CHAPTER 2 : WATER AVAILABILITY AND USE IN SOUTH AFRICA UNDER PAST AND CURRENT MANAGEMENT AND ALLOCATION REGIMES

2.1 Introduction

The Republic of South Africa is situated at the southern most tip of the African continent, falling roughly between 16 to 32 degrees longitude and 22 to 35 degrees latitude. It is bordered by four countries namely, Namibia, Botswana, Zimbabwe and Mozambique and is regarded as the economic powerhouse of the south. It covers a total surface area of 1,2 million square kilometres, making it the third largest country in the SADC region (DBSA, 1998). Much of its surface area is classified as semi-arid or arid. Summer temperatures fall between 18°C and 40°C, while winter temperatures range between minus 4°C and 15°C.

Despite having a coastal zone enriched with good rainfall, the majority of the country is classified as water-scarce. The average annual rainfall is 500mm compared to the global average of 800mm, and is further limited by its variable and unpredictable nature (McKenzie et al, 1999). South Africa's poor endowment of ground water combined with high evaporation rates and the direct demands of a population of 45,5 million people currently growing at an average annual rate of 2,3 percent (DBSA, 1998), place further pressures on its scarce surface water resources.

In light of the above-mentioned natural constraints to water supply, this chapter aims to place the need for water demand management in South Africa into context by providing an overview of water availability and use and the policy regimes that govern water resources within the country.

The first section of this chapter outlines the water sector by identifying the various sources of supply and the management structures under which they fall. The second section provides a sectoral analysis of water use and the consequential implications for water scarcity. Section three provides an overview of the water policies both historical and current governing water resources within South Africa and section four identifies the area selected for the purposes of this study, giving a general overview of its characteristics.

2.2 The water sector

The South African water sector has been likened to a "large plumbing system" evidenced by the intricate systems of inter-basin transfer schemes and varied sources of supply (Haasbroek and Harris, 1998). It is also managed at numerous levels through hierarchical governing bodies. The NWA (DWAF, 1998) has made water a national asset that one may have the right to use for a stipulated period. In line with this thinking and the large number of people without access to basic water needs within the country, the first 6 litres per day will be supplied free of charge. The countries water resources are diverse and spatially extensive, resulting in numerous water related opportunity costs to the country. Hence, the need for different users of large-scale consumption levels, to apply for the right to extract and use the water.

2.2.1 Water supply sources

"Five types of water sources are recognised, namely, surface run-off from rainfall, ground water, unconventional water sources, reuse of effluent returned to public streams, and water imports from other countries" (DWAF, 1986). Surface run-off is the predominant source of water in South Africa with a total volume estimated at 54,500 million cubic meters per annum (DWAF, 1986). Groundwater is distributed throughout the country in a series of aquifer systems. It provides on average an economically utilisable volume of about 5,400 million cubic meters per annum. Water supplies reclaimed through effluent recycling are expected to meet the demands of regions with rapidly expanding urban and industrial growth, where this water meets the required quality standards. However, this approach is only expected to become a reality for domestic purposes when it is no longer economical or practicable to draw from or develop conventional sources. As mentioned in chapter 1, the developments of a number of unconventional sources are being investigated. Desalination is being used to improve brackish ground water or purifying recycled water but is still too costly an approach in improving large quantities of seawater. Rainfall augmentation is regarded as one of the more feasible supply options for the interior although research results have been inconclusive. International developments on the use of icebergs are being monitored but are not regarded as possibilities at present. Moisture is being obtained from the atmosphere on a very small scale in suitable regions and water harvesting is being considered as an option, as well, in order to meet the increasing demands. Finally, water imports from neighbouring states have proven to be very successful, one such example is the Lesotho Highlands water project, although such schemes are dependent on the political stability of the region (DWAF, 1986; Hassan, 1997).

2.2.1.1 Surface water

Perennial rivers cover over a quarter of South Africa's surface, mainly in the southern, south-western and eastern plateau parts of the country. Non-perennial rivers occur over a further quarter of the country, while episodic and random flows occur in the remaining rivers. Strong seasonal fluctuations combined with irregular flow patterns characterise the perennial rivers making flow predictions difficult and increasing water stress during certain times of the year and within certain regions (DWAF, 1986).

2.2.1.2 Groundwater

Ground water occurs in secondary aquifers over 80 percent of the area of South Africa at depths of up to 50 meters. Most of these aquifers are limited in the volume of water that can be extracted from them and as a result are mainly used on farms or in rural areas to provide small quantities of water for domestic use, stock-watering or small-scale irrigation. However, groundwater stored in dolomite strata 200m to 1,900m thick, may be mined in large volumes capable of servicing urban and irrigation demands on a larger scale. The occurrence of sinkholes does however remain a threat to extensive dolomite based aquifer mining. The occurrence of primary aquifers within the country is limited. Depending on the rate of recharge of these aquifers and the rate of extraction of water, they may be classified as either renewable or non-renewable water resources and need to be managed with caution. Furthermore, water abstracted form these sources is often not suitable for consumption and requires investment into purification technologies (DWAF, 1986).

2.2.1.3 Water transfer schemes

South Africa is epitomised by an intricate inter-dependent network of inter basin transfers. Due to the limited supply options of many catchments pressured by rapid economic and population growth, these schemes have proven to be invaluable in meeting the demand requirements in many areas, facilitating industrial growth and relieving drought stricken areas. The water transfer schemes transfer water from one river catchment to another via a network of dams, pumping stations, pipelines, canals, tunnels, and weirs. The major water schemes in South Africa are:

The Komati Scheme: This scheme transfers water from the Komati Basin to the Olifants River Catchment area. An average of 131 million m^3 water is transferred through this scheme in order to supplement the Olifants River and the water needs of the Eskom power stations.

The Usutu Scheme: This scheme was built after the Komati Scheme, and transferred water from the Usutu River in order to supply the Camden, Kriel and Matla power stations. A total of a 103 million m^3 water is transferred annually by this scheme.

The Usutu-Vaal Scheme: This scheme was built in order to provide water to the Sasol oil-from-coal plant as well as to the Matla and Duhva power stations. A total of 100 milliom m^3 per annum may be pumped into the Vaal River system through this scheme.

