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WATER PROVISION IMPROVEMENTS: A CASE STUDY OF TRINIDAD.

WILLINGNESS TO PAY, PRICING POLICY, COST REDUCTION AND INSTITUTIONAL STRENGTHENING

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A Thesis Submitted to the Faculty of Graduate Studies and Research in Partial Fulfilment of the Requirements of the Degree of Doctor of Philosophy (Interdisciplinary)

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CONTRIBUTION TO KNOWLEDGE

1) This thesis provides a synthesis of a wide range of difficulties in water provisioning and recommendations for solving these very complex problems. The problems are situated within the context of shifting paradigms in development theory. The interpretation of the various aspects of the problems, integrates physical, socio-political, financial, management and consumer perspectives.

2) The development of refined estimates of household demand for a better water service using a combination of three methodologies; contingent ranking, contingent valuation and the household production function. The combined methodologies provide policymakers with a potential tool for determining cost recovery possibilities, projecting revenue, determining consumption charges and connection fees, selecting the appropriate level of service, and identifying settlements which may be able to meet specified cost recovery targets.

3) The case study of the most urbanized region of Trinidad, known as the Capital Region, is unique in that it is a survey of the willingness of urban households to pay for improvements in water supply and is of practical relevance to tackling the issues of water provisioning.

ABSTRACT

Government expenditure on infrastructure has been high in most developing countries. However, though access to services has broadened, the general condition of infrastructure is poor, and the quality of service has deteriorated. Water services is a good example of this problematique.

The purpose of this thesis is to provide a demand-oriented perspective on water provision for domestic users. The thesis examines cost recovery potential based on household willingness to pay more for an improved service and water pricing. Also, factors contributing to rising provision costs are explored, with the aim of formulating prescriptions for demand management and lowered costs. The thesis also focuses on institutional strengthening scenarios which achieve a demand orientation in water delivery. To this end, competition in the provision of water services and the regulation of service providers are examined.

A case study of domestic users in Trinidad was undertaken. Households in the main urban area were surveyed to test willingness to pay for water improvements using a questionnaire which incorporated three methodologies; contingent ranking, contingent valuation and the household production function. The household production function examined the revealed preference of consumers, whereas the contingent ranking and contingent valuation considered the stated preference for different features of the water service.

The survey found that most consumers were willing to pay more than twice the current price of water, contingent upon a guaranteed improvement in service, particularly reliability. The main factors influencing willingness to pay were household income, the price of water, number of service hours, and housing and land tenure. The results indicate that while the potential for cost recovery does exist, formulating demand-oriented water policies with a focus on improved reliability is necessary.

Extensive interviews were also conducted with professionals from both local and international agencies involved in the water sector, to elicit their perspectives on the problems of water agencies and possible solutions. There is a consensus among sector professionals that water agencies should emphasize improvements in operational performance, system maintenance and rehabilitation, and quality and reliability of service, instead of increases in capacity through new investments. Professionals took the common position that institutional capacity building was needed to achieve these results.

RÉSUMÉ

Dans la plupart des pays en développement les investissements en infrastructure ont accaparé une part importante des dépenses publiques. Or, bien que l'accessibilité à ces infrastructures se soit améliorée, leur état général demeure précaire et la qualité du service se détériore. L'approvisionnement en eau est un bon exemple de cette problématique.

Cette thèse désire fournir une perspective de gestion de l'approvisionnement en eau domestique qui s'appuie sur la demande de consommation. Pour satisfaire le besoin des utilisateurs, les agences responsables de l'approvisionnement en eau doivent générer des revenus adéquats. La récupération des coûts pourrait potentiellement s'effectuer au travers de la disposition des ménages à payer pour une amélioration du service et de la tarification. La thèse révise les facteurs qui contribuent à l'augmentation des coûts d'approvisionnement et tente d'établir des principes de gestion de la demande et de réduction des coûts. Finalement, elle s'attarde sur divers scénarios de renforcement institutionnel qui permettent d'axer l'approvisionnement en eau sur la demande, accordant une attention particulière à l'introduction de la compétition dans le secteur ainsi qu'à la réglementation des fournisseurs.

Une enquête réalisée dans la principale agglomération urbaine de Trinidad permet d'évaluer la disposition des ménages à payer pour une amélioration de leur approvisionnement en eau. Trois méthodologies furent utilisées: un classement par contingent, une appréciation par contingent ainsi qu'une estimation de la production économique domestique. Les ménages devaient classer des aspects de l'approvisionnement en fonction de l'importance qu'ils accordaient à chacun. Par la suite, on demandait directement à des individus d'identifier le montant maximal qu'ils étaient disposés à payer pour une augmentation du service. L'activité de production domestique, pour sa part, constitue une mesure alternative des valeurs accordées lors du classement.

L'enquete démontre que la plupart des consommateurs sont disposés à payer jusqu'au double du prix actuel dans la mesure ou cette augmentation garantit l'amélioration du service. La grande majorité de ceux-ci accordent une importance primordiale à la fiabilité du service. Les principaux facteurs qui influencent la disposition à payer sont le revenu par ménage, le coût de consommation, le nombre d'heures de service, ainsi que le mode de propriété des ménages. Les résultats indiquent qu'une récupération des coûts d'approvisionnement est envisageable mais qu'elle dépend nécessairement de l'amélioration du service et de la prise en compte de la demande dans la formulation des politiques de gestion.

Des entrevues furent également réalisées auprès de professionnels d'agences d'approvisionnement en eau locales et internationales afin de connaître leur perception des problèmes que confrontent les agences. Ces professionnels considèrent que les agences devraient prévilégier la réfection et l'entretien du réseau, l'amélioration de leur performance, de la fiabilité et de la qualité du service plutôt que de chercher à augmenter leur capacité au travers de nouveaux investissements. Ils partagent aussi la conviction qu'un renforcement de la capacité institutionnelle est requis pour accomplir ces résultats.

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GLOSSARY OF TERMS

ARV	Annual Rateable Value
AIC	Average Incremental Cost
CR	Contingent Ranking
CSO	Central Statistical Office
CV	Contingent Valuation
CVM	Contingent Valuation Methodology
CWDA	Central Water Distribution Agency
GOTT	Government of Trinidad and Tobago
HDI	Human Development Index
JICA	Japan International Cooperation Agency
LPCD	Litres per capita per day
O&M	Operation and Maintenance
NAR	National Alliance for Reconstruction
NGO	Non-Governmental Organization
PPF	Production Possibility Frontier
PPP	Public-Private Partnership
PUC	Public Utilities Commission
RWG	Redistribution With Growth
TWI	Thames Water International
TT	Trinidad and Tobago
TCPD	Town and Country Planning Division
UFW	Unaccounted for Water
USAID	United States Agency for International Development
WASA	Water and Sewerage Authority
WSD	Water and Sanitation Division
WHO	World Health Organization
WTP	Willingness to Pay

TABLE OF RATE OF EXCHANGE TT$/US$

Year	Average (TT$ to $1 US dollar)
1987	3.60
1988	3.82
1989	4.25
1990	4.25
1991	4.25
1992	4.25
1993	5.70
1994	5.80
1995	5.85

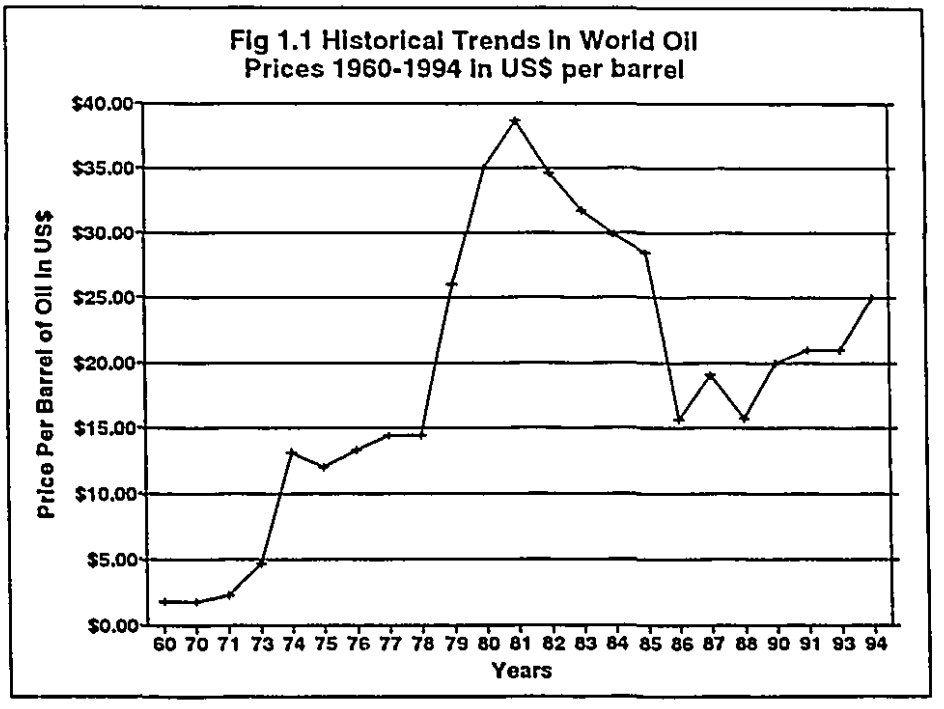
INTRODUCTION

Traditionally, in developing countries the largest part of infrastructure finance has been provided by central governments. This model of finance has never been fully satisfactory, as attested by the large and growing infrastructure deficits in most countries. Experience has shown it to be weak in providing steady, reliable investment budgets, that can finance projects outside the capital region, initial construction, provide for maintenance, and grow over time with inflation and population growth. Further, in recent years the financial flexibility of central governments has been weakened by the burdens of international debt repayment, and the steep decline in new capital inflows. This case study of Trinidad shows that this happens, even to once oil-rich countries.

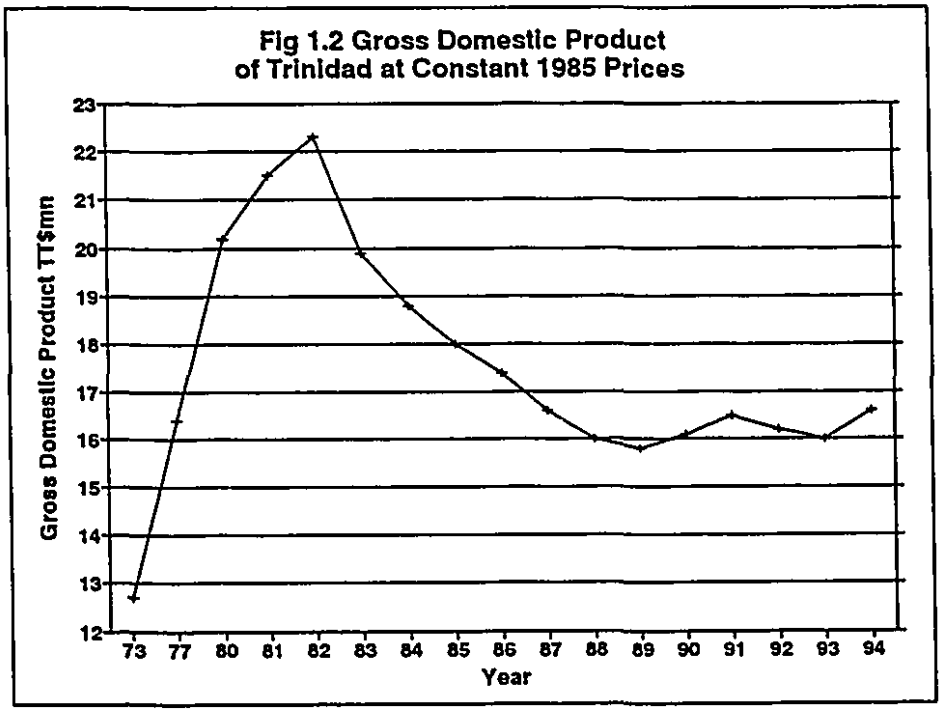
Background

Trinidad and Tobago is a twin-island state of 5,000 square kilometres, located in the Caribbean Region, with a population of 1.28 million people (Central Statistical Office,1991). The United Nations Development Programme (1994) reported, that it ranks 35th in the world and 2nd among the developing countries (newly industrialized countries are not counted as developing countries) in terms of the Human Development Index (HDI).[1] The World Bank (1994) classifies Trinidad and Tobago as an upper-middle income country with a Gross National Product per capita of US$3,940, which back in 1982 was almost double this amount. The national economy's major exports are petroleum and petro-chemicals. During the oil crisis of the 1970s, the economy boomed, but with falling oil prices in the 1980s as shown in Fig 1.1, recession was triggered. Current unemployment is about 20% to 25% (Central Statistical Office,1994), and 18% to 22% of the population live below the poverty line (Henry,1993).

[1] Indicators used to establish the HDI are life expectancy at birth, adult literacy, mean years of schooling, educational attainment, and adjusted real Gross Domestic Product per capita.



Adapted from Alleyne 1998 and GOTT 1994



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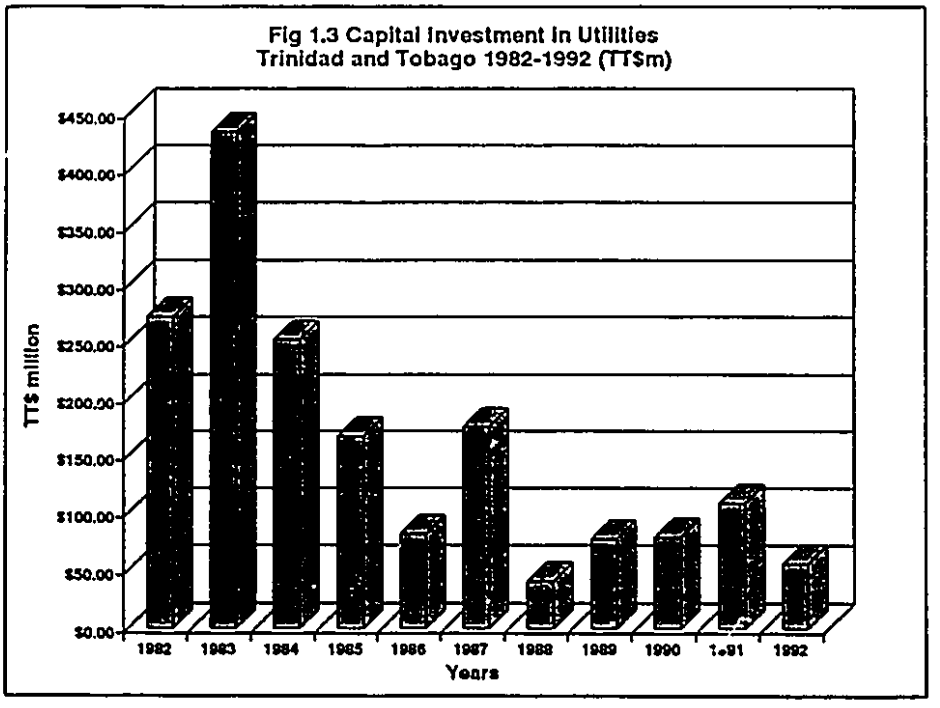


Adapted from GOTT 1992

During the boom years, there was massive public spending on infrastructure financed from the country's growing Gross Domestic Product (GDP) (See Fig 1.2). In 1983, the Government's capital investment in the utilities peaked at TT$433.7 million, which represented 27% of its total expenditure, or 2.3% of GDP as illustrated in Fig 1.3. The utilities together received TT$5.4 billion from the Government for the period 1982 to 1992. However, recession, falling GDP, growing debt to the international agencies, and several currency devaluations have taken place since the mid 1980s. As shown in Fig 1.2 the buoyant economy plummeted after 1982, requiring changes in fiscal policy. The burden of fiscal adjustment is manifested in Government capital expenditure which declined from 48% of total revenue in 1982, to 8.3% in 1989.

Central Governments can no longer afford to draw on general taxes to finance the magnitude of additional investment to overcome current infrastructure problems. Innovative measures are needed to achieve the optimum mobilization of locally generated revenues in order to enhance the performance of existing infrastructure and contribute to new infrastructure investments. But, infrastructure agencies in developing countries lack the institutional capacity to plan, finance, implement and manage infrastructure. This situation has emerged because they often lack direct control over their investment resources and priority-setting, and fiscal transfers from Central Governments give them perverse incentives, in that they reward them for large deficits and poor performance.

Fiscal discipline and reliance on local resources have become watchwords for the 90s. One of the key activities to be seriously affected by changes in Government policy is water provision. However, water is critical for human survival, economic development, and the environment. Indeed, few other resources affect so many areas of human activity, the environment and the economy. As a result, since 1990 the planning, financing and management of water services has received significant attention in international circles. Among the initiatives were the 1990 Montreal International Forum on "NGOs Working Together" which highlighted the problems of supplying drinking water, the New Delhi Global Consultation on Water held in 1990, the 1992 International Conference on Water and the Environment in Dublin, and the United Nations Conference on the Environment and Development held in Rio de Janeiro in 1992.

Treasury funding for Trinidad's water sector was drastically reduced from TT$380 million in 1982 to TT$45 million in 1993. With contractions in Government spending, the Water and Sewerage Authority (WASA) is unable to maintain existing supply facilities, provide an uninterrupted water service to consumers, invest in new facilities, and expand the service into new areas. Yet, the Government continues to interfere in WASA's cost recovery policies, and day to day management activities. Its ideology for over four decades, is that water is

a public good, which must be subsidized, and be accessible to all users. It also fears the political repercussions of raising water rates, especially in relation to poor households. However, "scheduled" water rationing, and low pressure have been the norm for so many years, that households have accepted these problems as a way of life. Many households have spent considerable amounts of money on water storage tanks and electrical pumps to rectify these problems, although they pay water rates to WASA.

In 1994, water rationing grew worse as WASA fell into bankruptcy. The utility applied for an increase in water prices to help reduce its financial problems, but there was public outcry that higher charges were unjustified in the light of frequent interruptions in supply.

Thesis Objectives

The principal objectives of this thesis are:

(1) To ascertain the cost recovery potential of water entities based on consumer demand behaviour, household willingness to pay more for an improved service, and appropriate pricing policies;

(2) To explore the main factors which contribute to rising water provision costs and formulate prescriptions for reducing these costs, so as to extend an improved service to as many users as possible;

(3) To examine the role of Central Governments in water provision, and to explore alternative institutional strengthening scenarios, the introduction of market competition, and regulatory issues that may lead to benefits for the end users and service providers; and

(4) To examine these issues of water supply and consumer demand in relation to a case study of Trinidad.

Research Methodology

A review of water provisioning issues was first undertaken by examining international literature and numerous studies done in Trinidad. This was followed by a survey of 420 households which was conducted in the main urban area of Trinidad to answer these research questions. The challenge was how to measure the value households placed on a public good, that was not bought and sold in the market place as are private goods. It attempted to elicit the maximum monthly amount households are willing to pay for improvements in the features of the water service such as reliability, pressure and quality, and an upgrade to a higher service level (where this was applicable). The operational definitions of these features are: (1) level of service refers to delivery mechanisms, piped or not piped, external or internal to the dwelling, for example stand pipes, yard taps, house taps, rivers, springs etc; (2) reliability is measured by frequency and length of service interruptions; (3) water pressure is the volume received per unit of time; and (4) quality is defined by odour, colour, taste and turbidity.

Consumer willingness to pay for water improvements was tested using a questionnaire that incorporated three methodologies;*contingent ranking, contingent valuation and the household production function.* Under the contingent ranking method, households were asked to rank in the order of importance, the features of reliability, pressure and quality. This methodology was used to establish the value placed on these characteristics. The contingent valuation method was used to ask individuals directly, the maximum amount they were willing to pay for a better service. The household production function was used to examine the actual production activity or behaviour of households, which was an alternative measurement of the value placed on certain features of the water service.

At the same time, to supplement the survey data, extensive interviews were conducted with professionals from both local and international agencies involved in the water sector, to elicit their views on the water agency's problems and possible solutions.

Structure of Thesis

The thesis falls into three main parts; the first lays out the context of the problem, the second the field research procedures and results, and the third the array of policy approaches which must be investigated in seeking a solution. Part I consists of the first four chapters, Part II is made up of chapters 5 to 7, and Part III consists of chapters 8 to 11.

Chapter 1 examines shifting paradigms in water provisioning policies at the global level, and their impact on Trinidad's policies. It also traces the genesis of the Government's ideology of water as a public good, and identifies newly emerging concepts of water provision in the 1990s. Changing policy orientations are divided into five major periods: 1950s to 1960s, economic growth, modernization, independence, and state capitalism; early 1970s, redistribution and growth; late 1970s basic needs approach; 1980s, free market approach; and 1990s, privatization.

In chapter 2, a background of the history of water supply and demand in Trinidad, the formation of the Water and Sewerage Authority, its mandate, organizational structure and jurisdiction is presented. It then provides an overview of the water supply system, followed by a description of water demand patterns, customer classes, and service provision by WASA.

Since its formation in 1965, WASA has been plagued by a host of problems which ultimately impact on the quality of service delivered to consumers. Chapter 3 is devoted to a diagnosis of WASA's main problems which are broadly classified as those related to the supply system, economic and management practices, and other problems associated with political interference and graft. The views of professionals are useful in identifying underlying problems and potential solutions for water delivery. A summary of interviews conducted with local and international professionals, who either work in or formulate policies which affect the water sector, is presented in chapter 4.

Consumer information is important, although it is often neglected in developing demand-driven policy prescriptions. Chapter 5 therefore first reviews consumer demand theory and models of water demand behaviour. It then discusses the challenge of how to measure the value consumers place on a publicly provided good such as water, which is not bought and sold under normal market conditions. The concept of consumer willingness to pay and its relationship to welfare economics is then examined. This is followed by a review of willingness to pay research methodologies, and a detailed presentation of the contingent valuation (CV) approach and its use in willingness to pay research.

A nexus exists among problems of unreliability, poor water quality and pressure, low revenues, huge operating deficits, poor cost recovery and bankruptcy. Given that ultimately domestic consumers are affected by these issues, are households willing to pay for improvements in water provision? Chapter 6 describes the survey of households willingness to pay for water improvements which was conducted in Trinidad. This chapter provides details on the questionnaire design, survey methodology, field procedures and background information on the study area.

The focus of chapter 7 is a discussion of the survey results. It is divided into three main parts; the general survey results are first presented, the next section analyses households willingness to pay for a better water service, and this is followed by an examination of whether the results meet the criteria of reliability, accuracy and validity.

Chapter 8 first examines the usefulness of willingness to pay models as a basis of forecasting revenue, and the potential for cost recovery and revenue generation, arising from consumers indication of a willingness to pay for service improvements. Policy issues of willingness to pay in relation to the poor are then discussed including affordability and ability to pay, cross-subsidization of low income households and targeting the poorest of the poor. This is followed by an

analysis of policies of price differential based on willingness to pay for various levels of service, differences in willingness to pay based spatial location, land tenure and housing tenure. Problems of unreliability, response strategies and willingness to pay, and their policy implications are then discussed, followed by a examination of the importance of timing improvements in service with increased charges.

Although household willingness to pay for improvements may be established, the challenge facing decision-makers is to formulate appropriate pricing policies. An overview of the most important issues arising from an analysis of water pricing is provided in chapter 9. The complexity of the matter warrants a careful exposition of four concerns in pricing water: economic efficiency, equity, human and environmental externalities, administrative feasibility and political acceptability. Many economists are prone to emphasize efficiency, but all four concerns need to be considered if policy-makers are to arrive at a reasonable compromise among them. In this chapter flat user fees versus volumetric based water charges are discussed using these four criteria. This is followed by a review of the much debated rule of marginal cost pricing for public goods which highlights that considerable amendments are required before it can be applied. Two kinds of refinements that need to be undertaken before applying the rule are examined. The first is a specification of the dimensions of cost and output of water, and a recognition that the cost may vary across consumer classes, space, and time. This consideration leads to a more complex formulation of the rule, without, however, affecting its basic validity. The second refinement is to amend the basic rule because one or more of the assumptions on which it is based do not hold. This relates to externalities and subsidies, marginal social cost pricing and distortions elsewhere in the economy. This discussion is followed by an analysis of water pricing policies in relation to administrative and transaction costs, closing fiscal gaps arising from amendments in the marginal cost pricing rule, the need to promote self-financing in water agencies, and the political acceptability of policy changes.

An understandable objection of consumers to price increases, stems from the perception that not enough has been done by WASA to reduce its costs. Water provision costs result from capital expenditure on the expansion of supply capacity, poor operation and maintenance, urban sprawl, very low or high population densities, topographical constraints, inappropriate development standards as well as technological choices, and environmental damage. Three policy approaches to cost reduction are explored in chapter 10; traditional supply management, regulatory and market-based approaches. It is argued that no one approach is a substitute for the other, but rather they are complementary to each other. The appropriateness of each approach to the Trinidad context is discussed, and an attempt is made to prioritize which ones should be focused on, as a first step toward reducing costs.

There is considerable debate as to whether WASA should be less like a bureaucracy and more like a business. Chapter 11 tackles the institutional options that are open to WASA. First, earlier attempts to improve WASA's performance are reviewed, followed by an analysis of alternative scenarios such as invoking market forces into a public water utility through corporatization, performance agreements and contracting out services; introducing competition for the market using leases or concessions under a public-private partnership; or full privatization of the water monopoly. The importance of regulating water entities and protecting consumers from an abuse of market powers and the occurrence of externalities is emphasized. This is followed by a discussion of the need for regulatory resources, autonomy and credibility of the regulating agency and a review of regulatory instruments.

