cost.

	Quantity of water supplied (A)	**Fixed cost (dams, pipelines) (B)**	**Variable cost (energy, chemicals, etc.) (C)**	**Total cost B + C = D (D)**	**Marginal cost 3D–2D = 3E (E)**	**Unit cost D / A (F)**
1	1 000 000	R10 000 000	R150 000	R10150 000		R10.15
2	2 000 000	R10 000 000	R300 000	R10300 000	R150 000	R5.15
3	3 000 000	R10 000 000	R450 000	R10450 000	R150 000	R3.48
4	4 000 000	R15 000 000	R600 000	R15600 000	R5150000	R3.90

In the example above (Table 5.6), providing the first 1 million units of water will cost R10 150 000 (R10 m for infrastructure + R150 000 for operations and maintenance), the unit cost of water will be R10.15.

As supply moves to 2 million units, fixed cost will remain the same (dam/pipeline), however, variable cost (energy/chemicals) will increase in proportion to the increased volume supplied. This will result in a marginal cost of R150 000 (due to the additional unit supplied), however the unit price will drop from R10.15 to R5.15 because the fixed cost remains the same (*cf.* Table 5.6).

As volumes move to 3 million units the marginal cost (the difference between line 2 and 3 in column E) is still R150 000 but unit cost reduces further from R5.15 to R3.48 also due to an unchanged fixed cost and an increase in volumes (*cf.* Table 5.6).

As volumes increase to 4 million units it is assumed that the dam and pipelines needs to be expanded, therefore a further R5 million is spent on upgrading the infrastructure, this increases fixed cost to R15 million, and variable cost will increase to R600 000. This will have the impact of increasing marginal cost by R5 150 000 (4(E)) (Table 5.6). Unit cost will also increase from R3.48 to R3.90.

In order to understand the marginal cost of water, the following details for each water infrastructure scheme:

1. Total fixed cost per scheme (ROI + Depreciation charges) or finance charges
2. Total variable cost per scheme (operations and maintenance charges)

3. Volumes sold from each scheme
4. Projected future demand
5. Cost of infrastructure development and expansion

5.3.3.2.1 Raw Water (Use) Tariffs

The raw water use tariffs/charges in terms of the raw water pricing strategy (RWPS) that influence the marginal cost of water covered:

(i) Water resources management (WRM) cost to plan, manage, protect, allocate and control water use from and water quality of water resources, which functions will in future be undertaken by CMAs per WMA. The mean annual tariff was R1.78/m^3 (SD±R0.94) for domestic and industrial for the survey, a not significant ($p>0.25$; $F_{0.05;\ 1,\ 36} = 0.626$; N = 38) mean increase of 12.32% (SD±0.48%) from 2008/9 (year-on-year), and slightly above the CPI. The mean annual tariff was R4.37 (SD±R0.95) per province, although not significant ($p>0.25$; $F_{0.05;\ 1,\ 16} = 0.304$; N = 18) increase from the previous year(s). The costs are very still low since much of these charges are currently subsidized form the national revenue fund (central fiscal).

(ii) Water resource infrastructure charges on Government Water Schemes (GWS). Such costs can include recovery of capital costs, taking cognisance of any state funded grant, social contribution and/or commercial loan funding. The capital should include refurbishment and betterments over the lifetime of the infrastructure. Added to this are the operating, maintenance and statutory costs. A spatial comparison between schemes, provinces and municipalities are used to assign the relevant charges/tariffs of schemes to the institutions. Due to DWA's revaluation of assets some schemes showed higher increases, which is expected to continue for a number of years due to a capping on increases specified in the DWA water pricing strategy. These capping and exemption provisions impact negatively on DWA's income generating ability, which in turn leaves insufficient funds for the development, maintenance and refurbishment of water infrastructure.

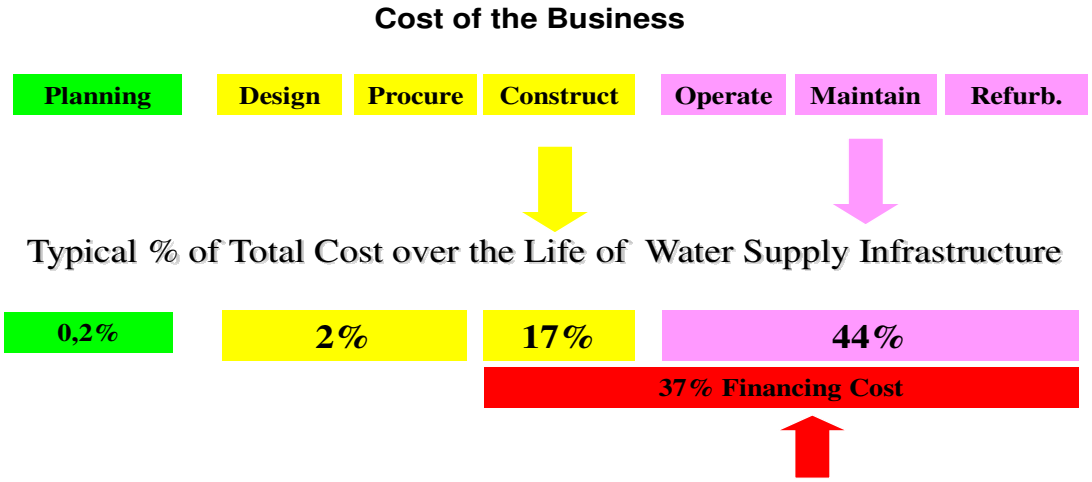


Figure 5.12: Total cost of the business for the water supply infrastructure

(iii) Economic charges such as incentives to increase economic value and efficiency of water use.

(iv) Waste Discharge Charge System (WDCS) to affect the "polluter pays" principle for mitigation of environmental costs, sustainable development, and protection of the resource. The main objectives of the raw water use charges are to ensure social equity, ecological sustainability, financial viability and economic efficiency.

5.3.3.2.2 Bulk Water Tariffs

Water boards act as intermediaries to distribute raw and potable water across vast distances to multiple users (i.e. regional water supply schemes). Not all municipalities are dependent on regional bulk water supply infrastructure and hence can operate independent of both DWA and water boards as long as they do so within the norms and standards of the Water Services Act, National Water Act and related regulations and strategies.

The mean annual tariff was R3.05 (SD±R2.35) per water board. The increases varied significantly with the mean increase of 14.33% (SD±20.57%) being above the CPI of 9.5%

for the period of surveyed. Most tariff increases were between 2% and 57%, however, above the CPI, although not significantly differently ($p<0.10$); $F_{0.05;\ 1,\ 34} = 2.239$; N= 36) from the previous year. The study identified the main customers of each WSP and intersected the supply areas with the local municipality boundaries to create a first-order linkage of WSP tariffs with municipalities. The bulk water supply figures are normally indicative since they vary significantly from scheme to scheme. Specific tariffs are negotiated between WSPs and WSAs.

5.3.3.2.3 Municipal Water Tariffs

The 2010 municipal tariffs reflect the outcome of a survey among all local municipalities which obtained tariff information from 236 out of 237 local municipalities. All tariffs quoted are VAT inclusive and the information includes the volume blocks used by municipalities and sell to them by water boards. Also captured were the raw water and bulk water tariffs which influence the determination of the municipal retail tariffs.

Municipalities expressed a concern regarding the cost of the raw water as well as life-cycle cost compared to their equitable share contributions. Municipalities indicated unaffordability of the water cost in the wake of water supply projects implementation and off-take agreements. It would therefore be required that National Treasury assists Municipalities financially not only by providing the funding for the water infrastructure, but also to fund the shortfall in equitable share over time.

5.3.3.2.3.1 Residential Domestic Water Tariffs

The national mean domestic water tariff, from the survey, for 2010 (VAT inclusive) was R5.98 (SD±R1.30) for the 6 kilolitre to 20 kilolitre (kl) block, R7.33 (SD±R1.66) for 20 to 60 kilolitre and R8.78 (SD±R2.17) for usage >60 kilolitre ($P<0.05$; $F_{0.05;\ 2,\ 24} = 4.17$; N = 27) (*cf.* Figures 5.13 and 5.14). In comparison, the provincial mean tariffs for the 2009/10 increased by 13.6% (SD±7.7%) for the 6-20 kl block, 13.1% (SD±9.6%) for the 20-60 kl and 16.9% (SD±10.4%) for the >60 kl block. These national increases were above the corresponding Consumers Price Index (CPI) of 9.5% year-on-year to March 2010/11.

The highest domestic water tariffs were in Gauteng, KwaZulu-Natal and the Western Cape. The higher tariffs in Gauteng and Western Cape were generally associated with the high cost

of water supply over long/vast distances (via inter-basin transfer schemes). The Western Cape, Gauteng and KwaZulu-Natal have had steep rise in their block tariffs, indicating a demand management approach. The low(er) tariffs are associated with areas that have high levels of poverty and low levels of affordability, i.e. Eastern Cape, Limpopo, Mpumalanga, North-West and Northern Cape Provinces.

About 57% of municipalities increased tariff within the CPI range, while about 23% of municipalities increased tariffs below the CPI and a further 20% increased tariffs at levels above the CPI range. Comparing the different tariff books, percentages increases were higher for the high-volume blocks, which indicate increased demand management and utilisation of income from high volume users to cross-subsidise the lower volume users. A comparison of urban and rural municipalities is about 10% below the equivalent tariffs in urban areas.

The mean commercial tariffs were R7.07 (SD±R0.48) for 6-20 kilolitre, R7.88 (SD±R0.32) for 20-60 kilolitre and R8.70 (SD±R0.30) for volumes >60 kilolitre/month (*cf.* Table 5.8). The respective increases in these tariff blocks were, 12%, 16% and 17%, which is in line with the increases of the domestic water use tariffs and about 20-70% higher than the CPI for the same reporting period. The commercial and industrial tariffs are higher than the domestic tariffs in the lower blocks and in line on the higher use blocks thus indicating cross-subsidisation to the domestic water use sector. This is to be expected as many of the new domestic water services are for the low income and indigent customers.

The tariffs for 2010 indicate that rural municipalities charging more than urban municipalities. This was attributable to the water shortages in rural areas, but can also indicate the need for cross-subsidization in the rural poorer municipalities. It must be noted that the user profiles differ from municipality to municipality and that it can be expected that affordability of users will reflect in the specific tariff structure of a municipality. In general, rural municipalities are less affluent and tariffs are expected to be cheaper for the lower blocks, while reducing the margin in the upper blocks.

The study further applied modelling techniques to gain a deeper understanding of the social and financial impact of the tariffs. The results are shown in Table 5.7 which indicates:

- The mathematical average adds the tariffs of all municipalities within each block and then divides the sum by the total number of municipalities (returns). This represents the average tariff between municipality institutions, regardless of their size.

- The population-weighted average considers the number of people affected within each Local Municipality (LM) and by each tariff block. This reflects the typical rates paid by a household for each block considering the fact that fewer people use the higher blocks due to limited affordability.
- The volume-weighted average considers people and their service levels, thus representing the average value of 1kl of water used in each of the blocks.

The population-weighted and volume-weighted average tariffs were higher in the upper blocks as the number of people using such an extent of water (high levels of services) was relatively few compared to the majority of people using water in the lower two blocks. The weighted averages would be better figures to use at national reporting.

Table 5.7: Applied modelling for the 2010 water tariffs per block.

Unit of Analysis	Tariff 0-6kl (incl. VAT)	Tariff (6-20kl) (incl. VAT)	Tariff (20-60kl) (Incl. VAT)	Tariff >60kl (Incl. VAT)
Mathematical average (Mean)	R2.49	R5.81	R7.22	R8.78
Population-weighted average (Mean)	R2.23	R7.26	R11.10	R13.40
Volume-weighted average (mean)	R2.21	R7.33	R10.13	R13.71

5.3.3.2.3.2 Commercial Water Tariffs

Larger municipalities have separate tariffs for commercial and industrial users (*cf.* Figure 5.13). Both Figure 5.13 and Table 5.8 summarize the average tariffs for commercial use of 2010.

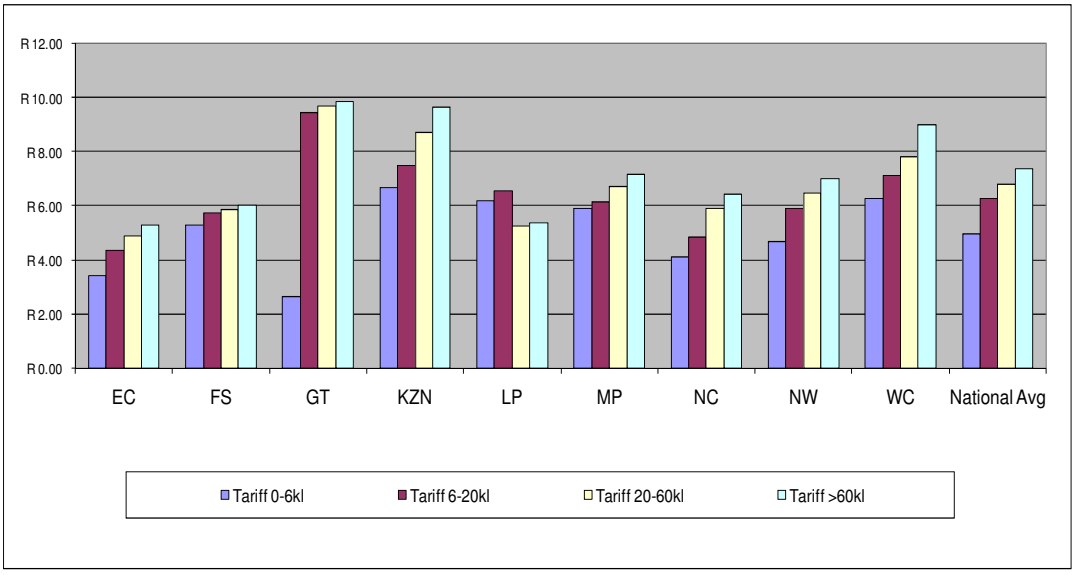


Figure 5.13: The average provincial tariffs for commercial and industrial users.

Table 5.8: Average commercial tariffs for 2010

Urban or Rural Dominance	Tariff 0-6kl (incl. VAT)	Tariff (6-20kl) (incl. VAT)	Tariff (20-60kl) (Incl. VAT)	Tariff >60kl (Incl. VAT)
Rural	R6.08	R6.59	R7.56	R8.49
Urban	R6.87	R7.54	8.20	R8.91
Mean	R6.52	R7.11	R7.92	R8.72

The following can be concluded:

- The increases from 2010 were as follows:
    - 17% in the 0 to 6 kl block
    - 14% in the 6 to 20 kl block
    - 17% in the 20 to 60 kl block
    - 19% in the >60 kl tariff block
- The percentage increases were substantially higher, possibly correcting some of the below-inflation increases. This may also be due to increased financial pressures in municipalities and the use of higher commercial tariffs to subsidize residential tariffs in the lower affordability areas.
- The higher increase in the upper blocks indicated the introduction of stronger demand management measures for this user group.