The Emergency scheme: The Komati, Usutu and Usutu-Vaal Schemes were designed in order to provide for water security in the presence of drought. As 80 percent of South Africa's power generation is dependant on these schemes to varying degrees, they were constructed in an inter-linked fashion so that water could be drawn from any of the three schemes during times of need.

The Orange-Sundays-Great Fish Water Transfer Scheme: This scheme draws water from the orange river in the central parts of the country and channels it through a series of tunnels and canals over 100km in length to the Sundays river in the eastern part of the country, thereby also supplying the Great Fish with water for irrigation agriculture.

The Tugela-Vaal Scheme: Pumps water over the Drakensberg Mountain range (escarpment) at a height of 550 meters above the source into the upper Vaal catchment. This supplies the urban and industrial heart of the country (the Gauteng Province) with water. Construction commenced in 1969 and was subsequently updated. This scheme allows for a saving of about 455 million m^3 of water annually in the Vaal River system.

The Lesotho-Highlands Water Scheme: Construction on the Lesotho Highlands Water Scheme commenced in 1998, aiming to transfers headwaters from the Orange River in Lesotho to the Vaal River System in South Africa via a system of tunnels. This scheme is an example of what can be achieved through transboundary co-operation and agreement. It is currently recognised as the largest inter-basin transfer scheme in Southern Africa (Haasbroek and Harris, 1998). The Lesotho Highlands Water project consists of four phases, the first of which is expected to be entirely completed by the year 2004 at a cost of between R15 to R20 billion. Phase 1B is expected to increase dependable supplies of water to South Africa from a current 17m^3/s to 29m^3/s. There is still deliberation as to the continuation of the next three phases in light of the enormous costs involved (Poggiolini, 2001). The complete scheme is expected to transfer 2,200 million m^3 of water per annum. Table 2-1 shows the water delivery capacity of the scheme at its different stages.

Table 2-1: Lesotho Highlands Water Scheme – water delivery capacity

Water delivery	1A	1B	II	III	IV
Increment (m^3/s)	18,2	1,9	9,5	25,4	9,6
Total (m^3/s)	18,2	20,1	29,6	55,0	64,6
Year of commissioning	1996	2002	2004	2017	2020

Source: Lesotho Highlands Water Scheme, 1991

Many smaller schemes have also been constructed within South Africa, particularly after 1994, in the country's efforts to connect a multitude of new users to fresh water supplies (DWAF, 1986b).

These supply-side solutions to meeting increasing user demands lie at the core of the historical approaches to water management within South Africa. This has, however changed in light of tighter budget constraints, increasing costs, limited exploitable sources and expanding rural connections. The new water policies currently aim to use demand-side management strategies to combat the threat of water scarcity (see section 2.2.4).

2.2.2 Water management areas in South Africa

There is a move within South Africa towards decentralising the management of water resources. One of the key components towards this end is the establishment of catchment management agencies. The decentralised hierarchical management structure in which catchment management agencies fall is shown in figure 2-1.

The country is divided into eleven provinces governed by independent provincial bodies. The National Water Resources Strategy prescribes a framework within which water will be managed at catchment levels falling into defined water management areas. As a result, the country is also split into nineteen water management areas (DWAF, 2000). Figure 2-2 shows the water management areas of South Africa, they are marked by the red borders and the names of the major rivers within these catchments are shown in the white blocks. The black borders outline the nine provinces and the black dots indicate the situation of the major towns. Tshwane is indicated on the map under the former name, Pretoria and falls into the northern section of the Gauteng Province and the Upper Vaal Catchment Management Area.