Chapter 12 draws together the various threads of argument, enunciates the main conclusions of the study, and advances recommendations for policy-makers and researchers in the field.

CHAPTER 1

SHIFTING PARADIGMS IN WATER PROVISIONING POLICIES

In most developing countries, planning was initially concerned with economic growth. Upon gaining political independence, post-colonial countries set about to address the unmet backlog of physical and social infrastructure, low rates of economic growth, and poverty. Since the post-independence era, development in the non-industrialized countries has undergone significant changes in both scope and approach, arising from shifts in international agency policies, as well as local factors. These transformations are reflected in issues such as infrastructure provision, of which water supply is a prime example.

1.0 AIM OF CHAPTER

The aim of this chapter is to: (1) provide a schematic presentation of five periods of shifting paradigms in water provisioning policies globally, and their impact on Trinidad's water policies; (2) analyse the genesis of government ideology of water as a public good; and (3) identify the new concepts in water supply which have emerged in the 1990s internationally, and locally.

The evolution of water provisioning policies is divided into five major periods: 1950s to 1960s economic growth, modernization, and state capitalism; early 1970s redistribution and growth; late 1970s basic needs approach; 1980s free market approach; and 1990s privatization. Each section will discuss world trends fostered by international agencies, and then Trinidad's manifestation of these, particularly in relation to water policies (See Table 1).

TABLE 1 SHIFTING PARADIGMS IN WATER PROVISIONING POLICIES

1950s-1960s		**Economic Growth, Modernization, State Capitalism**
Globally	*	Accelerated Economic Growth Model adopted.
Locally	*	Political Independence in 1962. High Government involvement in infrastructure provision eg.water to achieve rapid economic growth,industrialization and to meet public needs.
	*	Creation of Water and Sewerage Authority 1965 to manage water resources because of water shortages.
1970s		**Redistribution with Growth (RWG)**
Globally	*	Failure of economic growth model. Inequalities increased, rising unemployment and poverty.
Locally	*	Limited income redistribution. Black Power Riots 1970 fuelled by high unemployment among black urban poor.
	*	Local elites benefit from State incentives.
	*	Government applies for loan to build large dam, expands water facilities, subsidizes water agency, and keeps water rates low for social equity reasons.
Mid 1970s to late 1970s		**Basic Needs Approach**
	*	Failure of Redistribution with Growth.
Globally	*	United Nations placed basic needs fulfillment top on its agenda. Concerns for safe water, shelter, health.
Locally	*	Oil boom in 1973.Major social and economic projects embarked upon by Government; subsidized housing, health, water, and transport.
1980s		**Free Market Economics**
	*	Global recession, rising burden of public financing
Globally	*	Resurgence of free market economics (Thatcherism and Reaganomics), cuts in public expenditure.
	*	International Drinking Water Supply and Sanitation Decade.
Locally	*	Oil price decline and economic recession. Cuts in transfers to public utilities. Mandatory submission of public utilities accounts to Ministry of Finance.
1990s		**Economic Crisis and Privatization**
Globally	*	International Conferences on Water & the Environment.
	*	Visible deterioration of infrastructure, and quality of essential services eg. water.
	*	Privatization of public utilities.
Locally	*	Structural adjustment package from World Bank and International Monetary Fund.
	*	Visible deterioration of water service; emergency funding from World Bank for rehabilitation.
	*	Privatization of public utilities eg electricity, telecommunications and maybe water.

It is necessary to emphasize from the outset, that although issues are discussed in the period in which they first came to light, in the case of Trinidad, some have continued to be important in subsequent periods, although often with a different emphasis, or in conjunction with other problems. These links will be highlighted throughout the chapter.

1.1 ECONOMIC GROWTH, MODERNIZATION AND STATE CAPITALISM (1950s-1960s)

In the 1950s and on through the 1960s, economists tended to dominate the development debates, and essentially determined their intellectual scope. Globally, the concern with economic objectives was manifested in a preoccupation with increasing the rate of growth, productive capacity and major economic development projects. Urban-based industrialization and the modernization of infrastructure were also equated with economic growth (Moser,1993). These trends are reflected in the Trinidad Government's budget speech of 1961, which announced that

"There may, conceivably in the future, be found another road to continuous growth and higher living standards. In the present state of human knowledge, however, there is no alternative to industrialization" (Budget Speech, 1961:255).

State capitalism and paternalism were features of the post-independence era. The view of the "big push" by the State was embraced by the Trinidad Government, when soon after independence from Britain in 1962, Dr. Eric Williams, the Prime Minister of Trinidad and Tobago, adopted the West Indian development model advanced by W. A. Lewis (a West Indian himself) which promoted "industrialization by invitation" (Lewis,1959). The Government noted that social overhead investment was essential to clear the backlog of physical and social infrastructure created during colonization and increase the rate of economic growth. In its opinion, as an underdeveloped economy, the stock of social overhead capital (electricity, transportation services, health services, and various aspects of water development) did not exist, and therefore a policy of heavy initial public sector investment in physical and social infrastructure was

warranted. Such investment was characterized by a lengthy gestation lag between the original investment and the beginning of a return, which meant that investment in projects such as water supply would be supplied by the public sector. In the first development plan after gaining independence from Britain in 1962, the role of the State was enunciated as simply to provide basic subsidized infrastructure such as water, roads and electricity and the fiscal arrangements within which the context, the private sector (foreign and domestic), would create employment in an increasingly diversified economy, particularly through fiscal incentives, geared to encourage the development of a vibrant manufacturing sector (Budget Speech,1962).[1] Indeed, it was in 1965, that the Central Water Distribution Agency was disbanded and the Trinidad and Tobago Water and Sewerage Authority (WASA) was created, to develop a comprehensive management of water resources, following a water supply deficiency that emerged from the rapid industrialization in the early 1960s.

A feature of the 1950s to 1960s was also the growing concern among international agencies about the scale of urban water supply problems globally (Lee, 1969). The basis of this concern was serious health hazards which were attributable to deficiencies in urban water supply. Hence, in 1959 a special programme was established by the World Health Organization (WHO), to improve the provision of piped water supplies at the community level in urban areas. A distinction was made between urban and rural, on the assumption that the provision of water in urban areas was more relevant to economic development, and improvements in public health. The goals and standards of the programme were based on the findings of a survey of existing conditions in seventy-five developing countries. The ultimate goals of the programme were as follows:

1. Piped water supply should be provided to all premises;
2. Adequate service should be maintained at all times;
3. Water for drinking, household, and other purposes should be provided in adequate volume;

4. Standards for drinking water quality should be adopted and enforced, that would be no less rigid than those set by the WHO;
5. Water sources should be protected against pollution;
6. Water schemes should be administered independently from Central Governments, and according to sound management practices; and
7. Regular revenues should be established to cover operation, maintenance, capital charges, and depreciation.

Another major aid agency disturbed by growing water supply problems on a global scale, was the United States Agency for International Development (USAID). The basic points of USAID's programme were (Lee,1969):

1. Water supply systems should be considered as a public utility in the same way as electricity, gas, or telephone systems, and users or beneficiaries should pay the full cost of supplying water;
2. Community water supply development and management should be the responsibility of a single agency, preferably at the municipal or metropolitan level. In less developed countries, it argued, this was not always feasible, and the responsibility for water supply should lie in the hands of an autonomous national or regional agency; and
3. The national or state public health agency should be the primary agent of government for the promotion of community water supplies since the lack of water, in most underdeveloped countries, constituted a major health hazard. The control of public water supplies should not lie with water resource agencies.

Strong arguments for government direction and centralized planning were made by decision-makers because the market price system was unable to give proper "signals" to private entrepreneurs and capitalists in developing countries. Accordingly, the failure of the market meant Government would produce goods such as water, that were warranted and in the "public interest" (World Bank,1988).

But by the end of the 1960s, the euphoria about economic growth had died. None of the assumptions underlying the justifications for rapid economic growth turned out to be universally true. Except for a very few countries, there was no automatic tendency for income to be widely spread, nor did governments take radical corrective action to reduce poverty. The gap between the few rich and the many poor widened, and the "trickle down" effect did not materialize, as new opportunities went to those who were better qualified (Nagamine,1981). Only a small percentage of the population of many countries of the "South" had access to basic services such as potable water.

1.2 REDISTRIBUTION WITH GROWTH (1970s-mid 1980s)

The new emphasis in the 1970s eventually shifted to redistribution with growth (RWG) (Higgins,1981). The objective was to achieve a greater distribution of wealth. The reasoning behind the RWG approach was that a more equal income distribution was a pre-requisite to generate the mass markets which could exploit economies of scale.

Given the integration of Trinidad's economy into the global economy, the Development Strategy 1969 to 1972 focused on growth and income redistribution. In the budget speech of 1969, the Prime Minister announced that

> *" Our policy has always been to pursue economic development within the framework of social justice. Economic development without social justice would be meaningless in any country, even more so in our country, with its peculiar history of colonialism, slavery, indentureship and exploitation" (Budget Speech,1969:459).*

Worldwide, the golden age of growth with greater equality, ushered in after a period of growing inequality, began to move into a distant future, no sooner had it arrived (Higgins,1981). Unemployment and under-employment were seen to be the cause of inequality. Consideration was given to the redistribution of productive assets as a path to reduced inequality. But it was soon discovered that reductions in inequality did not reduce poverty.

The failure of income redistribution in Trinidad, led to deep social and ethnic cleavages, which was precipitated by the Black power riots of 1970. Although employment increased in absolute terms, there developed an acute sense among the lower income groups, and especially among the urban Black population, that the benefits of growth were by-passing them. This was in spite of a Government strategy of providing short-term employment relief, in areas of more depressed economic and social conditions, through the Special Works Programme initially targeted at urban and peri-urban areas (Henry,1988). On the other hand, the traditional local elite or "gatekeepers" (strategically-placed individuals, groups and institutions with the ability to control access to society's rewards or resources) who were invariably of white or French creole ancestry, were able to take advantage of the fiscal incentives for industry, along with the foreign private sector. Carrington (1971) has shown, the employment generated by these new enterprises started by local elites, did not justify incentives provided by the Government. The Black Power riots of 1970 were therefore, in some sense, the tangible reaction to a perceived failure of income redistribution, and increased inequality.

The 1970 riots surely unnerved the Government which derived most of its political support from the predominantly Black urban population, and forced the Government into a redistributive stance, made possible by the oil boom (Yelvington,1993). During the period 1970-1973, the Government expanded social services, including public health and education, and provided heavily subsidized low-cost housing, water supplies, and public transport facilities. In relation to water improvements, it applied to the Inter-American Development Bank to fund the building of the country's largest water dam, but it also undertook several water supply expansion projects, provided large subsidies to WASA, and did not adjust water tariffs in keeping with inflation. Ironically, low tariffs enjoyed by many households had a limited redistributive effect spatially, since there was no water transmission to some parts of the country, or an unreliable service in other areas.

1.3 BASIC NEEDS APPROACH (1970s)

Globally, from the 1970s, the development objective narrowed-down to meeting basic human needs (Higgins,1981). A number of studies in the early 1970s had pointed to the continuing deplorable living conditions of the urban poor in particular. Although income redistribution was attempted, taxation favoured privileged groups with the result that income redistribution was not apparent.

As a consequence of the growing problems of mass poverty, despite substantial economic growth, the United Nations Development Decade (1970 to 1979) announced the failure of growth-oriented development planning, and placed prime consideration on the fulfillment of basic human needs. The strategy, which was essentially the invention of the international development community was introduced in housing and infrastructure sectors in World Bank funded projects. The strategy shifted from highly aggregated magnitudes like "national income" and "growth rates" to increasingly disaggregated objectives such as safe water, adequate shelter, cheap transport and preventive medical services. Thus the decade of the 1970s witnessed the disenthronement of the GNP and the enthronement of "basic needs". The appearance in the 1970s of primary needs at centre stage, marked the beginning of a new act in the continuing drama of world development (Higgins,1981).

While the international community began to give recognition to meeting basic needs in the 1970s, Trinidad's development policies of the 1950s were already reflecting these concerns. In the People's Charter, a document produced in 1956 by the People's National Movement under the guidance of Dr. Eric Williams, promised the creation of a welfare state, and stated that social services were a right, and not a grace.

Experiences of Trinidad in the context of basic needs were notably different from that of other developing countries in Latin America, Asia, Africa and the Middle East. Two dynamic socio-economic forces in its history helped

shape a strategy for the fulfillment of primary needs. Firstly, the peculiar nature of the colonial plantation economy, the historical experience of slavery and indentureship, and the concomitant disparate ethnic and economic groups in the society, required a development strategy at the earliest stage of nationhood, which addressed the fundamental needs of disadvantaged groups in the society. These groups did not have equal access to shelter, education and jobs in pre-independence times and the immediate post-independence period. Secondly, while other countries were discussing the importance of meeting their populations' basic needs, and much of this remained development rhetoric, the global oil crisis of 1973 led to boom times and provided Trinidad with the actual means to embark on major social and economic projects. For instance, socio-economic indicators during the period 1970 to 1990 showed that household access to piped water in the dwelling unit improved from 36% to 55% (CSO,1990). The Government defended its heavy subsidies to water users on the grounds that such benevolent interventions addressed the equity issue.

In hindsight, the decade of the 1970s was marked by excessive government according to Todaro (1985) and others. Exponents of this view suggest that limited finances and skilled manpower in developing countries, meant that government intervention was necessary to modify resource constraints, by choosing and coordinating investment projects which channelled scarce resources into meeting basic needs (Todaro,1985). For Trinidad, although the 1970s was marked by tremendous oil revenues, the limited indigenous entrepreneurship and an embryonic private sector, required Government involvement (Rampersad,1988).

1.4 FREE MARKET ECONOMICS (1980s)

Global recession of the 1980s and disenchantment with central planning, influenced a growing number of (mostly Western) economists, some finance ministers in developing countries, and the heads of the major international development organizations, into advocating the increased use of the market

mechanism as a key instrument for promoting greater efficiency, and more rapid economic growth (Todaro,1985). The decade of the 1980s came to be known as the era of Reaganomics and Thatcherism which emphasised "rolling back the frontiers of State". If the decade of the seventies may be described as a period of increased public sector activity in pursuit of more equitable development, the early eighties witnessed a re-emergence of free market economics as part of an ever-changing development orthodoxy.

Among the international agencies preaching the virtues of the free market were the International Monetary Fund and the World Bank. The World Bank began scrutinizing its project lending to ensure proposed projects could not otherwise be undertaken by the private sector. Much of the new emphasis came in the light of the rising burden of public spending. Given the poor maintenance of public projects, many of the "free marketeers" argued that a greater role for private enterprise in undertaking projects could lead to the more efficient utilization of resources.

Growing population and worsening water quality, had also become obvious in the late 1970s. As a result, the United Nations' International Drinking Water Supply and Sanitation Decade 1981-1990 was declared. As Brookshire and Whittington (1993) observed, both Governments and opposition parties responded to grassroots demand for improved water by re-asserting that access to water was a basic human right, and it was the Governments responsibility to see that all citizens were supplied with clean, and sufficient supplies.

By the early 1980s, Trinidad (after being spoilt by oil like Venezuela, Mexico and Nigeria), entered into a debt crisis, as oil prices tumbled from US$45 in 1973 to US$15 per barrel. However, even after the "boom- bust" it was "business as usual" as the Government continued to maintain all its welfare programmes, and high levels of public sector employment in agencies such as WASA (Barsotti,1988).

The Government maintained its philosophy of the 1950s and 1960s, that water was a public good, and the frontiers of the State could not be rolled back to allow free market forces to operate. While cautioning that it was necessary to cease the almost total reliance of the utilities on the Exchequer, it contended that State involvement in the provision of essential services such as water was important to cushion the effects of economic adjustment on the populace, particularly the more disadvantaged members of the society. The Finance Minister stated that

> *"the Government, as prime mover in the economy, unhesitantly accepts the responsibility for giving the lead in the process of adjustment. In the face of less buoyant revenues, public expenditures must be contained. However, the imperative of providing public goods and satisfying legitimate aspirations for basic amenities must continue" (Budget Speech, 1984:20).*

In 1987, with a change in Government, the philosophy embraced by the newly elected party, the National Alliance for Reconstruction (NAR), was one of making the utilities less dependent on the Treasury. Allocations to public utilities such as WASA were cut across the board. The level of Government transfers and loans to State enterprises and Public Utilities was reduced by 61% from TT$1,135.5 million in 1983, to TT$438.5m in 1989.

A World Bank mission to Trinidad in 1987 reported that many of the subsidy programmes were badly structured and administered, in that the intended beneficiaries received little benefit, while others who did not need assistance got it. It further noted that public utilities and state enterprises received transfers as a matter of course, without serious insistence on their adopting policies to improve efficiency and reduce costs. The World Bank concluded that "however desirable it might be from a social point of view, the Government cannot afford to provide the present level of welfare and heavily state-subsidized services without adopting tax measures that could affect the recovery of economy..." (World Bank, 1988:11).

In adopting the World Bank's recommendations for a programme of policy reform and renewed growth, measures of fiscal discipline were introduced to ensure that the adjustment plans were consistent with these objectives of economic restructuring. The Government announced that

"In many cases the adjustment will imply the institution of more appropriate cost-recovery and pricing policies, the rationalization of employment and establishment of more effective expenditure control systems". (Budget Speech 1989:33).

Public utilities such as WASA were required to submit reports on a regular basis to the Ministry of Finance and the Economy, for review, analysis, and monitoring of these agencies. The Government argued that

"Trinidad and Tobago has come to the end of one era, and stands at the threshold of another. For a long time certain unhealthy and dangerous notions have been propagated in our society. They included the notion that the State could somehow be a tireless mother, forever providing, a guarantor of welfare, and a haven of security, while making no demands for effort and energy on our part. There was also the propaganda that hard work bore no necessary relation to our survival and success, and that providing quality service to our customers and clients was either an unreasonable expectation on their part or, at best a favour to be occasionally dispensed.Now all of this must change. To escape from this crisis, and to transform this society once and for all, requires a veritable revolution in how we as a people think and perceive...." (Budget Speech, 1989:39).

1.5 RESPONSES TO CRISIS:PRIVATIZATION (1990s)

Development policy since the mid 1980s, has been dominated by the global economic crisis, and the International Monetary Fund and World Bank macro-economic reform packages of structural adjustment, designed to assist bankrupted economies on the road to economic recovery. Among the most visible manifestations of crisis is the decline in the delivery, maintenance and quality of essential urban services such as water.

In 1993 to 1994, the highly visible deterioration of Trinidad's infrastructure required rushed negotiations for emergency loans from the Inter-American Development Bank and the World Bank, for the rehabilitation of water and

sewerage facilities which were collapsing due to neglect in maintenance. Some of the loan disbursements have been made as recently as 1994. In the 1994 budget speech presented by the re-elected PNM government, it was announced that

> *" In respect of the public utilities, the inefficiencies and problems of our water distribution and electricity generation systems are well known. Government is fully sensitised to the chronic water supply shortages in certain parts of the country, the problem of leaking mains and distribution pipes.....Government is committed to the restructuring and upgrading of the public utilities so as to enable them in the near future, to deliver an efficient and reliable high quality service to all customers at affordable rates".*

Globally, in the wake of the growing infrastructure crisis and a continued call for less central planning, more recently, the concepts of water as an economic resource, cost recovery, self-financing and autonomous institutions, deregulation and privatization, have been gaining currency among practitioners in the water sector. Starting in 1990 with a global consultation in New Delhi to examine the achievements of the International Drinking Water Supply and Sanitation Decade (1981-1990), the main statement issued was that with regard to water there should be "Some for all rather than more for some" (UNDP,1990:8). This meeting was followed by international consultations in 1992 in Dublin, Brussels and Rio de Janeiro. From these sessions the principles of a comprehensive framework emerged: water must be managed as an economic good which would lead to proper pricing and greater efficiency, and free up funds to extend services to the poor; sector institutions must be more responsive to consumer demand; participation gives people the opportunity to make choices and contributions to their ownership of new facilities; and Government should be a promoter rather than a provider of services (UNDP and World Bank,1994). One of the main statements to emanate from the International Conference on Water and the Environment held in Dublin in 1992 and endorsed by international agencies such as the World Bank and the United Nations, was that water has an economic value in all its competing uses and should be recognized as an economic good, and that past failure to recognize this had led to wasteful and environmentally damaging use of the resource.[2]

The privatization process is taking place rapidly in Trinidad in the 1990s. Among the aspects of Government slated for divestment and/or privatization of management are the public utilities. The Minister of Finance in 1994 expressed the view that liberating aspects of the public utilities will improve their efficiency, and by accessing new and cutting-edge technology, the private sector can enjoy economies of scale and increases in productivity, which in turn is likely to impact on exports by contributing to economic efficiency and ultimately, lower domestic costs.

1.6 SUMMARY

Shifts in water provisioning policies in Trinidad have been influenced by those of international agencies, among them the International Monetary Fund, the World Bank, the World Health Organization, the United Nations and the United States Agency for International Development. As summarized in the Table 1, in the 1950s to 1970s, State capitalism and paternalism, globally and locally, were predominant because it was felt necessary to provide public goods such as water for economic growth, industrialization and modernization, income redistribution and basic needs fulfillment. By the early 1980s, global recession was accompanied with calls from the new right to reduce public spending. The decade became known as that of Thatcherism and Reaganomics. Since that time, privatization has become popular. Many issues such as the implications of privatization on cost-efficiency, the quality of services or the local decision-making process, and the role of users of these services in their management, are coming under scrutiny from international agencies such as the World Bank, which has been a major proponent of privatization of publicly operated utilities. The World Bank (1994) argues, that in many ways, the process of privatization of public utilities represents the transition to a modern State.

After three and a half decades (1950s-mid 1980s) of high levels of public sector spending on water infrastructure, low water tariffs and subsidies to WASA, the Trinidad Government was confronted with declining oil revenues and its own

debt crisis. Economic recession led to the voting out of the old political regime, which was replaced by a new Government in favour of spending cuts on public utilities. In the 1990s, a wave of privatization sweeping countries across the globe has reached Trinidad's shore, as the Government has slated the water agency for privatization by 1995.

END NOTES

1. The high degree of State control over the economy, was not only a developing country strategy. It was a part of the philosophy of "maitres chez nous", in the quiet revolution of the early sixties in Quebec, Canada. State capitalism was seen as a mechanism for developing the local economy, and wresting control from English, American and Ontarian multi-nationals.

2. In January 1992, the International Conference on Water and the Environment:Development Issues for the 21st Century, held in Dublin, Ireland called for new approaches to the assessment, development, and management of freshwater resources. The four main recommendations were: First, the effective management of water resources demands a holistic approach linking social and economic development with protection of natural ecosystems, including land and water linkages across catchment areas or groundwater aquifers. Second, water development and management should be based on a participatory approach involving users, planners, and policymakers at all levels. Third, women play a central part in providing, managing, and safeguarding water. Fourth, water has an economic value in all its competing uses and should be recognized as an economic good (World Bank,1993:24).

CHAPTER 2
BACKGROUND OF THE WATER AND SEWERAGE AUTHORITY:THE SUPPLY SYSTEM AND DEMAND

The Trinidad and Tobago Government invested revenues from the oil boom, in the construction of new water supply facilities which resulted in significant increases in water production. The purpose of this chapter is to (1) present a brief background of the history of the water situation in Trinidad; (2) outline the formation of the Water and Sewerage Authority, its mandate, organizational structure and jurisdiction; and (3) describe the existing water supply system and consumer demand.

2.0 PRE-WASA ERA

The Trinidad water system started in 1853 with the construction of the Maraval Weir and pipeline to Port of Spain. This represented the first organized water supply to the capital city (Trintoplan, 1974). In 1902 the River Estate Waterworks was developed to provide water for the western part of Port of Spain. The development of the country's resources continued in the 1920s to facilitate the improvement of supplies to the main urban centres, namely Port of Spain, San Fernando and Arima. Between 1933 and 1939, the first island-wide project and major surface water source, the Hollis waterworks was developed. Water from that source was piped to Port of Spain and remote areas in East and South Trinidad. The country's groundwater resources were also developed.

In spite of infrastructure developments, water problems in Trinidad were notorious. In 1903 there was a water riot in Port of Spain reflecting the inadequacy of the water supply. By 1937, social discontent erupted over the shortage of water in all parts of the country and the West India Royal Commission of 1938 to 1939 was forced to give high priority to water, health and housing to eradicate the enormous deficiencies of the earlier period (Bereton,1992).

Between 1935 and 1944, using a British model, water supply and distribution were consolidated under a Central Water Works Board. However, in the early 1960s, soon after independence, a decentralized system of water distribution was adopted. A number of agencies were responsible for developing and operating the public water systems. These were the Port of Spain City Council, the San Fernando and the Arima Borough Councils, the Government Water Department and the Central Water Distribution Agency (CWDA) (WASA, 1994). The Government Water Department supplied water in bulk to the three municipal authorities which in turn distributed water and collected rates in their areas. Rural areas were serviced by wells and rivers.

A board of seven members appointed by the Minister and headed by a Chairman acted as a policy-making and administrative body for the CWDA. The Board appointed a Manager, Secretary and Accountant subject to approval by the Minister; other personnel appointments were made without ministerial approval. Although the distribution of water was decentralized, in practice decision-making regarding board appointments remained centralized.

2.1 FORMATION AND MISSION OF WASA

In 1965, a Bill for the establishment of a new public authority was completed with the assistance of the Pan American Health Organization, and in September of that year Act No.16 of 1965 was passed by Parliament, establishing the Water and Sewerage Authority (WASA). The new Authority thus became the sole agency for administering and providing water supply and sewerage services.