- The commercial and industrial tariffs were higher than the domestic tariffs in the lower blocks and in line on the higher use blocks thus indicating cross-subsidization to the domestic water use sector. This was to be expected as many of the new domestic water services were for the low income and indigent customers.
- Free basic water was generally not applied to commercial use thus making the first block much higher for the commercial users.
- Gauteng, KwaZulu-Natal and Western Cape had the highest tariffs, while Limpopo, Mpumalanga, North Cape and North West were on the lower end.
- Eastern Cape had the highest annual increases of 37% in the lower blocks up to 57% in the higher blocks, reflecting on the drought in the region and the demand management intervention.
- Limpopo, Free State and Gauteng were second highest with increases of 17% to 34% from lower to higher blocks. The other provinces had increases within the CPI.

5.3.3.2.3.3 Industrial Water Tariffs

In total, 110 of the 237 municipalities (46%) have indicated that they have industrial water tariffs (Table 5.8).

The following can be concluded:

- The highest tariffs were in Gauteng, followed by WC, KZN and NC. Lowest tariffs were in EC, FS and LP.
- Increases in industrial bulk potable tariffs were similar to the increases in residential tariffs and slightly less than commercial increases. The increases from 2008/2009 to 2009/2010 were:
    - 14% in the 0 to 6 kl block
    - 13% in the 6 to 20 kl block
    - 13% in the 20 to 60 kl block
    - 15% in the >60 kl tariff block
- Less than 50% of municipalities offered a bulk potable water tariff (108 of 237 LMs). The number had, however, increased significantly from the previous year (77 to 108 LMs) which indicated the rising need to cater for bulk industrial uses separately.
- It was also noted that the differences in blocks was not as significant as with residential tariffs and that no FBW was offered to these users.

- Most Local Municipalities (LM) in the Free State had a fixed tariff across all blocks with only 3 of 15 LMs applied differentiation.
- Bulk untreated water was provided by LMs at tariffs of about R4.19 per kl, varying little across the different blocks.

5.3.3.2.3.4 Comparison of Municipal Water Tariffs

Figure 5.14 compares the various tariff structures on an equal basis (i.e. all are consolidated to equal block sizes of 0-6kl, 6-20kl, 20-60kl and >60kl). The comparison indicates that:

- Residential domestic water tariffs had a steeper block structure. This was primarily to offer affordable basic services (often under cost) and to cross-subsidize from higher-end users to lower-end users.
- The big discrepancy in the first block was mainly due to the effect of free basic water on the average residential domestic tariffs, while commercial and industrial users did not apply free basic water. Industrial potable water tariffs were the highest and also showed the least differentiation between blocks. The flat structure implied less demand management and reflected the importance of water for economic growth and development.
- The detailed tariff lists furthermore showed that residential tariff structures had more blocks than any other tariff (up to 12). Commercial was second, while most industrial tariffs had less than three blocks.
- Indications were that commercial and bulk potable industrial users were cross-subsidizing the residential users in the lower blocks.

5.3.3.3 National Water Tariff

This national tariff or water sector specific tariff should be introduced in South Africa for funding the following:

- New capital water infrastructure for water security and for increase water demand and supply, i.e. specific funding for capital expenditure only.
- Operations and maintenance of water infrastructure to the extension of its remaining useful life (RUL), i.e. a separate funding mechanism for operations and maintenance (*cf.* Figure 5.15)

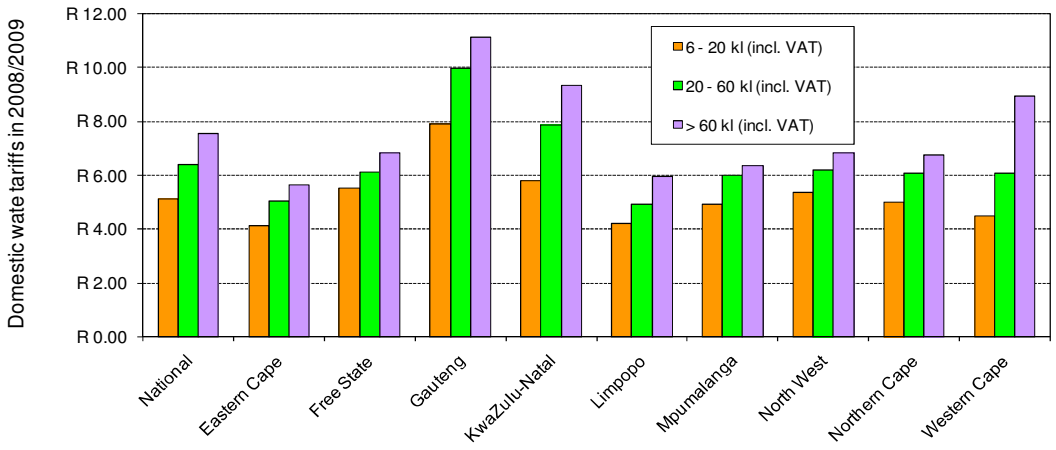


Figure 5.14: The average municipal water supply tariffs for domestic users are shown per province.

The above should be obtained and done at premium cost to ensure affordability and for cross-subsidization in the water sector, especially at local government level (municipalities) and amongst major water users in the country. Furthermore, it would ensure affordability, ensuring an income stream and minimize marginal cost. These mechanisms should be introduced since return of asset (ROA) investment is not enough and the DWA has not been able to create a reserve in the water trading entity (WTE) for capital expenditure on new water infrastructure and for operations and maintenance of existing water infrastructure.

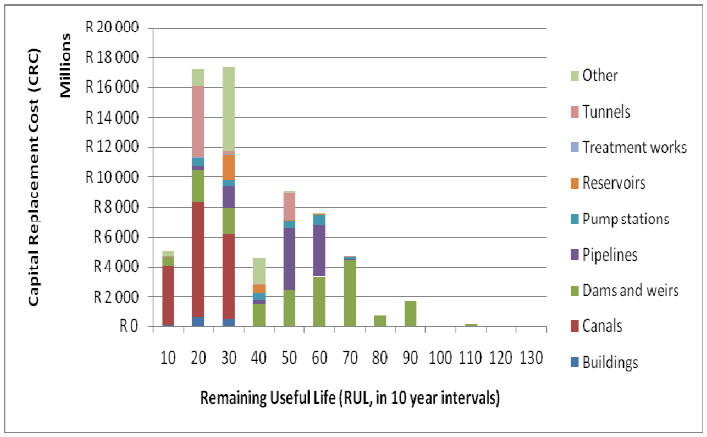


Figure 5.15: Remaining useful life (RUL) of water infrastructure in South Africa.

5.3.3.3 Water Trading Entity

5.3.3.3.1 Water infrastructure management

The Water Trading Entity (WTE) has two components, i.e. water resource management and infrastructure management. The focus here is only on the water resources infrastructure component which deals with the operation and maintenance of existing infrastructure as well as development of new infrastructure.

Currently, the national water infrastructure is valued at R147 billion. The Water Trading Entity recognises that the benefits of investing in infrastructure are derived from the dual purpose of infrastructure being a final good providing services directly to consumers (e.g. water) as well as an intermediate input that raises the productivity of other sectors (e.g. energy, mining, industry, commercial, etc.). In order to realise these benefits, it is imperative that the infrastructure provider is operationally efficient, that services are appropriately priced and that they are accessible to users.

The Water Trading Entity has unfortunately also not escaped from the general deterioration of its infrastructure during the past three decades. In part this was due to a shift in policy in favour of social development imperatives resulting in inadequate investment in maintenance of infrastructure. Operation efficiency, competitive pricing and accessibility continue to hamper water infrastructure delivery.

For the maintenance and supply availability of bulk water infrastructure, the following were identified:

- New augmentation schemes implemented – It comprises the development of new bulk water infrastructure using internal resources mostly for meeting needs of social users. When needs of commercial users are to be met and the full cost of the supply of water can be recovered, off-budget funding is employed. In such cases an implementing agent, to date mainly the TCTA, has been appointed;
- Utilising internal capacity and skill to implement new regional bulk water infrastructure systems and water services on behalf of the Department;
- Operating and maintaining existing water resource infrastructure valued at a replacement value of R147 billion to supply 7 billion m^3 of bulk raw water annually to users, either with in-house resources or on an agency basis. It includes the supply of bulk raw water and the collection of Revenue;

- Existing water resource infrastructure rehabilitated and refurbished; and
- Promotion of recreational use of water surfaces and surrounds by the development and implementation of Resource Management Plans (RMP).

A key focus over the medium term is to eradicate the backlog on maintaining rehabilitating existing national water resources infrastructure. Refurbishment and rehabilitation projects are undertaken to ensure the integrity of key large water infrastructure for the delivering of water to users. In accordance with the budget reprioritising imperatives, most of this expenditure is being allocated to schemes where the construction has already commenced.

5.3.3.3.2 Revenue management and benchmarking

Total revenue for the year 2009/10 and 2010/11 remained the same at R2.1 billion (*cf.* Table 5.9). This is due to construction revenue that showed a 74% decrease, due to reduction of project executed on behalf of third parties by construction unit. Total revenue increased from R2.6 billion in 2010/11 to R3.9 billion in 2013/14, at an average annual rate of 9.2%. However, the revenue is comparatively far lower, on *pro rata*, for the asset value of that for other state own entities (SOE) (*cf.* Table 5.9). The water resource management contribute an estimated revenue of R230 million and water resource infrastructure R3.2 billion for 2011/12 financial year. The increase over the medium term is due to increases in water resource management and water resource infrastructure charges, which are projected to increase from R2.6 billion in 2010/11 to R3.4 billion in 2013/14.

The entity is currently not generating enough revenue due to the price caps set by the water pricing strategy, and has incurred a deficit of R1.2 billion in 2009/10 as a result of this. The entity is therefore not able to generate enough revenue to fund the refurbishment, improvement of infrastructure assets and new development of infrastructure assets. Non-payment of accounts also impacts negatively on the entity's financial position. The total real expenditure (excluding reversal of depreciation on revalued assets and bad debts) decreased from R3.8 billion in 2009/10 to R3.6 billion in 2010/11, at an average annual rate of 5.4%. The annual increases are due to inflation related adjustments. After the inclusions of reversal of depreciation on revalued assets and bad debts, 2009/10 expenditure decreased from R3.2 billion to R2.9 billion as a result the annual average increases increased from 13% to 21%. The Water Trading Entity is currently billing for Trans-Caledon Tunnel Authority (TCTA) estimated revenue of R2.8 billion for 2011/12 financial year. This amount should be paid to

TCTA whether the Water Trading Entity has collected from its customers or not. The payment to TCTA is meant for repayment of loans.

Table 5.9: Benchmarking of the WTE with other infrastructure public entities in South Africa.

Comparison of State Owned Entity	**2007**					**2010**
	TRANSNET	**TELKOM**	**ESKOM**	**RAND WATER**	**SANRAL**	**WTE**
	R'000					
Asset value	77 254	59 146	128 579	6 257 337	9 826 333	66 260 107
Revenue	28 214	52 157	40 068	4 118 601	2 539 000	1 266 583

5.3.3.4 Water Boards

Over the MTEF period (2011 to 2014), water boards will reduce total interest bearing debt to minimise the cost of finance and interest. The financial plan will ensure that Water Boards contributes to an affordable tariff, maintains optimal debt levels, improve return on assets by investing appropriately in order to enhance its shareholder value.

Revenue collected by water boards comes mainly from the sales of bulk water to water services authorities in their areas. Revenue from the consolidated sale of bulk water increased from R7.2 billion in 2007/08 to R873 billion in 2009/10, at an average annual rate of 910%. Revenue is expected to reach R12.4 billion in 2012/13, at an average annual rate of 10.8%. This increase over the MTEF period is mainly due to the new approved tariffs in terms of the water pricing strategy. Expenditure is expected to increase over the medium term at an average annual rate of 12%, from R8.2 billion in 2010/11 to R11.5 billion in 2013/14 due to the combined effect of adjustments for inflation and the construction, upgrading and rehabilitation of water infrastructure. The water boards made a consolidated net surplus profit of R903 million which represents a decline of 29% from the previous year profit/surplus.

These cost increases comes against the background of a negligible growth in volumes sold and only a 4.4% increase in sales value. This suggests that overall water boards are transferring the benefits of their cash reserves to water users. However this practice needs to be reviewed against the background of anticipated Capital Expenditure (CAPEX) spending in the coming years. However, costs are being contained by redeeming a portion of the long-term loans, thus effectively reducing interest cost. It is anticipated that over the medium term these cost will be contained within budget. The refurbishment of infrastructure will result in efficient utilisation of resources which will also have a positive impact on cost containment.

5.3.4 Funding through the raising of funds on the financial markets (off-budget) - Special Purpose Vehicle

Currently the DWA uses two special purpose vehicles for raising funds from the financial markets, off-budget, for the financing of water infrastructure, i.e. the Trans-Caledon Tunnel Authority (TCTA) and Komati Basin Water Authority (KOBWA).

5.3.4.1 Trans- Caledon Tunnel Authority (TCTA)

The TCTA is a multidisciplinary organisation specialising in project financing, implementation and a specialised liability management entity. Its mandate is to raise off-budget finance for the development of bulk raw water infrastructure which delivers water for industries and consumers in a cost-effective manner (*cf.* Figure 5.16). It also provides financial and treasury management services together with tariff setting and debt management services.

The mandates granted to TCTA include managing, financing and implementing of bankable mega-water resources infrastructure projects (*cf.* Figure 5.16). TCTA's debt management strategies start with asset-liability framework that seeks to repay debt within a specific timeframe and that takes into account the base assumptions, viz. risk factors (controllable and inherent including mitigation measures of known risks), micro- and macro-economic factors (CPI, yield curve, liquidity, etc.) and project specific factors (credit risk, constructions risk, operational risk, etc.) (*cf.* Figure 5.16). The over-riding principle is always to apply revenues or water sales proceeds to fund ongoing operational requirements, reduce debt (current and future) and thus minimise future finance costs. Each project maintains adequate cash for

immediate maturities (usually up to 3 months) to increase efficiency both in terms of the cost of funding and the cost of cash management.

Finance cost forms the biggest part of TCTA overall cost. TCTA manages these costs by focusing on maximising the tenure of the loans, interest rates cycle, investment philosophy guided by TCTA investment policy, maximising draw-downs and maintaining appropriate capital structure without increasing the costs.

The TCTA derives its revenue from the sale of bulk water and the provision of advisory services to the water sector. The marginal increase masks some important developments in the work of the authority. Over the MTEF period, revenue is expected to grow at an average annual rate of 6%. Revenue will increase from R3.6 billion in 2009/10 to R3.7 billion in 2013/14 due to the income earned in water resources infrastructure which has become operational from July 2009, as well as the impact from tariff increases.