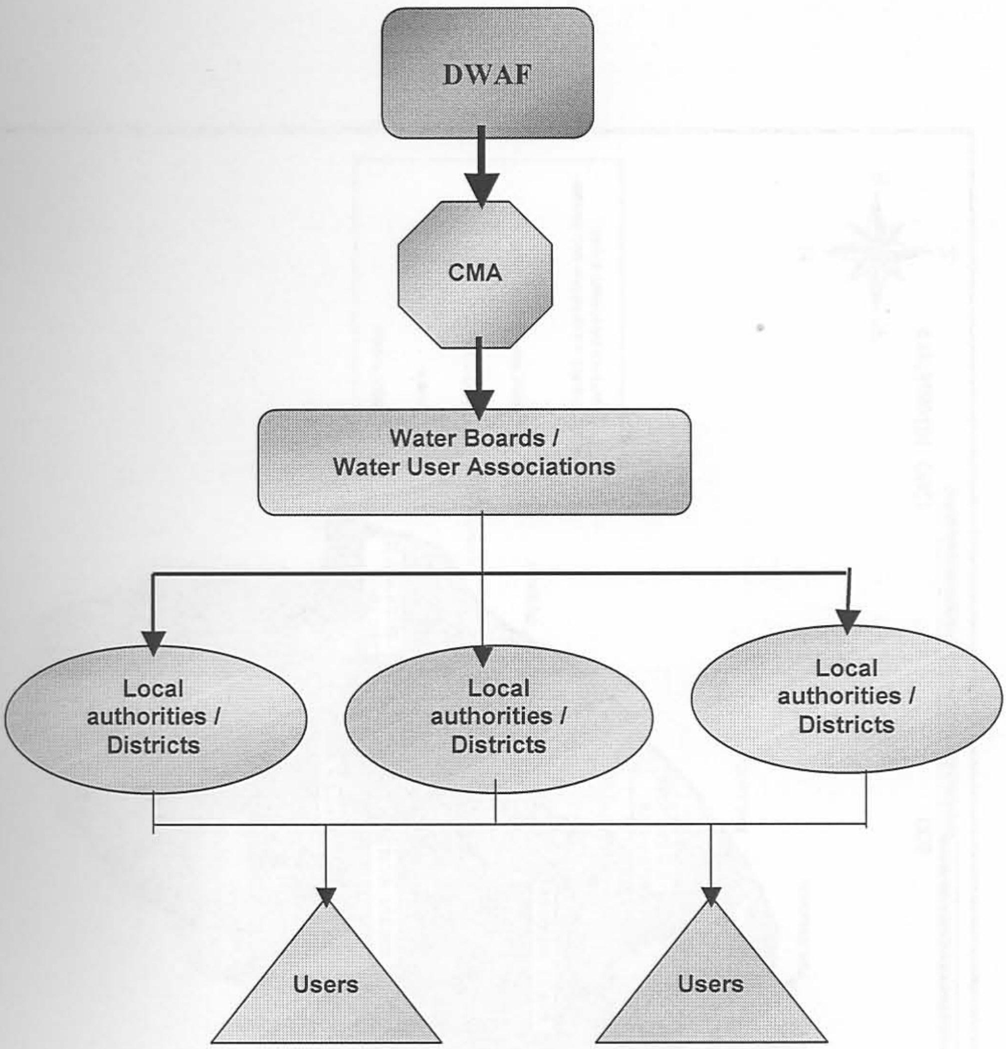

Figure 2-1: Water supply hierarchy for South Africa

Source: Own creation

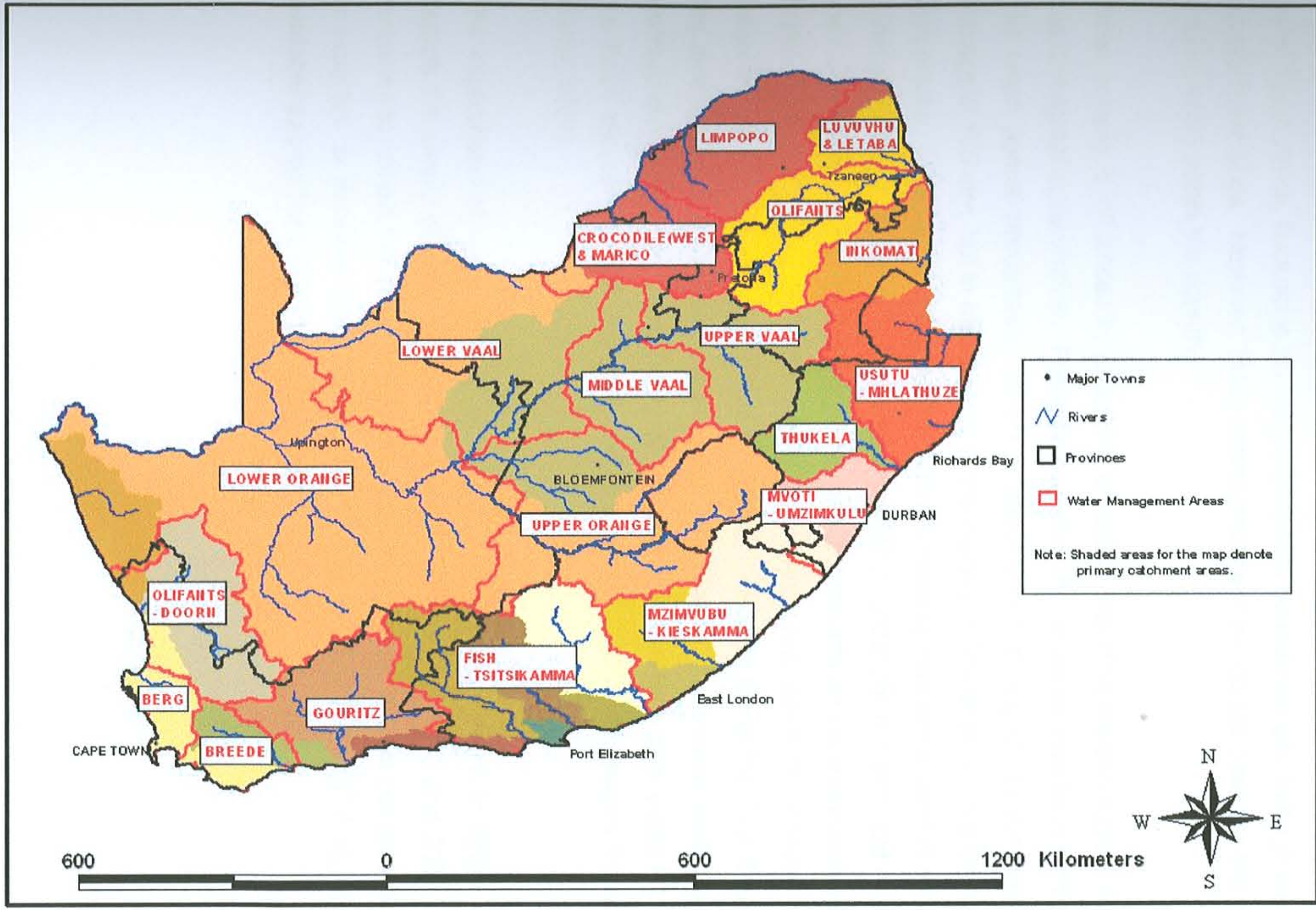

Figure 2-2: Water Management Areas of the RSA

Source: CSIR, 2000

2.2.3 Water demand and supply imbalances

Regarded as one of the most valuable resources to the functioning of the South African economy, water scarcity may prove to be the "limiting factor to economic growth and social development," while inducing water-related health problems and environmental degradation (Haasbroek and Harris, 1998). Water is renewable to some extent in the short-run but long-run supply is generally recognised as being fixed. It also varies greatly within South Africa, fluctuating across geographical boundaries and through temporal and seasonal demands. However, these characteristics alone do not preclude the situation of water scarcity within the country.

Water scarcity is influenced by a number of factors including meteorological, topographic and demographic constraints. Precipitation within the countries' interior is highly sporadic. The mean annual precipitation (MAP) is about 500 mm, slightly above half the world average of 860 mm, but in many areas of the country is further pressured by high rates of evaporation. Diverse climatic conditions prevail, ranging from winter rainfall and dry windy summers in the western parts to summer rainfall (thunderstorms) and cold dry winters in the north-eastern Highveld. The interior is arid to semi-arid and is characterised by erratic annual rainfall matched by extremely high temperatures, while the coastal belt has a relatively high rainfall with subtropical conditions extending along the East Coast. Due to the diversity in topographical, climatic, and evaporation constraints, water availability is distributed extremely unevenly. Only 20 per cent of the surface area yields 60 per cent of the mean annual runoff (MAR), estimated to be 50150 x 10^6 cubic meters (Haasbroek and Harris, 1998).