The mission of the Authority as enshrined in the Water and Sewerage Act No.16 of 1965 is:

(a) To provide an adequate and reliable water supply;

(b) To effectively collect, treat and dispose of wastewater; and

(c) To promote conservation and effectively manage the country's water resources.

The Act sets out, among other things, that WASA must ensure that its revenues are sufficient to cover operating, maintenance, depreciation and long term debt interest expenses; cover long term debt exceeding depreciation; and create reserves for future expansion.

2.2 JURISDICTION OF WASA

According to the Act, WASA is responsible for maintaining and developing the waterworks and other related properties and promoting the conservation of the water resources of Trinidad and Tobago. At the same time, WASA may authorize, through granting a license, any person or industry (water purveyor) to supply water to the public. It is also responsible for the approval of water distribution and sewerage collection networks and waste treatment plants constructed by the National Housing Authority, and private housing developers. The Ministry of Public Health is responsible for setting water quality and waste water effluent standards.

2.3 INSTITUTIONAL STRUCTURE

WASA is under the control of the Ministry of Public Utilities, the Ministry of Finance and the Public Utilities Commission. It is managed by a nine member Board of Directors appointed by the President of the country, upon the advice of the Minister of Public Utilities.

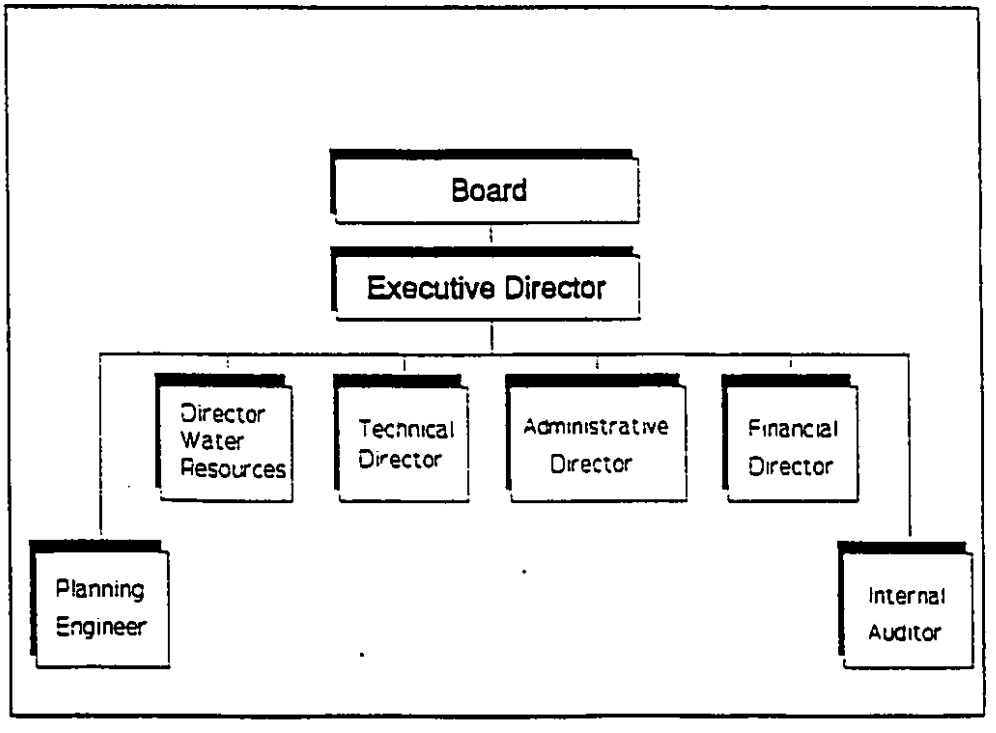
The Executive Director is vested with the highest responsibility for the management of WASA. Three staff organizations namely the Internal Audit Unit, Corporate Planning and Corporate Secretary are managed directly by the Executive Director. The Deputy Executive Director is responsible for the daily operation and maintenance of five technical and management divisions which include the Technical Division, Administrative Division, Water Resources

Division, Financial and Accounting Division and Information System Division (See Fig 2.1).

Under the Technical Director, there are two Chief Engineers responsible for Projects and Waste Water, one Chief Chemist for Quality Control and One Operation Manager responsible for Operations (See Fig 2.2). The Technical Division is organized into four regional offices; the North, South, Caroni and Tobago, and are managed by the Operation Manager.

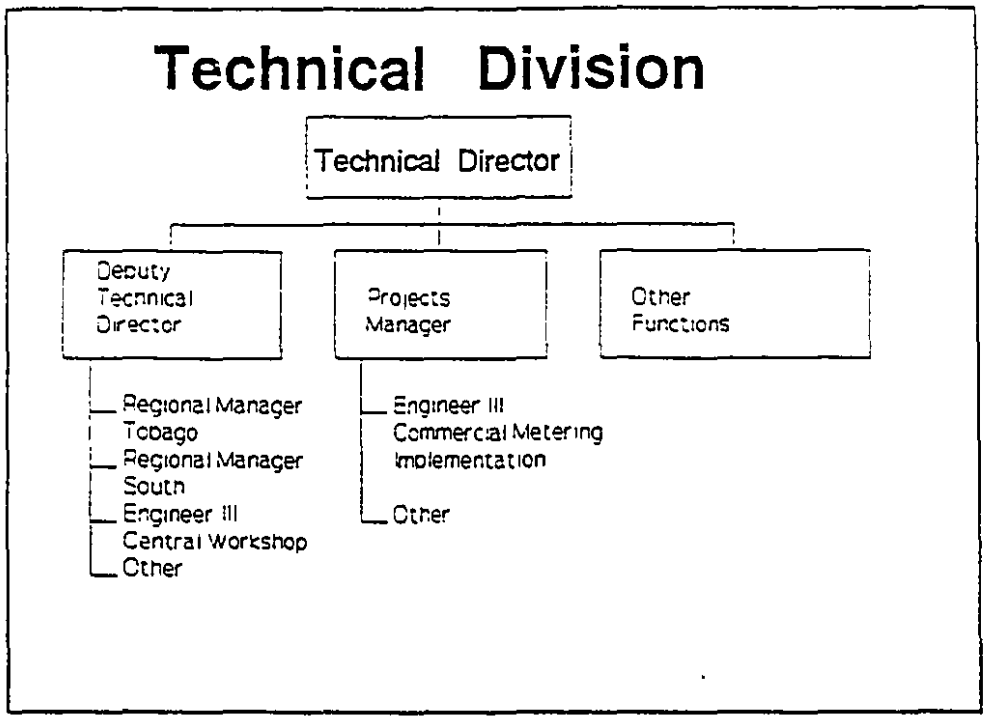
The water billing functions are carried out by the Commercial Section of the Financial and Accounting Division. Its main activities are water billing, meter reading, rate assessments, the handling of customer queries, payment receipts and the collection of revenues (See Fig 2.3).

Fig 2.1 Overall Structure of WASA



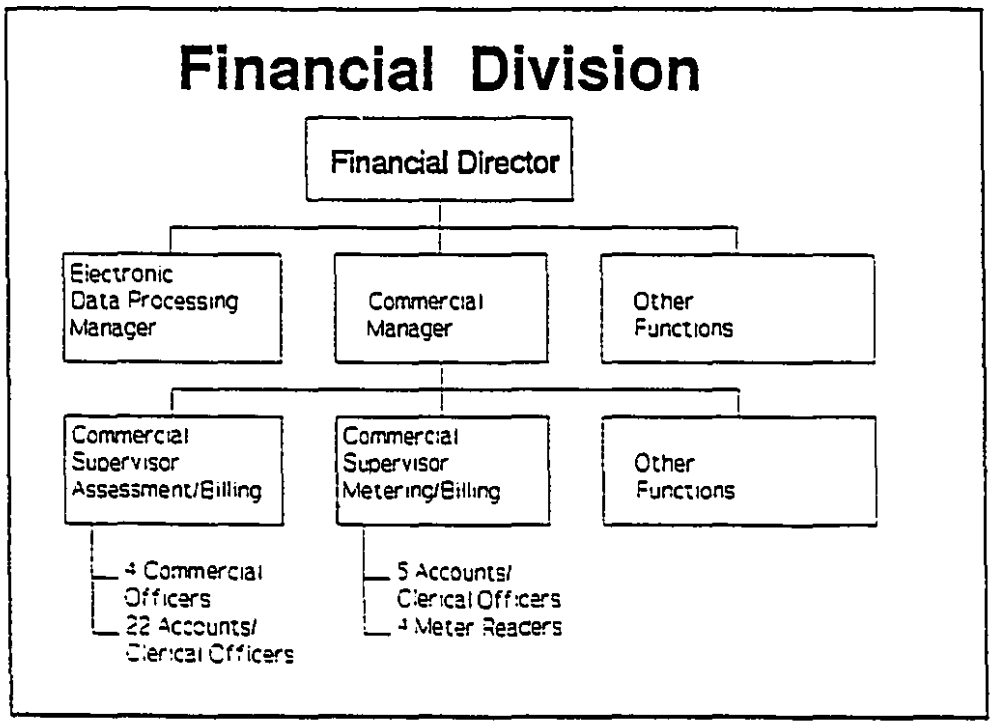
Source:WASA,1994.

Fig 2.2 Structure of Technical Division



Source:WASA,1994.

Fig 2.3 Structure of Financial Division



Source:WASA,1994

2.4 THE PUBLIC UTILITIES COMMISSION

The Public Utilities Commission was established by an Act of Parliament in 1966, and was given powers (1) to determine rates set by any utility, including WASA; (2) to obtain basic financial and other information about the operations of all the utilities on an annual basis or at shorter intervals if required; and (3) to conduct research of its own into the operations of a utility relating to its efficiency and economy.

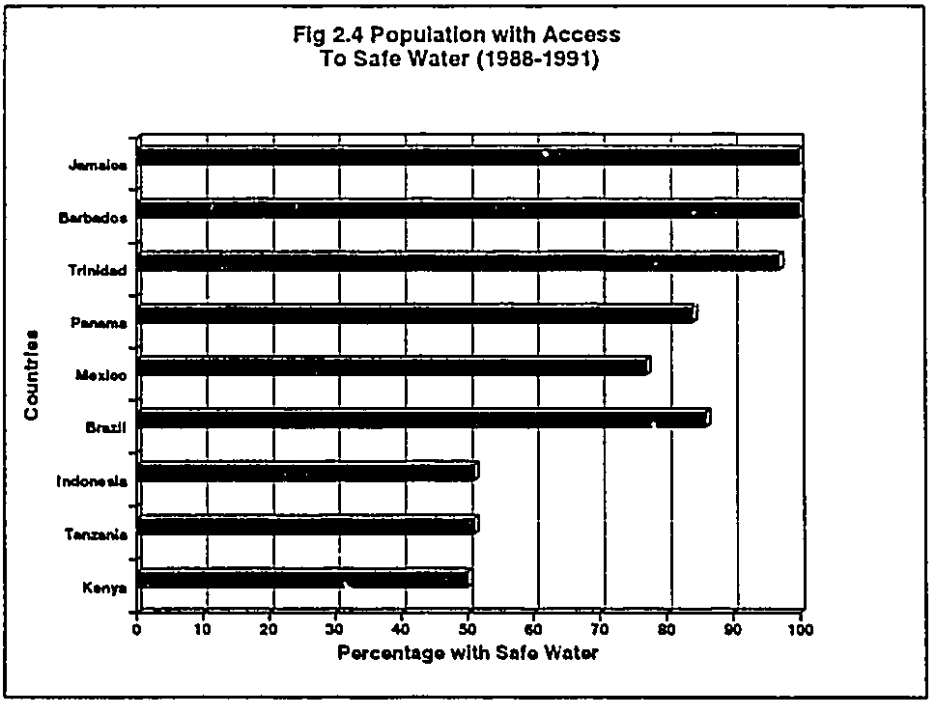
Throughout the 1970s and the early 1980s the PUC was not allowed to determine rates because of political interference. However, the new Government in 1986, restated that the primary function of the PUC was to receive and consider applications for rate adjustments. An in-depth study of each public utility was carried out to determine the true financial status and prospects with special reference to long-term viability, short-run survival, potential for autonomy, the appropriate institutional form, and the position of the utility in the order of national priorities (Ryan,1992).

2.5 EXISTING WATER SUPPLY SYSTEM

This section examines water quality, the water source and production facilities, the transmission and distribution system, the monitoring system, operation and control of the existing water supply and maintenance activities of WASA.

2.5.1 WATER QUALITY

Trinidad meets the World Health Organization's (WHO) standards for water quality. According to the United Nations Development Programme (1994) an estimated 98% of the country's population has access to a safe, potable supply of water which is higher than some Asian, Latin American and African countries (See Fig 2.4). Water is treated by applying a combination of aeration, coagulation, sedimentation and filtration processes before chlorination.



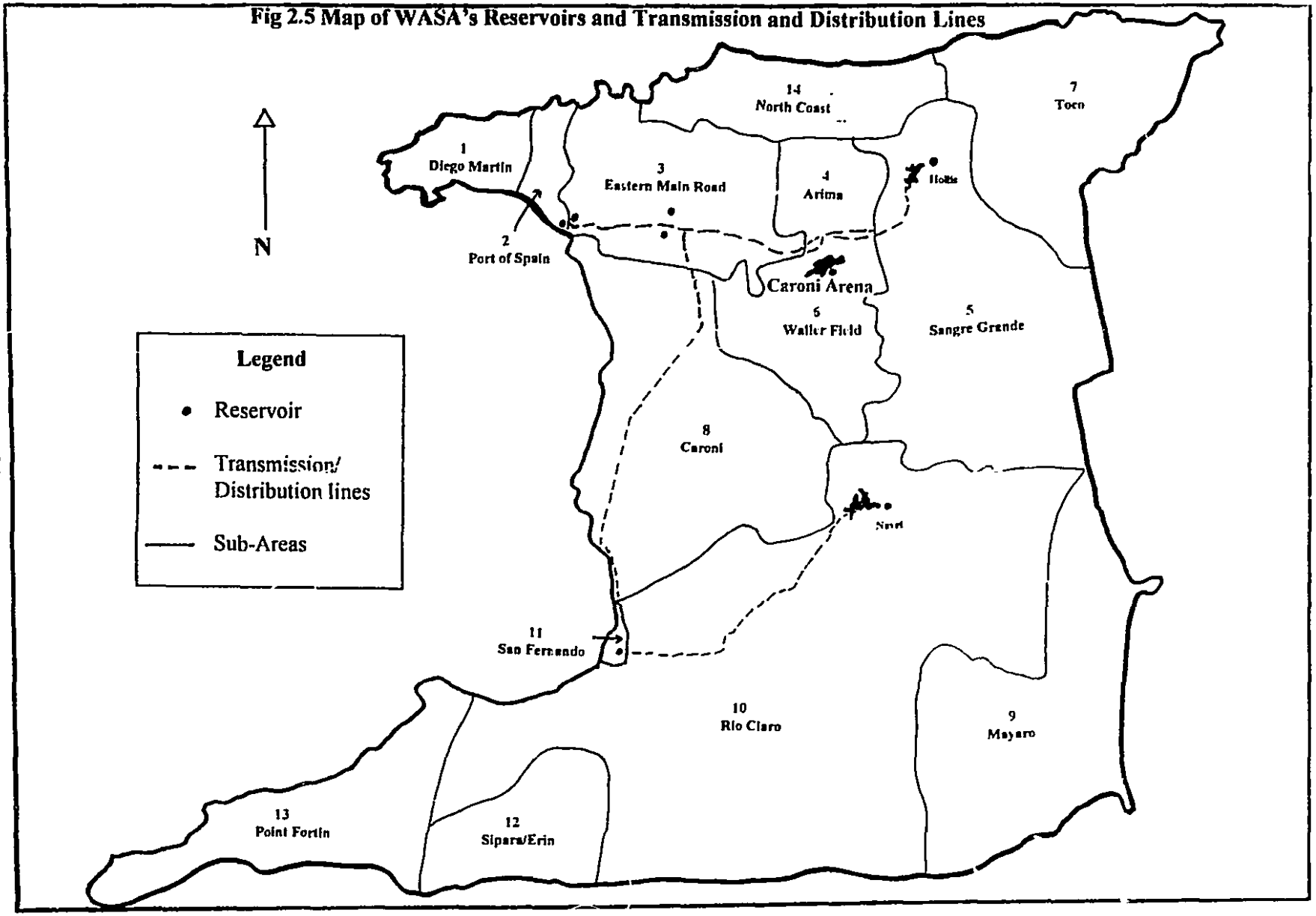
Source:United Nations Development Programme,1994

2.5.2 WATER SOURCE AND PRODUCTION FACILITIES

Trinidad has no scarcity of water resources, a finding reiterated by numerous studies and reports commissioned since the 1960s, and more recently confirmed by a Government-appointed Task Force in 1993.[1]

WASA has 92 separate production facilities including four large-scale waterworks (Caroni-Arena, North Oropouche, Hollis, and the Navet) and impounding reservoirs, river water, groundwater and springs. An estimated 79 of these sources are located in Trinidad. The four large-scale sources account for 60% of total production, of which 40% is produced by the Caroni-Arena Dam (WASA,1991) (See Fig 2.5). Medium-scale systems also provide water to areas which are not served by the large water works. Further, small-scale systems are located in rural areas, and contribute greatly to the supply of potable water to remote towns and small villages.

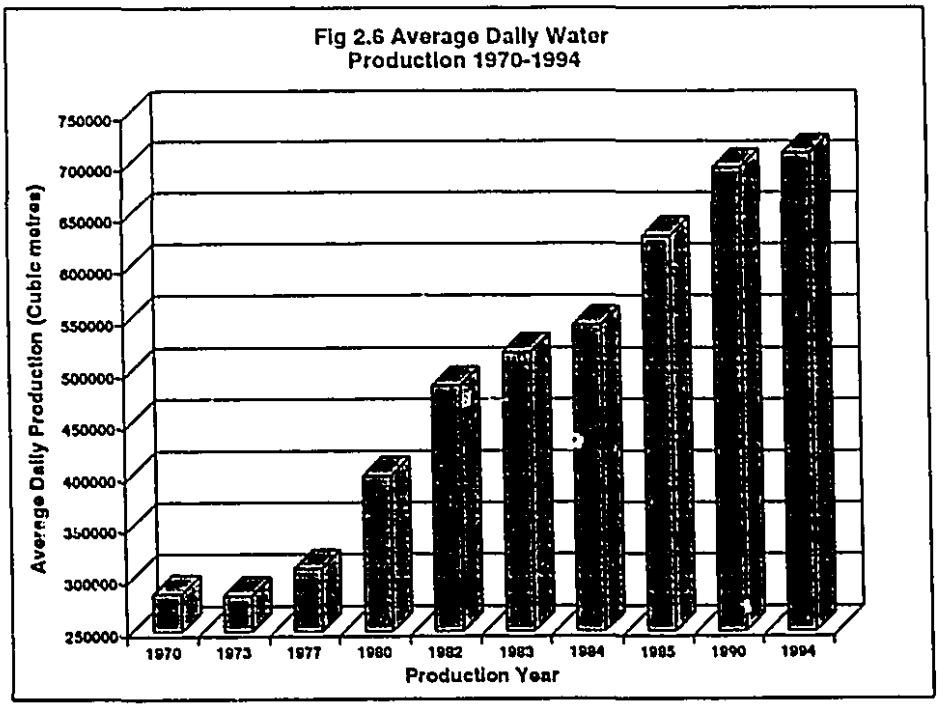
Fig 2.5 Map of WASA's Reservoirs and Transmission and Distribution Lines



Approximately 74% of water production is from impounding reservoirs and river sources and less than 30% of production is dependent upon groundwater sources. The majority of wells are located in the northern part of Trinidad where good quality groundwater is available (Water Resources Agency,1994).

Precipitation falls into two patterns; infrequent rain in the dry months between January and May, and abundant rainfall in the months of May/June and ending in December. March is the driest month and July and August, the wettest. Despite the small size of Trinidad, mountain ranges have a significant effect on the distribution of rainfall. Trinidad's average annual rainfall varies from over 3300mm in the northeast to about 1500mm at the extremities of the northwest and southwest peninsulas. The difference between total rainfall in the dry and wet seasons is large; approximately 80% of the annual rainfall occurs in the wet season. Water resources are therefore abundant. However, rivers are generally short in length with limited catchment areas, and the seasonal fluctuation of the discharges are very large due to the different rainfall patterns in the two seasons, so that the production level in some reservoirs tends to decrease during the dry season.

Water production has increased steadily, particularly between 1980 and 1985, largely due to the construction of the North Oropouche Works in 1979, and the Caroni-Arena Dam in 1981. But as shown in Fig 2.6., since 1985 total production has increased by only 2% per annum. In 1994, the total average daily water production was 712,665 cubic metres.



Source:WASA,1994

2.5.3 TRANSMISSION AND DISTRIBUTION FACILITIES

Major distribution pipelines extend from the large-scale sources and are connected with pipelines from medium-scale sources. By contrast, small-scale sources are generally found in isolated areas which are not linked to the major distribution pipelines and supply water to a limited number of inhabitants of rural areas (Japan International Cooperation Agency, (JICA), 1991). The location of WASA water sources are shown in Fig 2.5 in conjunction with existing major transmission/distribution pipelines.

The existing transmission/distribution system consists of 99 service storage reservoirs, six high lift pumping stations, 52 booster pumping stations, and transmission and distribution pipelines, although the total length is unknown.

1. Service Storage Reservoirs

Most service storage reservoirs have a capacity of between 45 to 45,500 cubic meters. They are mostly tanks located at higher elevations near water demand zones to achieve gravity flow. In 1991, JICA reported that 22 of the 99 reservoirs were not in use. JICA (1991:I-4-5) attributed this to:

a) The failure of treated water from the waterworks to reach the reservoirs;
b) Difficulty in financing the implementation of comprehensive schemes for rehabilitating/upgrading wells and pumping equipment; and
c) A large amount of leakage on the transmission/ distribution pipelines.

2. Booster Pumping Stations and High Lift Pumping Stations

In the Northern Range Hills, housing developments have taken place above the level of service reservoirs. It is not uncommon for water to pass through three separate booster pumps in order to reach higher properties (Thames Water International (TWI),1991). In 1994, booster pumping stations were failing regularly due to the lack of maintenance and spare parts for repair, leaving many settlements with an unreliable water service.

3. Transmission and Distribution Lines

The majority of transmission and distribution pipelines are very old and are largely the cause of high water loss through leakages. Details of this problem are presented in chapter 3.

2.6 SUPPLY SYSTEM MONITORING

The existing water supply system is operating with malfunctioning, outmoded monitoring equipment. A survey by JICA (1991), showed that complex air purge meters that require routine maintenance were defective and not in working condition. Some of the pressure gauges were not functioning because of worn-out elastic elements and appurtenances. Moreover, the Central Supervisory System was malfunctioning, despite WASA's intention of monitoring and recording automatically the water level, pressure and flow rate at the designated

points in the water supply system. As a result engineers walk the distribution pipelines to determine the source of leakages (Charles,1994).

2.7 SUPPLY SYSTEM OPERATION AND CONTROL

WASA utilizes high pump head for the purpose of supplying more water to consumers because the water distribution system is not sufficiently zoned. In many cases pumps are operated above their pressure design capacity which results in increased power consumption, and more leakage from the pipe network (JICA,1991).

2.8 SUPPLY SYSTEM MAINTENANCE

As argued by Ostrom, Schroeder and Wynne (1993) no infrastructure facility can continue to operate efficiently for its expected life without some level of routine and emergency maintenance. They make the point that the most important maintenance tasks are routine activities, which are undertaken at specified intervals, as opposed to emergency repairs which are carried out in response to unexpected failures in a structure. WASA's mechanical and electrical equipment is malfunctioning and facilities are left without proper routine maintenance. The Executive Director of WASA in 1992 reported to the PUC that the Authority no longer did preventative maintenance because the stock of spare parts at most of WASA's stores had been completely used up, and the agency had neither the cash nor access to credit to replace them (PUC,1992). In effect, WASA is undertaking emergency repairs more frequently, while routine maintenance is irregular. The following were the outstanding problems of the system of maintenance (after JICA,1991:I-4-12):

1) Some artesian wells were over-extracted and saltwater had begun to intrude them;
2) Inadequate inventory of spares developed into a practice of overhauling and cannibalizing defective pumps. Despite these efforts, many malfunctioning pumps were left in operation with worn-out parts;
3) High pump head designed by WASA caused an increased occurrence of

valve cavitation and more leakage from the distribution network;

4) Malfunctioning altitude valves due to worn-out accessories were found at several major service storage reservoirs and were not maintained; and

5) Vast amounts of leakage occurred at several points in the distribution network.

2.9 EXISTING WATER DEMAND

WASA provides potable water to 98% of the population which is approximately 1.28 million people by direct connections to houses, public standpipes, and truck-borne supplies (See Table 2.1). In 1990, the estimated total daily water demand which covered all categories of water use (domestic, commercial, agricultural, industrial, institutional) and unaccounted-for-water (UFW) (including system leakages), was approximately 669,000 cubic meters per day. Given that total daily production is 712,665 cubic metres, supply utilization is very close to system capacity most of the time.

Table 2.1 Percentage Population served by Different Levels of Service

Type of Service	Percentage Population
House tap	52%
Yard tap	20%
Stand pipe	14%
Other (truck supplied water, rain, rivers)	14%

Source: WASA,1994.

Up to 1992, domestic water consumers accounted for 72% of total water demand consumption, industries and agriculture used about 8%, and commercial and public institutions accounted for 20%.