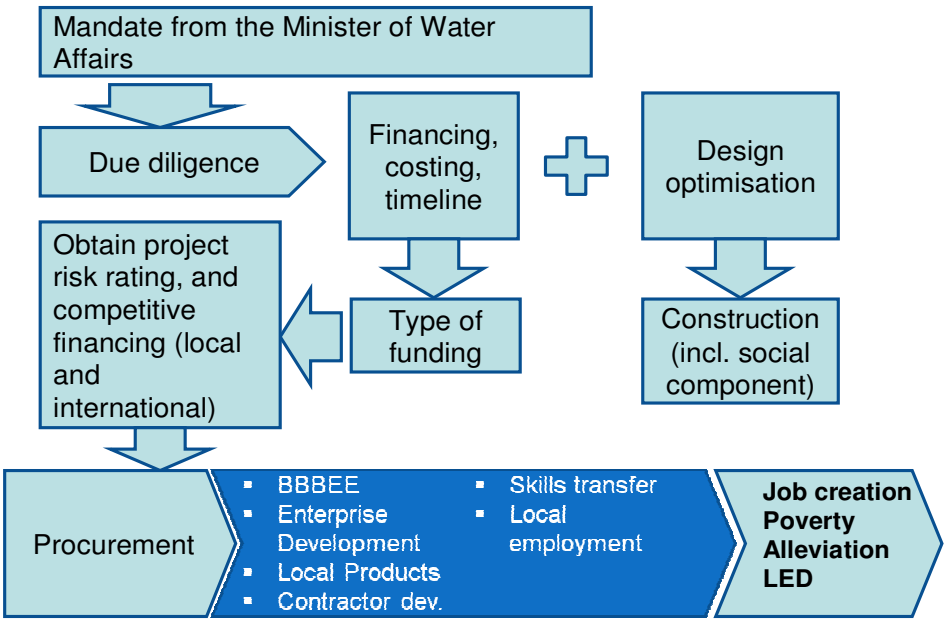


Figure 5.16: Operations model of TCTA for the implementation of water infrastructure projects.

Interest, dividends, rent and financing charges accounted for 80% of all expenditure incurred by the authority in 2010/11. Expenditure increased from R2.7 billion in 2007/08 to R3.7 billion in 2010/2011, at an average annual rate of 18%. Expenditure is expected to increase to R3.4 billion to R4.8 billion over the medium term, at an average annual rate of 11.7%. This is due to an increase in operational expenditure over the medium term as the number of projects the authority is mandated to implement increases from 3 to 7 with a total water resources infrastructure capital cost of R20 billion.

5.3.4.2 Komati Basin Water Authority

The Komati Basin Water Authority was established in terms of a treaty between South Africa and Swaziland. The aim of the authority is to manage the water resources of the Komati River basin sustainably. The authority is responsible for financing, developing, operating and maintaining the water resources infrastructure in the basin. (*cf.* Figure 5.16).

Total capital development costs for the water infrastructure (two dams) that this authority manages, including capitalised interest on debt capital, are R3 billion. With the construction of both dams complete, the authority's focus is on operations, including finance and loan administration, and maintenance of this vital bulk water supply infrastructure.

5.3.5 Funding through Private-Public-Partnerships

Although the government has taken the important and necessary steps, it should be recognized that in the past, that some public-private initiatives have been used for the implementation of water infrastructure development projects (*cf.* Figures 5.2, 5.10 and 5.17). Recently an institutional framework has been developed to guide this type of development and this both accounts for and contributes in part to the mixed experiences. The implementation of this framework is essential in allowing the inclusion of the private sector for the implementation of water infrastructure development projects. More importantly, this would also help convince the public that private involvement or other forms of non-traditional funding or delivery are appropriate (*cf.* Appendix 4). This is especially important when the public is not aware of the real cost of the infrastructure – a perception that needs to change. There have been attempts to involve the private sector in the creation of public infrastructure but not with the commitment, the consistency, or the legislative protection that would encourage and protect private sector investment and encourage long-term partnerships.

The consequences of government failing to work with private interests include increasing foreign investment in our few privatization initiatives due to lack of local experience and/or resources; potential capital flight and loss of local investment to offshore projects.

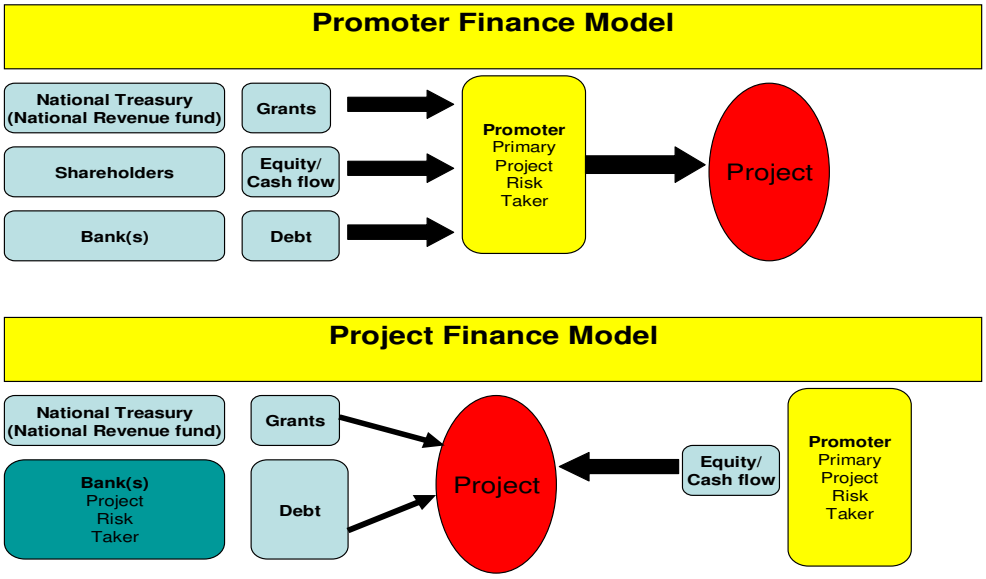


Figure 5.17: Promoter finance and finance models for Public-Private Partnerships for water infrastructure development in South Africa.

5.3.6 Funding through private sector markets

The DWA position on water privatisation is nuanced. Whilst there is strong support for the injection of private capital into new water infrastructure, customers are wary of full-scale water privatisation, whilst recognising that a well structured privatisation model could be part of the water infrastructure development and operations and maintenance solutions (*cf.* Figures 5.10 and 5.17). Understandably, customers fear that water charges would become 'another tax' with no improvement in the quantity and quality of the water infrastructure. If water infrastructure and water charges were to be introduced customers would want to see clear incentives and commitments for extra capacity. They would then be in a position to try and assess whether or not there would be a net gain in their own organizational cost-benefit ratio. The off-setting of tax reductions on water users would also be required. This could be funded by implementation of an Economic Recovery Plan, reducing current public spending and thereby permitting offsetting reductions in direct and/or indirect taxation elsewhere.

5.3.6. 1 Private sector investment tools

The following were identified from the data as financial management tools for the funding models for water infrastructure development projects:

- Private Sector investment in the form of Build Own Operate Transfer (BOOT) scheme (*cf.* Fraser *et al*., 2000).
- Establishment of special banks or financial institutions to underwrite low interest loans for the investment in water infrastructure (*cf.* Urban Logic, 2000).
- Issuing of medium and long-term tax-free bonds for specific or dedicated water infrastructure funding can also be generated through the issuing of bonds, however, is very dependent on market conditions and thus, research in present and future market conditions should be undertaken before applying this option.
- Creation of water infrastructure as a service entity, bureau or consortium - shares in this new organization can then be issued on the stock exchange or through private subscriptions (*cf.* Urban Logic, 2000);
- Accessing of capital markets for specific and dedicated financial assistance such as revolving loans and other similar debt structures (*cf.* Urban Logic, 2000);
- Application of incentives such as matching ratios to stimulate investment. Under this type of arrangement the central government would match (according to the specified ratio) the amount of funds invested into the water infrastructure by other groups. This type of venture would encourage governments to seek out investment for their water infrastructure so that they can access government funds (where appropriate) (*cf.* Nebert, 2001).

5.3.6. 2 Pension funds and infrastructure investment

While major investments of over R110 billion are necessary to close the infrastructure deficit gap, significant institutional funds appear to be available for the right type of projects if the investment process is understood and standardized. South Africa's largest public sector pension funds, should announce a major shift in its investment policy away from equities and towards infrastructure as an asset class necessary for its long-term pension requirements. South Africa's pension funds represent a vast and growing pool of finance that should be looking for long term investment opportunities presented by infrastructure projects, i.e. water

infrastructure. These investments are long duration assets that are expected to produce stable returns in excess of those obtained in the fixed income markets.

5.3.6. 3 Dedicated financial institution for infrastructure

There is an urgent need of a national infrastructure bank to help finance transformative projects of national importance (*sensu* Tyson, 2011). Realizing the highest possible return on infrastructure investments depends on funding the projects with the biggest impact and financing them in the most advantageous way (*sensu* Tyson, 2011). Properly designed and governed, a national infrastructure bank would overcome weaknesses in the current selection of projects by removing funding decisions from politically volatile appropriations process (*sensu* Tyson, 2011). A common complaint today is that projects are often funded on the basis of politics rather than efficiency. Investments could instead be selected after independent and transparent cost-benefit analysis by objective experts.

5.3.7 Demand (market) risk funding model for water infrastructure

The provision of finance is an essential ingredient into the overall strategy for national water infrastructure. If it was not to be forthcoming there would be a number of risks and actions which could not be taken. The finance available should be used to augment in the most economic manner rehabilitation and refurbishment which have the highest economic benefit first and then used for future investment. If the total capacity to obtain finance is not there, there is a risk that the infrastructure will continue to deteriorate from its existing poor level with consequences of failure to supply as well as quality issues which may well be akin to those of ESKOM.

There is a risk that if tariffs are not tapered fairly rapidly to a reasonable economic level with explicit subsidies and social pricing as inherent ingredients then the operations and maintenance will continue to decline and stagnate with serious consequences not only to the health but to the population and livelihoods whether they be agricultural, industrial or other.

The *first challenge* is therefore to explore the availability of finance from the traditional sources namely the National Treasury (NT) and through off balance sheet funding through the TCTA. The *second challenge*, which depends on the decision about the National Water Resources Infrastructure Agency, is to see whether a further line of finance run directly by

the Department could be established. The *third challenge* is then to explore other off balance sheet sources of finance both from other agencies such as The World Bank and private sector finance with in some cases finance guaranteed by end users. The *fourth challenge* is to obtain political support from all levels the sources of funding for tariff changes improvements to the regulatory framework and the recognition that enhanced tariffs applied equitably are essential.

These types of water infrastructure projects are where the private sector bears market (demand) risk and revenues are typically derived directly from the users of the infrastructure rather than government (*cf.* Figure 5.18). Examples of economic infrastructure projects include water infrastructure projects in South Africa (*cf.* Figure 5.18). This approach to sourcing revenue differs markedly from so-called social infrastructure projects (water services supply to communities), where the government retains demand risk and provides revenue directly through a performance based payment mechanism (National Revenue Fund). The private sector is paid a service payment (or availability payment) by the government subject to the private sector providing the contracted facilities and services in line with the contract standards.

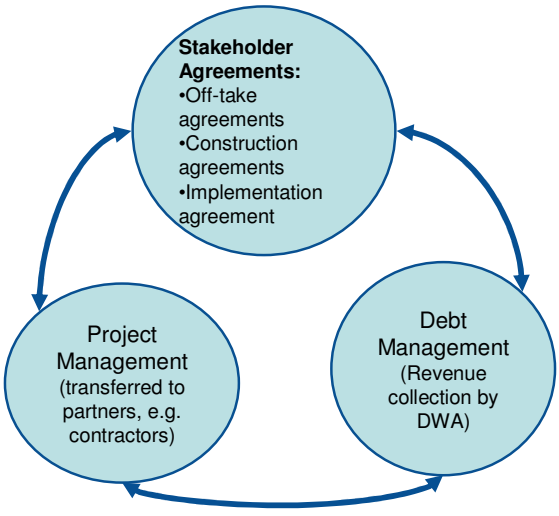


Figure 5.18: Risk model for the water infrastructure development projects in South Africa.

5.3.8 Innovative financing models

The data obtained exemplified that innovative financing must be embraced by the government as the preferred alternative to deliver certain large public infrastructure projects (Figures 5.19 and 5.20). Government must provide leadership on innovative financing as the private sector cannot credibly promote these ideas due to their perceived vested interests (Figures 5.19 and 5.20). Everywhere innovative financing has been successfully applied; it was spearheaded by the government, with the private sector participating only after the "rules of engagement" were clarified.

Three innovative financing models allow the public and private sectors to forge efficient partnerships and enable a robust pipeline of economic infrastructure to be built around the country without delay (Figures 5.19 and 5.20). Importantly, these models allow the public sector to provide capital that can also earn a potential return and are recycled (Figures 5.19 and 5.20).

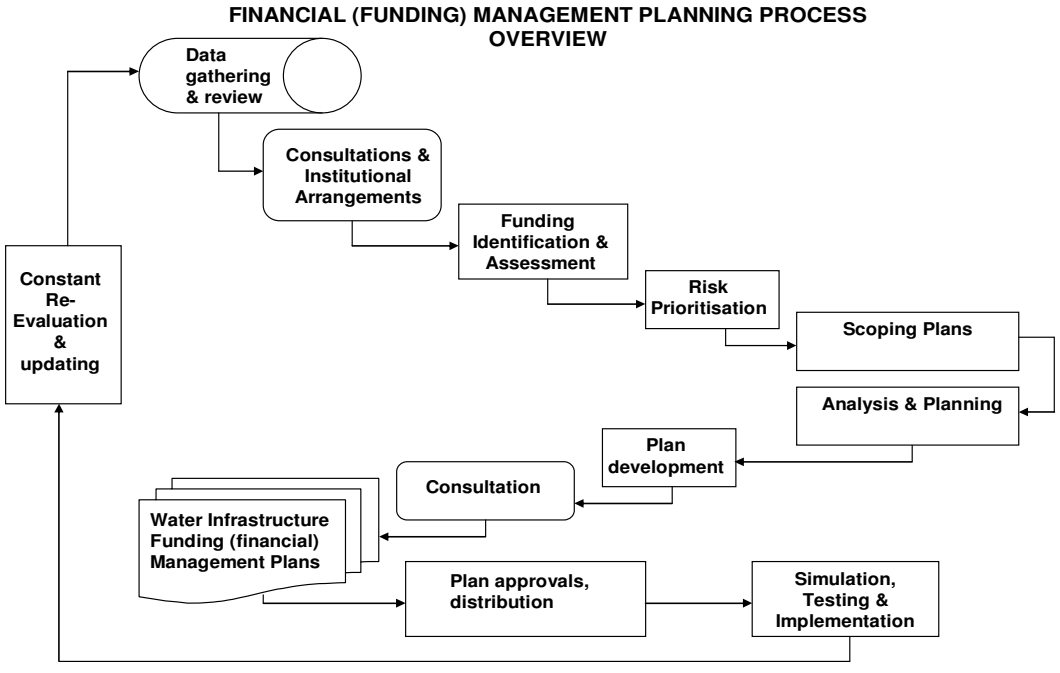


Figure 5.19: Water infrastructure funding flow process.