The implications of water scarcity within South Africa are evident in figure 2-3, which depicts the supply of water against the demand for water in 1996 and 2030. Supply is estimated to remain the same at a level of 33,290 10^6 cubic meters per annum. Demand is expected to increase from 20,045 (10^6m^3 / a) to 30,415 (10^6m^3 / a), reducing the available surplus from 13,245 to 2,875 (10^6m^3 / a).

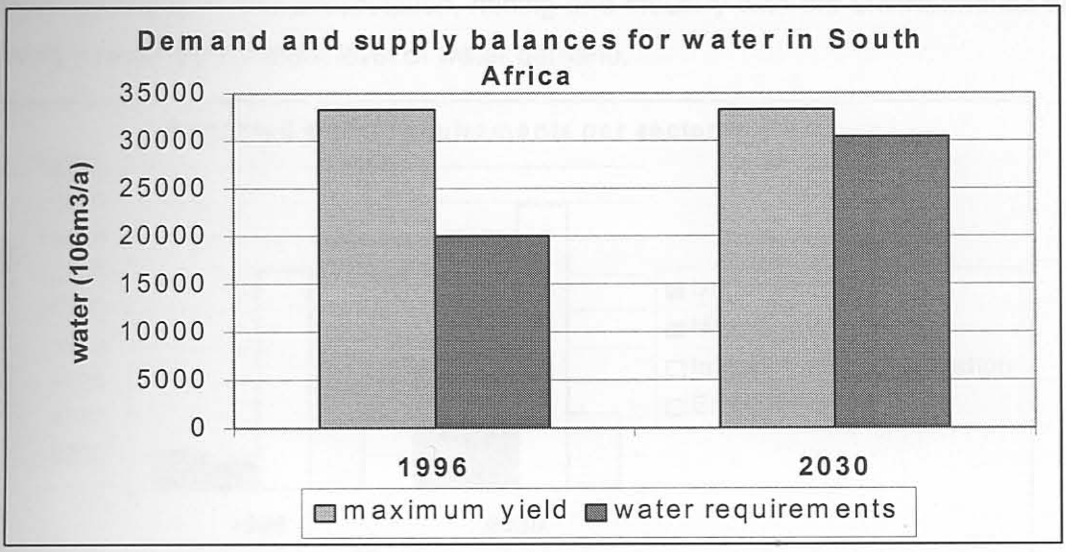

Figure 2-3: Water Demand and Supply balances over time in South Africa, without inter-basin transfers included
Source: Basson et al, 1997

The scenario depicted at a national level in figure 2-3 is disaggregated by region including the impacts of inter-basin water transfers in figure 2-4. It shows that the Northern, South Western and Central regions will be faced with the greatest water pressures by the year 2030. This is expected as these areas are projected to be the largest economic growth areas. The Eastern Inland and Eastern Coastal regions are depicted to be more water abundant in terms of meeting the regional demands.

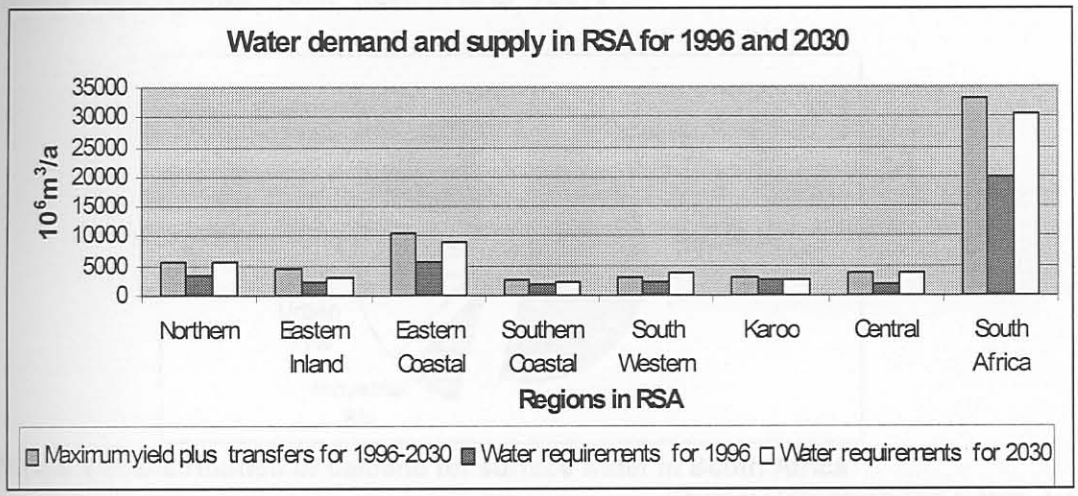

Figure 2-4: Past and projected sectoral growth for water demand in South Africa
Source: Basson et al, 1997

Regional growth in water demand is often also indicative of sectoral growth, the disaggregated demand for water by sector is shown in figure 2-5. The urban and domestic sectors are predicted to be the largest growth sectors from 1996 to 2030, followed by irrigation and afforestation, mining and industry with the environmental sector showing a relatively constant level of water demand.