2.10 DIURNAL DEMAND PROFILES

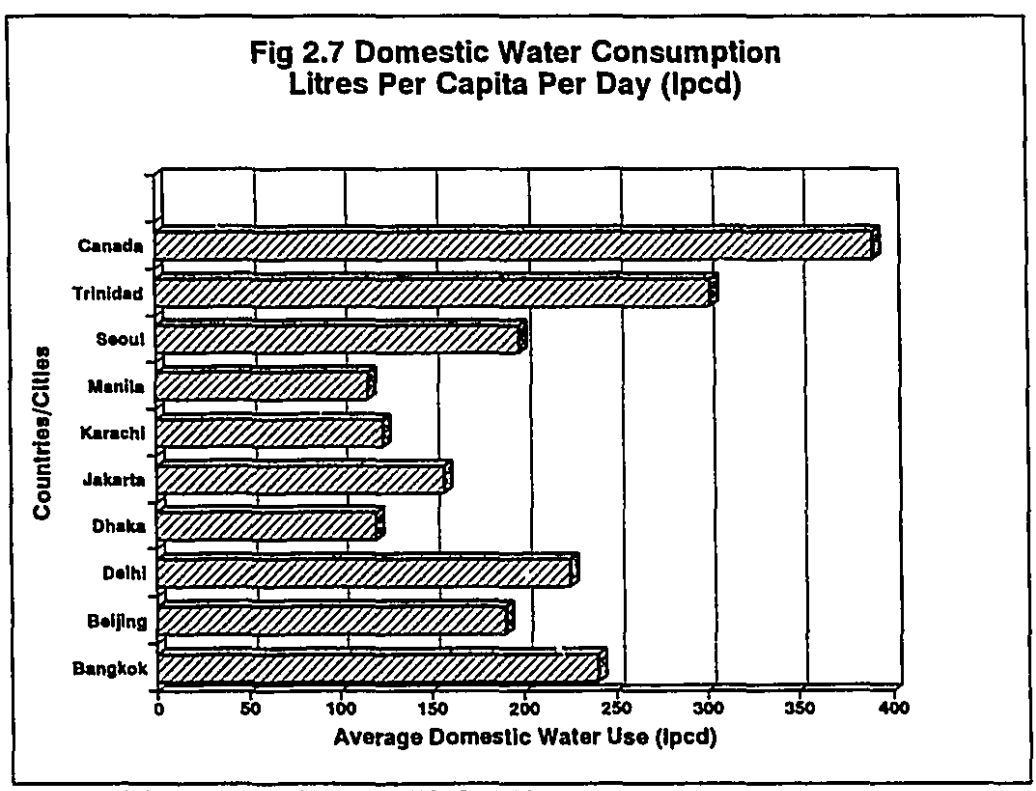
At present diurnal variations in demand, particularly domestic demand, are affected by scheduling and the fact that households have private storage tanks

(Halcrow and Partners,1994). Therefore, it is difficult to determine peak demand periods.

2.11 AVERAGE DOMESTIC WATER CONSUMPTION

Trinidad's domestic water consumption is higher than many developing countries, including those of Asia and the Caribbean (See Fig 2.7). The average domestic water consumption in the Caribbean is 225 litres per capita per day (lpcd), compared with Trinidad's, which lies somewhere between 230 and 373 lpcd, although most customers are unmetered and therefore this figure is likely to be a considerable under-estimation of actual consumption (TWI,1991).

Consumption varies by the different level of servicing. For instance, Trinidad households with unmetered internal plumbing use 348-370 lpcd, metered internal plumbing 227 lpcd, standpipe users 36 lpcd, and yard tap users 305 lpcd (See Table 2.2).[2]



Adapted from MacIntosh 1994 & WASA 1994

Table 2.2 Average Domestic Consumption of Trinidad Households by Level of Service

Customer Type	Consumption (lpcd)
Stand pipe	36
Yard tap	305
House tap (unmetered)	348-370
House tap (metered)	227

Source: Delcan, 1992.

2.12 CUSTOMER CLASSES

Residential users account for 89% of WASA's billed customers, industries (8%), commercial (2%), and agricultural users (1%). WASA's water transmission and distribution system serves urban areas (97%) as well as many rural customers (77%) throughout Trinidad and Tobago. Much of the rural development is concentrated along roads which are served by WASA water mains, which is one reason that potable water is within the reach of 95% of Trinidad and Tobago's population (WASA,1994).

2.13 LEVEL AND PRICE OF SERVICE

The level and price of water service provided by WASA to domestic users is as follows:

1) **Stand pipe**: Outside taps are installed along water mains where customers do not have service pipes. All customers within 400 metres of a stand pipe are considered to have access to piped water and are charged a flat rate of TT$33.75 per quarter;
2) **Yard Tap**: Customers whose premises are served by a single tap which is located on their property, but outside their buildings. They are considered to have no internal plumbing and are charged a flat rate of TT$67.50 per quarter;
3) **Internally Serviced (No Meter)**: Customers with an unmetered internal plumbing service are charged based on their Annual Rateable Value; and

4) **Internally Serviced (Metered)**: Customers with a metered internal plumbing service are charged on the basis of the volume of water used.

2.14 SUMMARY

Trinidad's water quality meets the standard set by the World Health Organization. Moreover, there is no scarcity of water resources. It is clear that substantial progress has been made in expanding production over the years, with the result that there is almost universal access to a safe piped service. But despite dramatic increases in water production, supply capacity is close to daily operating capacity.

END NOTES

1. In the past 10 years the following major studies on the public water system in Trinidad and Tobago have been undertaken: *The Study on the Improvement of the Water Supply Supervisory System in Trinidad and Tobago by* Japan International Cooperation Agency (JICA) (1991); *A Feasibility Study to Determine Methods of Leak Detection* by Thames Water International in association with ADeB Consultants (1991); *A Feasibility Study on the Cost/Benefit Analysis of Universal Metering in Trinidad and Tobago* by Delcan International Corporation in association with Lee Young & Partners (1992); and *The Water System Balance in Trinidad*, Lourde Marte Braithwite (1985).

2. A survey by Thames Water International (1991) revealed that Jamaican households with internal plumbing use 320 lpcd.

CHAPTER 3
DIAGNOSIS OF PRESENT WATER PROBLEMS

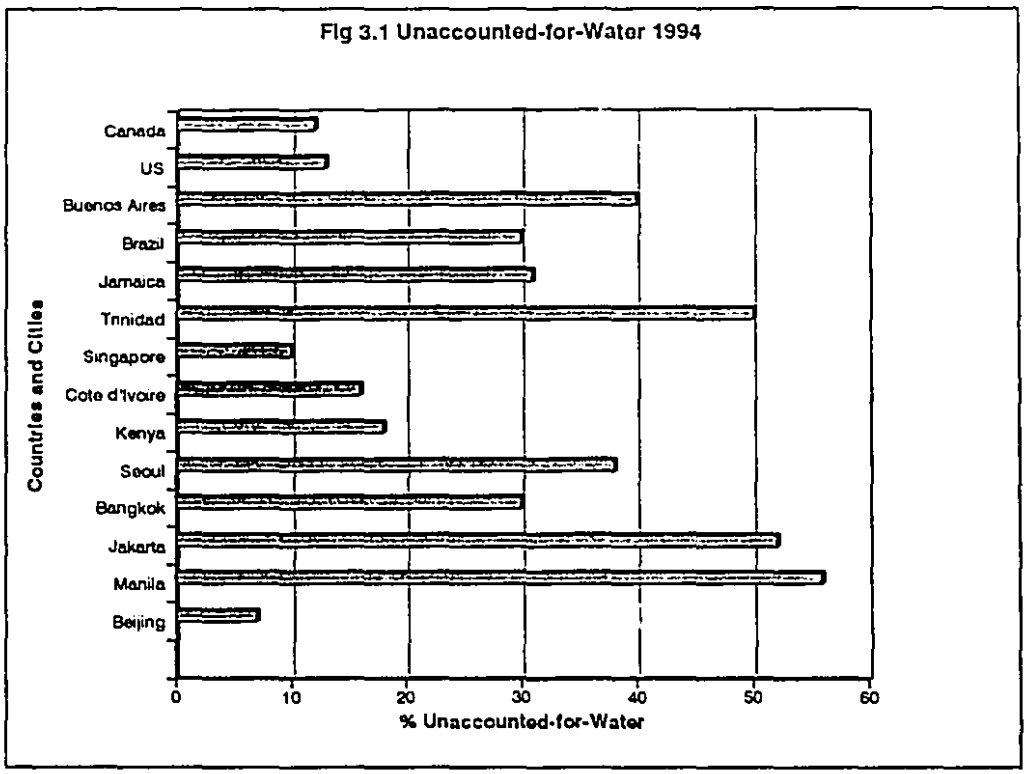
Trinidad's water problems can be broadly classified as those of the supply and distribution system, economic and management problems of WASA, and those associated with politics and corruption. All of these ultimately affect consumers. The aim of this chapter is to diagnose these problems.

3.0 WATER SUPPLY AND DISTRIBUTION PROBLEMS

The main water supply and distribution problems are high levels of unaccounted-for-water (UFW) and unreliability.

3.1 UNACCOUNTED-FOR-WATER

Unaccounted-for-water is the difference between the volume of water delivered to a supply system and the volume of water accounted for by legitimate consumption, whether metered or not (World Bank,1993). Studies done by the World Bank (1993), have established that the level of UFW in most developing countries is three to five times typical levels in industrialized countries. The extent of leakage in Trinidad cannot be accurately measured; it can only be estimated in the absence of universal metering. However, WASA (1994) reported that about 50% of production is lost through leakage. This is significant compared with some developing countries: Singapore for example, cut UFW to 10% and Bangkok successfully reduced UFW from more than 60%. to less than 30% in 10 years (McIntosh,1994) (See Fig 3.1). Studies done by Yepes (1990) showed that the average UFW for the more efficient Latin American companies was 34%, which contrasts with 40% to 60% for poorly operated companies in Latin America. The sample of European companies in Yepes' (1990) study had an average UFW of 22%, the USA 13% and Canada 12%.



Source:United Nations 1994

UFW in Trinidad is due to technical losses (leaks from pipes and other water handling facilities), and non-technical losses (illegal connections) stemming from deficiencies in the commercial system such as outdated cadastre information and inadequate accounting of users.[1]

3.1.1 LEAKAGE FROM TRANSMISSION AND DISTRIBUTION PIPELINES

Leakage occurs from the reservoirs, pipelines, gatevalves, fire hydrants, service pipes, fittings in the public system, and on private property. However, most leakage occurs through transmission and distribution pipes which are in poor condition (Thames Water International (TWI) 1991).

A variety of pipe materials are used, namely, steel, cast iron, pre-stressed concrete, ductile iron, PVC, asbestos, cement and galvanized steel pipes. The

ductile iron and PVC were installed in the late 1980s. Cast iron and steel pipes installed more than twenty years ago, are seriously deteriorated by corrosion due to the absence of coating and/or lining, so that their conveyance capacity has decreased and leakages have increased. The asbestos cement pipes are brittle and vulnerable to heavy loads. In addition, the wall thickness has decreased in pipes which have been in use for a very long time because the asbestos is soluble in water. This may be a contributing factor to the frequent pipe breakage, and high levels of water leakage.

TWI's (1991) study of leakage detection noted the following problems in repairing leakages in the transmission and distribution pipelines:

1) The lack of vehicles to take repair gangs to the site is a major contributing factor to the difficulties encountered when repairing leaks. Much of WASA's available transport is very old, and in a poor state of maintenance;

2) Another problem is the lack of appropriate equipment for repair work. For instance, there are more backhoes than compressors in virtually every district. TWI (1991) noted that this was very surprising, considering that the vast majority of all repairs are service pipe repairs which require a compressor, but are not suitable jobs for use of a backhoe. Laying or relaying services at 450 millimetres cover requires a trench of only minimal width, which cannot be achieved using a backhoe;

3) There is also no compaction equipment available to any of the repair gangs. As a result, compaction of backfill is either ignored completely, or the completed trench is only partially compacted by driving an available vehicle, such as a backhoe over the trench. Pipes inevitably suffer unnecessary stresses due to ground movement, and the reoccurrence of bursts is frequent;

4) The general shortage of materials, and lack of funds to pay suppliers, adversely affects the repair rate and has the effect of wrongly prioritising jobs; leaks are repaired according to the availability of materials and funds, rather than the nature or size of the leak;

5) Response times are reliant on the availability of materials, equipment and transport. The average period of time between reporting a leak, and its repair is not currently reported by the tracking system. However, based on observations of repairs in the North region, this figure is between 2 and 4 weeks;

6) Repair techniques for service pipes and mains are generally inadequate. Many service pipes have been laid at a very shallow depth, frequently less than 100 to 150 mm deep and often in the sub-base of the road. The laying of pipes at such shallow depth is a major contributing factor to the very high number of failures recorded, as they are extremely susceptible to loads imposed by traffic; and

7) Poor repair practices used for mains also increases the occurrence of leakage. It is common practice in WASA to salvage and re-use pipe fittings where possible, but the repair of recurrent leakage is more costly than using a new fitting in the first place.

3.1.2. SERVICE RESERVOIRS

Six reservoirs in service were known to have significant leaks according to TWI (1991). These were Picton 1, Mc Shine, Mount Hope, St Augustine, Chacon Tank and Pepper Hill Tank. Total leakage from Mount Hope and St.Augustine was 1.89 million litres per day (Mld) which was measured when the reservoirs were low. Water loss could have been 4Mld if the tests were conducted when the reservoirs were full.

3.1.3 VALVES

Large numbers of valves within the distribution system are either inoperable or can only be partially closed. This is partly due to valve maintenance receiving a low priority historically, and partly due to the damaging effect of using sluice valves to control flows (TWI,1991). Partially opened valves reduce the efficiency of boosting water to residential areas located at high elevations. As noted by TWI (1991) "any valves letting water leak through the system would result in water to a boosted zone being effectively pumped in circles at a heavy cost" (TWI,1991:28). Leakage losses in residential areas are very high according to a JICA pilot leakage survey conducted in 1989. The loss from leakages ranged from 32% to 84% of the water supplied to ten residential areas in the sample.

3.1.4 SERVICE CONNECTIONS

There is a high level of leaks in service connections which are faulty. In 1990 alone, the estimated number of reported leaks in service connections was 38,000.

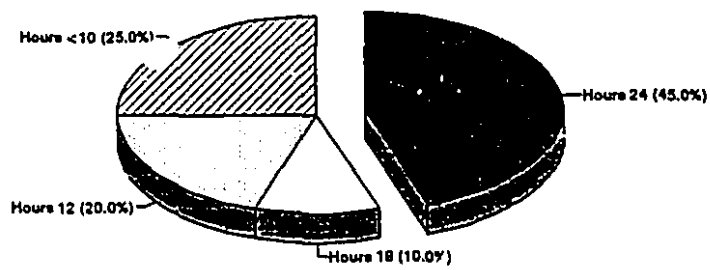
3.1.5 ILLEGAL "GHOST" CONSUMERS

A major source of UFW is through illegal consumers. The incidence of piracy is significant, judging from recent data which estimate that in 1994 there were approximately 40,000 "ghost" customers (WASA,1994).

3.2 UNRELIABILITY

In many developing countries, water companies are unable to provide a 24 hour service (See Appendix 3.1).[2] In the case of WASA, its primary mandate is to provide an adequate and reliable water service, but only 45% of its customers receive a 24 hour supply seven days a week, as illustrated in Fig 3.2.

Fig 3.2 WASA Customers Receiving
Unreliable Water Supply (Hours Per Day)



Adapted from WASA 1994.

Domestic consumers in north, central and south Trinidad were severely affected by water shortages in 1993 and 1994. Some residents were without water for over two and a half months, while other residents were without water for six months, and in extreme cases two years. To offset the water shortage, WASA uses a scheduled interruption, whereby households are informed that water rationing is in operation, during specific times, on particular days.

Unreliability is so widespread that a significant percentage of domestic users (66%) have private water storage facilities, which are used to store water provided by WASA, and later used when water is rationed (JICA,1991). In the past, free truckborne water was provided by WASA, to areas affected by water shortages, but since 1994 the programme has been discontinued because WASA is unable to pay contractors for this service.

3.3 WASA'S ECONOMIC PROBLEMS

Legislative provisions exist for WASA to recover operating, maintenance, and certain capital costs, but its economic performance shows that this has not been accomplished due to its income and expenditure patterns.

3.3.1 REVENUES

Since its inception, WASA has had shortfalls in revenue due mainly to the system of water charges it has adopted, infrequent rate adjustments, and the high percentage of accounts receivable. Revenues in the early 80s were a mere 7% of total recurrent expenditure, but since then this has increased substantially due to cuts in Government funding and the need to recover costs. In 1994, revenues accounted for a little over 50% of total recurrent costs, while the remainder was covered by State subsidies and debt financing which amounted to TT$156 million. Despite improvements in revenue an enormous accumulated debt of $TT516 million was incurred in 1993, which led to utility to declare itself bankrupt one year later. Table 3.1 provides a balance sheet of WASA's revenue and expenditure patterns in relation to water (not sewerage).

Table 3.1
Summary of WASA's Revenue and Expenditure in Million TT$ 1988-1993

	1988	1989	1990	1991	1992	1993
REVENUE FROM WATER	127	132	128	125	149	154
EXPENDITURE ON WATER	268	246	290	356	287	316
a) Production	51	51	53	62	64	69
b) Distribution	41	37	44	54	42	37
c) Transmission	13	10	13	14	12	9
d) Administration	55	50	69	96	59	96
e) Common Services	71	65	78	98	89	72
f) Depreciation	37	33	33	32	32	33
GOVERNMENT TRANSFERS	71	63	67	68	66	45

Source: WASA, 1995.

N.B * Administration includes administration, bad debts provision, financial accounting, commercial and audit fees.

* Common services include transport, engineering and administrative costs, major maintenance, construction, building gang, water resource agency, investigation and designs, laboratory, drawing office, systems investigations, major projects control unit.

* Government transfers include amounts given to cover operating deficits and development expenditure.

Table 3.2 Schedule of Water Rates 1995 (TT$).

Unmetered Industrial, Commercial, Public Buildings	Minimum bill TT$474 per month
Metered Industrial, Commercial, Public Buildings	TT$3.50 per cubic metre Minimum bill per month TT$35
Agricultural Unmetered	15% of ARV Minimum bill per month TT$105
Agricultural Metered	TT$2.25 per cubic metre Minimum bill per month $20
Churches and Registered Charitable Organizations Unmetered	TT$108 per quarter
Churches and Registered Charitable Organizations Metered	Up to 150 cubic metres TT$1.75 per cubic metre Above 150 cubic metres TT$3.50 per cubic metre. Maximum Bill TT$30 per quarter
Domestic Unmetered (Standpipe Users)A1	TT$33.75 per quarter
Domestic Unmetered (Yard tap Users) A2	TT$67.50 per quarter
Domestic with unmetered internal plumbing A3	ARV (TT$) Charge Per Quarter 0-500 95% of ARV Minimum$108 510-1000 81% of ARV Minimum$118 1001-2000 54% of ARV Minimum$203 Over 2000 47% of ARV Minimum$270 Maximum TT$304 per quarter
Domestic with metered internal plumbing A4	Up to 150 cubic metres TT$1.75 cubic metre Above 150 cubic metres TT$3.50 per cubic metre Minimum Bill TT$30 per quarter

Source:WASA,1995.

1. USER CHARGERS:THE ANNUAL RATEABLE VALUE

WASA uses a combined system of metered water charges and unmetered charges for customers based on the Annual Rateable Value (ARV), which is the assessed annual rental value of a property used for real estate taxation purposes. Approximately 99% of WASA's domestic customers are charged according to the ARV. The tariff is oriented towards an imputed ability to pay, rather than the amount of water used (See Table 3.2). This issue will be discussed in Chapter 9.

The ARV system results in a large proportion of minimum bills, which reduces its effectiveness in generating sufficient revenues to cover costs. Although the following example is based on WASA's 1991 rates, it provides some explanation of how limited revenues are: (also see Table 3.3).

1) **Domestic ARV Customers (A3)** 50% are billed according to the minimum $0-500 ARV range and pay the minimum $80.00 per quarter. Only 7% pay the maximum which is equivalent to an ARV of $2,700 or more;

2) **Industrial ARV Customers (B3)** The minimum bill of $425 per quarter is equivalent to an ARV of $13,600. Approximately, 44% of industrial customers fell into the minimum category, and 22% had an ARV exceeding $50,000 and paid over $1,560 per quarter;

3) **Commercial ARV Customers (C3)** Almost 75% of commercial customers were assessed at $13,600 or less and paid the minimum quarterly $425 charge. The remaining 25% ranged above this charge.

4) **Institutional Customers** Government buildings (offices, schools etc) have very small ARV's and are billed the minimum rate.

Table 3.3 Profile of Annual Rateable Values by Customer Class 1991

ARV Range	A3 Domestic		B3 Industrial		C3 Commercial	
	Number	%	Number	%	Number	%
0-500	65,177	50%	22	7	1,363	19
501-1000	31,436	24	11	3	601	9
1001-2000	21,640	16	10	3	595	9
2002-2500	3,924	3	1	0	244	3
2501-5000	6,418	5	33	10	877	12
5001-10000	2,184	2	51	15	1,096	16
10001-13600	300	0	21	6	434	6
13601-20000	214	0	32	10	513	7
20001-50000	106	0	80	24	779	11
Over 50000	33	0	75	22	584	8
Total	131,432	100	336	100	7,086	100

Source:WASA,1991

The limited potential for generating revenue is further aggravated by low water tariffs, which do not adequately cover all operating and maintenance costs and debt service obligations, and thus are unable to contribute to the expansion of the system. In 1993, the cost of producing a cubic metre of water was US$0.43 and the rates charged to all categories of users up to that year were below this amount, reflecting considerable subsidization. In comparison to other Caribbean and Latin American countries with the exception of Colombia, there is clear evidence that Trinidad's tariffs are low (See Table 3.4).

Table 3.4 Comparison of Water Tariffs in US$ Per Cubic Metre (1993)

Country	Commercial	Industrial	High Domestic	Low Domestic
Colombia	0.06	0.06	0.65-1.25	0.20-0.60
Costa Rica	0.70	0.82	0.40	0.51
Barbados	0.85	0.85	0.85	0.06
Trinidad	0.36	0.36	0.21	0.03
St.Lucia	0.84	0.84	0.63	0.33

Source: WASA,1993.

2. INFREQUENT RATE ADJUSTMENTS

Another factor that accounts for WASA's weak revenue situation is the infrequency of rate adjustments. Water rates remained unchanged from 1937 to 1985, mainly for political reasons.[3] Ryan (1992), notes that it is possible that the political costs of raising rates in the early 1980s were considered too high, given the imminence of a general election in 1986, and an economy in decline.

By the end of 1984, WASA recognized that it was in dire financial straits after recording a deficit of TT$308 million. It therefore applied for a rate increase in 1985. WASA informed the Public Utilities Commission (PUC) that in designing the new rates, it had taken into account the inherent distortions relating to the use of the Annual Rateable Value (ARV) as an almost exclusive method for charging consumers. Additionally, although the Act entitled it to earn a level of revenue equal to its cost of service, it did not apply to the PUC to recover 100%

of the costs. Instead, an application was made for a rate increase that would have enabled an 80% recovery of operating and maintenance costs. Capital costs were met by the Government.

More than nine months of hearings by the PUC Tribunal transpired before a six-fold rate increase was finally granted in 1986, though not without resistance from several agencies and individuals. Despite these adjustments, it was still unable to meet its operating costs from the revenues collected.

In 1991, with a huge deficit between its operating costs and recurrent expenditure, and substantially reduced Government subvention, WASA again applied for a rate adjustment. The PUC granted a 20% increase in the rates of all metered customers, un-metered non-domestic customers and water abstractors.

A deterioration in the utility's revenue position, growing costs and the collapse of many its water supply and distribution facilities, propelled it to apply for a further rate increase by 1993. However, there was an outcry from many consumers who felt that the rate increase was not justified because of the unreliability of the water service, and that paying consumers were being penalized for WASA's inefficiency. The PUC Tribunal indicated that the rate increase should not to be implemented, until WASA introduced a rebate system for customers who did not receive a regular water supply (16 hours or less per day). However, under WASA's present operational problems it would have meant a greater loss of revenue, than the gains made from higher rates. Under pressure from the Government, the PUC awarded a 35% rate increase for domestic consumers, which took effect in late 1994.

3. ACCOUNTS RECEIVABLE

Water utilities usually require an adequate level of cash on hand to pay all operational expenses, and to pay contractors and suppliers, so that current assets are sufficiently managed, but non-payment of water bills is a major

problem affecting WASA's cash flow. Delcan (1992) reported that uncollected accounts were about 25% of billings annually, and at the end of 1990, the outstanding accounts were approximately $231m, of which $50m was considered bad debt and therefore uncollectible. The receivables of $177 million in 1992 were $50 million or 40% higher than that of 1988 (WASA,1993) (See Table 3.5). While annual revenues increased by 15%, accounts receivable increased by 40% over the four year period. Faced with a worsening cash flow situation, WASA increased its short term borrowing and postponed payments to creditors, as opposed to embarking on a programme to drastically reduce its receivables. Creditor balances increased rapidly over the period 1988 to 1992, by $261m or 337%, and bank overdraft grew by $7.7m or 101% for the same period.