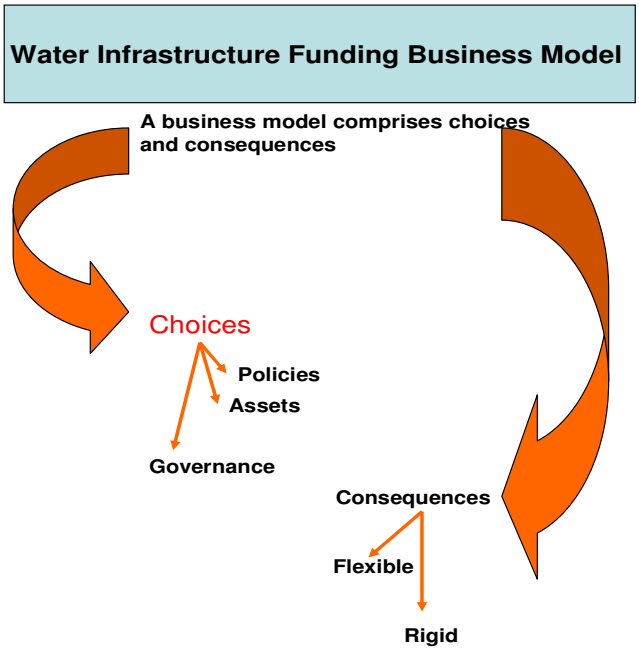


Figure 5.20: Possible funding business model for water infrastructure (Adopted from Casadesus-Masanell and Ricart, 2011)

Model 1: Public sector subordinated notes

Aside from mitigation of demand risk one of the key considerations to be made in financing economic infrastructure projects is how public funding can best be structured alongside private sector capital (Figures 5.18, 5.19 and 5.20). There is a need for more innovative funding solutions to ensure the public sector is treated as a true partner of the private sector with consideration of how public sector capital is secured and ranked alongside private sector debt and equity (Figures 5.19 and 5.20). Simple provision of public sector grants does not meet these goals.

Critically the public sector needs to participate in this future upside as the public sector capital contribution contributed to the de-risking of the project (Figures 5.19 and 5.20). This means utilising more complex funding instruments rather than simple upside sharing of revenue (Figures 5.19 and 5.20). One way to achieve this is through government-issued subordinated notes.

Model 2: Public Sector Development Entity (State Own Entities/Enterprises)

For those situations where it is almost impossible to secure any private sector funding for infrastructure projects on reasonable terms, an alternative option would be for governments to step in and take responsibility for the project during the development stage (Figures 5.19 and 5.20). The intention would then be to refinance the project with private sector capital after it is built and revenue streams have been proven.

Projects could be financed with public sector debt and equity and be structured along commercial lines aiming to replicate the private sector (Figures 5.19 and 5.20). Consequently, water infrastructure projects would be provided with an arm's length concession. Water use charges would be set to provide a viable finance plan (*cf.* Table 5.5; Figures 5.9, 5.19 and 5.20). Subject to the construction works being satisfactorily completed and the actual water use reaching a stable level, steps could then be taken to sell water infrastructure project.

Model 3: Public Sector –supported Super Fund Vehicle

The third model aims to tap into superannuation funds. Super funds are conservative investors and have been burnt in the past by investments in green-field infrastructure assets, where it must be taken on construction and patronage risk (Figures 5.18, 5.19 and 5.20). This makes super funds more inclined to invest in brown-field assets – that is, developed assets that have been built and achieve stable revenues (Figures 5.19 and 5.20). Due to their long-term investment horizon and conservative risk profile super funds are the logical long term investors in economic water infrastructure assets.

Under this model the public sector might co-invest equity alongside super funds and provide revenue guarantees over the asset for a specific period of time (Figures 5.19 and 5.20). The guarantee would fall away once certain revenue thresholds have been met, which could be three to four years after the new infrastructure has been opened. Here, the public sector is simply providing a bridge for private sector finance (Figures 5.19 and 5.20).

5.4 Alternative funding models

In attempting to unlock the challenges in terms of the funding of water infrastructure, a few alternatives were proposed form the research results which could be considered in order to make the water infrastructure development projects bankable and ensure implementation (*cf.*

Table 5.10). The options seek to provide clarity on the form of credit enhancement with the related impact on DWA, NT and TCTA.

Table 5.10: Envisaged Government financial support models, alternative funding models, in the order of preference

OPTION	DESCRIPTION	IMPACT TO FUNDING	IMPACT TO PROJECT DELIVERY
1	**NT provide funding via DWA and/or WTE for full mplementation of water infrastructure projects**	Provide funding for social and commercial portion on-budget. NT can consider options of repayment, e.g. consider as pre-funding and DWA pay tariffs back to NT to fully refund investment cost (with or without interest component), consider as seed funding from NT to DWA to assist in establishing sustainable WTE. To ensure the full economic value of water is reflected, i.e. commercial and social components are reflected in the full demand. The DCOGTA to budget for social component whilst the municipalities grow into their full demand. Charge "elevated" commercial tariffs, and/or steeper block tariffs as allowed for in the Pricing Strategy. Lowest tariffs achieved for domestic	DWA/SPV (e.g. TCTA, WBs, KOBWA, etc.) able to implement. This addresses the crux of the ability to commit to bankable water supply projects. The users can then pay for water at the time when they actually use the water instead of a take or pay principle which most are opposed to.

		water users, where needed.	
2	**NT provide pre-funding via DWA and/or DCOGTA and once the Project is bankable, SPV (e.g. TCTA) could refinance it off-budget and repay NT.**	NT provide pre-funding of the commercial portion. NT being refunded if required in future once the project is bankable through committed off-take water agreements. NT enabling the project to be implemented whilst being fully refunded at a future point in time. Full costs will be recovered over time from the commercial users to Government and is therefore not seed funding but covering funding for a bridging period. Commitment to social funding by fiscus through MTEF (DWA and/or COGTA).	DWA/SPV able to implement. SPV (e.g. TCTA) able to raise off-budget funding in future with committed revenue stream at that stage. This addresses the crux of the water users' ability to commit to bankable water supply projects. The users can then pay for water at the time when they actually use the water instead of a take or pay principle which they are opposed to Cost effective funding
3	**NT provide explicit Government guarantee for the full project cost**	A committed guarantee for the full project (social & commercial). NT makes good the revenue stream shortfall in the bridging period to repay the loans. This is different in that the exposure of NT is only limited to the portion of the project income not recovered shortfall. NT can be assisted in the event of unavailable	Enabling the SPV to raise funding on an off-budget basis. This will address the crux of the water users' ability to commit to bankable off take water infrastructure projects and agreements. The users can then pay for water at the time when they actually use the water instead of a take or pay principle. No

		liquid cash from the National Revenue Fund to fund the social component whereby SPV (e.g. TCTA) can raise the funding for social against the Guarantee and NT covers the loan payments over an extended period. Full costs will be recovered over time from the commercial users to Government and is therefore not seed funding but covering revenue shortfalls.	refinancing risk for the project. Cost-effective funding.
4	**NT provide explicit Government guarantee for the commercial portion until the incremental commitment is fully committed by the water users and social funded by the National Revenue Fund (NRF).**	A committed guarantee for the commercial portion of the water infrastructure project. NT makes good the shortfall in the income stream to repay the loans sourced in the market for the commercial portion. NT's risk on providing the guarantee is limited to periods of shortfalls and not full exposure of the loans. Commitment to social funding by fiscus through MTEF. Full costs will be recovered over time from the commercial users to government and is therefore not seed funding but covering revenue shortfalls.	SPVable to implement. Enabling the SPV to raise funding off-budget for the commercial portion. No refinancing risk for the commercial portion of the project. This addresses the crux of the water users' ability to commit to bankable water supply projects and agreements. The users can then pay for water at the time when they actually use the water instead of a take or pay principle. Cost- effective funding.
5	**NT provide short-**	NT provides an interim	SPV able to implement.

	term interest cover guarantee for commercial portion until projects reaches bankability and social funded by the fiscus. TCTA to refinance once bankable	guarantee to pay the interest shortfall until the project reaches bankability without Government support. NT's risk on providing the guarantee is limited to periods of shortfalls in interest payment and not full exposure of the loans. Commitment to social funding by the NRF through MTEF.	Enabling SPV to raise funding off-budget for the commercial portion with extended repayment terms of 20-years after bankability instead of 20-years after implementation. This addresses the crux of the water users' ability to commit to bankable water supply projects and agreements The users can then pay for water at the time when they actually use the water instead of a take or pay principle.
6.	**10-year explicit Government guarantee and underwriting the risk of refinancing in year 10**	10 year committed explicit guarantee. Underwriting commitment for the balance of the project life. Reduced commitment by government for refinancing in year-10 which will be without an explicit government guarantee and based on the committed revenue stream at that stage. NT makes good the income stream from the water users if insufficient funds are received in the 10 year period for SPV to meet the financial obligations to the funders. Full costs will be recovered over time from	SPV able to implement. Enabling SPV to raise funding off-budget for the commercial portion. Refinancing risk for project underwritten by NT as financiers will not accept non-guaranteed refinancing risk. SPV should be able to refinance in year 10 as construction risk is eliminated and revenue streams would have been established. This addresses the crux of the water users' ability to commit to bankable water supply projects and agreements.

		the commercial users to government and is therefore not seed funding but covering revenue shortfalls. Commitment to social funding by NRF through MTEF.	The users can then pay for water at the time when they actually use the water instead of a take or pay principle.
7	**Preference shares issued by Development Finance Institution(s), i.e. IDC, DBSA, AfDB, WB, etc. to take care of cash flow mismatches.**	Provide some level of comfort and support to the issuer in terms of PFMA due to the strategic nature of the water infrastructure project from the development impact. No requirement to make good any shortfall because the dividends and capital repayments will be matched to available cash flows at any given point otherwise they will be accrued. Provide funds for the social component of the project. Financial institutions have expressed interest in this project as such it will spare SA Govt financial resources. However, funders have indicated that they will be required unequivocal support of SA Government. Preferably this could be a debt instrument or quasi debt instrument offered by the	SPV able to implement. Increased ability to raise funding off-budget. No stringent requirement for take or pay principle. No refinancing risk for the commercial portion of the project. SA Government financial resources will be spared for other competing high priority projects. SPV able to implement the full project on off-budget. No stringent requirement for take or pay principle upfront. This will be one of the tests of the potential benefits.

		Development Finance Institutions with clear redemption strategies Since this could be tied funding wherein private companies would require to implement the project, this could happen in a joint venture arrangement in accordance with South African terms and conditions.	

The funding models in respect of the government guarantee suggest a paradigm shift in the manner in which a traditional guarantee model is structured in that the NT's financial exposure will be limited to the shortfall in the income stream from the users as a result of timing mismatches. Furthermore, this research project has fully exhausted exploring all the commercial structuring models for water infrastructure projects and has come to conclude that a level of government support is required.

5.5 Comparative analysis: Solving the water infrastructure problem

From the desk top comparative analysis, South Africa is not alone in this dilemma, other emerging and developing countries (economies) face a similar significant infrastructure funding deficit. Some of these countries have addressed this problem earlier and have found acceptable methods of integrating private funds and initiatives to help pay for some of their public infrastructure requirements. This has sometimes been a trial and error endeavour as not all were successful. South Africa can learn from this experience and from countries that have a track record of involving the private sector in some manner in the delivery or financing of their public infrastructure requirements. These include:

- In Australia, the first design/build/finance/operate (DBFO) occurred in the early 1990s. In some cases these failed and the public sector had to re-assume responsibility for the schemes. Victoria, New South Wales and Queensland have now developed partnering policies and ambitious plans for future investment. A Nation PPP Forum was set up in 2004 to facilitate greater consistency and cooperation across

jurisdictions in the provision of infrastructure through public private partnerships (PPPs). Information at the National PPP Forum indicates that across the country, there are currently 29 projects being contracted, 17 projects in the market, and another potential 17 projects in the pipeline, of which 5 projects are expected to be released to the market within the next 12 months.

- Brazil enacted a Public-Private Partnership (PPP) law to attract private investment for important infrastructure projects. The Bill establishes general rules and requirements for public-private partnership bidding processes and contracts within the jurisdiction of the government and public sector entities. It also creates an executive managing group with the objectives of setting procedures for PPP acts or contracts; definition of activities, investments or services; and authorization for starting public tenders. The government is eager to attract investment in utilities using this PPP model, especially in highways and energy projects.
- In Mexico, public/private partnerships are being used as a solution to a $20 billion project schedule. Individual states are encouraged to come up with pilot projects as well.

5.6 Conclusion

Concluding from the results above, a solution to the funding of water infrastructure problem could be a combination of the models listed above. Some of the funding models are already in existence but they are fragmented and in need of serious review and reconfiguration. If there is the intention to proceed on the tenet that water infrastructure is an essential part of the nation's capital infrastructure providing a basis for economic, social and environmental development, then there should be in place funding models for water infrastructure just as how funding models exist for other capital infrastructure development, e.g. electricity, energy, transportation (roads), and telecommunications. Combining the models would depend on government structure, financial markets and the political climate, to name but a few. If the water infrastructure is classified as an essential part of a nation's capital infrastructure producing goods for public benefits, then the above models should be favourable alternatives for obtaining capital financing. These models can be consolidated to create a water infrastructure funding model pool (Figures 5.2, 5.8 and 5.19). From this pool suitable model(s) can be selected for water infrastructure financing based on the implementation environment (Figures 5.2, 5.8 and 5.19).

Based on the funding business models, the new era of advanced and smart management identified the following financing and funding imperatives (*cf.* Figure 5.2):

- Own funding
- Loan funding
- Co-funding
- Grant funding (MIG; RBIG; Conditional Grants; Equitable Share; Maintenance Grant)
- Water User funding

It is also significant to note that the tariffs charged for raw water are skewed and mainly based on historic cost. There appears to be no coordinated view of water resource tariffs and the wider water sector costs and although consumers pay stepped tariffs the raw and bulk water pricing does not recognize the full replacement cost at present or indeed the stepped tariffs that consumers pay. The significance is important because tariffs are capped at the present time and it may well be a situation where a change in the framework of tariffs is needed and under the proposed revision of the pricing strategy this may be enabled. Furthermore if an independent regulator was to be appointed this process would be facilitated. It is also significant that new technologies in water scarce areas for waste water treatment, desalination, acid mining and inter basin transfers will have an impact both on the supply of water and on the tariff process. For these reasons the finance thematic area is important as an enabling strategy, and the acceleration of the augmentation process alongside water conservation and demand management.