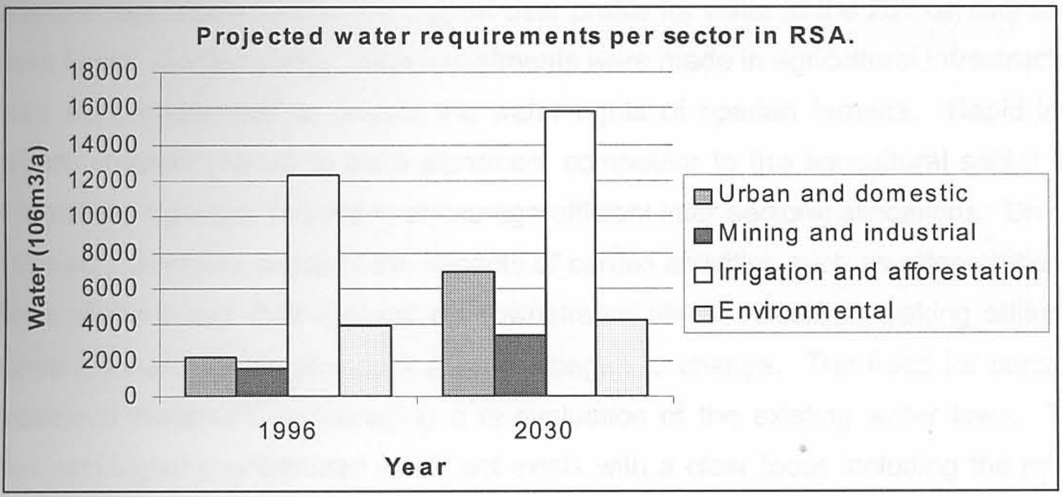

Figure 2-5: Projected water requirements per sector in South Africa

Source: Basson et al, 1997

The five major water-using sectors in the country are agriculture, industry, urban, afforestation, and the natural environment, figure 2-6. Irrigation agriculture represents 54 per cent of the total water demand in South Africa and is mainly consumptive use. Both the industrial (including mining) and the afforestation sectors use eight per cent of the total surface water respectively. The urban and domestic water use estimate is associated with major metropolises and does not include rural domestic supplies (Haasbroek and Harris, 1998; DWAF, 1986; Basson et al, 1997).

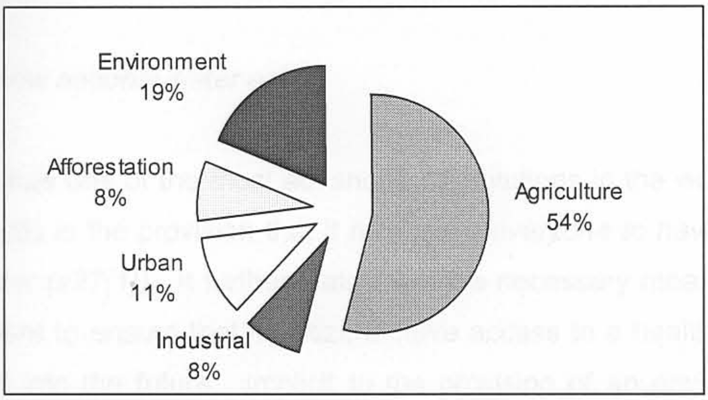

Figure 2-6: Distribution of demand for surface water in South Africa

Source: Haasbroek and Harris, 1998

2.2.4 Water policy

Water legislation and policy in South Africa aims to ensure some level of access to water is attained for all people, in an equitable manner. Water resources are to be managed and used in a sustainable manner now and into the future.

With a structural governmental policy focussed on food production and national growth, irrigation agriculture formed the biggest user profile for water in the 20th century and it still does today. Consequently, large investments were made in agricultural infrastructure and laws were established to protect the water rights of riparian farmers. Rapid industrial growth however proved to be a significant competitor to the agricultural sector and the 1956 Water Law was passed to encourage efficient inter-sectoral allocations. Droughts in 1966 only served to highlight the impacts of certain activities such as afforestation on the flows of rivers and their impacts on downstream users. Decision-making attitudes that perceived water as an abundant resource began to change. The need for conservation measures increased, encouraging a re-evaluation of the existing water laws. Today a new and highly sophisticated water act exists with a clear focus including the role of the environment and water demand management strategies.

The Water Act of 1956 (Act 54 of 1956) vested the powers for water management in a centrally controlled body. Although water shortages were foreseen, planning focussed on the development of extensive water schemes and inter-basin transfers. Pricing was highly subsidised especially for certain sectors such as agriculture and aimed mostly at cost recovery. Water rights were vested in riparian-land owners and all groundwater belonged to the land under which it flowed. By classifying groundwater in this way, it was perceived to be a private resource, which in turn limited opportunities for its further development. As a result, water management strategies were not equitable or particularly efficient.

2.2.4.1 The new national water act

South Africa has one of the most advanced constitutions in the world. An integral part of its Bill of Rights is the provision that it makes for *everyone to have the right of access to sufficient water (s27(1))*. It further states that the necessary measures must be taken by the government to ensure that its citizens have access to a healthy environment that will be sustained into the future. Implicit to the provision of an environment that facilitates well-being, health and environmental sustainability is the provision of reliable, clean water.

Consequently, the focus of the National Water Act is on the development of a comprehensive framework for water resources management that reflects the social, economic, and environmental objectives of the nation (DWAF, 2000). It stipulates that the allocation of water among users (after basic needs and the Reserve requirements have been met) be "guided by social equity and economic efficiency goals" (Hassan, 1998a).

The Reserve refers to the quantity and quality of water necessary to satisfy basic human water needs and protect aquatic ecosystems. Another important aspect of the act is the provision it makes for water demand management and the use of economic incentives for water management. It states that "the Minister may establish a pricing strategy for charges for any water use (s56)", (DWAF, 2000). The recently published pricing strategy for raw water user charges (Government Gazette 1999) identifies economic mechanisms such as: the imposition of economic charges, water licence auctioning, and the establishment of water markets as possibilities for ensuring allocative efficiency among users (DWAF, 2000).

The Act further provides recommendations on the following:

- Forecasting water demand
- Strategies for service provision
- Policies on water rights, cost recovery, pricing investment, private sector roles, environmental protection and restoration
- River basin activity and relationships
- Interrelations between water sources
- Integrated basin and watershed management

2.2.4.2 The Water Services Act

Passed in December 1997, the Water Services Act provides prescriptions on water services and sanitation issues, including tariff structures and management institutions. It establishes an individual right of access by each South African to water supply for basic needs and sanitation, while concurrently addressing conservation needs. Various water bodies and institutions such as: water service authorities, water service providers, water boards and water service committees are expected to include measures in their policies that will realise these rights for the nation. The water services act also outlines norms and tariffs for water services. These norms and tariffs directed by the standards of the Department of Water Affairs may differentiate on an equitable basis between:

- Users of water services,
- Types of water services,
- Geographic areas and their characteristic socio-economic and physical attributes.

Tariffs are also expected to address concerns of social equity, financial sustainability of the service, cost recovery, returns to invested capital, and drought relief or flood protection (DWAF, 1997).

Two concepts arise from the National Water Act and the Water Conservation and Demand Management National Strategy Framework, namely, 'water conservation' and 'water conservation and demand management'.