Table 3.5 Indicators of WASA'S Collection Effort 1988-1992

	1988	1992	Increase/Decrease	Percentage Change
Accounts Receivable	$126,513,909	$176,584,812	+$50,050,903	40%
Revenue	$150,419,846	$172,522,673	+$22,030,827	15%
Bank Overdraft	$7,602,576	$15,315,679	+$7,713,103	101%
Accounts Payable	$77,419,716	$338,661,557	+$261,241,841	337%

Source:WASA,1993.

WASA's accounts receivable are approximately 11 months outstanding. Yepes (1990) points out that a high level of accounts receivable (more than two to three months) is indicative of problems in the commercial system (billing and collection), of an insufficient effort in collections, and of inadequate policies in dealing with overdue accounts (including low or no penalties for late payment). The importance of keeping this ratio as low as possible is particularly relevant in situations of high inflation.

As Table 3.6 shows, receivables due to WASA were highest among domestic consumers which may be attributable to not having accurate addresses and poor customer records.

Table 3.6 WASA Accounts Receivable by Consumer Class 1993

Category	Billing Cycle	% of Total	Average No.Days Receivables Outstanding
Domestic	Quarterly	61%	454
Commercial	Monthly	34%	347
Industrial	Monthly	5%	132

Source: WASA, 1993.

In 1993, WASA started disconnecting public sector agencies in arrears. Central Government pays the bills for water provided free of charge or at subsidized rates by WASA to old age pensioners, public assistance recipients, standpipe users, schools and pioneer industries. But with Government being a major defaulter on payments to WASA, the utility is in effect bearing the cost of these subsidies. The situation is not unique to Trinidad, as studies show that in most of the large Asian cities, government agencies are major defaulters in paying water bills. This is prevalent notes McIntosh (1994) where governments provide a subsidy to operational expenses, as they treat the issue as a mere paper transfer.

3.3.2 EXPENDITURE

Another major problem is WASA's expenditure pattern. Table 3.1 showed that between 1988 and 1993 expenditure significantly exceeded revenue. Trends in capital spending, recurrent expenditure, depreciation and interest payments are discussed in this section.

1. CAPITAL EXPENDITURE

Fixed assets, such as capital, are financed by Government grants and contributions from other agencies, which explains why user rates have not been expected to recover capital costs. Capital expenditures between 1988 and 1992 were limited and amounted to TT$89.7 million (WASA,1993). However, about 55% of the funds granted for capital development were used to meet daily cash requirements which led to an erosion of WASA's asset base, a deterioration of

the physical plant, and the large number of customer complaints received by the PUC, of intermittent or non-existent water supplies (PUC,1993).

Recent estimates of projected capital budget needs indicate that WASA needs approximately TT$2 billion between 1994 and 2004, to cover the cost of rehabilitation of its present facilities (TT$966 million), and the development of new ones (WASA,1994).

2. DEPRECIATION

Depreciation is used as an accounting method of charging capital costs over the life of a project. In 1990 and 1993 depreciation represented about 15% and 12% of total annual expenses respectively. This may not generate enough capital funds to provide for future growth. According to Delcan (1992), for most water utilities 30% to 40% of total annual expenses are related to capital works, which means that WASA's depreciation cannot meet capital requirements.

3. PRODUCTION COSTS

It cost WASA in 1993 on average US$0.43 to produce a cubic metre of water (WASA, 1995). However, the price charged to all users is below production costs. As shown in Table 3.3 both commercial and industrial consumers pay US$0.36 per cubic metres, while high and low domestic users pay US$0.21 and US$0.03 per cubic metre respectively, and thus receive substantial subsidies.

4. RECURRENT COSTS

Recurrent costs consist of operation and maintenance, and personnel costs (including wages and salaries).

* OPERATION AND MAINTENANCE COSTS

Expenditure on operation and maintenance (O&M) of plant equipment has been drastically reduced in the last five years, leaving WASA less able to provide water services, and its assets in a state of disrepair. Asset maintenance, which

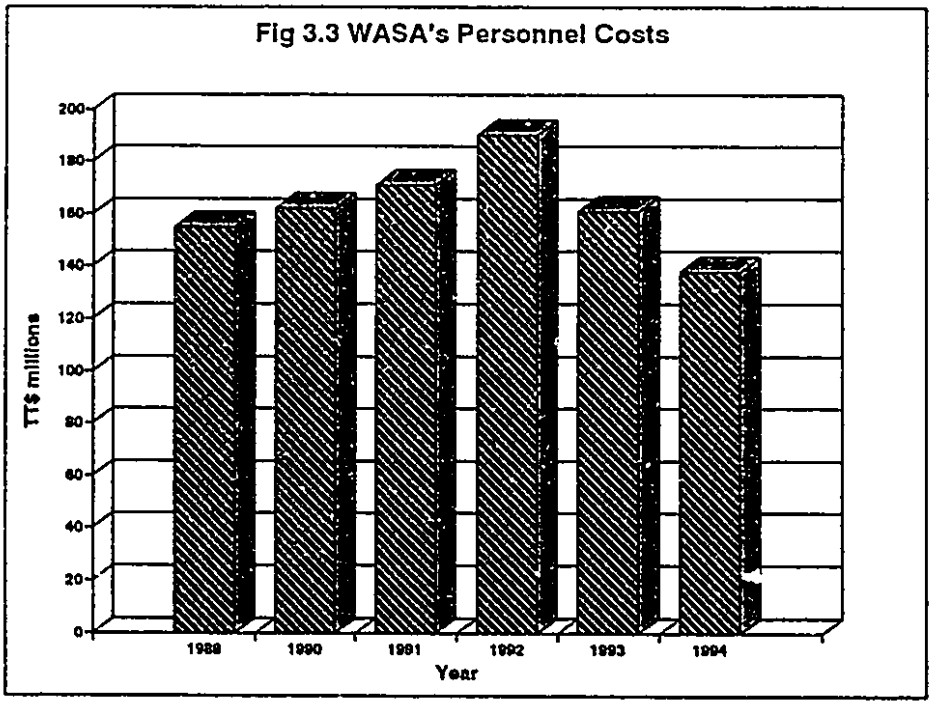
lacks the political glamour of the development of new water works, is largely ignored.[4] Thus, new investment proposals to expand facilities continue to be made under the Public Sector Investment Programme, while existing facilities deteriorate. The neglect of O&M led to the need to seek emergency funding from the World Bank in 1994 for system rehabilitation.

* PERSONNEL COSTS

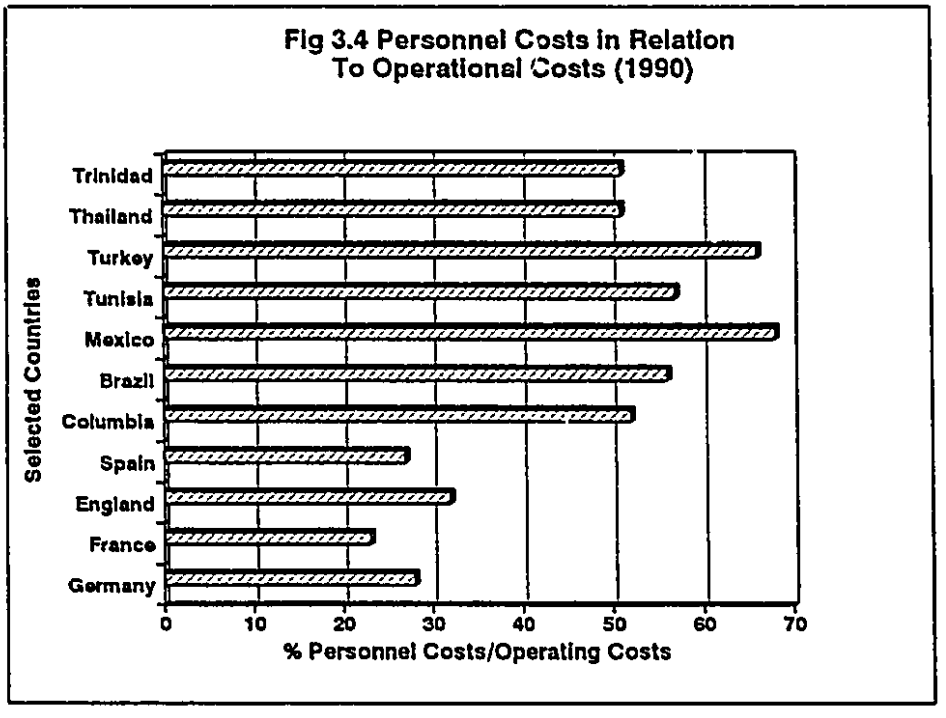
Personnel costs have risen significantly over the period 1988 to 1992 (See Fig 3.3). Much of the increase in 1992 is explained by increments, overtime payments, and compensation packages given to retrenched workers, and those that opted for voluntary early retirement. Since that time personnel costs have declined due to less payments for overtime, as well as the continued downsizing of the labour force.

Yepes' (1990) research found that among poorly operated water companies in Latin America personnel costs accounted for more than 50% of total operating costs. WASA's personnel costs accounted for 51% of total operating costs in 1990.[5] By contrast, the ratio of personnel costs to operating costs (PC/OC) for utilities in England, France, Germany and Spain was under 30%. Although they are high, they remain lower than that of developing countries (See Fig 3.4).

According to Yepes (1990), one of the reasons for the high personnel costs relative to operating costs is that public enterprises are key elements of patronage systems. Over-staffing is rife, and appointments to senior management positions are frequently made on the basis of political connections rather than merit". Ryan (1992) has argued that the Black Power crisis of 1970, and "the anxiety to pour water on all possible areas of political combustion" forced the Government and WASA's Board to appoint large numbers of people to WASA, which came to be regarded as one of the most inflated utilities in terms of the number of workers on the pay roll. Two Ministers were said to have sent the



Source:WASA 1994.



Adapted from Yepes 1990

names of at least one thousand persons to high executive officials of WASA (whose appointments were also politically influenced), who considered such recommendations as authorizations to employ (Ryan,1992).

The ratio of staff per 1000 water connections (S/1000wc) is frequently used as an indicator of a company's performance. Connection implies the physical pipe connection to the building from the water supply. WASA has a ratio of 16 to 18 employees to every 1000 connections, which as the World Bank (1994) noted, is two to three times the ratio found in well-run utilities. Yepes (1990) found that the average ratio of employees per 1000 water connections for a sample of Latin American companies with good operational practices was 5. Companies with a weak performance in Latin America had a ratio of 10 to 20 per 1000, and are comparable with some Asian megacities (See Appendix 3.1). Staff productivity for water, in the sample of European (Spain and France), the US and Canada in Yepes's study, was 2, 3 and 2 per 1,000 respectively. The higher productivity in some of these water companies is the result of the extensive use of state-of-the-art technology and better trained staff (Yepes,1990). Such high numbers of workers results in higher connection charges, which are outside the reach of the poor thereby leading to an increased number of illegal connections.

An equally serious issue is that salaries are growing at a disproportionate rate relative to productivity levels.[6] The World Bank (1993) reported that based on a sample of projects implemented between 1965 and 1987, the incidence of salaries on the cost of water sold, grew in real terms (over a 6 to 10 year period) at unsustainable rates. In the case of WASA, monthly paid workers received four increments, and some categories of workers got seven increments in 1970 owing to union pressures, but a commensurate increase in productivity levels did not occur. In 1994, despite being financially insolvent, WASA workers also got a salary raise. Union pressures have made it difficult to contain personnel costs.

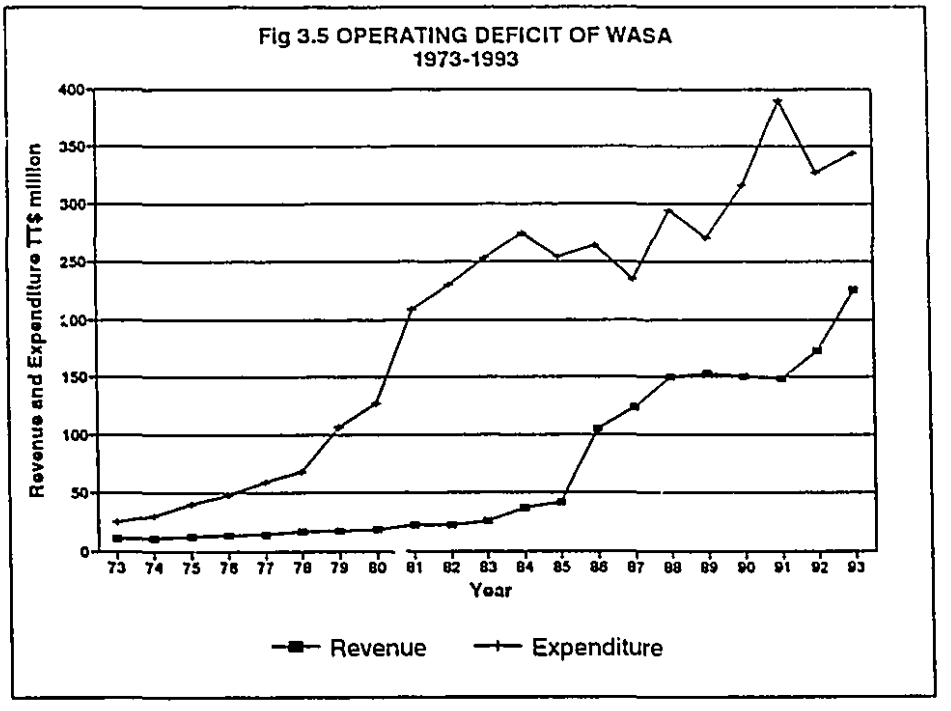
High or rising personnel costs that are not matched by productivity gains cast doubts on the sustainability of the industry's operations especially since far more is being spent to meet workers salaries and very little of total operating expenditure is allocated to routine maintenance of the physical facilities. They also raise equity questions when these high costs are at the expense of adequate services, particularly to the poor. Further, private companies interested in joint ventures with public water utilities, usually state that cuts in worker redundancy and improvements in worker productivity are essential before they enter into negotiations with Governments, because they do not want to inherit a bloated agency with high personnel costs, and difficult workers' unions.

* **INTEREST PAYMENTS**

Another component of a utility's recurrent costs is long term debt interest expense. Such interest is not charged because WASA receives loans interest free from the Government, which helps minimize its total expenses (Delcan,1992). However, these costs should really be taken into account if all costs are to be estimated and recovered.

* **RECURRENT OPERATING DEFICIT**

A recurrent operating deficit develops if there is a gap between recurrent expenditure and revenue. WASA's operating deficits have been huge for close to two decades as illustrated in Fig 3.5. The agency was entirely dependent on State transfers to meet operating deficits and its debt obligations. But, subsidies had an unfavourable effect, as observed by the World Bank study of Trinidad in 1986, which reported that " of the main causes of subsidies failing to achieve expected results is that subsidies remove the incentive to reduce costs or to increase revenues. This in turn leads to further inefficiency, greater deficits, and a need for further subsidies.....Increased subsidies have often resulted in lower productivity, with substantial "leakage" of the subsidy into higher levels of staffing, wages and unit costs" (World Bank,1988).[7]



Adapted from WASA,1994.

After 1983, there was a significant reduction in transfers from the State arising because of growing economic recession. In 1982, treasury funding for WASA's operation was TT$380.3 million, and by 1993 this had decreased to TT$44.6 million as shown in Table 3.7. Between 1982 and 1993, WASA accumulated losses totalling TT$2.4 billion.

Table 3.7 Treasury Funding to the Water and Sewerage Authority 1982-1993 in TT$ million.

Year	Operating Deficit	Debt Servicing	Development Expenditure	Total
1982	274	0	106.3	380.3
1983	255	0	80.7	335.7
1984	199.4	0	55.4	254.8
1985	255.6	0	28.1	283.7
1986	140	0	3.90	143.9
1987	162.3	0	5.10	167.4
1988	62.8	0	8.0	70.8
1989	43.5	0	19.5	63.0
1990	43.5	0	23.7	67.2
1991	59.5	0	8.7	68.2
1992	58.6	0	7.7	66.3
1993	36	0	8.6	44.6

Source: WASA, 1994.

* ACCOUNTS PAYABLE

Reduced Government funding has been accompanied by a corresponding increase in the debt portfolio to meet operating deficits. Table 3.8 provides a summary of WASA's debt. Its growing debt is attributed to outstanding claims from trade creditors, payment of loans and compensation packages to retrenched workers and those who retired voluntarily. Claims by trade creditors grew from $13.9 million to $344 million over the period 1983 to 1993. At the end of 1993, more than 200 water contractors ceased operations as a result of WASA's failure to meet payments for services rendered. The Trinidad Court impounded some WASA's vehicles and ordered the agency to pay its suppliers.

Table 3.8 WASA's Debt in TT$ million 1982-1993

Year	Creditors	Local	Foreign	Total
1982	21.7	0.2	0	21.9
1983	13.9	0.2	0	14.1
1984	35.4	10.5	0	45.9
1985	28.9	0.2	0	29.1
1986	64.7	6.9	0	71.6
1987	26.7	1.7	0	28.4
1988	77.4	7.7	0	85.1
1989	125	0.1	0	125
1990	198.3	67.8	0	266.1
1991	279.0	127.9	0	406.9
1992	368.2	137.7	0	505.9
1993	344.0	152.8	0	496.8

Source: WASA, 1995.

3.4 MANAGEMENT PROBLEMS

WASA's main management problems are limited cost recovery, poor collection procedures and inadequate customer records, in addition to the overstaffing, high personnel costs and low levels of productivity already mentioned.

3.4.1 LIMITED COST RECOVERY

Many water companies in developing countries experience difficulties in recovering costs according to studies done by the World Bank (1991). The World Bank (1991) reported that 50% of water bills were uncollected in Kenya. In Conakry, Guinea, only 10% of water bills were collected in 1988, but with an improved management, in 1991 it collected 98% of its arrears. Similarly, WASA has had a poor cost recovery record in that it collected less than 50% of monies due to it during the period 1979 to 1983. In 1992, there was an improvement in its collection drive, which netted 60% of the monies owed to it (WASA, 1993).

Collection of outstanding rates has seldom been enforced in the past for a number of reasons. One factor is that a combination of Board policies and Ministerial directives discouraged such efforts. Ryan (1992) reported that one of the earliest attempts at cost recovery was stillborn, after Members of Parliament protested. The Government decided to empower WASA to recover water and sewerage rates through the sale of the premises of defaulting owners at public auctions, but this attempt was snuffed-out by the Senate through the combined action of independent and opposition senators, who felt that WASA already had adequate powers to deal with defaulters.

A major setback to its debt collection drive is that the serving of notices requires acknowledgement by the consumer, but some refuse to accept them, and in many cases the person to whom the bill and notices are addressed, cannot be located (WASA,1994).

Additionally, the difficulty of improving collections is that disconnection costs are inherited by WASA. Disconnection, for collection purposes, often requires excavation and the disconnection of the customer's water service at the water-main. The charge for disconnecting and reconnecting a service is TT$500 (disconnection fee $312 and reconnection fee $188), but the total cost to WASA of the disconnect/reconnect process can often exceed TT$1,000 (Delcan,1992). Therefore disconnection costs are higher than the amount owed to WASA, which explains the reason for its passive disconnection policy. Customers sometimes do not pay their bill after disconnection, and may reconnect themselves or d aw water from a neighbour. Indeed, records for 1990 showed that 45% of disconnected customers did not pay for reconnection.

3.4.2 INACCURATE CUSTOMER RECORDS

Yepes (1990) notes that the precondition for good financial management is a cost accounting and financial forecasting system that provides timely and reliable information. WASA is unable to estimate its costs accurately, and its cash

flow situation (including accounts receivable), because of its inadequate consumer data base.

One of the barriers to successful cost recovery, is the inadequate consumer data base of the commercial department. While the number of customers on WASA's roll has increased as shown in Appendix 3.2, the system of customer records is best described as primitive. WASA indicated that the integration of different Water Authorities which existed prior to its formation in 1965, presented difficulties for the consumer record base. It also claimed that some records were lost during its relocation to the new headquarters.

WASA reported at the PUC hearings in 1985, that files were only maintained for customers who paid water service rates based on the ARV. No files were kept for customers who paid the general water rate. Further, those consumer records that were maintained, were classified according to areas consisting of twenty four districts and three municipalities. An assessment list was maintained in Account number sequence. There was also an index in Land and Building Tax number sequence and a Consumer Name and Address Index, but the latter recorded the first name (not the surname) of the consumer first. The PUC Order 54 (1985) advised that this been redone with the recording of the surname first in alphabetical order.

The updating of the assessment list is still done mainly from the Warden's Assessment Rolls, and any errors in these would be duplicated in WASA's records. At the end of December 1993, the number of consumers on WASA's consumer base was 269,791 (WASA,1994). An estimated 8026 consumers in the data base represented duplicated accounts, that is, more than one account for the same property.

In addition, there are many reported cases of connections being made legitimately to WASA's mains, but which are not on its data base, because

WASA's workmen making the connections did not report back to the commercial department (PUC Order 54,1985). From these experiences, it is clear that a proper tracking system for identifying and recording consumers is not in place.

Ultimately, WASA's revenue performance suffers from the extent of illegal connections. It is known that there are properties with direct connections to WASA's water system, but which are not registered in the billing records because normal channels are bypassed and illegal connections are made. Although water services are particularly vulnerable to illegal connections, squatters are a problem to all servicing. They have not been officially recognized, but they are unofficially tolerated.

3.5 OTHER PROBLEMS FACED BY WASA

Apart from problems with the water supply and distribution system, economic and management problems, other problems faced by WASA are the lack of autonomy, sabotage and graft.

3.5.1 LACK OF AUTONOMY

The foregoing discussion demonstrates that WASA's fiscal problems and inefficiency in its management performance, is to some extent attributed to political interference and the lack of autonomy.

A number of studies were commissioned over the years, to examine the restructuring of WASA. Many of the recommendations of these studies were either ignored by the political powers, or implemented in a piecemeal fashion, thus diluting the potency of any reforms within the sector. Economic prosperity and political expediency quite often reinforced mismanagement within WASA.

A Working Group on the Organization and Streamlining of Public Service Practices and Procedures in Trinidad and Tobago raised the fundamental question of autonomy in utilities such as WASA. The Committee expressed itself as being:

"Unable to determine in what way these corporations differ essentially from the average government department. Given the range and extent of the administrative and financial controls exercised over these corporations, their boards...the management, the staff are all frustrated because real authority.....all real decision-making capacity ....rests outside the corporation. The Working Group accepts that commercial judgement and objectives must sometimes yield to considerations of the public interest. The Working Group considers, however, that there are far too many controls exercised over these corporations which, as a result, function as Government Departments and very expensive ones at that" (Ryan,1992:53).

A further erosion of WASA's autonomy has been reflected by its lack of control over its budget. The budgets, which often included requests for funds to expand the supply of water, were often arbitrarily cut by the Ministry of Finance, since it was always understood that WASA would have to come back for supplementary funds to meet its wage bill and other commitments.

Other areas of lack of autonomy and political interference were in the appointment of political party members, many of whom were not skilled for the job. Ryan (1992) notes that WASA was an extension of the ruling party. The Executive Director of WASA was Chairman of the West Branch of the ruling People's National Movement in the 1980s, and the Deputy Director was at one time Chairman of the Port of Spain East Constituency. The former Chairman and Deputy Chairman of the Board of WASA were also long standing members of the party.

Political interference was also evident in the way WASA's Executive Director often committed the Authority to supply water to housing and developmental projects, without consulting the Board or the Technical Section. The intrusion of party politics in the affairs of the Authority led to the chaos within WASA. Certain key ministers of Government dabbled in the running of WASA for their own pecuniary and political benefit, which also gave rise to the massive entanglement of the lines of communication of the Authority, with the

result that no clear signals emerged as to what was to be done with the utility (Ryan,1992). The government is usually in so powerful a position, and has so many opportunities for persuasion or inducement at its disposal, that it can almost always influence a public enterprise to do what it wants, whatever the legal text may say.

3.5.2 ACCUSATIONS OF SABOTAGE AND GRAFT

Another aspect of institutional weakness is corruption within WASA rank and file, which has tarnished its public image. Corruption has long been a feature of the utility, as became evident through the Commission of Inquiry (1975) into WASA. The Prime Minister in the 1974 budget speech raised the question of worker sabotage when he announced that "it is unconscionable that millions of dollars should be borrowed to ensure that the population has an improved water supply system, only to have this water locked off without reason". Graft within WASA has been encouraged by the poor records of equipment maintenance, the inability of staff to prepare meaningful estimates of the cost of projects, to maintain adequate costs controls, and provide an effective internal auditing system. The Commission of Inquiry found a totally collapsed system of accounting in 1973. The current system of accounting has been described as anarchistic. The Auditor General, repeatedly declared his inability to certify the accounts of WASA, and his reports invariably told the same story of missing files, vouchers, paysheets and other financial records. The Commission of Inquiry expressed alarm that "a public utility, utilizing public funds, should have failed in its duty to preserve all its records evidencing how its funds were spent. In effect, it was impossible to conclude whether all the funds disbursed to WASA were indeed spent on that for which they were allocated" (Commission of Inquiry, 1975).