Within this framework there are certain claims on water which are not subject to pricing, basic human needs and others, but the key components are considered under water use sectors. The water use sectors to which unit sectoral water resource management charges must be calculated are:

- Municipal (water services authorities)
- Industry, mining and energy
- Agriculture (Irrigation of agricultural crops)
- Stream flow reduction (commercial forestry at this stage other sectors may be added)

Anticipated internal and external factors (liabilities and risks) that could otherwise negatively impact on water supply and service delivery through the provision of water infrastructure includes:

- The impact on the consumers or major water users in South Africa;
- Repayment schedules
- Comparative funding models in other emerging or developmental economies, i.e. failures and successes, benchmarking, comparative analysis and best management practices, from other countries.
- Identify local infrastructure funding options;
- Facilitate consensus building among the various stakeholders regarding those funding options;
- Make the information available to the Legislature for ongoing and future deliberations; and
- Assist in developing legislation to implement the agreed upon funding policies, if appropriate.
- To address the major challenges facing the construction industry
- To offer solutions to governments and other stakeholders with one collective voice (management and labour)
- To build on research already done on addressing the Infrastructure Funding Deficit
- Infrastructure & Innovative Financing
- Growth Planning / Land Use Planning
- Regulatory Reform

Thus, from the results it can be further concluded that the South African government recognizes that it simply does not have the resources required to finance and build large water infrastructure as quickly and readily as everyone would like. As such, alternative delivery models are required. After considering various financing and procurement options, the government determined that Alternative Financing and Procurement (AFP) will allow South Africa to finance and implement many large infrastructure projects better and sooner, without tying up public funds that can be used for other purposes. This means the construction work could be financed and carried out by the private sector, which will assume the financial risks of ensuring that the project is finished on-time and on-budget. The completed facility would be publicly owned, publicly controlled and publicly accountable. AFP models can be selected for given projects on the basis of an assessment against the principles articulated in

the NWRS framework for planning, financing and procuring public infrastructure. The government has also made it clear that it is committed to keeping core public services such as water and sewage treatment facilities will remain under public ownership and control.

CHAPTER 6: DISCUSSION

6.1 Models of water infrastructure provision

Emerging infrastructure backlog and deficient capability warrants immediate attention if South Africa is to build upon, and secure, its already impressive record of sustained economic growth and productivity gains. *The first task* is to overcome the highly visible and well-documented backlog in existing infrastructure. *The second task* is to establish new, forward-looking and resilient institutional frameworks to facilitate timely infrastructure investment by integrating the full range of strategic planning, management and technical expertise in South Africa's public and private sectors.

The economic benefits associated with investment in infrastructure capital are extensive. There are also very significant economic costs if infrastructure assets are allowed to deteriorate. Statistics South Africa argues that, for the South African business sector in general, a R1.00 investment in public sector capital stock generates an annual saving of 17 cents in produce cost savings (six-year payback).

The classic South African, and other ***c***omparable countries e.g. Australian, Brazil, Mexico, etc., public provision model of government planned, installed and financed infrastructure with pricing at marginal cost or on a loss–making basis – with returns recovered through the taxation system (National Revenue Fund) – continues to characterise much of South Africa's publicly provided infrastructure. In terms of general infrastructure provision, significant changes began in the 1990s with corporatization and agentisation of water infrastructure. Nowadays, infrastructure is split between fully public (most water, most ports), fully private (airports, some energy, gas pipelines, some ports, telecommunications, some water) and mixed ownership (e.g. road PPPs, energy, electricity). The trend towards private provision of infrastructure has been reinforced by the emergence of significant capital availability in South Africa for infrastructure investment resulting from financial deregulation and South Africa's superannuation policies in the post-1994 era. Private direct investment in new infrastructure has significant potential while governments continue to avoid or delay investment in new capacity. Water offers similar potential, especially if network access and pricing outcomes are resolved. Supply of significant new infrastructure via PPP frameworks seems most likely. Further innovation in infrastructure investment, including closing the circle between public and private-sector capital, is required. Complex issues of pricing, access, public policy and regulation, risk–sharing, tendering processes, taxation and governance have arisen

as key challenges that will influence whether private provision of infrastructure can grow as a viable new model in South Africa. Sustainability has introduced a further new dimension into the calculus of infrastructure provision. A framework that takes account of environmental and social aspects, as well as economic aspects, is now widely accepted as necessary. Long and costly bureaucratic processes are a frequent complaint of private-sector participants involved with infrastructure provision and financing. Public administration in South Africa working alone seems no longer up to the job. South Africa now has an impressive and world-class range of managerial, financial and engineering skills in the private sector. These should be deployed more fully, together with public-sector expertise, into the national task of infrastructure provision.

It is recognized that there is an infrastructure deficit, which must be resolved to enhance our quality of life and improve economic competitiveness. Over the last few years, South Africa has made impressive moves in the right direction with its new investment strategies and initiatives to encourage investment in public infrastructure, in particular water. It had released a five year water infrastructure investment plan which set priority and targeted more than R30 billion for water infrastructure investments by 2014. Innovative participation of the private sector to help fund the infrastructure deficit is appropriate, but not in all situations. There are significant funds available to finance public infrastructure through the creative use of public sector pension funds. If these funds are not put to use in South Africa, they will continue to be invested to help finance other needs and initiatives than public water infrastructure. Innovative financing opportunities will, however, require a commitment by the government. Consistency and standardization in developing projects should be promoted. A regular and consistent flow of AFP projects should be appropriately communicated to potential investors. Workforce availability could be an issue with respect to getting all the work done given the demographic projections and a reduction in availability of skilled trades. The public must recognize that public infrastructure is not “free” and that in certain instances user fees are appropriate.

6.2 Characteristics and criteria of a funding business model

Casadesus-Masanell and Ricart (2011) have identified three characteristics of a good (funding) business model which can tell whether it will be effective depends on three criteria (*cf.* Figure 5.17 and 5.18):

1. Is it aligned with organizational, company or institutional goals? The choices made while designing a funding business model should deliver consequences that enable an organization to achieve its goals.
2. Is it self-reinforcing? The choices that executives make while creating a funding business model should complement one another; there must be internal consistency. When there's a lack of reinforcement, it's possible to refine the funding business model by abandoning some choices and making new ones.
3. Is it robust? A good model should be able to sustain its effectiveness over time. Although the period of effectiveness may be shorter nowadays, robustness is still a critical parameter.

6.2.1 Funding of the First Generation of Water Infrastructure

The majority of today's existing water infrastructure evolved from central government. Thus, a significant proportion of their funding is derived from the budgets of national government (National Revenue Fund). Therefore, the first generation of water infrastructure had similar funding structures. That is, they were mostly a combination of Government Funding (derived from taxation and external funds), special project funds and to a lesser extent Private/Public Sector Funding (derived from fees charged to customers) (*sensu* Rhind, 2000). Funding of the early water infrastructure was done in a piece meal manner as they evolved with not much consideration for future funding. However, if next generations of water infrastructure are to be successful then there must be in place properly structured funding mechanism for their implementation and maintenance. The next generation of water infrastructure will also be affected by the universal changes adopted by governments through today's society. That is, governments are implementing measures to reduce their financial responsibility towards infrastructure development.

With this in mind and the changing nature (maturity) of the next generation of water infrastructure, it can be concluded that water infrastructure programme managers will have to develop alternative funding models and or persuasive arguments for the maintenance of government financing for water infrastructure implementation.

6.2.2 Funding Models for National Level Water Infrastructure

Water infrastructure at the National level is very important to a nation's development and requires a strong political will and contributions from all sectors of the society for its

successful implementation (*cf.* Figures 5.2, 5.19 and 5.20). Another key success factor to water infrastructure implementation at this level is well-designed funding models (*cf.* Figures 5.1, 5.2, 5.19 and 5.20). There are a number of methodologies that can be used to design funding models for water infrastructure implementation at the national level. These methodologies will differ based on the different issues associated with the implementation environment (Giff & Coleman, 2002). The view that water infrastructure is a provider of public good with positive externalities and thus, selected this issue as the key designing factor (Giff, 2001; Giff & Coleman 2001; Martinez & Frank, 2001). This selection is justified, since at the national level the main function of water infrastructure is to satisfy national needs (Rhind, 2001). There are two main economic theories (problems) associated with public goods that are significant to the designing of the funding models. They are:

- The production of public goods normally results in market failures and
- The creation of natural monopolies (Economides, 1993, 1996; Yevdokimov, 2000; Giff & Coleman, 2001; Martinez & Frank, 2001).

The above problems are significant in the design of the models since they require government intervention to successfully correct those (Economides, 1993). Therefore, government policies will play a key role in the designing of the models. With water infrastructure viewed as a Classic Infrastructure/ Natural Monopoly producing public goods it's the duty of the government to intervene and correct the economic problems associated with this type of infrastructure. There are four main remedies available to the government to reduce or eliminate the negative effects of market failure and natural monopolies on the society. They are:

- Economic Regulation;
- Monetary incentives or deterrents;
- Seeking compensation in the courts; and
- Government provision of the goods and services (Fraser *et al*., 2000)

Government's role in water infrastructure development at the national level is further emphasizing by private sector demands on them to improve access, viz. services and information or data. This implies that government has a very significant role to play in the economic development of water infrastructure and thus, their function must be considered in the design of the models. In designing the models the remedies of economic regulation and the provision of the goods and services by government play a significant role. However,

consideration should be given to the fact that governments are cutting back on infrastructure expenditure although there should be increased in public infrastructure funding. The models must be designed on the premise that if water infrastructure is considered to be classic infrastructure/a natural monopoly then it should be possible to treat the financing of water infrastructure to that of any other infrastructure which is of national importance in terms of economic and social benefits. Thus, it should be possible to develop water infrastructure funding model using analogies and lessons learnt from the financing of other infrastructures, i.e. highway networks, railroads, and telecommunication networks to name a few.

6.2.3 Funding Models for Local Level water infrastructure

A funding at this level is only a component of the national water infrastructure (Figures 5.2, 5.19 and 5.20). Therefore, the funding structure should be less complex since the amount of funds required for implementation is less. Local level water infrastructure should involve more private sector participation since, as mention before the lower one goes on the water infrastructure ladder the expected business activities to be generated should be greater (Figures 5.8 – 5.10). Funding Models that may be applicable to this level of water infrastructure implementation (*cf*. Figures 5.2, 5.19 and 5.20) can be:

1. Private Sector investment both monetary and non-monetary
2. Local Government capital funding
3. Local Government –Private sector partnerships (e.g. water utilities)
4. Local Government – Public sector/community organizations partnership
5. Accessing special projects funding or aligning with central government financed special initiatives
6. The issuing of tax incentives for water infrastructure investments which would form components of the local water infrastructure
7. Central -Provincial-local Government partnerships
8. Project Financing

A number of the components of a local level water infrastructure can be derived from projects carried on by the private sector and or special government projects. Additional funding for these projects can also be obtained through the above models with more emphasis been placed on private sector contribution.

6.2.4 Funding Models for Regional Level Water Infrastructure

The financing of a regional water infrastructure are mainly the responsibility of the central government (DWA and National Treasury) within the specific region (SADC, AU) (Figure 5.2). Therefore, funding models for water infrastructure implementation at this level may take on the following formats:

1. Membership fees paid to the regional organization by the central governments of member nations (participating members e.g. Lesotho, Swaziland), e.g. LHDA and TCTA payments by central governments for the LHWP, KOBWA with payments by central governments for the Driekoppies and Maguga dams. The level of contribution can be based on GNP and/or Southern African Customs Union (SACU).
2. Contribution from International Development Agencies (e.g. USAID; European Union, etc.)
3. Low interest loans from International Funding Agencies (e.g. World Bank, EIB, DBSA, IDB, etc.) based on a business model for the water infrastructure
4. Access funds designated to regional development for public benefits and or align with other regional bodies that are participating in work for public benefits (e.g. SADC, AU, etc.).

6.3 Funding through water tariffs

Water boards are separate legal entities that have their own boards of governance, own assets and are required to be self funding. They are key strategic organisations that primarily provide bulk potable water services to water service authorities (municipalities), other water service institutions and major customers within a designated service area. Water boards vary considerably in size, activities, customer mix, revenue base and capacity, one of them has been around for more than 100 years, viz. Rand Water, while others are still considered to be emerging.

Most of the older and more established water boards are cantered in areas where there are significant urban development nodes (e.g. Rand Water, Umgeni Water, Magalies Water, etc.), while other water boards operate in more demographically diversified areas where there is an urban and rural mix in the customer base. Water boards while providing bulk treated water to municipalities, in some instances also provide retail water and sanitation services on behalf of municipalities.

6.4 Funding through Public-Private Partnerships (PPP)

Clearly, other governments have managed to establish mechanisms and controls that allow the involvement of the private sector in the provision of some public infrastructure. Control and public benefit is secured through legislation and a strict method of measuring the benefits of the non-traditional approach against more traditional ways of funding public infrastructure. This is not to say that the recommendation that public/private partnerships or non-traditional funding should become the main delivery vehicle for public infrastructure. But there must be a role for non-traditional approaches which can assist in financing public infrastructure. Meaningful involvement by the private sector is, however, not automatic; from the experience of other countries, the following are noted as important prerequisites for such financing:

- Political commitment: Political commitment enshrined at the policy level is important for the private sector, because unless there is a stable investment environment and continuing business opportunities, firms will be reluctant to develop the necessary resources required to bid for contacts.
- Enabling legislation: Non-traditionally funded projects often need to be supported by enabling legislation that is firmly embedded in the legal structure.
- The existence of a concession law that can be readily applied; the removal of tax anomalies; and refining of public expenditure capital controls to accommodate non-traditional financing.
- Evaluation Framework: A review/evaluation framework, within which all significant public infrastructure projects are assessed, should be used to determine if non-traditional delivery mechanisms are appropriate.
- Expertise: Both the public and private sectors must have the necessary expertise to deal with process. The public sector procurer, for example, needs to be able to negotiate individual project contracts and to access the appropriate financial, legal and technical expertise.
- Project prioritization: The government needs to identify those sectors and projects that should take priority and are amenable to a non-traditional process. A review of the commercial deliverability of the scheme, prior to the commencement of the procurement process, can be a source of comfort to the private sector. It helps to reduce the incidence of unsuccessful competitions and avoid the associated bidding costs that would otherwise be incurred.