Water conservation is defined in the act as the *efficient use and saving of water, achieved through measures such as water saving devices, water efficient processes, water conservation and demand management, and water rationing (s1(1)(v)).* The Water Conservation and Demand Management National Strategy Framework however, includes in its definition of conservation the care and protection of water resources. It states that water conservation is the *minimisation of loss or waste, the preservation, care and protection of water resources, and the efficient and effective use of water (p12) (DWAF, 1999; DWAF, 2000).* Both provide a policy prescription for the efficient and effective use of water.

Defined as *the adaptation and implementation of a strategy (policies and initiatives) by a water institution to influence the water demand and usage of water in order to meet any of the following objectives: economic efficiency, social development, social equity, environmental protection, sustainability of water supply and services, and political acceptability* by the Water Conservation and Demand Management National Strategy Framework *(DWAF, 1999).* Water conservation and demand management rather provides a management tool through which conservation policy goals can be achieved.

The largest water demand sectors (agriculture, urban, and industrial) have already began implementing water demand management techniques. They have however, proven to focus mainly on specific singular approaches, rather than on integrated demand management that incorporates not only technical solutions such as leak detection and maintenance, but also economic and social incentive based approaches.

Economic and social sectors also vary greatly within South Africa. This is evidenced through the diversity of water supply systems and the sources of these supplies; the cost structures associated with different levels of assurance and the spatial locations of supply; the diverse sectoral needs; the ability to pay by different social groups, and the behavioural responses of these groups and sectors within the country. Consequently, water demand and supply gaps need to be carefully evaluated for each sector and each water management area. Water demand management strategies will prove to be more efficacious if they are implemented in a holistic manner, combining social, technical and economic tools to elicit desirable responses.

The implementation of water demand management within South Africa requires further investigation into the following areas:

- Information on water use in each sector
- Institutional frameworks and water authorities, so that the correct levels in the management structure may be targeted for implementation and monitoring
- Consumer behaviour and incentives
- The marginal value of water

A number of research efforts on water demand management have recently been completed and a few of them will be discussed further in chapter 3, they are:

- The Lower Blyde River Irrigation Network
- The Greater Hermanus Water Conservation Programme
- The Working for Water Programme

In conjunction with the new Water Act, increasing public awareness and the threat of a water scarcity crisis, water demand management approaches are expected to achieve great cost savings and user efficiency. The expected outcome will be the availability of a resource, previously allocated elsewhere, for the development of marginal sectors, the protection of the environment, and the servicing of basic human needs within the country.

2.2.4.3 Pricing practices in South Africa

It is expected that all significant water resource use within South Africa will be charged for irrespective of where it occurs, this will include the use of water for disposing of effluent and the intercepting or re-directing of water that affects downstream users (DWAF, 1997a). The government is aiming to achieve realistic water pricing objectives for uses other than for basic human needs within a reasonable timeframe.

Numerous costs are incurred in supplying water to different users or in making it available at a source within South Africa, they are the following (DWAF, 1997a; 1997c),

- *The costs of operation and maintenance of publicly-provided schemes.*
- *Capital costs, comprising a return on paid-up assets, the repayment of loans and, in some cases, contributions to a fund for new schemes to make sure that they do not cause sudden tariff increases.*
- *Overheads such as the administration and support required to operate such schemes.*
- *An allowance to provide for depreciation, replacement or refurbishment.*
- *Catchment management costs.*
- *Social and environmental costs.*

As mentioned earlier, water is a good that is necessary for the perpetuation of life and hence it may be necessary for government to subsidise water for certain users. Government policy for water services recognises that subsidies have been allocated historically to many economic sectors in order to support development. With the new focus on pricing water efficiently and equitably, many of these subsidies need to be re-addressed. However, a basic policy framework exists that will support the subsidisation of basic water and sanitation provision services as follows (DWAF, 1997a),

- *Government subsidies will be made available to communities that cannot otherwise afford minimum water supply and sanitation services.*
- *Subsidies will only be available to cover the cost of minimum services provision and will not cover operating and maintenance costs.*
- *Other subsidies provided by the Department of Water Affairs and Forestry for water supply and sanitation provision will be phased out, particularly in respect to operation and maintenance costs, except in cases where subsidies are required in the public interest such as for the protection of the environment.*
- *Subsidies will normally be paid to local authorities or statutory Local Water Committees, rather than direct to a service provider.*
- *The amounts of subsidies will be determined locally by the actual cost of providing basic services.*

This approach to subsidisation is however, dependent on the number of households to be served and the cost of supporting such provision.

Another component of water pricing that is currently recognised in South Africa is that of resource scarcity and resource economists purport the need to price the resource at a level that reflects this scarcity while concurrently, providing the first six thousand litres of water for essential needs, free of charge.

2.2.4.4 Integrated catchment management agencies

Historically, water management at a regional level has been carried out by offices of the national department. According to Principle (23) of the White Paper on Water Management (DWAF, 1998), "the responsibility for the development, apportionment and management of available water resources is to be delegated to a catchment or regional level in such a manner as to enable interested parties to participate". This in turn requires investment in technical and managerial expertise at these levels of decentralization, so that the national objectives of a more responsive and effective water management process may be achieved. Support from the National Department in the form of capacity building and effective monitoring is expected to facilitate the process of decentralization, ensuring that equity and corrective action goals are strengthened.

i) Catchment management agencies and committees

Central to the implementation of the new Water Act is the establishment and supported functioning of Catchment Management Agencies (CMAs), by the national department, as and where conditions permit. Such agencies are expected to have a wide range of functions delegated to them "depending on the requirements of the specific catchment(s) and systems within their jurisdiction, their capacity to undertake the management tasks, and policy decisions on the overall approach" (DWAF, 1998).

The roles of CMA's will include the following:

- Control over dams for recreational and conservation purposes based on national guidelines and standards.
- Serving the interests of equity, corrective action and the optimum use of water.
- Governance structures will be responsible for the effective management of the catchment area, while addressing the interests of various stakeholders.
- Become financially viable in line with the new approach to water pricing policy.

ii) Catchment management plans

Catchment or system management plans have been proposed in order to facilitate water management at a regional or catchment level. They are expected to be drafted by the respective CMA's in consultation with all stakeholders, under the guidance of the nationally determined framework. These plans will include details on the following:

- water allocations,
- the requirements of the Reserve and international obligations,
- the main issues affecting water quality and quantity which require intervention,
- management goals for addressing the critical issues, and
- potential management strategies and responsibilities for action to achieve these objectives,
- financial arrangements.