Allegations of corruption have continued to surface from consumers. The PUC (1986) confessed that one of the inevitable consequences of an inadequate supply of water and uneven distribution, is the accusation of discrimination and

unfairness. In 1994, media coverage brought into focus, the suspicions held by residents regarding water shortages in their settlements. Consumers felt that if they were located in an opposition constituency they were being sidelined. Some residents indicated that there were acts of sabotage by WASA workers, who were holding residents to ransom, and withholding water by tampering with waterlines. Others contended that personal differences between officials at booster stations had been responsible for the non-functioning of the facility. Some residents believed that the problem intensified after the Government announced that the system would be privatized. Based on interviews conducted as part of the fieldwork, domestic consumers also reported that WASA personnel gave a new version of the problem, each time residents called to enquire about the water situation such as:

> *"There is a burst line in your area". "Call back, there are no turncocks here". "Call another district office". "They have a schedule of the service. Water would be available tomorrow" (Interviews,1994).*

Under the circumstances WASA is finding it difficult to do "damage control" to an already tarnished public image. Suspicions held by two important stakeholders, consumers and workers, have not helped to mitigate the water shortage problems being experienced in many parts of the country. Additionally, the lack of confidence and trust by consumers is so well-ingrained, that even with proposed rate increases, many do not expect any radical improvements in water delivery. Further, a growing percentage of households seem to favour privatization because of frustrations with the current water shortage. WASA remains the largest and the most politically sensitive public utility in the country.

3.6 SUMMARY

Routine maintenance of capital stock by WASA is neglected, resulting in the rapid deterioration of existing facilities. There is no programme of systematic rehabilitation of old distribution pipelines and pipe repair techniques are

inadequate, thereby leading to high levels of unaccounted-for-water, and frequent interruptions in the water supply.

Research by Lorentzen (1987) supports the diagnosis of WASA's problems, in that it revealed the lack of financing is not the only cause of asset deterioration, but it is symptomatic of fundamental management deficiencies, such as insufficient user charges which do not cover all of recurrent costs, inefficient resource allocation for O&M purposes, and macro-economic constraints on imported spare parts.

From an ***economic perspective***, WASA is a bankrupt public utility, unable to raise commercial loans or float bonds (WASA,1993). The main economic issues are:

* Recovery of capital costs has not been a priority because the Government financed these costs from general revenues;
* More than a half of the funds granted for capital development was used to meet daily cash requirements which led to an erosion of WASA's asset base, a deterioration of the physical plant and frequent water rationing;
* Low tariffs and infrequent adjustments have not been sufficient to offset operating costs, provide funding for routine maintenance, system upgrading and expansion of the service into new areas, and discourage waste by users;
* Huge operating deficits were recorded annually, but were subsidized by the Government so that WASA had no incentives to perform efficiently;
* Accounts receivable (61% from domestic consumers) were outstanding in some cases for more than a year, which helped create the perception among users that water was not an economic good and there was no need to pay for water. The importance of keeping accounts receivable as low as possible is especially relevant in situations of high inflation;
* Accounts payable have grown significantly and WASA is unable to pay its creditors, and has lost credibility with the banking community and

suppliers thereby making it difficult to raise local finance for its operations;

* Personnel costs between 1988 to 1992 accounted for on average over 50% of total operating expenses. The first year that personnel costs fell below 50% was in 1993. High personnel costs and low productivity make it impossible to improve water services when so little of the total operating budget is left over to undertake system maintenance, after wages and salaries are paid;
* Over-staffing is rife partly due to political patronage---in 1994, the ratio of staff per 1000 water connections was 16 to 18 (two to three times the ratio found in well-run utilities)---even though there was downsizing of employees. Such high personnel costs make household connection charges high, and outside the reach of poor households. This tends to encourage a high level of illegal connections;

The World Bank (1993) reported such problems are sometimes beyond the control of the utility, but that they can also be attributed to the inefficiency of technical choices, operational inefficiencies, and poor commercial operations.

From a ***management perspective***, WASA's track record is no less weak. One problem area is its outdated and inaccurate customer rolls which do not reflect 40,000 unregistered customers. A pre-condition for good financial management is a cost accounting and financial forecasting system, that provides timely and reliable information. However, WASA is unable to estimate its costs accurately and its cash flow, including accounts receivable because of its inadequate consumer base. Additionally, poor collections and cost recovery procedures have eroded WASA's revenue generating capacity, maintenance of capital stock particularly distribution pipelines, and long term planning initiatives. Moreover, its passive disconnection policy serves to only make delinquent customers unwilling to comply with notices to pay their bills, and to not treat water as an economic good.

The lack of autonomy and its inability to flush out corruption among its workers has also emasculated its management effectiveness. Further, customer confidence in WASA's ability to provide a better service has undergone attrition, because it gained the reputation over the years, as a public utility suffering from the "sleeze syndrome".

3.7 CONCLUSION

In a country where oil and money flowed, water did not always flow likewise. The vapourization of Trinidad's oil revenues has left WASA a major casualty as Government has retreated from making heavy subventions to public utilities. The overall picture of WASA as that of a bankrupt water supply agency, unable to fulfil its main mandate of providing a reliable supply of water to its consumers, expanding the service into new settlements, and upgrading in existing areas, begs the fundamental question **"Are consumers willing to pay more for water supply improvements?"**. This question is important for three reasons. Firstly, several generations of Trinidadians have grown up without water rate increases for almost fifty years (1937 and 1985). Secondly, water rates were State subsidized given that water payments were a deductible expense for personal income tax purposes up to 1986. Thirdly, water tariffs are so low that consumers have been subsidized for a long time, and may resist increases.

END NOTES

1. Research done by Yepes (1990) showed that technical losses normally account for 15 to 20% of UFW based on experience of some Latin American companies, while non-technical losses (illegal connections) account for 5 to 10%.

2. Unreliability in water provision occurs in many tropical countries which have an abundance of rainfall and therefore no shortage of water resources.

3. Ayub and Kuffner (1994) report similar findings in Algeria, where water is seen as a free good, water charges are resented, and the Government finds it difficult to raise charges when incomes are low and unemployment is high.

4. VanDomelon (1988) in reviewing Public Investment and Expenditure in the Water and Urban Sectors, had a similar finding. The experience of Argentina is well documented in her report.

5. Personnel cost as a percentage of total operating costs (PC/OC) has been falling. Between 1988-1993 PC/OC was as follows:

1988	52%
1990	51%
1992	59%
1993	47%

6. The Chairman of WASA's Board testified that WASA workers did not work, there was a malaise, low productivity and inefficiency, and workers were still asking for overtime.

7. The annual Federal subsidy for water and sewerage services to Mexico City amounts to over US$1 billion a year, or 0.6% of Gross Domestic Product (Briscoe and Garn, 1994)

CHAPTER 4
INTERVIEWS WITH POLICY-MAKERS IN THE WATER SECTOR

Interviews were conducted, between October 1993 and May 1994, with professionals of both local and international agencies, involved in policy-making that impacted on the water sector. The objective was to ascertain their perspectives on water supply issues, and to examine if these were different from the diagnosis of problems in chapter 3. Responses are analysed according to types of organization, professional background or discipline, and position held in the organization's hierarchy. Views are presented under the same four broad headings used in chapter 3; supply, economic, management and other problems. A list of the interviewees names is provided in Appendix 4.1.

4.1 INTERVIEWS WITH PROFESSIONALS OF LOCAL AGENCIES

Local professionals represented WASA, its Management Board, the Water Resources Agency, the Ministry of Public Utilities, the Valuation Division, the Public Utilities Commission and the Town and Country Planning Division.

4.1.1 EXECUTIVE DIRECTOR OF WASA

Water Supply Problems

The Executive Director noted that Trinidad was well endowed with water resources. Further, considerable amount of progress had been made in increasing the production of public water supplies over the years, and every effort had been made to consolidate these gains through leak detection and repair.

Economic Problems

Several factors affecting WASA's service were identified. Financial problems were described as recent, because in the past subventions were made by the Government. Further, water was seen as a public good which required

subsidies, and for almost fifty years water rates remained unchanged due to such an ideology. The Public Utilities Commission was also seen as a hindrance to rate increases and cost recovery. It was argued that WASA was called upon to provide a more extensive and efficient service, while its financial resources were sharply reduced.

Management problems

It was felt that WASA's management was affected by the lack of information. To this end, a Geographic Information System was being developed to update the customer data base which was expected to improve revenue collection.

Lack of Autonomy

It was argued that even though it had a cadre of well-qualified staff to carry out its mandate, there was too much interference in day-to-day management. WASA's role was seen as important, even if a private entity were to become involved in the water sector, because of its experience in water provision.

4.1.2 COORDINATOR OF INSTITUTIONAL STRENGTHENING UNIT

The Team Coordinator of the Institutional Strengthening Unit (ISU) at WASA is an engineer, appointed by the Government under a two year management contract, with responsibility for addressing institutional problems within the agency.

Water Supply Problems

Trinidad was described as a country rich in water resources, but that water shortages occurred from leakages. The leakage problem was attributed to the thinking among engineers and politicians that routine maintenance was not visible. The predominance of engineers in WASA, and too few management experts was reflected in the construction of capital facilities, and a de-emphasis on efficient

operations and regular maintenance. Further, it was argued that decision-making by engineers on the type of materials used in pipe-laying, pipe-laying techniques, and the failure to fix malfunctioning valves, contributed to system leakage. It was stated that recurrent expenditure on leakage reduction was TT$1 million every four months, and that leakages could not be easily resolved because WASA was bankrupt. The situation was alluded to as a "catch 22", in so far as there was no money to fix the leaks, and because of the leaks, there was no money.

It was pointed out that no work was being conducted in relation to demand reduction, but that public education, new water saving technologies (low flush toilets), metering, and use of the price mechanism would be effective in achieving desired results. He argued that these measures would modify consumer behaviour, but Government policy was unable to influence the type of technology--- rather the market would dictate these changes. Metering was favoured because some advantages were expected to spin-off from its implementation.

Economic Problems

It was pointed out that tariffs were too low, and the Government hoped to revise tariffs upward. Charging on the basis of actual consumption was regarded as a politically sensitive issue, which was the reason given for the continuation of the system of rates based on the annual rateable value. He argued, that as a consequence of this, and the failure to increase water rates from 1937 to 1985, every generation may have to bear the costs of future expansion, and replacement costs. It was suggested that WASA required fiscal autonomy and independence in decision-making, and de-linking WASA's system of charges from the annual rateable value of properties was a fundamental step in this process.

The high number of customers in arrears was seen as another problem. It was pointed out that the disconnection policy was difficult and costly to implement, because of the excavation work involved. Updating the data base was seen as crucial to improving revenue collection.

Lack of Autonomy

Political interference was identified as a major factor undermining WASA's autonomy, and eroding its planning and management capabilities. Integrated planning between WASA, and agencies such as the Town and Country Planning Division, was severely affected by political decisions to lay "election pipes" in areas where the ruling party hoped to capture votes. It was pointed out that the law gave the Minister of Public Utilities power over technicians, but the Minister did not have a thorough understanding of issues, even with the best technical advisors available. It was contended, in keeping with the British Model of Public Administration, the managers of public utilities in Trinidad were expected to function like "apolitical managers", but in small-island economies the strong interface between professionals and politicians, inevitably allowed politics to creep into policy-making and decision-making. Freedom from political interventions and to pursue commercial practices was needed. The establishment of a Water Committee in Parliament was recommended to achieve a balance of power and independence, if properly constituted with professionals who had a track record for achieving results.

In relation to the question of privatization, it was argued that production could not be separated from distribution, and that both aspects of WASA would need to be privatized. Legislative reform was needed to effect the transformation of WASA. It was suggested that foreign managers were preferable because of severe interference by the Government, and it was necessary for nationalism to be replaced by pragmatism.

4.1.3 DEPUTY HEAD OF COMMERCIAL DEPARTMENT

The Deputy Head of the Commercial Department reported that cost recovery was very weak because of an outdated consumer data base, and a high number of illegal connections and customers in arrears. It was noted that disconnection was never governed by any set procedure, but depended on WASA's cash flow. Prior to 1991, it was pointed out, debt collectors were sent

into the field to serve notices, but a grace period was given to customers. If there was a failure to pay outstanding amounts owed within 1 month, a disconnection order was prepared and sent to the regional office, where disconnection was carried out. In 1994, given WASA's financial constraints, and no subventions from the Government, the disconnection policy became aggressive. WASA phoned customers in arrears and delivered notices, giving them 24-28 hours to pay. Failure to pay-up within this time, resulted in disconnection. Nonetheless, it was argued, disconnection was hampered by the lack of materials and equipment. Notably, WASA lost more because of disconnection, since the cost of reconnection was high.

With respect to the proposed privatization of WASA, it was argued that there was no attempt by the Government to show concern for workers, national stability, and economic hardship.

4.1.4 ADVISOR TO THE MINISTER OF PUBLIC UTILITIES

The advisor to the Minister of Public Utilities was also the former Executive Director of WASA, and the Water Resources Agency, and an engineer by training.

Water Supply

The advisor to the Minister of Public Utilities noted that Trinidad had no shortage of water resources, and enough water was harnessed, impounded and stored, but that poor management of WASA was responsible for the unreliable water supply. A major concern was the weakness in managing system leakages. The lack of macro-meters to monitor the spatial source of leakage was highlighted. Further, the high unaccounted-for-water was considered to be the result of difficulties regulating and enforcing penalties against illegal connections, as well as corruption among WASA workers involved in connecting users illegally.

Economic Problems

The current method of water charges was considered inadequate, and a price cap formula was recommended in its place, because this responded automatically to inflation. It was further pointed out that many households in affluent areas received water at a subsidized rate, and the system of water charges was inequitable. A suggested cost recovery method was to make it mandatory that developers paid WASA a bond, to have distribution lines brought to newly developed suburban residential developments, because the private developers had already factored-in development charges in the land and properties sold to purchasers.

4.1.5 MEMBER OF WASA BOARD

Economic Problems

The Board Member revealed that WASA was insolvent, and it was impossible in the short term, to meet debt repayments to creditors. Further, it was pointed out that levies on WASA were taking place at a rate of 6 to 7 per week, and that creditors had no confidence in WASA's ability to pay them.

Personnel costs were regarded as high, and downsizing WASA's labour force was an important aspect of organizational reform. The unions were criticized for being archaic in their policies aimed at job preservation, instead of adjusting their thinking, in line with labour productivity improvements.

Management Problems

It was pointed out that WASA's revenue was limited by the Public Utilities Commission ruling, that the charging of full costs was unjustifiable due to the agency's inefficiency in water distribution.

Updating the consumer data base was seen as a necessary forerunner to other reforms. It was stressed that undertaking cashflow projections for planning, required accurate knowledge of the actual size of the consumer base. Too many

duplicate accounts was seen as problematic, and a house-to-house survey was elemental to updating the consumer base. Further, the high number of customers in arrears encouraged by WASA's weak collection efforts, was described as a serious problem. It was suggested that a moratorium on arrears up to a certain cut-off date be declared because there was a slim chance of recovering outstanding amounts due.

Lack of Autonomy

A major concern was that Central Government was too involved in decision-making, often times over-riding WASA's Board. He used the example, that although the Board had identified the main deficiencies, and ways to improve its performance, the Government dismissed WASA's existing management, and brought in its own institutional strengthening team. Workers were hostile and reluctant to cooperate with the new management team, arising out of fears and rumours of retrenchment. Financial autonomy was regarded as the only solution to political interference. It was feared, however, that politics was a real threat to attaining efficient management within the agency, because of nepotism, and the fuzziness that existed between technocrats who worked in WASA, and who were also politicians.

4.1.6 FORMER DEPUTY CHAIRPERSON OF WASA'S BOARD

Water Supply

The Former Deputy chairperson of WASA's Board stated that water rationing was unnecessary because of Trinidad's high water resources endowment, and negative public outcry was justifiable, given that interruptions occurred in areas where there were no technical difficulties.

It was pointed out that the maintenance of its storage facilities was adequate, but repairs to transmission and distribution lines were grossly neglected.

Economic Problems

Updating the consumer base and reducing illegal connections were seen as important aspects of reform. Further, WASA's independence from the Valuations Division regarding property re-assessments and the annual rateable value was suggested. It was argued that the disparities in rates were too severe, and there were numerous cases of properties which were located side by side, paying vastly different rates. An amendment of the Act was also suggested to separate WASA's earning potential from the Valuations Division.

Water provision was regarded as a commercial service, and WASA was unable to provide water free of charge to low income households. But, it was felt that poor households required social assistance from the Government, since it was the responsibility of the State to address the basic needs of disadvantaged groups in the society. Cross-subsidization of poor households by industries and commercial enterprises was considered essential.

Management Problems

An on-going evaluation of the organization's performance was recommended. A comprehensive review of manpower requirements was suggested. Other areas of concern included disciplinary action, over-staffing, low worker productivity, and the replacement of staff, especially since some more senior, experienced staff took the offer of early retirement.

Institutional Reform

A water resources management agency was recommended to manage the country's water resources. It was suggested that the country be divided into 3 river basins: Caroni, Caparo, Oropouche. This proposal shelved some years ago, had advanced the formation of an autonomous Water Management Authority with responsibility for water allocation among competing uses, and the determination of water charges, with the Water Resources Agency as the nucleus.

It was felt that operational work should be privatized and contracted out. An independent, third party perspective was considered advantageous because policies were likely to be less blinkered, than if done from within WASA. The role of Government was still regarded as one of a regulatory nature. Legislative reform was not considered necessary because the Act governing WASA was comprehensive, and sufficiently flexible for it to achieve success in the fulfilment of its mandate.

A strong case was made for strategic planning, since WASA's pre-occupation with short term problems affected its ability to resolve long term issues. For example, long term planning in site acquisition for future developments was ignored. Integrated infrastructure and land use planning was deemed to be essential, but WASA was reactive to new developments which generated demands, for which provisions were not made.

4.1.7 THE WATER RESOURCES AGENCY

A senior engineer at the Water Resources Agency (WRA) was interviewed. It was pointed out that the function of the WRA was water resource management, data collection and research.

A major problem, she argued, was that water allocation was done without a formula. Instead, it was done on a first come, first serve basis. A comprehensive plan was needed for the proper allocation of water to the respective users. It was pointed out that the situation had become more critical, with industrial expansion, and the advent of large scale petrochemical plants, which required large volumes of both process and cooling water.

It was articulated that WASA provided a reasonably good quality of water. However, it was felt that certain elements rendered it unsuitable for various purposes. Land use activities such as quarrying and agricultural activity, and some heavy metals from industrial waste were identified as major sources of

pollution. However, the present monitoring system allowed for only a limited range of chemicals to be tested, and was inadequate for effective management and protection of water quality.

4.1.8 THE COMMISSIONER OF VALUATIONS

Economic Problems

The Commissioner of Valuations was of the opinion that there were no substitute pricing mechanisms for water rates based on the annual rateable value of property. It was felt that ARV based charges ensured consumers received water on the basis of their ability to pay, and it was the most equitable and fair way of charging households for water consumption. It was admitted that the outdated and incomplete cadastre arising from a shortage of valuation staff, meant WASA's revenue base had not widened.

It was also argued that WASA's revenue problems were not entirely related to the annual rateable value system and irregular assessments, but WASA's poor collection history, and its failure to disconnect customers in arrears. It was noted that the Act governing WASA, empowered it to disconnect consumers in arrears, but it did not employ such powers.

Political Interference

Further, it was argued that a revision of taxes and other charges is an emotive and politically sensitive issue, which made the political directorate postpone any increases in water rates and property taxes, helped by windfall gains from the change in oil prices in the 1970s. In 1969, the Government instructed that residential properties which had not undergone any improvements were not to be reassessed, later widened in 1978 to include all types of property. Political interference in the property tax system, and WASA's inefficient operations were seen as the major factors which weakened WASA's economic and management performance.

4.1.9 CHAIRMAN OF THE PUBLIC UTILITIES COMMISSION

Water Supply

A lack of an operation and maintenance programme was identified as the main reason for high system leakages, and an unreliable water service.

Economic Problems

It was further noted, WASA's poor revenue performance could not be blamed on the Public Utilities Commission. The PUC, it was pointed out, had two mandates; namely to set rates and conduct research on utilities. The Chairman was of the opinion that heavy State involvement barred the PUC from adjusting rates in keeping with WASA's revenue needs, and for more than 15 years after its formation, the PUC remained dormant, while the Central Government ruled that rate increases were unnecessary.

It was also pointed out that water rates did not reflect costs because lengthy PUC hearings to decide on revisions, resulted in rate increases long after the initial proposal. The hiatus between the initial submission and approval rates meant that costs rose while rates were approved on the basis of the increase applied for earlier on. Lengthy tribunals were blamed on the absence of full-time PUC Board members (apart from the Chairman), who had difficulty synchronizing times to schedule meetings and rate hearings.

Lack of Autonomy

While the PUC had been criticized for not granting approval for rate increases, the Chairman argued that it continued to play an important function as a watchdog, especially in safeguarding that inefficiencies in water distribution were not passed on to consumers. The Chairman argued that even if WASA were privatized, the PUC's role remained that of protecting the public from unfair practices.

4.1.10 DIRECTOR OF TOWN AND COUNTRY PLANNING

Water Supply

The Director of the Town and Country Planning Division (TCPD) argued that consumers received an irregular service because of topographical constraints and engineering problems. Households living in elevated areas were affected by low pressure, since overworked booster pumps broke down frequently. Low density settlements also received an irregular water supply due to limited improvements in the extension of distribution pipelines to these areas. Further, settlements on the end of the distribution network were more likely to suffer from an unreliable service.

Linkages between land use planning and water resource management, which affected the quality and quantity of water available, were pointed out. It was noted that housing was not permitted above the 300 foot mean sea level contour line because WASA was unable to supply settlements in high elevations. However, the implementation of this policy was difficult, because although the TCPD was able to regulate formal development, it was not as successful in containing informal development which tend to encroach in these areas. The new forestry legislation was seen as important in mitigating development impacts in areas which threatened watersheds.

A water conservation programme was seen as fundamental to lowering costs. It was argued that regulatory and pricing policies, and public education were best used in combination, and that the 3Rs--reduce, reuse and recycle--would help improve water management. Further, it was pointed that the proposed Environmental Management Agency had an important role to play in addressing pollution.

Economic problems

It was felt that considerable subsidies to consumers also limited WASA's economic returns. In this respect, a major recommendation was that the utility

should operate as a commercial entity which was accountable to its customers, and provided transparency in its rate setting. A voucher system was recommended to cover low income households who could not afford water rates. The general idea was that if poor households paid WASA with Government-provided vouchers, they would appreciate that costs were associated with water production, and were less likely to waste water.

Inter-Agency Co-ordination

Greater inter-agency co-ordination was regarded as necessary to achieve better water resource management and cost reduction in water provision. Strengthening the organizational framework for inter-agency co-ordination was viewed as essential. It was argued that while greater coordination existed between WASA and industrial developers, more of this was needed for residential development. It was noted that the Public Sector Investment Programme was set-up to help integrate the activities of both agencies, but water shortages still occurred in some new settlements due to limited inter-agency and inter-sectoral co-ordination.

Institutional Changes

Decentralization was regarded as necessary to bring the service closer to users, and that the country should be divided into functional units to accommodate a bottom-up approach to water service delivery.

There was little confidence that the local private sector had any interest in managing WASA, and a foreign water entity was probably more feasible. It was suggested that one approach was to let WASA produce water, and privatize water distribution. Non-governmental organizations (NGOs) were considered important in serving poor settlements, especially since they were able to mobilize resources, and rely on social networks to provide water to these settlements. Financial assistance to NGOs was not seen as a problem, but strict accountability in the use of funds was needed to ensure support.

4.2 INTERVIEWS WITH INTERNATIONAL AGENCY STAFF:THE WORLD BANK

Staff of the Urban Division and the Water and Sanitation Division of the World Bank were interviewed. Three out of four of the respondents were economists by profession, and senior members of their respective divisions.

4.2.1 URBAN DIVISION CHIEF

Water Supply

The Urban Division Chief was a political economist by training. He noted that water investment projects in most countries were too large, which reflected a supply bias. However, it was pointed out that there was an under-utilization of capacity, although consumers were affected by water shortages. The real issue was not that of stock, but of the flow of services i.e delivery.

It was pointed out that water distribution costs were rising in most developing countries, and were related to pumping water over long distances to provide urban dwellers. It was suggested that a more efficient urban form with higher population densities, and at lower elevations, may assist in reducing costs, but the low capacity of Governments to regulate land use, made achieving this difficult. Recommendations were made for the use of urban planning and pricing, to discourage inefficient urban forms which result in higher water provision costs.

Economic Problems

Financing options for water provision were also discussed. It was suggested that a mortgage market should be used to spread the costs of on-site infrastructure over the mortgage period of about 30 years. This technique was described as affordable because it allowed households to pay for infrastructure, over a longer period. It was felt that water agencies could not become commercial entities, and yet provide a subsidized service. It was argued that the two objectives were inconsistent, and that policy decisions would need to deal separately with these two important issues. It was argued that some consumers

had the ability to pay for water services, but water agencies lacked the capacity to respond.

Another point raised was that water saving technologies could reduce provision costs, some of which have been used by the World Bank in settlement upgrading projects, even where there were undersized parcels.

Institutional Strengthening

It was pointed out, that one of the early prescriptions of the World Bank, was that water agencies should be autonomous and should take the form of parastatals with the power to appoint a Board of Directors, and hire and fire staff. A newly emerging consensus within the World Bank was that the poor performance of public water utilities suggested that privatization was worth exploring. It was argued that Governments still had a role to play which was a regulatory one. Governments, it was also felt, needed to provide a climate for competition to thrive.

4.2.2 WATER AND SANITATION DIVISION

Three members of the Water and Sanitation Division (WSD) were interviewed. Their views were similar in many respects.