- Shared Risk: An essential tenet of the public/private partnering process is that there should be a transfer of risk to the private sector partner. The risk should, however, be carefully defined and limited to risk over which they have control.
- Deal flow and standardization: A regular and predictable flow of deals, based on recognized risk allocation templates, nurtures the development of a successful and strong program. Guidance on contract structure also helps to keep costs down.

6.5 Funding through private sector markets

The establishment of an infrastructure bank could provide the most appropriate form of financing for each project, drawing on a flexible set of tools such as direct loans, loan guarantees, grants, and interest subsidies for possible "Build South Africa Bonds" (*sensu lato* Lamb, 1984; Tyson, 2011). It could be given the authority to form partnerships with private investors, which could increase funding for infrastructure investments and foster efficiency in project selection, operation, and maintenance. That could enable the bank to tap into the significant pools of long-term private capital in pension funds and dedicated infrastructure equity funds looking for such invest opportunities. The concept of infrastructure banks with a pool of funds for low-interest loans has been endorsed in certain countries (Lamb, 1984). The Southern Africa the Development Bank of Southern Africa (DBSA) was established as a "bank for regional development" to fund local infrastructure improvements using the strength of its balance sheet providing financial instruments such as low interest loans, revolving loans, issuing of infrastructure bonds, etc. Other measures considered by Lamb (1984) involve privatization and would include sale-lease backs and service contracts. Still other approaches include liquidation or recapitalization of non-public-purpose or marginally public-purpose facilities to private ownership, and various cost-reduction strategies.

6.6 Demand (market) risk management

Following the Global Financial Crisis bankers have become more risk averse to investing in infrastructure and have looked for more support from government. This has been particularly evident in the context of willingness to accept demand risk, where the private sector sponsor is not necessarily well placed to assess and manage the risk. Demand for infrastructure and willingness to pay user charges can be difficult to assess as it involves consideration of many factors beyond the scope of the project, such as capacity of users to pay, price regulation, the overall infrastructure supply chain and alternative ways of meeting demand. This has been

demonstrated with recent experience with water infrastructure projects in South Africa, where private finance has solely relied upon the adequacy of revenue to service debt and provide a return to equity.

Against this background private investors have been loath to finance infrastructure assets that have demand risk attached. Some say the answer is for the public sector to simply step in and underwrite demand and use so-called availability payment structures as used on recent water infrastructure projects. But historically, one of the main drivers for economic infrastructure was to transfer the funding burden from the public sector to the private sector and access additional funding that is truly off the Government balance sheet. Indeed the privately financed water infrastructure projects in South Africa would never have proceeded under an availability based model with all the debt on the State's balance sheet.

Moreover, even when projects are structured on an availability payment basis, there may still be a need to assess demand risk. The availability payment mechanism may be structured to provide a capital recovery element to provide greater certainty of ability to service debt but leave equity partially exposed. This could also be achieved either through a KPI regime, whereby availability payments are abated if patronage is low, or straight financial incentives linked to patronage. This raises the question what can the private sector reasonably be expected to do to increase patronage. But the objective is more to align private sector and public sector interests rather than allow the private sector perversely to benefit from lower maintenance costs, consequent upon an under utilised facility. Finally, infrastructure can have greater appeal to equity when investors have the scope to generate upside returns through higher utilisation as the economy grows. Conversely, pure availability payment based infrastructure, provides limited upside as investment is narrowly focused on maintaining assets and delivering services to meet a specific contract's obligations.

The impact of a more risk-averse approach by bankers will undoubtedly constrain the amount of private sector capital that could be contributed for the funding of water infrastructure. This applies if the funding model was to be undertaken with the projected water revenue stream providing the source of repayment. Bankers will focus more on downside demand scenarios and question the robustness of water supply and demand forecasts. More rigorous analysis will be required of factors such as customer willingness to pay water use charges, demand elasticity, justification of the value attributed to water provision, and alternative water (provision) delivery modes. More conservative financing parameters such as debt sizing

ratios, gearing, and debt tails can be adopted. The inevitable end result will be that Government will need to supplement private sector capital and explore with the private sector how public funding can be best structured alongside private sector capital. This has already been implemented on other completed water infrastructure deals, where the government contributed funding for part of the capital works. This does potentially transform the risk profile for Government and additional safeguards are required to avoid the public sector co-investing in poorly structured private projects or taking on unreasonable termination liabilities.

6.7 Innovative and alternative funding/financing models

Innovative approaches to financing can only be considered where definite value for money can be demonstrated. It is also important to understand that value for money cannot be at the expense of existing public sector staff. To ensure that these objectives are met and consistently applied, innovative financing models can only be considered under the following conditions:

- The private sector has to have experience and there has to be a demonstrated value for money (there is a formal documented process which must be used to demonstrate value for money);
- It must be possible to clearly define and measure expected service outputs can be third party performance audits;
- It must be demonstrated that involving the private sector as part of an innovative financing scheme is the best procurement model given other possible options;
- It must be possible to life cycle cost the service over on extended period of time; and
- Projects must be of sufficient size and scale of transaction costs (both for the government and private sector participants) are not disproportionately large.

Although there is a bias to use innovative public sector financing schemes where there is a long-term operating and/or maintenance component, construction projects with long-term take-out financing that do not involve a parallel arrangement for operation and maintenance are also considered. A national approach can be deployed in South Africa, in order to:

- Promote consistent approaches to developing projects across South Africa – including standardized risk allocation models, tendering processes, interactive bidding processes and so on.

- Develop better coordination, information sharing and support. Greater consistency in the implementation of PPPs by South African Governments would reduce bidding costs, whereas increased national co-operation will streamline the bidding process and better co-ordinate the pipeline of projects going to the market. Governments will also benefit from a more competitive market, with improved value for money in project delivery.

6.8 Financial and economic analyses, requirements instruments

6.8.1 Financial analyses and requirements

Based on the scheduling of projects as presented in Appendices 1 and 2, together with the cost estimates and construction times used in the unit reference value (URV) calculations, projections were made of the capital investments as well as of the operation and maintenance costs required (*cf.* Appendix 5). A summary of these, for all the regions in the country, is presented in for the period until 2020 (Tables 5.2 – 5.5; Figures 5.2-5.5; Appendices 1 and 2). All the costs are in constant June 2009 money values, representing the relevant annual expenditures (Tables 5.2 – 5.5; Figures 5.2-5.5; Appendices 1 and 2). Particularly evident is the high initial investments required with respect to water infrastructure. In addition, the successful implementation of water conservation/water demand management (WC/WDM) is a necessary prerequisite to achieving the lower demand curves on which the scheduling of all the augmentation options is been based (refer to Appendices 1 and 2). Also evident is the high capital costs for the construction of new schemes, compared to lesser expenditures (operations and maintenance) during later years. This is reflective of the backlog that has developed with respect to the implementation of new water infrastructure schemes, and where further delays are likely to put the water supply situation to several key economic and growth areas in the country severely at risk. The strong growth in operation and maintenance costs in future (all in current money values) will be largely attributable to the large energy requirements for future pumping of water and desalination of seawater, where needed and appropriate.

6.8.2 Economic analyses and requirements

The economic value of water refers to the assessment of the economic benefits that are typically achieved through the use of water in different sectors of the economy. It is therefore not based on the cost of water in any way. From an economic perspective, however, it is

important that the value of water to be derived from the application thereof for purposes of economic production be in excess of the cost of water supply for that particular use. Should this not be the case, it would imply that other sectors of the economy would indirectly be subsidising the relevant use. The criteria as above, however, does not apply to the primary uses of water such as basic human needs and for environmental purposes, which are not measured in economic terms but where other norms apply.

Economic effects are conveniently expressed in terms of production and employment. A well-known production indicator is the Gross Domestic Product (GDP). Reference can also be made to Gross Value Add (GVA). Employment is expressed in jobs (person years) per unit of water. Issues such as social impacts as well as construction costs and transfer costs are excluded from the above.

Charges for achieving the equitable and equitable and efficient allocation of water (Economic charge) must be used. The administratively determined charge can be used in water stressed catchments to provide an incentive for existing users to increase economic efficiency. The administratively determined charge will be based on the opportunity cost of water as determined by prevailing trading transactions but will be capped to the level of the return on assets charge for the relevant scheme or system (DWA 2007).

The administratively set economic charge will not be introduced before compulsory licensing is implemented, and then only after consulting the relevant stakeholders and water management institutions. This annual charge will be an add-on to any charges levied for water resource management, depreciation and use of waterworks (DWA, 2007).

Where amounts of water are still available for allocation after compulsory licenses have been issued, and there is competition for using this water, the public auction procedure can be followed. The price established in this manner will be based on market clearance principles by allowing applicants to take up the entire available supply through bidding or tendering process, in accordance with the National Water Act. Another market-orientated mechanism, which is already in place, is the transfer of water use entitlements via trading transactions in terms of the NWA between water use sectors. This may obviate the need of setting economic charges administratively in water-stressed catchments (DWA 2007).

The Department, and all the stakeholders, concurred with the economic view that social welfare is maximized when all costs are reflected in prices, a concept sometimes referred to as "full cost pricing" or the "polluter pays principle". Only when production and consumption decisions take into account all costs to society can an appropriate balance between supply and demand be achieved on the basis of pricing. When prices are artificially low, consumption tends to be excessive.

While it is unlikely that the Department will be able to fully cost all externalities into water charges, it is important to use pricing to encourage consumers to appreciate the true value of water and effect changes in their patterns of consumption. The Department has a raw water pricing strategy, introduced in April 2007, which levies four charges: water resource management; operations and maintenance; depreciation; and Return of Investment (ROI).

Water prices can be used to encourage customers to use less water and to achieve efficiency gains that enable water infrastructure and system managers to postpone the need for new water infrastructure capital outlays. The general types of conservation pricing options must include: 1) the repeal of discounts to industry as an establishment incentive; 2) repeal of water use charges capping; 3) increased block tariffs; 4) seasonal rates, with higher tariffs during dry seasons and droughts; and 5) excess use charges.

Resource poor farmers are excluded from the ROI charge in relation to irrigation, which poses a threat to DWA's ability to recover the cost of supplying water and operations and maintenance. There is a definite sense that water is too cheaply priced for this irrigated agriculture sector despite average increases in excess of 20% per annum since the new pricing strategy was introduced. The sector could be provided with financial incentives to upgrade their irrigation systems to support water conservation. These incentives could be financed by introducing a 1% ROI charge to water used for irrigation, (while all other user sectors pay a ROI of 4%). A further incentive will obviously be the resultant water savings, which could be sold to the state or be traded in areas where water is in surplus. In areas of water scarcity, trade between users must be regulated to ensure the best possible socio-economic use of water.

The application of pricing as a tool to manage demand in a municipal (domestic) and industrial (commercial) context needs to factor in both affordability and revenue stability. In terms of affordability, municipal level pricing should take into account the characteristics of

particular customer classes and their ability to pay higher rates. “Lifeline” rates structures can mitigate undue hardships for low-income customers and should cover the basic volumes of water needed for sanitation. With respect to revenue stability, the total loss from water reticulation systems for the country was approximately 1 150 million m3/a, which is equivalent to 28.8% of the approximately 2 000 million m3/a of total municipal system water input at that time. Revenue instability is the most frequently cited obstacle to the adoption of water conservation projects. This is because conservation results in less water being sold; one way of mitigating this loss of revenue is to shift some charges from a volumes base to a fixed charge. In essence, domestic and commercial users must be encouraged to invest in water infrastructure maintenance projects that will minimise water losses, any resultant loss in water income could be mitigated by reducing volumetric charges and increasing fixed charges.

6.9 Comparative analysis

As noted, many countries have well-established policies and procedures, not only to select projects where innovative financing procedures could apply, but also to ensure that the “deal” meets established project guidelines and is, in fact, a good deal. It is important to note, however, that does not, necessarily, imply a sale of the asset or loss of public control. In many countries the focus is on creating an environment where private funds and other private sector strengths can be employed, without loss of public control over pricing and quality of service. Using alternate financing methods to supplement direct investment by the public sector is also not applicable to all types of projects for a variety of reasons. Nevertheless, in the UK 10% to 13.5% of the annual investment in public infrastructure is now funded in a non-traditional manner involving private sector financing. There is an extensive range of generic models for infrastructure financing. Some of these lend themselves to private sector involvement (a more specific listing of models where the private sector could participate in financing and operating is in Appendix 4). From a review of this list, it is clear that not all models apply to all situations and, in fact, they often achieve different policy objectives. The UK experience is perhaps most interesting for South Africa.

Poor governance and inadequate investment are resulting in billions of people not having access to water and sanitation services (OECD, 2009). The Organisation for Economic Co-operation and Development (OECD) produced a report in 2009 on pricing and financing water (OECD, 2009). It can be concluded, amongst others:

- The water and sanitation sector is seriously under-financed in many countries. In some developing and transition (emerging) economies, this has led to the deterioration and the eventual collapse of infrastructure.
- Effective financial planning for the water sector requires finding the right mix of revenues from the so-called "3Ts": tariffs, taxes and transfers (including official development assistance (ODA) grants).
- Full cost recovery from tariffs which may theoretically be the ideal solution, in practice remains a distant objective in many countries. However, even very poor countries can reach important cost-recovery targets at the sub-sector level: such as cost recovery for operation and maintenance (O&M) and investments in urban water supply, or cost recovery for O&M expenditures in rural water supply. Increasing revenue from tariffs requires a comprehensive approach, which includes reforming tariff levels and structures and increasing bill collection rates, but also increasing levels of service and putting in place social protection measures.
- Where full cost recovery from tariffs cannot be achieved, public budgets and, for poorer developing countries, ODA will need to play an important role in financing sector costs. The water sector should therefore aim to achieve cost recovery from a combination of financial sources, including user charges, public budgets and ODA, rather than from tariffs alone – a concept that has been termed "sustainable cost recovery".
- Tariffs have to meet diverging financial, economic, environmental and social objectives, some of which may be conflicting. A major challenge therefore is designing tariffs in a way that strikes an appropriate balance among competing objectives. This is ultimately a political task and needs to be addressed through a transparent, democratic, participatory process.

From the World Bank findings there were arguments against full cost recovery through water pricing which in the developing countries are not achievable (World Bank, 1994, 2010). Several countries are exploring unique pricing-related issues, worthy of mention, Israel, is considering charging different prices for irrigation water of different quality (saline water, waste water, fresh water), adjusting prices to reflect water supply reliability, and implementing a resource depletion charge. Several countries are considering adjusting charges to reflect regional differences in water supply costs. A few countries have addressed the need to charge the end-user for safer drinking water by including treatment costs in the

water tariff. Water pricing has twofold aims of expanding water supply and encouraging more responsible use of the water resource.

Thus, the following can be considered from emerging and/or developing countries (economies) from the Private Funding Initiatives:

- As funds do not flow to the private partner until the project is ready, schedules are typically fully adhered to and budget exceedances are very unusual unless project scope or specifications change. The benefits are not achieved from construction alone (particularly in a design build situation). The real benefits are obtained if the private sector is involved in the project for the long term and is "forced" to consider life-cycle costs.
- It is generally recognized that the government's cost of capital is usually lower than the private sector. However, when these projects have been evaluated on a risk adjusted basis (incorporating sch ule and cost over-runs), the private sector approach is often less costly.