CMA's will comprise of various water organisations such as water boards, irrigation boards and other stakeholders. Organizations that are already established and display historical competence in water management decision-making, are more likely to continue in these roles acting in the capacity of a CMA (DWAF, 1998).

2.2.4.5 International obligations / agreements according to the NWA

South Africa's water management strategy includes another vital component, the implications for shared water resources. International customs and practices are adhered to for the management of trans-boundary water resources and various protocols are recognised in the efforts to facilitate regional co-operation, such as the SADC Protocol on Shared Water Course Systems. Other international agreements are outlined below:

"South Africa is playing an active part in the development by the International Law Commission of new rules to regulate the use of non-navigable rivers under the auspices of the General Assembly of the United Nations. South Africa is also signatory to several international protocols which are important for water management policy, such as the Ramsar Convention on the Protection of Wetlands, the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), and the Convention to Combat Desertification" (DWAF, 1998).

2.3 Water availability and use in Tshwane

In order to address these shifts in water management regimes and provide a clearer picture of the role of water demand management, the Tshwane municipality was selected as a case study. The nature of water resources and management structures within Tshwane are outlined in this next section. During the year 2000, the greater Pretoria Metropolitan Area was renamed using the authentic African name for Pretoria – Tshwane, and became known as the City of Tshwane Metropolitan Municipality. This new municipal area increased its area of jurisdiction and includes the following local authorities:

- Greater Pretoria Metropolitan Council
- City Council of Pretoria
- Town Council of Centurion
- Northern Pretoria Metropolitan Substructure
- Various local area committees and representative councils such as: Ga-Rankuwa, Mabopane, Themba, Hammanskraal and Pienaarsrivier.

Data for this study was collected for the period July 1995 to June 2000, and is therefore based on the former municipal boundaries for the Pretoria Municipality and not the newly recognised boundaries of Tshwane. It is also important to note that post 1994, Attridgeville and Mamelodi became part of the reporting and billing structure of the Pretoria Municipality for municipal services, hence they are included as an intrinsic part of the study. Therefore, many of the statistics listed below refer to the former Pretoria Municipal area and not specifically to the City of Tshwane. The data used in the estimations was collected from the Pretoria Municipality. In keeping with the initiatives of the South African government and the name changes to many areas within the country, this study will continue to refer to the study area as Tshwane, while asking the reader to keep in mind that the outcomes of this study are based on the municipal boundaries for which the former Pretoria municipality maintained records.

The metropolis of Tshwane – capital city, Pretoria, is the governmental and diplomatic centre of the country. It is situated on the main air, rail and road routes approximately 60 kilometres north of Johannesburg and lies about 1,310 meters above sea level (see figure 2.7). It has a population of 1,057,825[4] living within its municipal boundaries and forms part of the Gauteng Province. The former Pretoria municipal area covers about 70,319 hectares of land. The city is known for its estimated 70 000 Jacaranda trees. The region is highly dependent on the Vaal-Harts river system for the majority of its water. The

[4] This population figure pertains to the estimate at 30/6/99, (Pretoria City Treasury, 2000).

system is a closed system and as a result, quality controls are stringent. The Tshwane Municipality draws its water from bulk suppliers such as Rand Water as well as from its own supplies of surface water (the Roodeplaat and Rietvlei dams) including underground aquifers. The evaporation in the Johannesburg and Tshwane metropolises is twice as high as the observed rainfall.

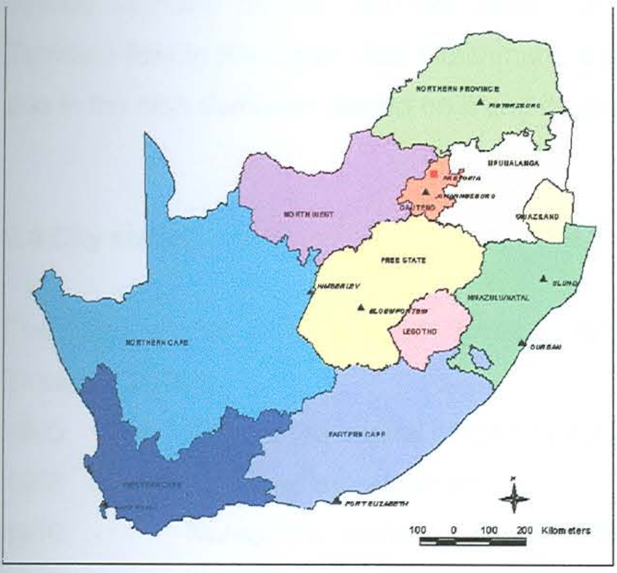

Figure 2-7: Map of South Africa emphasising Tshwane and the capital Pretoria
Source: Own picture, CSIR, 2001

2.4 Growth within Tshwane

Growth within the former Pretoria municipal boundary has been substantial over the past ten years and is shown in the following table:

Table 2-2: Growth of the Pretoria Municipality from 1989 to 1999

Sector of growth	30-06-1989	30-06-1999	Change (%)
Area of Pretoria	63,25 ha	70,32 ha	+ 5.29
Population	848,870	1,086,075	+ 12.26
Total income	774,613,824	2,890,323,000	+ 56.87
Total expenditure	766,799,920	2,789,225,000	+ 28.00
Number of employees	13 159	10 178	- 12.77
Number of street lights	47 623	58 000	+ 9.82
Average monthly water consumption	6,176,803 kl	8,742,048 kl	+ 17.19
Number of electricity consumers	140 394	213 668	+ 20.70

Source: Department City Treasury, 2000

The statistics above indicate that the overall income to the municipal area has increased by fifty-seven percent between the period 1989 and 1999, simultaneously with a population growth of twelve percent and an increase in expenditure of twenty-eight percent. In line with these growth figures, municipal services such as the number of street lamps, water consumption and electricity consumption have also increased substantially at a rate of between ten and twenty percent, thereby placing further pressures on an already stressed natural resource base. In particular, the water resource base, as Tshwane falls in the upper Vaal Catchment, a system that is already regarded as 'closed' due to the high demands placed on it and its dependency on water imports.