INTERVIEW No.1

Water Supply

One member of the WSD argued that a major problem which affected the water sector was the different definitions of "demand" by engineers and economists. Demand was defined by economists as quantity wanted at a particular price. Engineers on the other hand, adopted a different approach based not on water "requirements" in relation to price, but population growth (estimated per capita consumption per household, extrapolations for industrial demand, unaccounted-for-water consumption). Engineers it was argued, did not "factor-in" price change and its impact on demand. It was felt that the way engineers defined

demand resulted in over-sizing water facilities. This manifestation was described as a paradox of excess capacity, while people suffered from water shortages.

Economic Problems

Another observation was that rising water provision costs stemmed from overconsumption encouraged by low tariffs. Cost recovery was seen as important to make financial resources available for rehabilitating distribution facilities. No country, it was felt was successful at full cost recovery.... at least the full cost recovery of economic costs. It was argued that what was more important than full cost recovery, per se, was the signal sent to the user, and the need to make suppliers more responsible for sizing investments. It was believed that different cost recovery rules determined the incentive of water agencies to improve efficiency. For example, if the cost recovery rule was to recapture 20% of water provision costs, then the incentive effect to improve service quality would be low. If, however, the rule was to recover 80%, then the incentive effect would be greater, and the agency would try to increase efficiency. It was further argued that cost recovery was not too difficult, given the World Bank's research findings that in developing countries, consumers willingness to pay for service improvements was high.

Autonomy

It was observed that there was a growing trend toward democracy, and this was good because more accountability to the public would put greater pressure on agencies to deliver the goods. Another suggestion was that water should be managed at the lowest appropriate level, which would give greater freedom to water managers (without political interference) at the urban or rural level, and lead to the more efficient use of resources.

The growing momentum of privatization of water agencies was observed. It was pointed out that the poor performance of publicly operated water agencies in developing countries had given rise to this trend, as well as a rethinking of the

relationship of the State, and role of the market mechanism in the provision of services. It was suggested, the main way privatization would work was through the use of enforceable contracts, which required good contract drafting.

INTERVIEW 2

Water Supply

In an interview with another staff member of the WSD, it was suggested that the over-design of water systems in urban and peripheral areas was possibly the result of suspect contracts, and kickbacks to politicians. It was felt that the emphasis was too much on photogenic projects. Regular operation and maintenance of the existing system was seen as a better option, as opposed to building more expensive new systems.

Economic Problems

Over-staffing problems in water utilities was identified as a major problem which led to higher water provision costs. Shaving the agency of excess labour was regarded as necessary.

Management Problems

Cost recovery was described as too limited. The poor accounting system and, billing and collection needed to be reformed to improve cost recovery and the flow of revenues. It was pointed out that consumer willingness to pay for water was high in a number of developing countries. Governments had plenty of room for manoeuvre with water tariffs to enhance cost recovery, such as charging larger consumers higher rates. A strong case was made for user fees since direct charged tended to be more transparent---consumers knew what they were paying for, and why they should conserve. On the other hand, it was stressed that the social realities of inequity and urban poverty could not be ignored in setting tariffs. Preparing people to expect price changes was considered to be as important as disaster-preparedness.

Water conservation was regarded as a key policy issue. A gradual phasing-in of metering was suggested because it was felt that it was a costly exercise. Raising the community's consciousness about wastage was believed to be important.

INTERVIEW No.3

Another interviewee of the WSD was an economist with experience in public enterprise reform, private sector development, and public-private partnerships. Institutional reform in the water sector was described as important because of public utilities failures in providing an efficient water service. A contractual model involving public and private sector partnership in the water sector, was recommended. It was believed that the renewal of contracts was an important way of regulating the new entity. Examples of the use of contract agreements in the developing countries were discussed. For example, it was pointed out that Guinea Government entered into a 10 year lease agreement with a private water company, and in Argentina the Government retained the ownership of assets, while a 25 year concession agreement was signed with a French water company to manage the water agency. It was felt that for this arrangement to work, there had to be some confidence that contracts would be observed, and there was a willingness on the part of consumers to pay. The role of Government was regarded as that of regulating tariffs, quality of service and network expansion by the private entity.

4.3 SUMMARY

Most of the operational, economic, and management issues diagnosed in chapter 3 were identified by the interviewees. There is a broad consensus that change is needed in the sector. The professionals expressed a willingness to explore new financing, institutional and management options. Perspectives on the main problems tended to be similar, but the main differences of opinions relate to the origin and solutions to the problems. Solutions advanced by respondents

TABLE 4.1
SUMMARY OF PROBLEMS AND SOLUTIONS TO WASA IDENTIFIED BY LOCAL AND INTERNATIONAL PROFESSIONALS

PROBLEMS	SOLUTIONS	INTERVIEWEES
SUPPLY SYSTEM PROBLEMS	Routine Maintenance	*Exec.Dir.WASA *Head of ISU WASA.
* High Unaccounted-for-Water	Tackle illegal connections ☞	*Advisor to Minister P.U.
	Divide country into river basins ☞	*WASA Board Member.
	Comprehensive Water Allocation Plan ☞	*Senior Engineer Water Resource Agency
	New Forestry Legislation will regulate hillside squatting ☞	*Dir.Town and Country Planning
* Oversizing Water Facilities	Demand estimation based on quantity demanded at particular price, not engineers estimation of water requirements ☞	*WSD Staff World Bank
ECONOMIC PROBLEMS *Low Water Rates	Price cap formula & Developers Bond ☞	*Executive Dir. WASA *Head of ISU WASA *Advisor to P.U. Minister
	Abandon Annual Rateable Value Charges ☞ Metering, Transparent Direct User Fees ☞ Update Tax Rolls ☞	*WASA Board Member *WSD World Bank *Commissioner Valuations Division
	Finance infrastructure extended over 30 year house mortgage ☞	*Urban Division Chief World Bank
*High Personnel Costs	Downsize Labour Force, Strategic and Manpower Planning ☞	*WASA Board Member
*High Overall Operating Costs	Cost reduction by urban form, density, pricing and conservation ☞	*Urban Division Chief World Bank
MANAGEMENT PROBLEMS		
*Poor Cost Recovery *Customer in Arrears	Declare moratorium on arrears ☞	*Exec.Dir.WASA *Head ISU WASA *WASA Board Member
*Outdated Consumer Records	Update Customer Records ☞	*Commissioner Valuations
*Weak Disconnection Policy	Aggressive disconnection policy	*WSD Staff World Bank
OTHER PROBLEMS		
Lack of Autonomy	Greater Decision-making Autonomy ☞	*Executive Dir. WASA *Head ISU WASA *World Bank Staff
	Financial Autonomy ☞	*Board Member WASA
	Decentralization	*World Bank
	Privatization (full or partial) ☞ using management contracts, public-private sector joint venture	*Head ISU WASA *Board Member WASA *World Bank Staff

N.B. WSD=Water&Sanitation Division, ISU=Institutional Strengthening Unit, P.U. Public Utilities.

varied according to the type of agency, professional background, and position in the organization's hierarchy. A summary of the main issues is found in Table 4.1.

CHAPTER 5
CONSUMER DEMAND THEORY AND WILLINGNESS TO PAY METHODOLOGIES

A knowledge of consumer demand theory and the concept of willingness to pay is important to policymakers in the water sector. Inadequate and incorrect information on water demand can adversely affect project design, in terms of technology choice, level of service, the timing and scale of capacity expansions, and the price structure established. Not only is it possible to misallocate resources, but the financial viability of the water system may be seriously misconstrued. Large shortfalls in revenue and inability to reach cost recovery targets are commonplace, with the result that operations and maintenance are not carried out, and systems fall into disrepair. If water supply systems are to be both sustainable and replicable, an improved planning methodology is required that includes a procedure for eliciting information on the value placed on different levels of service. A key concept in such an improved planning methodology is that of "***willingness to pay***" (WTP). If people are willing to pay for a particular service, that is a clear signal the service is valued, it is most likely to be used and maintained, and that it will be possible to generate the funds required to sustain and improve water distribution.

5.0 OBJECTIVES OF CHAPTER

This chapter will (1) review models of consumer demand theory, (2) examine the concept of willingness to pay, and (3) describe various willingness to pay methodologies which have been used in research.

5.1 CONSUMER DEMAND THEORY

Economic theory suggests that an individual's demand for a good is a function of:(1) the price of the good; (2) prices of substitute and complimentary goods; (3) the individual's income; and (4) the individual's tastes (measured by the individual's socio-economic characteristics eg. age, gender, income).

Demand in the traditional economic sense, refers to the schedule of quantities that consumers would use per unit of time, at particular prices. It is assumed that the good is traded freely in a competitive market (pure private good), and that it is not a public good or a quasi-private good (See Table 5.1).

Table 5.1 Classes and Characteristics of Goods

Class of Good	Characteristics	Examples
Pure Private	Ability to exclude Potential Consumers Traded freely in competitive markets	Groceries, beer
Quasi-private	Ability to exclude potential consumers Not freely traded in competitive markets	Recreation in parks
Pure Public	Cannot exclude potential consumers Not traded in any organized market	Water, Air, Visibility National Defense

Adapated from:Mitchell and Carson,1989.

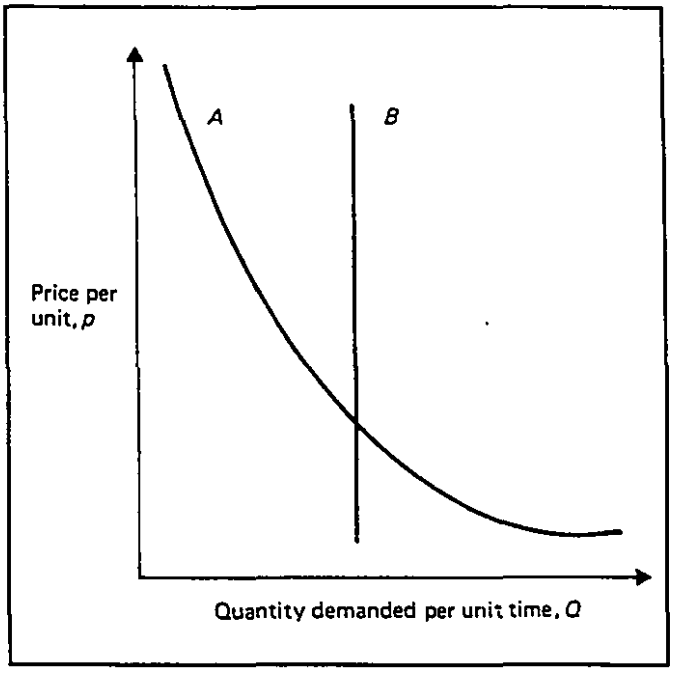
5.1.1 THEORY OF CONSUMER DEMAND FOR WATER

The theory of consumer demand for water incorporates general economic theory, but it also reflects the specificities of water as a good. Water demand models for instance, make a distinction of "water demand" versus "water requirement". The term "demand" is often used interchangeably with "requirement" in discussions of water use, but this confuses two ideas usefully kept separate. Demand is a general concept used by economists to denote the willingness of consumers or users to purchase goods, services, or inputs to production processes, since that willingness varies with the price of the thing being purchased (Kindler and Russell,1984). It is generally assumed that as price per unit increases, the quantity demanded decreases. The demand function *A* in Figure 5.1 conforms to this expectation of a negative relationship between price and quantity demanded.

A "requirement" is something that does not obey this commonsense rule: no matter what the price, the same quantity is purchased as illustrated by *B* in Figure 5.1 Additionally, there are minimum requirements for many things in life

that are unresponsive to price. Water is one with an inelastic demand defined as B.

Fig. 5.1 Demand Functions



Adapted from:Carson and Mitchell,1989.

5.1.2 CONSUMER DEMAND THEORY OF DEVELOPED COUNTRIES

A number of studies developed models of consumer demand for water, but many relate to countries in North America and Western Europe. Such models focused on econometric demand analysis as researchers underlined the variability of per capita consumption, exploring the relationship between water rates or consumer income, and water use. However, these earlier consumer demand theories of water cannot be universally applied, primarily since water use behaviour in industrialized countries differs from developing countries.

The model developed by Grima (1967) postulates that there are six major factors which influence consumer demand for water; physical factors, family income, other household characteristics, the type of service, management and

cultural factors. While the model is useful, in providing some of the explanatory variables which can be tested to determine the household's use of water in developing countries, the validity of the hypothesized relationships is questionable in the developing world context. The model is limited in its application to countries of the "South" for the following reasons:

1) Less industrialized countries have different levels of services other than the house tap service, and several sources from which water is used; and
2) The model is based on the assumption that water supply is metered, but in many developing countries water is unmetered, which results in different prices and consumption levels.

Research done by Fourt (1958); Howe and Linaweaver (1967); Linaweaver, Fryer and Wolff (1967); Grima (1972); Sewell and Roueche (1974) and Kitchen (1975), focused on municipal areas in Canada and the United States, but also has limited application in less developed countries. Grima's (1972) study of residential water demand in municipal areas of Canada makes three assumptions: (1) all consumers have a piped in-house water service; (2) there is a single source of water (the municipal agency) for all households; and (3) all users have a metered water supply. All three assumptions have little relevance to developing countries.

5.1.3. CONSUMER DEMAND THEORY OF DEVELOPING COUNTRIES

Whittington, Briscoe et al (1987) have tried to develop a theory of consumer demand for water in developing countries because of the limitations of the earlier theories. Since much of their work focuses on households' WTP for water in less industrialized countries, they have calibrated theoretical models which reflect the characteristics of water demand relationships in such countries.

Although the theory advanced by Whittington (1987) and his research team propounds similar explanatory variables to the model advanced by Grima (1972), the assumptions made are different as follows:

1) The level of service is varied in developing countries;
2) Several sources of water exist;
3) Households use all of the water (for bathing, cooking, drinking and cleaning) at the home and not the source; and
4) Water supply may be metered or unmetered;

Based on these assumptions, the model developed by Whittington et al postulates that in developing countries, water use behaviour is influenced by the household's socio-economic characteristics, the level of service, the source characteristics, the price of water, consumer tastes and perceptions of water quality and culture, which are shown in Table 5.2.

Table 5.2
Independent Variables Which Influence
Consumer Water Demand in Developing Countries

A)	**Household Socio-Economic Characteristics**	**B)**	**Source Characteristics**
*	Household income (cash and kind)	*	Level of Service and source
*	Expenditure patterns	*	Reliability
*	Household size and composition	*	Pressure
*	Length of residence	*	Quality
*	Age structure of household	*	Time
*	Education of household members	*	Distance
*	Value of time by household	*	Cost
C)	**Price charged**	**E)**	**Climate**
D)	**Perceived Water Quality** (Taste, colour, odour)	**F)**	**Culture**

Adapted from: Whittington, Briscoe and Mu (1987).

The following generalizations may be made about how the quantity of water used, and the source and level of service chosen by households:

A) HOUSEHOLD CHARACTERISTICS

1) **Income**: The amount of water demanded, and the source of water used by a household depend on the income available in either cash or kind, and presumably have a positive relationship.

2) **Expenditure patterns**: The amount spent on water and the quantity demanded depend on the household's budgetary allocations for other essential services, for example food, electricity, housing, transport.

3) **Household Size**: The number of persons living in the household influences the quantity of water used and has a positive relationship.

4) **Age of Household members**: The age of household members affects the quantity of water used, and the source of water chosen.

5) **Education of Household**: The level of educational attainment of household members determines the amount of water used as well as the source; as education increases, so too is the amount of water used and a higher level of service is desired.

6) **Value of the Woman's Time**: The extent to which time is valued determines the type of service that is selected. In households where the woman is educated and working, time is more valued, and these households choose a more convenient source of water, and a higher level of service such as a house tap or a yard tap, to reduce travel time.

B) SOURCE CHARACTERISTICS

1) **Level of water service and supply source**: The amount of water used depends on the level of service and source of supply. The source of water used by households is determined by the existence of alternatives or substitutes. If there are several sources (house tap, yard tap, standpipe, truckborne water, rainfed supplies, springs or rivers) water demand is influenced by a variety of dimensions such as reliability, convenience, quality and the real resource costs (money and time).

2) **Time**: In developing countries time is a major factor in the individual's decision. Time saved from not having to go to a source of water, queuing for water, time used in filling up water containers and time spent to carry water back to the house, essentially influences the source of water demanded.

3) **Distance**: If the water supply is outside the home, over a wide range of distances, the quantity of water used is sensitive to the distance of the home from the source (Whittington, Briscoe and Mu,1987). When people must carry water to their homes, they consume in quantities to meet basic needs and there is less wastage of water.

4) **Cost**: Three types of costs can be distinguished;

(a) *Transport costs*: The amount of water consumed depends on the cost of transporting water, if the source is not in the house or yard. Where water is consumed, is also determined by transport costs. If the total transport costs are greater than the convenience of using water at home, then water is used at the source, and not the home, and vice versa.

(b) *Treatment Costs:* The choice of water source depends also on the cost of treating water for improved quality.

(c) *Connection Costs:* The source of water used by households may also be influenced by the varying connection charges.

C) PRICE CHARGED FOR WATER

The amount of water consumed depends on whether water charges are flat rates, or are volumetric based. Where there is no meter, consumers use as much water as desired. The level of service used by the household is influenced also by the different prices charged for these various levels of service eg. house tap, yard tap or standpipe.

D) PERCEIVED WATER QUALITY

The taste, colour and odour of the water influences the amount of water used and the source from which it is drawn.

E) CLIMATE

The amount of water consumed is a function of climate. For example, in tropical countries people consume less water for outdoor use because their lawns are watered and their premises and cars are washed by heavy rains.

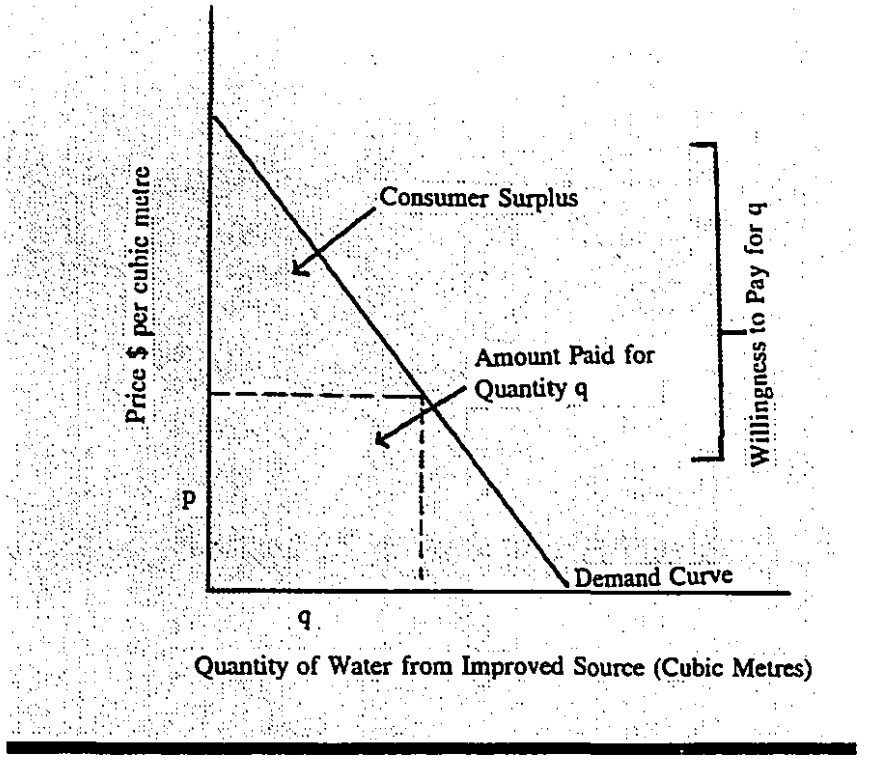
F) CULTURE

The amount of water used is explained partly by climate and culture. Housecleaning habits in developing countries differ from those of developed countries. For example differences in floor surfaces explains the tendency to mop floors in developing countries, as opposed to vacuuming carpets as is done in the colder, developed countries.

5.2 WILLINGNESS TO PAY CONCEPT

There is a link between consumer demand theory and willingness to pay for water. In economics "willingness to pay" (WTP) is defined as the maximum amount that a person would be willing to pay for a service rather than do without it. Figure 5.2 illustrates that WTP is the area under the demand curve. That is, it is not simply the amount paid for a service, but that amount plus the "consumers' surplus". Introduced into mainstream economic theory by Alfred Marshall, consumer surplus denotes the difference between the maximum amount the consumer would be WTP for a product or service and the amount he/she actually pays. This WTP is the economists' measure of the benefits to the individual of a water supply project. The water demand function illustrated in Figure 5.2 also provides water supply planners and engineers with information concerning the amount of revenue that may be recovered, if different prices are charged for water.

Fig 5.2 Water Demand Function,
Willingness to Pay and Consumer Surplus



Adapted from: Carson and Mitchell,1989.

The importance of the concept of WTP for water in rural areas has been understood for sometime. Almost 20 years ago, the World Bank concluded that adequate information on the WTP for water in rural areas was "absolutely essential for any noticeable improvement in the rural water supply situation in the developing world" (Saunders and Warford 1977). According to Whittington, despite this long-standing recognition, little progress had been made in the field. Until that time, most of the attempts to incorporate WTP considerations into project design were ad hoc, in large part because of the absence of validated, field-tested methodologies. Most earlier studies emphasized ability to pay and affordability, as opposed to WTP. Proposed water projects in the past evaluated whether potential users could afford the improvements based on their income

earnings or ability to pay. However, even though users have an ability to pay they may be unwilling to pay for the service, which results in poor cost recovery. Willingness to pay is influenced by actual and perceived utility and benefits of an improved water supply.

International agencies undertaking water supply projects in developing countries used the WTP approach but in a limited way (after Whittington, Briscoe and Mu,1988):

1) The WTP approach was applied in an adhoc and uneven manner;
2) Information collected on WTP was used after the fact, that is, as ex-post evaluations;
3) Many of the evaluations were actuarial rather than substantive;
4) Some of the projects ignored demand-side information (such as WTP) in infrastructure planning;
5) Data collected on WTP were not used in setting tariffs; and
6) The WTP information from studies were not incorporated into decisions on the levels of service to be provided.

Since the late 1980s, the World Bank has been undertaking WTP surveys to guide its planning and investment decisions on rural water supply projects. Based on the conclusion that ignoring demand-side information in infrastructure planning has resulted in poor service utilization and many project failures in cost recovery, the World Bank embarked on studies in Ghana, Burkina Faso, Kenya, Uganda, Pakistan, the Philippines and Haiti (Lindsey, Paterson and Luger,1995). These studies confirmed that residents were generally dissatisfied with the provision of public services and often resorted to private investments to raise the level of service on an individual basis. The higher than expected WTP, confirmed earlier evidence from demand studies on water supply in rural areas, in six countries and in six small cities in Morocco (Briscoe,1993).

Growing water supply problems faced by consumers in developing countries has led to increasing work on the WTP methodology. In a study undertaken by Whittington, Briscoe and Mu (1987), it was discovered that progress in improving the quality and quantity of water used by households in developing countries had been unsatisfactory. The main constraints noted were: (1) systems that had been built were neither used correctly nor maintained properly; (2) the extension of improved service had been slow; and (3) projects were unsustainable and not replicable.

Whittington and others argued that major impediments to improved performance in the water sector were inadequate information concerning response of consumers to new service options, and the use of several simple models of behavioral assumptions which proved incorrect, as was discussed in section 5.1.2. Their position was further substantiated by reviews undertaken by the World Bank, bilateral agencies and water supply agencies in developing countries which revealed that these models were inadequate in their assumptions (Sanders and Warford 1977; IBRD 1986a and 1986b; Australian Assistance Bureau 1983; Federal Republic of Germany 1983; European Economic Community 1983;).

Whittington, Briscoe and Mu (1987) advocated that if rural water projects were to be both sustainable and replicable, an improved planning methodology was required that included a procedure for eliciting information regarding the value that households placed on different levels of service. They were among the earliest proponents of a key concept in this improved planning methodology known as "WTP". The authors argued that if people were WTP for a particular service, that was a clear indication that (1) the service was valued and therefore will most likely be used and maintained, and (2) it was possible to generate the funds required to sustain and replicate the project.

5.2.1 WATER AS A PUBLIC GOOD AND CHALLENGE TO WTP SURVEYS

Most water activities are not strictly public or private goods, although they have been treated as public goods by many governments. The basic criteria for assessing the degree to which a good or service is closer to being public than private, pertain to ***subtractability and excludability.*** [1] Subtractability occurs with most traditional goods such as beer, where one person's use of the good or service decreases or subtracts from its value to others who use the same good or service (if one person drinks the beer, another person cannot have it). For public goods, there is no conventional consumption during use (zero subtractability), and the goods may continue to provide the same benefits to everyone, as long as they are not damaged or congested. When use is increased without any cost to society or subtraction from benefits to other consumers (the marginal cost of serving another user is zero), increased use adds to total economic welfare. Low subtractability characterizes facilities such as water lines as long as they are being used below full capacity.

A second characteristic of public goods is the inability to exclude, or the high cost of preventing a consumer, who does not meet the conditions set by the supplier, from using the resource. Water supply is characterized by the difficulty of excluding people from their use, particularly because of public health hazards which may ensue.

The World Bank (1993) makes the point that private firms do not engage in activities with low excludability, because it is difficult to get consumers to pay. Thus governments may have to provide funding to establish such activities. Where low subtractability exists, market forces do not produce an optimal level of output, and government investments or subsidies may be required. Not surprisingly, water is often regarded as a subsidized public good, to the extent that consumers have never paid its true cost, and therefore may have difficulty attaching a monetary value to it.