6.9 Conclusion

From the above discussions, a number of conclusions can be drawn from the funding models results:

- That over and above the capacity issues raised above, there is also a significant mismatch between the estimated capital required to develop or rehabilitate the water infrastructure necessary for the provision of basic services and the current available capital budgets
- For the immediate future, operating budgets (assuming effective revenue collection) will be sufficient to service the operating requirements. However, within 5 years or so, economically weaker municipalities (mainly categorised as low capacity municipalities here) will not be able to accommodate the operating requirements from rolling out services to mostly poor citizens from their economic base.
- That government must extends the period to eradicate the capital and rehabilitation backlog
- That government must adjusts the minimum standards in a manner that reduces capital and operating costs
- That increased funding must be made available to meet the capital and operating requirements.

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

7.1.1 Investment and maintenance backlogs

The institutional problems are serious enough on their own; however, they have emerged in the same period that the government has sought to extend access to water and sanitation to people and communities who have long been neglected and are often far away from existing infrastructure. Though this initiative was and remains justified on moral grounds, it has resulted in a massive backlog in investment and maintenance throughout the country. Given this, and the illegal use of water (notably in the upper Vaal River system), some 30 per cent of our usable water is being wasted. On current trends, then, the country is headed for a crisis of water security and quality that will hamper our socio-economic development, both directly and indirectly. One example of this arises in relation to South Africa's socio-economic development. It is usually easier and cheaper to supply water to urban centres than to low-density communities in remote rural areas. This means that, despite its political popularity, any ambition to extend services to all South Africans would raise input costs, increase wastage, and reduce efficiency. Obviously, not all schemes beyond urban areas are unaffordable or undesirable. However, the increasing scarcity of water means that its availability and quality has to be factored into decisions about public and private investment and resource allocation, including those about the balance between urbanisation and rural development. Water scarcity should also be taken into account in other areas. Government support for the expansion of some industries and the development of some geographical areas may need to be critically reviewed. Taking a very long view, water availability and price may well lead to a shift in the country's settlement pattern, with coastal areas being favoured because of the advent of economic desalination.

Over and above the condition of the infrastructure, the management as well as operations and maintenance thereof has been identified as a critical issue. Infrastructure refurbishment is provided through the WTE. An enterprise wide asset management approach is needed in terms of the requirements of the asset register for water resources infrastructure. Detailed inspections are conducted to establish the condition and remaining life of assets. This will further help the Department in prioritising refurbishment and rehabilitation plans.

In terms of water services, the most serious challenge to city infrastructure systems is inadequate funding. Cities need access to infrastructure funding that is substantial enough to

address their needs. According to the DCOGTA and SALGA, 79% of cities indicate that grants are among the top three most critical funding sources for street improvement and new construction. Additionally, limited state grants and loans are among the top three biggest challenges to financing the cities' sewer/waste water systems. Avoiding situations such as further infrastructure decay, moratoriums on new construction, difficulties in attracting new businesses and unaffordable utility services are some of the reasons why substantial funding is needed.

While spending and the magnitude of fiscal transfers dedicated for basic services infrastructure delivery has been consistently improving, there still remain considerable service backlogs, particularly in rural areas. Recent studies of infrastructure projects just completed still indicate issues in terms of the quality of construction; and the condition of existing infrastructure is still not being maintained at the level required to provide a consistent, adequate level of basic services to the more disadvantaged groups of the population. These issues are illustrated in greater detail in the next two sections. This indicates that the effective use and management of funding towards infrastructure needs is still an issue.

7.1.2 Recent government initiatives

The South African government has recognized that new delivery models are required to close the gap. Over the last few years, South Africa has made impressive moves in the right direction with its new growth path (NGP), new investment strategies and initiatives to encourage investment in public infrastructure, including the National Water Resources Strategy (NWRS), Water for Growth and Development (WfGD) and Strategic Framework for Water Services (SFWS) for planning, financing and procuring public infrastructure; 1) the long-term growth and infrastructure renewal planning across the provinces; 2) project priority; 3) the expertise by DWA to manage the implementation of AFP projects; as well as 4) the commitment in infrastructure expenditures in the MTEF budget.

In 2000, the South African government established the framework for planning, financing and procuring public infrastructure. The framework manages the process of planning, procuring, building and maintaining public infrastructure, to ensure it get the best value for public investments and proper life-cycle maintenance for public assets. This framework also help the government and the broader public sector assess proposals for new infrastructure,

select the best way to finance projects, ensure construction is completed on-time and on-budget, and maintain public assets properly.

In 2004, the South African government released a five year strategic infrastructure investment plan (NWRS) that will co-ordinate contributions from all levels of government, the private sector and public agencies to generate more than R30 billion for investment in public water infrastructure by 2014. DWA directs infrastructure investments to the most important priorities for socio-economic development and creates new connections between planning, funding and investment priorities. It sets priorities for critical infrastructure investments and shows how the government will work with partners to find new sources of investment.

With overwhelming demand for regional bulk infrastructure assets to be accelerated around the country implementation of any of these models will go a long way toward leveraging private sector investment in economic infrastructure assets and allowing the government to both recycle its capital and share in future recovery of financial markets, while at the same time addressing demand risk.

We need to retain the users-pays principle by charging users for use of infrastructure. This provides the benefit of enabling "non-Government" funding to be raised. But also leads to proper market based pricing signals being employed, which drives more efficient utilization of infrastructure. There is more rigorous due diligence on projects, as well as a more detailed, shared understanding between the public and private sectors of the key drivers of demand and this will help in encouraging the development of infrastructure assets on a true public private partnership basis.

In the future we will see more conservative finance plans and we must expect that, project agreements will be negotiated to mitigate demand risk and incorporate mechanisms to expressly protect private sector investment. Moreover, if demand due diligence identifies specific possible events that can be influenced by the public sector that affect demand, then provisions to expressly protect private sector investment against such events will need to be explored. In addition, the commercial framework should incentivize the public sector to partner with the private sector in mitigating the impact of those risks.

But, as the above models show, there are ways to incentivise the private sector to partner with the public sector, and at the same time mitigate the impact of demand risks and allow both parties to share in upside. Such new thinking is needed to get the next wave of infrastructure assets off the ground.

7.1.3 Finding the money (Funding Models)

If the public sector is unable to fund the required infrastructure spending and the private sector is unwilling to take on the entire burden itself, new and imaginative means of generating private investment will need to be developed. Certain projects are likely to be easier to fund privately than others. The infrastructure funding gap was compounded by the impact of the financial crisis, but this should not be seen as an insurmountable barrier. Whilst the Government will need to act very carefully in order not to distort savings and investment markets, the scale of the infrastructure challenge in the South Africa demands innovative solutions and new forms of funding models to maximise private sector investment. Even in the absence of the financial and fiscal crisis a game changing upward shift in infrastructure investment is a difficult proposition. Any increase in indirect taxation (such as green taxes or carbon taxes) must be offset by direct or indirect tax reductions elsewhere. As a country we must not slip into the idea that 'new green taxes' are a free lunch. They need to be seen as part of a gradual shift from direct to indirect taxation whilst not increasing the overall tax burden – indeed, reducing it in the wake of spending restraint elsewhere in the public sector.

7.1.4 How will the government implement the new investment strategies?

It can be concluded that the management of national water infrastructure and in particular bulk infrastructure can be improved in conjunction with the water security and availability scenario in South Africa. However, the Department has initiated various actions to strengthen its position on infrastructure development: i.e.:

- Upgrading Water Services Development Plans (WSDP) requirements, addressing local knowledge, ability and commitment
- Various water demand usage and planning studies have been undertaken to not only confirm the facts but also to identify intervention areas and opportunities
- Improved governance which includes improved regulation, discipline, institutional arrangements, performance agreements, intervention and planning
- Improved sector culture, professionalism and practices. This is aimed at especially the professional sector, providers, operators and advisors.

- Funding and financing for improving infrastructure development and systems
- Contributing to a comprehensive monitoring systems for integrated infrastructure development
- A national infrastructure situation and functional assessment
- An asset management strategy with associated actions; and
- Sustainable infrastructure and asset management as part of the feasibility studies required for water infrastructure

7.2 Recommendations

The review of the DWA's challenges, achievements, lessons and recommendations in terms of operation led to the following important recommendations/findings. It was clear that government would benefit from establishing a specialised technical and financial support mechanism. However, such a structure:

- Must be mandated, recognised by and promoted by government
- Will benefit from (structured) partnerships with key stakeholders
- Must have good systems and reliable service data
- Must have appropriate skills (including technical operational skills) mobilised in specialised technical units.
- Securing loans and/or financial assistance; and
- Dealing with the challenge of capacity constraints, both in terms of human skills capacity and financial capacity.

Although water user fees of various types partially fund some of South Africa's public infrastructure, the link between cost and use is not well-established in the public's mind. Reinforcing this relationship could lead to conservation measures and would also make it much easier to create stable funding vehicles that do not depend solely on general tax revenues. In order to encourage funding vehicles that use private funds to invest in South Africa, the recent initiatives should be continued. The government should also create a stable investment environment through political commitment (but not interference), consistency, a regular and predictable flow of deals, and suitable framing legislation. This ensures life cycle costing and the establishment of true user costs. A reasonable transfer of risk to the public sector should be a minimum government requirement of any partnership with the private sector. Third party performance audits are also required for successful partnering. User fees

should be considered and a strong public communications program developed to support the process. The standardization of risk allocation models, tendering processes, bidding processes, contract and evaluation would significantly reduce bidding costs. The well-established link between investment in public infrastructure and economic competitiveness means that South Africa must act now if it is to avoid a widening infrastructure gap.

The current Raw Water Pricing Strategy (RWPS) is not fit for the purpose it needs to be compared with the National Government mandate and strategies. It is not raising adequate funds or influencing behaviour in a way that supports water demand management and conservation. The Raw Water Pricing Strategy review process must address the setting of charges and allocating recovered funds for water infrastructure development and management (operations and maintenance). This issue must be resolved in terms of improved systems and procedures under the proposed institutional arrangements. The proposed institutional arrangements for national water infrastructure management in South Africa must, also as a matter of urgency, facilitate a new customer business orientation and related skills development programme within DWA. This must be linked to the drive for employment equity, particularly at the management and professional staffing levels. As part of its investigations into institutional options for the management of national water resources infrastructure, it is recommended that DWA must consider the following options:

- DWAF is to be responsible for managing water resources infrastructure (within a Branch structure), while TCTA funds and implements specific commercially viable projects.
- A National Water Infrastructure Agency (NWRIA) is to be established to finance, develop and operate national water resources infrastructure.
- Policies with regard to overt subsidies (e.g. free basic water and hidden subsidies eg. irrigation) need to be re-evaluated. Investment should be made in sources of additional water – e.g. groundwater
- Further sources of finance should be sought notably The World Bank and the private sector where involvement in infrastructure development and the provision of finance may apply
- The institutional arrangements reflecting the availability of finance e.g. TCTA, NWRIA (or WRIB), Water Boards need consideration

Thus, to ensure financing of water infrastructure through funding from investments, cost recovery, operations and maintenance, etc., a catalogue of the national water sector in S.A. is needed through (*cf.* Figures 5.2 and 5.19):

1. National Sector Policy setting and co-ordination
2. Environmental and Economic regulation and performance monitoring
3. water resources development and management
4. bulk water supply- cost of the water value chain
5. distribution of water
6. household sanitation
7. waste water collection, transport and treatment
8. funding of water sector is uneven
9. bulk water supply is not adequately funded

Long-term financial planning should be conducted to provide for the large capital investments in water resource developments together with the relevant operating and maintenance costs that will be needed during the coming decades. The implementation of projects needs to be expedited and decision-making streamlined to prevent further backlogs from developing. Continued monitoring and assessment of developments and of water requirements must be done. Further studies need to be conducted into the value of water in different sectors and uses, to inform the possible re-allocation of resources. Social, political and strategic aspects should be considered together with the economic value of water, to ensure that all are properly accounted for.

Opportunity still exists to capture some very significant funding sources available from the public sector pension funds in an innovative way to offset a portion of South Africa's public water infrastructure deficit. These pension funds have fiduciary responsibilities to their plan members. However, recommendations are therefore:

1. Initiatives should be investigated. Over the last number of years, the South African government has made some impressive moves in the right direction towards innovative financing.
2. The climate of uncertainty surrounding the relationship between the government, the public sector unions and potential infrastructure delivery partners should be avoided. Correct or not, the perception by certain politicians, and the civil service in general is that the ability of the private sector to deliver public services is highly over-rated.

3. Uncertainty arising from the current environmental assessment (EA) process should also be resolved. Current process for infrastructure investment by government involves lengthy EA process.
4. Innovative financing must be strongly supported by policy or legislation. This is a prerequisite and, for example, the use of innovative forms of funding is supported by legislation in some countries (e.g. Japan, Ireland, France, Chile) or by a strong policy position (UK and Australia).
5. A stable and consistent policy environment must be created. A consistent approach and policy is essential in creating a stable environment for private investors. Signals from governments that they are ready to commit the sort of stable, long term public-private partnerships, are essential in attracting pension funds to invest in infrastructure projects.
6. The level of standardization must be increased. Consistency and standardization is the critical success factor in delivering the AFP projects. The standardization of risk allocation models, tendering processes, bidding processes, contract and evaluation would significantly reduce bidding costs.
7. A regular and predictable flow of deals should be available and communicated to private investors. A pipeline of projects going to market can give forewarning to the market of future projects and indicating the sectors in which new business opportunities are likely to arise, e.g. forward planning of water infrastructure projects (*cf.* Appendices 1 and 2).
8. User fees or charges should be considered, further expand and/or improve. Innovative financing is well adapted to the application of user fees. As these fees would be applied to financing costs, ongoing operations and maintenance, contractual arrangements which limit cost increases are much easier to achieve. This is not the case if there is a sale of the water assets as privatization. The Sustainable Water and Sewage Systems legislation recognizes that user fees should reflect the true cost of providing the service and points to a window where new and innovative approaches to funding public infrastructure should be considered (DWAF, 1997; DWAF, 1998).
9. Innovative financing must not be seen as a way of shedding public sector jobs. Although an innovative financing scheme implies a long-term contractual relationship, its principal intent should not be seen as the elimination of public sector jobs.