2.5 City status

The city's status was founded through various steps as follows (Department City Treasury, 2000):

1860 - Named the capital of the "Zuid-Afrikaansche Republiek".
1903 - Achieved municipal status.
1910 - Named the municipal capital of the Union of South Africa.
1931 - Obtained city status.
1961 - Maintained status as the administrative capital of the republic of South Africa.
1997 - The west block of the municipal building was destroyed by fire on 3rd March. The total loss amounted to about R500 million.
2000 - Pretoria municipality name changed to the City of Tshwane and increased its judicial boundaries.

2.6 Water supply for Tswhane

The City of Tshwane receives its water from numerous sources, ranging from fountains and boreholes to water boards. Table 2-3, shows the disaggregation of water supplied by source, for the city. Own source refers to groundwater supplies and to dams owned by the municipality, the water rights for which they have acquired, based on historical use rights. Some of their water is purchased directly from the Rand Water Board and some of it is classified as losses through delivery.

Table 2-3: Water supply by source as a percentage of the total.

Supply Point	1995/96	1996/97	1997/98	1998/99
Supplied from own source (%)	24.31	24.10	22.76	24.70
Supplied from own source (kl)	28,011,934	31,355,550	32,611,278	35,106,421
Purchased from Rand Water (%)	75.69	75.90	77.24	75.30
Purchased from Rand Water (kl)	87,235,856	98,728,017	110,683,121	107,011,509
Losses (%)	(2.50)	(0.37)	(0.37)	(3.20)
Losses (kl)	(2,960,220)	(483,470)	(542,060)	(4,535,533)
Net total water supply (kl)	112,287,570	129,600,097	142,752,339	137,582,397

Source: Department City Treasury, 2000

* kl represents kilolitre

The dependency for water supplied from Rand Water increased marginally from 1996 to 1998 by 1.98 percent, but has since declined with a greater reliance shifting to the city's own water supplies for 1999. Losses were contained for the period 1996 to 1998 but have since increased by 2.83 percent for the period 1998 to 1999.

A recent development in the supply of water to households in the Tshwane Metropolitan Area, based on the Water Act, is the supply of water for basic needs 'free of charge'. The proposed marginal pricing structure is as follows (figure 2-8):

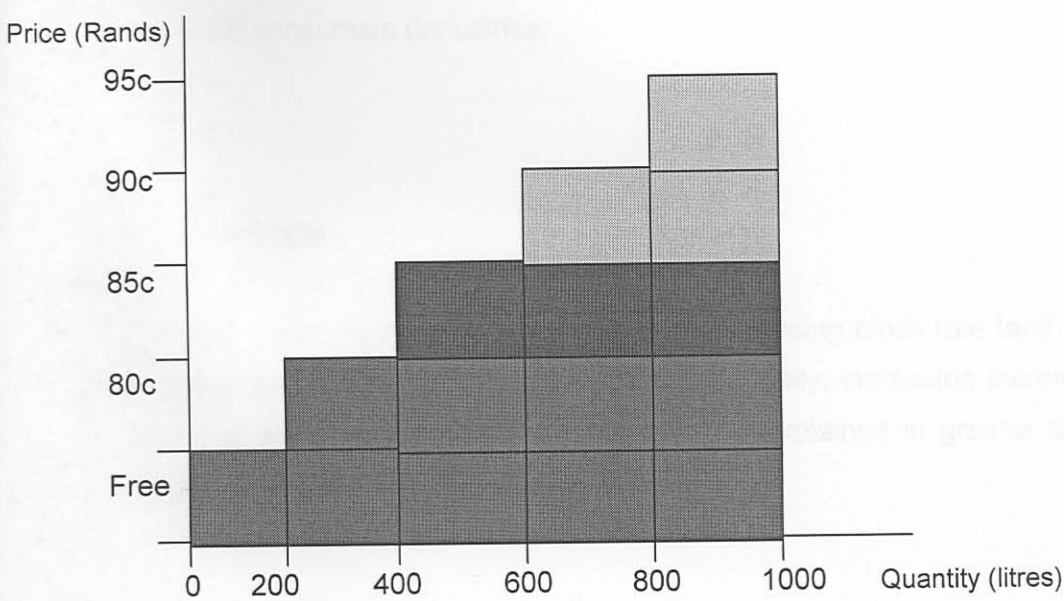

Figure 2-8: Pricing structure for Tshwane water supply

Source: Tshwane News, 2001

Translating into the following costs for a one month period of thirty days (table 2-4),

Table 2-4: Marginal costs for domestic water needs in the Tshwane Municipality

Monthly consumption	Monthly cost					Total cost
	1st 200 (litres)	2nd 200 (litres)	3rd 200 (litres)	4th 200 (litres)	5th 200 (litres)	
200 l * 30 days = 6 000 litres	Free	-	-	-	-	Free
400 l * 30 days = 12 000 litres	Free	R 24	-	-	-	R 24
600 l * 30 days = 18 000 litres	Free	R 24	R 26	-	-	R 50
800 l * 30 days = 24 000 litres	Free	R 24	R 26	R 28	-	R 78
10 000 l * 30 days = 30 000 litres	Free	R 24	R 26	R 28	R 30	R 108

Source: Tshwane News, 2001

2.7 Consumer categories

Water consumption in Tshwane is recorded under eleven consumer categories, namely (Department City Treasury, 2000):

- Agricultural areas and farm holdings
- Domestic dwellings
- Other consumers
- Flats
- Domestic businesses
- Old age homes
- Large scale consumers (industries)
- Mamelodi
- Attridgeville
- Centurian
- Voortrekkehoogte

Water is metered and charged for according to an increasing block rate tariff system. A lower charge is set for the first 0,2kl water consumed daily, increasing incrementally for larger blocks of water consumed, these rates will be explained in greater detail in the methodology and results chapters, chapter five and six.

2.8 Summary

The face of water resources management within South Africa is changing rapidly. Recognised as a world leader in its approach to water resources, the national government is actively striving to implement the theoretical principles on which the National Water Act is based, at a practical level. At the heart of this very goal lies the need to price water correctly, including operation and maintenance costs, delivery costs and some level of pricing for the scarcity value of the resource itself. Tshwane was selected as a case study because it is an established city dependent on a highly stressed water system. The underlying management approaches to water resources are discussed in the following chapter, chapter three. It is in this context that the role of price elasticities of demand for water becomes evident.