To benchmark and align the funding models for the financing of water infrastructure development projects in South Africa with international best practices and guidelines (i.e. World Bank, African Development Bank, Southern African Development Bank, Asian Development Bank, European Development Bank, European Directives, etc.) have to be taken into consideration in designing strategic responses and their interventions. The following are the recommendations provided:

- Increase assistance available through existing or new infrastructure grant and loan programmes
- Provide greater fiscal flexibility with existing resources

Whilst the required investment appears daunting, it could be achieved. If we want to build a truly world class water infrastructure, there is a way forward. Thus, the recommendation that the necessary funding can be found with the following measures:

Infrastructure 1 – Change existing fiscal plans that ring-fence other Government departments such as water affairs, in order that the only area of public spending to be ring fenced is infrastructure investment, because of its positive impact on the supply-side of the economy and long-term GDP growth. Current plans see public capital investment increasing over the 2011-12 to 2013-14 period.

Infrastructure 2 – Commit to a new *Strategic Investment Fund* (set at 1.5% of GDP per annum) earmarked for the most important strategic water infrastructure projects – funded by restraint in non-capital expenditure elsewhere in the public sector. The fund would not be limited to iconic projects. The Strategic Investment Fund could be used to pursue many of the small infrastructure investments, because in total they would add up to an impact of strategic significance. However, it would be more likely that local and city region authorities would be the channel to improve smaller scale investments.

Infrastructure 3 – Critical to success will be the ability to leverage in private investment on the back of public sector and accelerated planning approval through the Planning Commission. In addition to leverage, the key to maximising investment, with or without any public contribution, will be the policy environment.

Infrastructure 4 – Ring fence the future proceeds from bank privatisation and earmark this revenue for infrastructure investment. Potential revenue here could be R6bn plus. Other potential funding sources which might be considered include privatisation of the water infrastructure network.

Infrastructure 5 – Do not be compelled into identifying every possible funding source at the outset.

Finally, the government must establish and develop an *independent economic water regulator* which will ensure efficient pricing in the water value chain and to ensure that inefficiencies in the water supply sector are not passed on to the water sector users.

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APPENDICES

Appendix 1: Possible future large-scale water resource developments, primarily for domestic, urban, industrial or mining purposes

WMA	Name of dam site / scheme [4]	River	Province	Use	Possible completion date	Estimated yield or increase in yield [5] (mill m^3/a)	Comments
4	Raising of Flag Boshielo Dam	Olifants	Mpumalanga	Mining, urban, industrial in Olifants and Limpopo WMAs	2005	16	Complete
4	Dam at De Hoop	Steelpoort	Mpumalanga	Mining, domestic (urban and rural)	2010	90 [6]	Under Construction – due for completion 2012
4	Dam at Rooipoort	Olifants	Limpopo	Mining, domestic (urban and rural)	2010	45 [6]	Delayed because of delayed development of mines in area
5	Dam at Mountain View	Kaap	Mpumalanga	Domestic, irrigation	2012	64	Reconnaissance Study completed
5	Dam at Boekenhoutrand	Komati	Mpumalanga	Power generation, irrigation	2012	50	Dropped - Required yield provided by VREASAP project
7	Dam at Springgrove and aqueduct	Mooi	KwaZulu-Natal	Transfer to Umgeni system. Urban, industrial.	2010	88	Due for completion 2014.
8	Klip River Dam	Klip River	Free State / Mpumalanga	Urban, industrial, power generation on the Eastern Highveld	2009	50	Dropped - Required yield provided by VREASAP project
11	Dam at ISithundu	Mvoti	KwaZulu-Natal	Multi-purpose	2011	47	Raising of Hazelmere Dam will provide for this demand
19	Berg River Project	Berg	Western Cape	Urban, industrial	2008	81	Completed in 2008.
19	Voëlvlei Dam Augmentation	Berg	Western Cape	Urban, industrial	2015	30	Investigation to be completed in 2011
19	Table Mountain Group Aquifer	Berg and Breede	Western Cape	Urban, industrial	2016	70	Investigation to be completed in 2011

Appendix 2: Possible future large-scale water resource developments, primarily for irrigation purposes

WMA	Name of dam site / scheme [4]	River	Province	Use	Required completion date	Possible completion date	Estimated yield or increase in yield [5] (mill m^3/a)	Comments
2	Tzaneen Dam raising and a dam at nWamitwa	Letaba	Limpopo	Irrigation, domestic	Undefined	2007	50	Nwamitwa Dam due for completion 2016
6	Dam at Embiane	Black Mfolozi	KwaZulu-Natal	Irrigation, domestic	Undefined	2009	10	Postponed
14	Dam at Vioolsdrif	Orange	Northern Cape	Irrigation, improved operation of Orange River System	Undefined	2012	150	Dam feasibility study still to be undertaken. Water abstraction works planned for completion in 2015
17	Raising of Clanwilliam Dam	Olifants	Western Cape	Irrigation	Undefined	2009	10	Height of raising increased to provide 70 million m3/a additional yield. Due for completion 2016 (Olifantsdoring RWRP)
17	Dam at Melkboom	Doring	Western Cape	Irrigation	Undefined	2011	121	Dropped in favour of raising of Clanwilliam Dam

APPENDIX 3: Questionnaire for the collection data for the development of funding model for water infrastructure

1. General

1. Does South Africa need alternative finance and economic analyses and models for the implementation of mega water resources infrastructure development projects?

Yes; No

Reasons:

_____
_____
_____
_____

2. What kind or types of funding models for development of water resources infrastructure projects does South Africa need?

Type of funding model: _____

Reasons:

_____
_____
_____

3. Would South Africa benefit socially and economically from such a new approach in financing of infrastructure projects?

Social benefits:

_____
_____

Economic benefits:

_____
_____

4. What are the advantages and/or disadvantages for the country in adopting such a new approach?

Advantages: Yes/No

Reasons:

_____
_____

5. Why are the old methods of funding not relevant any more, and where are the shortcomings?

Shortcomings of old methods: Yes/No

Types of shortcomings:

_____
_____
_____

6. How have other countries overcome this obstacle and how/what was done to stabilize the situation to move forward?

Comparisons and benchmarking:

_____
_____
_____
_____

7. What credible funding institutions can be approached?

Types of credible funding:

_____
_____

8. What are risks and liabilities associated with the new approach?

Risks:

_____
_____

Liabilities:

_____
_____

9. What will be the impact for the pricing of a basic commodity such as water and what will be the social consequences?

_____
_____
_____

2. National funding

2.1 Funding Process

1) Please briefly describe your organization's involvement in planning and/or funding water and sewer projects.

2) Briefly describe the steps in a typical funding process. What impediments have you observed in this process?

3) How are the country's needs typically communicated to funding agencies, so they can decide which water infrastructure to fund?

4) What major factors do you think typically play a role consider when deciding which funding sources (including different public funding programs and private sources) to use?

5) What reasons might your organization or your own recommendation on multiple funding sources? How typical is it to make such a recommendation?

6) What methods of coordination (informal discussion, written agreements, joint funding, regional planning, etc.) are needed among stakeholders in the funding process?

2.2 Planning and co-ordination at National -level for funding

7) Please describe any specific times when more coordination would have benefited those involved?

8) What value do you think a well-prepared CIP and/or Water Supply Plan provide for the funding process?

9) Why do you think the current amount of financial planning for funding of water infrastructure among stakeholders is sufficient/insufficient to sustainably fund W/S infrastructure in South Africa?

10) What specific financial planning activities do you think is needed during the funding process?

11) Do you have any suggestions for ways that funding agencies (individually or in coordination with other agencies) can promote better financial planning at the local or national level for water infrastructure funding?

2.3 Organizational Structure & Extent of Services

12) Are there any organizations that you think should work closely with the DWA and its institutions to help it carry out its mandate or mission in terms of funding of water infrastructure?

13) Do you have any opinions about how the DWA should carry out its tasks in terms of funding of water infrastructure? For example, should the DWA have any committees and/or subcommittees, should it have its own staff, or should it rely on existing services from its institutions?

14) DWA is involved in prioritizing projects for funding, what criteria for prioritization would you like to see used?

15) A list of eleven nationwide funding and coordination services are provided that could be used at some point in the future. Tell if you Strongly Agree (SA), Agree (A), are Neutral (N), Disagree (D), or Strongly Disagree (SD) with the provision of each of these services.

SA, A, N, D, SD

a. ____Compiling a single national database of community W/S needs

b. ____Compiling a national summary of funder eligibility requirements

c. ____Long-term planning (i.e. national level)

d. ____Actively promote regionalization of utilities

e. ____Planning assistance for local sphere of government

f. ____Maintain updated and accessible central information indicating which communities have secured funding, which ones are currently applying to specific funders, and how much funding each agency has available for the current funding cycle

g. ____Hold informational conferences, workshops or indabas on the funding of water infrastruture

h. ____ Develop a single application for funding from multiple funders

i. ____Sell debt

j. ____Work with existing funders to "leverage" their funds (i.e. Bonds backed by existing appropriations)

k. ____Make recommendations to funders about which water infrastructure projects should receive funding and when they should receive it

16) Of the activities named, are there one or two that you think would provide a substantial benefit or cost to water infrastructure? Please elaborate.

17) Of the activities named, are there one or two that you think would be especially difficult to implement, and why?

18) Are there any other services that you think should be provided on a national coordinated basis?

2.4 How Much Coordination?

The final section of this interview will ask you some additional questions about potential national coordination with regard to W/S infrastructure projects. States throughout the country have very different coordination models. Consider the following two scenarios for statewide coordination:

I.) Formal Directive Role (similar to Arkansas model)

The DWA or a similar organization has the power to pool all applications and disburse grant and/or loan money according to a triage system based on criteria such as needs, project feasibility, regional benefits, etc.?

II.) Informal Coordination Role (similar to Ohio model)

The DWA facilitates informal discussion and coordination between and among the funders, applicants, and other stakeholders.

19) Which scenario do you think would best accomplish the country's objective to "maximize the use of current funding resources?" Please describe your reasons why or discuss a middle ground that would be preferable.

20) Do you think a state-level body should play a role in the coordination of non-traditional infrastructure funding, such as land preservation to preserve water

quality?

21) Do you think statewide coordination could help maximize the use of current funding resources distributed across the State? Why or why not?

22) Do you think statewide coordination could help distribute money more fairly to communities (rural and urban) across the State? Why or why not?

23) Do you have any additional comments with regard to coordinated funding for water infrastructure in South Africa?

Appendix 4: Models and Definitions of Generic Range of Non-traditional Delivery

1. Operations and Maintenance
    - Operations and maintenance by contract
    - Public sector continues to own the asset

2. Design-Build
    - Construction by contract
    - Contract can include construction financing, land, etc.

3. Turnkey Operations
    - Public sector finances the project
    - Private sector design-build-operate
    - Performance-based objectives drive the contract
    - Public sector maintains ownership for the duration of the contract

4. Wrap-around Addition
    - Private sector builds and finances an addition
    - Private sector operates total asset for a period of time, or until an adequate return on investment is achieved
    - Public sector maintains ownership

5. Lease-Purchase
    - Private sector designs, builds, owns and finances the facility
    - Leases the facility back to the public sector
    - Public sector operates the facility
    - Public gains ownership at the end of the lease period

6. Temporary Privatization
    - Ownership of an existing facility is transferred to the private partner who improves/expands the facility
    - Facility is owned and operated by the private partner for a defined period of time, or until there is a reasonable return

- Ownership reverts to the public at the end of the period

- Lease-Develop Operate or Buy-Develop-Operate
- Private sector purchases or leases the asset
- Private sector expands or modernizes the asset
- Private sector operates the asset under contract (which pays back acquisition cost)
- Ownership reverts to the public sector after a defined period of time

7. Build-Transfer-Operate
    - Public sector contracts with the private sector for them to build and finance the facility
    - On completion, ownership is transferred to the public sector (at no cost)
    - The facility is leased back to the private sector
    - The private sector operates the asset for a defined period of time at a fee to also recover its lease obligations and other costs

8. Build-Own-Operate-Transfer
    - The private sector obtains an exclusive franchise (or concession) for the service
    - The private sector builds and finances the assets required to fulfill the franchise obligations
    - The private sector operates the asset for a fee (or user fees)
    - The asset is transferred to the public sector at the end of the franchise period

9. Build-Own-Operate
    - The private sector gains ownership of an existing asset or builds new
    - The private sector operates in perpetuity

10. Swiss Challenge
    - Government department or agency requests bidder qualifications for a project and based on these submissions, selects an interim partner with which to develop preliminary business plan, program of requirements, preliminary engineering designs, etc.

- Document summarizing these initial efforts is open to competitive bidding for defined period (with appropriate bid bonds to maintain discipline of process).
- Government then has option to choose another bidder and pay initial partner for efforts to date, or proceed with original partner.

Appendix 5: Standardised assumptions for the calculations of unit reference values (URV) or marginal cost for water infrastructure projects (after Basson, 2010)

Various assumptions have to be made to ensure the uniformity of assessments and compatibility of results and findings, with respect to the different water infrastructure development and augmentation options and also for operations and maintenance. Many of the assumptions were necessitated by the different levels of detail to which water infrastructure options have been investigated as well as the non-uniformity of some of the approaches used. Greater standardisation needs to be introduced in future. Distinction is made between general assumptions that apply to all the options, and assumptions that are specific to particular options. A summary of the more important general assumptions is given below.

Main general assumptions:

- All the unit reference values (URVs) are representative of raw water. Where potable water would result from a process, such as the desalination of seawater, the normal raw water to potable water treatment cost was subtracted to reflect the raw water equivalent.
- All energy costs were priced at a representative marginal cost for electricity. It was assumed that all new generation until 2019 would be from coal-fired power stations at 60 cents per kWh. From 2020 onwards half of the new generating capacity would be from nuclear power at R1.20 per kWh, with a resultant average marginal rate of 90 cents per kWh.
- Provisions of between 2% and 15% were made for distribution costs, dependent on the location of the power station(s) relative to the point of supply.
- All costs (capital, energy, operation and maintenance) must be for x-year money values. VAT is excluded as it is not relevant from a national economic perspective.
- URVs are calculated for raw water to be delivered in bulk at representative locations. No clean water distribution costs are to be included.
- The URVs with respect to WC/WDM for all areas/systems are to be assumed to be the same, for which the comprehensive information must be made available.

Other assumptions pertaining to the URV calculations include:

- construction of developments during x to y-year, to be finished in y-year;
- water delivery (sales) to commence in z-year;

all water volumes delivered based on growth in water requirements from z-year onwards (i.e. no deficit or surpluses up to y-year considered - see **Appendix 1 and 2** for more information), and taking scheme capacity into account;

- discount rate of 8% over 30 years of water delivery, with no residual value; and where specific parameters were not given with respect to maintenance costs, standard parameters were assumed;
- All new water resource developments must fully comply to the release of ecological water requirements (EWR);
- The implementation of water releases for the EWR from existing dams is assumed to be phased in over a 5-year period, starting when new water resource developments on the same system are commissioned; and

Although unlimited quantities of seawater can theoretically be abstracted, assumptions were made with respect to practical sizes of schemes for the respective areas.