5.2.2 WILLINGNESS TO PAY METHODOLOGIES

Economists have long measured the value of goods that are routinely bought and sold in the marketplace. But ordinary markets do not exist for "public" goods such as environmental amenities or water. For several decades economists have been trying to find a way to value public goods such as water. A number of methodologies have been developed to accomplish this demanding and important task. Only those that are relevant to valuing water are treated here.

Mitchell and Carson (1989) undertook a very comprehensive review of WTP methodologies much of which is presented in this section. They suggest that the value that is placed by consumers on public goods may be determined by studying observed market behaviour, or by examining responses to hypothetical markets. Table 5.3 uses two dimensions; how preferences are revealed, and the type of behavioural linkages to distinguish four classes of behaviour-based methods of valuing public goods.

Table 5.3 Behaviour-Based Methods of Valuing Public Goods

	Indirect	**Direct**
Observed Market Behaviour	**Observed/Indirect** Household production Hedonic Pricing Actions of Bureaucrats or Politicians	**Observed/Direct** Referenda Simulated markets Parallel Private Markets
Responses to Hypothetical Markets	**Hypothetical/Indirect** Contingent Ranking Willingness-to- (behaviour) Allocation Games Priority Evaluation Technique Conjoint Analysis	**Hypothetical/Direct** Contingent Valuation Allocation Game with Tax Refund

Adapted from: Mitchell and Carson (1989).

1. OBSERVED/INDIRECT MARKETS

Observed/indirect methods rely on data from situations where consumers make actual market choices, as they do in deciding on buying a house. The value of the nonmarket good is inferred from market data for another good with which it has a known or estimatable linkage. In order to make this inference, the

researcher depends on a large number of assumptions. The process of determining values by methods of this class is like "detective work; piecing together clues that people leave behind, as they respond to economic signals" (Freeman 1974). Three approaches to the Observed/Indirect Methods are known; the household production function, hedonic pricing and actions by politicians.

* **HOUSEHOLD PRODUCTION FUNCTION**

The household production function advanced by Becker (1965) and Lancaster (1966), posits that consumers purchase marketed goods (which have no utility in and of themselves) that are combined with each other, with nonmarketed goods, and with household inputs, to produce the goods and services that ultimately generate household utility. The WTP for water may therefore be estimated using the observed production activity/behaviour of consumers. So for example, in the case of house tap users, the costs of electric water pumps, water storage tanks, water filters and labour, may be used to determine by proxy, how much households would pay to have water produced, and distributed on a 24 hour basis to them. For households using public taps, different types of costs may have to be established. Such households may pay a price for water at the source, certainly they will spend time going to the source, possibly waiting in a queue, and returning to the house with the water. Other inputs in the transport process may include buckets, jugs and other utensils. If a certain quality of water is desired for drinking, additional time and inputs may be required to improve its quality.

A variant of the household production is the travel cost method (Clawson,1959). The distance a household travels in going to a particular site is converted into a cost, and based on this cost factor it is assumed that this is what the household is WTP for these benefits. Such an approach may be used in measuring household WTP for different levels of water service. However, the travel cost method is problematic because it is difficult to know how to handle the

role of time, what elements of time are to be interpreted as costs, and what monetary values are assigned to these elements.

The procedure of estimating WTP based on observed behaviour is appealing because the results are based on what people actually do in practice, rather than what they say they will do. However, the household production function approach is flawed for the following reasons:

1) Models estimated with data on observed behaviour, require assumptions which may not be realistic, and may sometimes yield poor prediction;
2) The results of this indirect analysis are extrapolated from the range of data covered; and
3) There may be a discrepancy between the revealed value of a commodity to a household, and the payments which a household will actually make when the commodity is provided.

This approach requires that the researcher collect household-level information on the quantities of water consumed for different purposes, the time spent collecting water from different sources, perceptions of the quality of different sources, and socio-economic characteristics of the household. The data-collection effort may need to be carried out in areas which have a variety of sources and where households have real options, so that some choose one, and some the other. From the perspective of consumer demand theory and WTP, it is thus a complex task to predict how much households would be WTP for improvements in the water supply.

* **HEDONIC PRICING**

The other major observed/indirect method in common use is hedonic pricing (Adelman and Griliches,1961: Ridker and Hennig,1967: Rosen,1974).

This method assumes that the price of a marketed good is a function of its different characteristics.

The hedonic property value model has been used in the environmental and economics field to estimate the benefits from improvements in environmental quality (Freeman 1979a and 1979b); conceptually it may be applied to the problem of estimating the WTP for improved water supply services. The hedonic property value model describes a house as a bundle of neighbourhood, site, and structural characteristics, one of which may be the type of water supply.

If different houses in an area have different water supply facilities, variations in the equilibrium housing prices over the sites reveal the household's WTP for a change in the level of water services. The assumption is that the household can freely search over all houses and locations to find the optimal levels of housing attributes and there is a competitive, active housing market, with good information.

North and Griffin (1993) used the hedonic property value approach to test WTP for water among a very large sample of 1,597 rural households in one region of the Philippines. The study showed that the housing market in this poor rural area does place a value on water source and that it is capitalized in the price (or rental value) of the house. The hedonic property value approach for estimating WTP for water has been also successfully applied in El Salvador and Bogota (North and Griffin,1993).

It may be difficult to use the hedonic property value approach in Trinidad where meaningful data on market prices are not readily available, and there are severe price distortions in the housing market. Further, non-water characteristics such as number of bedrooms and proximity to the city centre may play an equally significant role in determining the cost of property or rental value. Whilst determining WTP indirectly by seeking out surrogate markets such as hedonic

pricing is useful, the method still requires, apart from a well-behaved market, adequate market data, and considerable statistical skill to distill out the marginal effect on total value of the particular characteristic associated with the commodity being valued (Hoogsteden and Williamson,1991). Limitations of the hedonic pricing method are summarized as follows:

1) A major limitation is that data requirements for a valid hedonic pricing study are unusually exacting. It may be possible to control for all relevant characteristics (structural, neighbourhood, and environmental). But where many resources are already in public hands, this may be impossible;
2) Sufficient market data for reliable estimations are difficult to obtain;
3) People must be aware of the actual physical differences in the levels of the characteristic being valued. To assume such awareness may be unreasonable when dealing with water quality, such as colour or odour; and
4) Expectations about changes in the good being valued, and other relevant characteristics are generally unobservable, but presumably enter into the determination of prices, especially property values (Carson and Mitchell,1989).

* **ACTIONS BY POLITICIANS**

The last method of the observed/indirect class concerns the actions of politicians who make decisions about providing public goods. Some have argued that voting for candidates is a useful source of imputed values for public goods (Barr and Davis,1966). The assumption is that political representatives maximize their chances of re-election by identifying and carrying out the preferences of the electorate, in particular the "median voter" (Downs,1957: Romer and Rosenthal,1979). With a sufficient number of observations on representatives' votes for different programme levels, demand for a specific public good may be derived by making assumptions about the distribution of the electorate's WTP for

specific goods, and the distribution of expected taxation. However, uncertainties about provision and taxation, and the likelihood that most politicians have multiple objectives when they vote on a given measure, suggest that the tortuous chain of assumptions needed to obtain the implied value are too fragile to yield valid estimates of WTP (Mitchell and Carson,1989).

2. OBSERVED/DIRECT METHODS

With the observed/direct class of methods, preferences are revealed in observed markets, and measurement of the value placed on the public goods are directly linked with peoples' preferences. These characteristics represent the optimal conditions for valuing goods, and are rarely realized for public or quasi-private goods. The observed/direct method consists of three approaches; (a) actual referenda, (b) simulated markets and (c) parallel private markets.

* ACTUAL REFERENDA

In a referendum on drinking water for example, voters may indicate their WTP for improvements in water quality. Referenda are of particular interest to contingent valuation practitioners because they provide an institutional model for asking people to express their preferences for public goods. Actual referenda are known to be very costly and time consuming to conduct.

* SIMULATED MARKETS

Experimental markets may be set up by researchers in which people actually buy and sell goods under controlled conditions. Mitchell and Carson (1989) maintain that simulated markets have somewhat limited application as a technique for valuing public goods, since they are restricted to quasi-private goods (because of the need for exclusion in order to institute the market), and are difficult and costly to conduct.

* PARALLEL PRIVATE GOODS MARKET

It is possible to use private parallel goods market, or a black market for a public good to estimate the WTP for a public good. For example, in Trinidad where an emerging shadow market exists for truck-delivered water by private contractors, the amount paid to contractors for water may be used as a proxy measure of WTP for improvements. Such shadow markets are used to infer the value of the publicly provided commodity.

3. HYPOTHETICAL/INDIRECT METHODS

Using the hypothetical/indirect methods, people are asked to respond to hypothetical markets, but their responses are only indirectly related to valuing the good of interest. Among the methods in this class are contingent ranking (CR), allocation games, the priority valuation technique, indifference curve mapping, and methods that ask about a respondent's willingness to engage in a particular form of behaviour. The last group of methods are regarded as hypothetical analogues of the Observed/Indirect behaviour methods. All of the indirect procedures, observed and hypothetical, may be viewed as two-step procedures.

* CONTINGENT RANKING

The contingent ranking (CR) method requires respondents to rank a set of outcomes consisting of different combinations of goods, and associated payment requirements.[2] It has been used to measure related benefits of improvements in water quality in Pennsylvania (Desvousges, Smith, and Mcgivney,1983). These researchers argue that the potential advantage of contingent ranking over contingent valuation, is that contingent ranking may obtain more accurate answers because the task of ranking a small set of cards is less demanding for respondents, than answering a WTP question for a proposed improvement in water supplies. But, Mitchell and Carson (1989) found that there was no evidence to suggest that response rates to the CR questions were better than those for contingent valuation (CV) questions in the Pennsylvania study.

As an example, contingent ranking and a hypothetical travel cost method, may be used to value a proposed aspect of water supply. Instead of being asked directly to place a dollar value on the provision of a hypothetical source of water, respondents under the hypothetical travel cost method may be asked how far they would travel to use such a source of water. Under the contingent ranking method, they may be asked how they would rank different sources of water. In order to translate these behavioural intentions into an economic value for the different sources of water, the researcher would have to posit how they translate into a change in utility, that can be expressed in terms of dollars. The justification for undertaking such a two-step valuation process is the belief that respondents are better able to give meaningful answers to related behaviour questions, than they are to direct valuation questions.

The CR methodology is not without its problems. A major disadvantage of CR is that it requires more sophisticated, and less direct statistical techniques to estimate the value of the outcomes, than those used for CV. Also, it is often difficult to identify the decision rules that respondents have used in completing a contingent ranking exercise. Another problem is that it elicits preferences in the form of attitudes rather than behavioural intentions. Instead of requiring respondents to declare clearly that they are willing to give up a specified amount of money in order to receive the good in question, the CR technique requires respondents to make rank-order preferences for a set of alternative choices.

* ALLOCATION GAMES AND PRIORITY EVALUATION

Allocation games and the priority evaluation technique both ask the respondents to allocate a fixed budget among a specified set of budget categories.[3] These approaches limit possibilities of strategic bias (as will be discussed in relation to the CV method) because the total budget is fixed, and respondents are explicitly required to consider the full range of possible allocations. Situations exist when the allocation game as a value revelation technique may be used, but are infrequent. One of the methodological problems

with the use of allocation games to measure WTP for water is the difficulty of describing each of a number of budget categories in sufficient detail, to allow specific changes in water supply characteristics to be valued. As an example, whereas a CV study would measure WTP for the provision of specific levels of service of a public good such as water, an allocation game would have to measure the relative WTP for an equally specific set of public good provisions, for a diverse set of policy areas (such as education, health and defense), within a given budget constraint. An even more serious problem is that allocation games do not require respondents to make a clear declaration of their willingness to give up a specified amount of money, to receive the amenity in question.

* **SPEND MORE-SAME-LESS METHODOLOGY**

This approach is based on ordinary survey questions which ask the respondent to say whether the country is spending too much, too little, or about the right amount for certain types of government programmes. Mitchell and Carson (1989) are of the view that as a result of interpreting the trichotomous responses to mean that "spending too much equals a preference for less of the good and lower payments", the researchers use superficial and uninformed scenarios as the basis for estimating demand curves for one or more public goods.

4. HYPOTHETICAL/DIRECT METHODS

The hypothetical/direct method measures people's valuation of particular hypothetical changes in water quality or quantity. It "fast tracks" the need to make the large number of assumptions required by the indirect linkage methods. Mitchell and Carson (1989) also describe these methods as flexible because the researcher can easily specify a variety of states of the good to be valued and the conditions of its provisions. Moreover, these need not be limited to current institutional arrangements or levels of provision.

5.3 THE DIRECT APPROACH: CONTINGENT VALUATION METHOD

In the economic literature the direct approach to estimating WTP is termed the "contingent valuation method" (CVM) because the interviewer is simply collecting information rather than actually proposing to deliver the goods or services, if the individual agrees to pay a specified amount.

The CVM first came into use in the early 1960s, when economist Robert K. Davis used questions to estimate the benefits of outdoor recreation in a Maine backwoods area. Davis thought it possible to "approximate a market" in a survey, by describing alternative kinds of areas and facilities to be made available to the public, and simulating market bidding behaviour. This method, he argued would put the interviewer in the position of a seller who elicits the highest possible bid from the user for the services being offered. The bidding game developed from this approach, as the interviewer would systematically raise or lower bids from an arbitrarily chosen starting point, until the respondent switched his reaction from inclusion, or exclusion, and thus revealed his or her maximum WTP.

The methodology for conducting CV studies was further developed in the 1970s and 1980s, largely by environmental and resource economists working on the problem of appraising the provision of public goods (Freeman 1979a; Cummings, Brookshire, and Schulze 1986; Mitchell and Carson,1989). Most of the applications of the CVM have involved attempts to measure the WTP of individuals for changes in environmental quality and have been conducted in the United States or Western Europe (Randall et al. 1978; Mitchell and Carson 1986).[4]

Prior to 1987, when a WTP for rural water supplies was undertaken in Haiti by Whittington, Briscoe and Mu (1987), no systematic attempts were made to determine the suitability of the CVM for assessing WTP for publicly provided essential goods in developing countries.

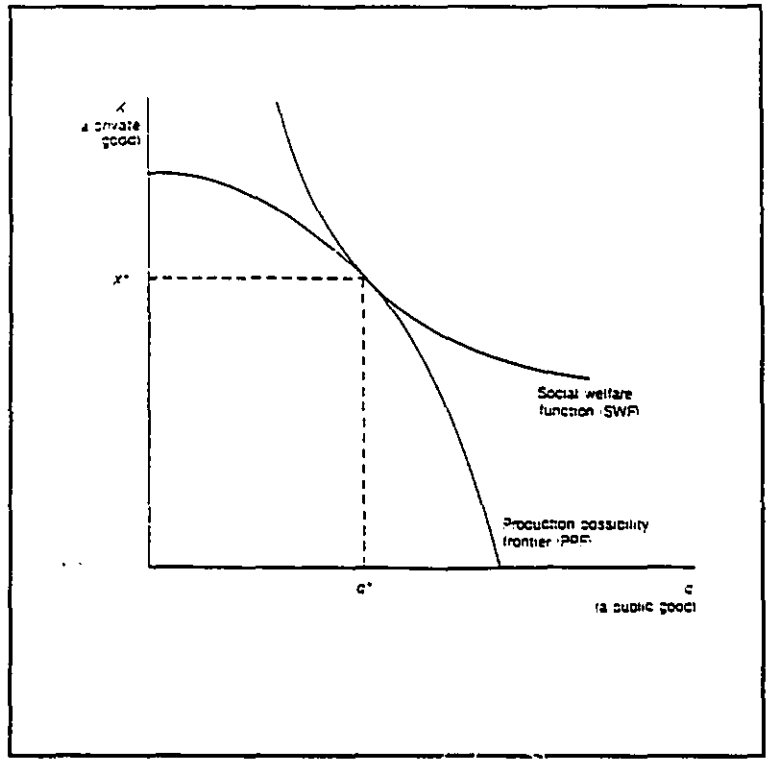
5.3.1 THEORETICAL BASIS FOR CONTINGENT VALUATION

The ultimate aim of a CV survey is typically to obtain an accurate estimate of the benefits and the costs of a change in the level of provision (quality or quantity) of some public good. To do this, the survey should simultaneously meet the methodological imperatives of survey research, and the requirements of economic theory (Mitchell and Carson,1989). To meet the methodological imperatives, the scenario ought to be understandable and meaningful to the respondents, and free of incentives which may bias the results. To meet the requirements of economic theory, a survey should obtain the correct benefit measures for the good in the context of an appropriate hypothetical market setting. In this section, the theoretical underpinnings of the CV method and the key elements of the conventional theory of consumer behaviour are reviewed.

The Basis of Welfare Economics

Two branches of economics exist, namely the positive and the normative. Positive economics describes how the world actually works, whereas the normative branch, often referred to as welfare economics, seeks to make judgements about the desirability of having government undertake particular policies or in other words, how the world could work best. The notion of "best" in economics involves consideration of both efficiency and equity. A large part of the history of welfare economics has been dominated by the notion of a social welfare function and the optimal output of an economy has been determined by the point of tangency between the social welfare function, and the production possibility frontier, that is how the production of one good may be traded off, in a technical sense, for production of another good. That point of optimal output is illustrated in Figure 5.3, which depicts a production possibility frontier (PPF) for a simple two-good economy capable of producing a private good x and a public good q, and a social welfare function (SWF); the optimal outputs as denoted as x^* and q^*.

Fig 5.3 Production Possibility Frontier
For Private and Public Goods



Source:Carson and Mitchell,1989.

The earliest interpretation of the social welfare function was Benthamite utilitarian in approach; the greatest good for the greatest number of people. The social welfare function was defined simply as the sum of the utility of the members of that society, for the production of different combinations of goods. Utility was assumed to be measurable in a cardinal sense, and comparable across individuals. By the late 1930s the notion of cardinal utility across individuals had been almost completely rejected by economists in favour of an ordinal definition of utility, with no comparability across individuals, that severely undermined the theoretical basis of the social welfare function. The social welfare function remains frequently used for illustrative purpose in economics texts, but plays no role in applied welfare economics.

Economists have adopted the Pareto criterion which states that policy changes which make at least one person better off without making anyone worse

off are Pareto-optimizing and should be undertaken. Pareto improvements may occur from points in the interior of the production possibility frontier until the production possibility frontier is reached.

Benefit-cost analysis, the applied side of modern welfare economics, operationalizes a variant of the Pareto criterion by trying to find ways to place a dollar value, on the gains and losses to those affected by a change in the level of the provision of a public good. This allows the calculation of net gain or loss from a policy change, and the determination of whether the change is potentially Pareto-improving.

Two basic assumptions of economic theory need to be explored in relation to WTP: (1) economic agents (individuals, households, consumers, or firms) when confronted with a possible choice between two bundles of goods, have preferences for one bundle over another; and (2) through its action and choices, an economic agent attempts to maximize its overall level of satisfaction or utility.

When agents are given initial endowments of resources and allowed to trade, the resulting actions and choices demonstrate a clear theory of value, argue Mitchell and Carson (1989). Agents are presumed to trade back and forth until there are no possible trades left, which will increase the utility of any two agents. The value is the maximum the agent is prepared to surrender in exchange for the good, out of the resources it controls.

Applying such a system of value to the provision of public goods involves clear-cut normative assumptions, as the initial endowment of resources (ability, income, wealth) plays a key role in determining value. In an economic context, nothing has value in and of itself; value is possible only in relation to the overall economic system. Even then, value is defined only as the most someone is willing to pay for a good, or the least the owner of a good is willing to take in exchange for it.

Two fundamental characteristics of benefit-cost analysis are important considerations; consumer sovereignty which means that the consumer is the best judge of what gives him or her utility than anyone else; and economic efficiency is emphasized as opposed to distributional effects. Efficiency is a natural focus for economists because its measurement follows directly from the underlying positive economic theory. Distributional effects, in contrast, have been more difficult to analyze because data on them are of poor quality, and many benefit measurement techniques are not well-suited to shedding light on distributional outcomes. The contingent valuation method is consistent with the consumer sovereignty assumption, and is unique among benefit measurement techniques in its ability to obtain detailed distributional information (Carson and Mitchell, 1989).

Economists argue that the criterion used by welfare economics to judge a given policy is whether that policy is Pareto-optimizing.[5] Since in practice there are very few, if any policy changes which make no one worse off, the only way such a criterion can be implemented is to allow those who gain from a policy change to compensate the losers. According to the compensation test, the Pareto criterion is met if, after the gainers have compensated the losers, one agent is better off and no one is worse off. In practice, however, compensation is rarely paid, and the compensation test is not of great practical use.

John Hicks (1939) and Nicholas Kaldor (1939) proposed a welfare criterion which has been alternatively called the potential Pareto-improvement criterion or the potential compensation test. The potential Pareto criterion has been controversial because, without the actual payment of compensation, it is possible to make a very small group of people much better off while making the vast majority worse off. While some economists contend that actually making the compensation transfer is not difficult as it appears, and hence only the compensation test, and not the potential compensation test should be considered, the potential compensation test has found remarkably wide acceptance and use among applied economists.

Use of the potential Pareto-improvement criterion has been justified on several grounds. The most common of these is the argument that projects should be decided on a basis of strict economic efficiency, since political authorities can, if necessary, use lump-sum transfers to address any distributional consequences. Closely related to this argument is that the potential Pareto criterion is only one piece of information available to policymakers, who are free to reject policy changes with adverse distributional consequences if they wish. Another common justification is that while any single policy change may have adverse consequences for some group, the government undertakes a large number of projects to improve the welfare of its citizens; if each of these projects meets the potential Pareto-improvement criterion, it is likely that everyone, or at least almost everyone, will be better off if they are all implemented.

The previous section placed the CV method in the framework of welfare economics and benefit estimation and concluded that there were strong theoretical grounds for using surveys to measure benefits, if truthful revelation of preferences can be obtained. The following section discusses the methodological issues concerning the survey design on WTP.

5.3.2 APPROACHES TO ASKING CONTINGENT VALUATION QUESTIONS

Asking CV questions is particularly challenging because of the number of misinterpretations and response bias by the respondent, which may affect the survey results. Several approaches have been used in asking the CV questions. The simplest and most straightforward is to ask the individual directly the maximum amount he or she would be WTP for a service improvement. One disadvantage of this approach is that some individuals may not understand the idea that they are being queried to give the maximum amount. Another problem is that people often need time to reflect on the question, and simply do not have an immediate response. They may need help in thinking about the question, such as information about how much they are paying for other public services.

Alternative approaches have been used to elicit individuals' WTP, including the bidding game, multiple choice questions, payment cards and yes-no questions regarding a single price.

A major problem with the CV method is that, for a variety of reasons, the individual may not answer the questions accurately, and thus not reveal his actual WTP for the goods or services. Literature regarding the use of the CV method is primarily concerned with the types of biases that may arise in the respondent's answers, and with means of estimating their magnitude. The following types of biases are of particular concern: hypothetical bias, strategic bias, compliance bias and starting-point bias. The task of the researcher is to adopt an approach which offers the highest potential for minimizing these various forms of bias.

1. Hypothetical Bias

Hypothetical bias may arise for two reasons. First, the individual may not understand the characteristics of the good being described by the interviewer. Researchers have found this to be a particular problem when the CVM has been used to measure individuals' WTP for changes in environmental quality. In the case of water supplies, it may be difficult for people to attach a price to water quality characteristics such as colour and taste. Second, the individual may not bother to answer the interviewer's questions accurately, because the interviewer does not control the provision of the goods or services being described.

2. Strategic Bias

Strategic bias arises when the individual thinks he may influence an investment or policy decision under consideration by not answering the questions truthfully. Strategic behaviour may influence an individual's answers in either of two ways. As an example, the individual may be asked how much he/she would be WTP to have an improvement in the reliability of the water supply. The respondent may think that by giving a high price, the Government may charge more and thus, he/she will have an incentive to understate his/her actual WTP.

Hypothetical and strategic bias are related in an unfortunate way. It is possible to assume that an individual is less likely to attempt to answer strategically, when he feels that his response is unlikely to have much effect on future policy or investment decisions. In this case, however, the likelihood of hypothetical bias increases, because the individual does not have as much incentive to think carefully about the questions being asked.

3. Compliance Bias

A third type of bias in CV surveys is compliance bias. This may arise when a respondent gives a WTP bid which differs from his/her actual WTP because he wants either to a) comply with his perception of the expectations of the sponsor of the study **[sponsor bias]** or b) please or gain status in the eyes of the interviewer **[interviewer bias]**.

4. Starting-Point Bias

A fourth threat to the validity of CV surveys is termed the "starting-point bias". Starting-point bias exists if the initial price used by the enumerator affects the individual's final willingness-to-pay bid. Empirical evidence from studies done in the United States, indicate that starting-point bias can be a significant problem in CV surveys (Boyle, Bishop, and Welsh 1985).

Contingent valuation has been severely criticized by some researchers. The conventional wisdom has been that these various sources of bias make CV surveys unreliable, and at best inferior to "hard" market data (Cummings et al,1986). In the specific case of rural water supplies, the World Bank also concluded more than a decade ago that "the questionnaire approach to estimating individuals' WTP has been shown to be virtually useless" (Saunders and Warford 1977). On the contrary, available evidence indicates that the magnitude of these biases is not as large as some economists initially feared (Cummings, Brookshire, and Schulze 1986). In a wide variety of situations, people in the United States and Western Europe appear to answer CV questions truthfully.

Whittington et al (1987) argue that despite the potential problems posed by various biases, the CV method has several significant advantages as an approach for estimating the WTP in developing countries for rural water supply. It is relatively inexpensive and a small fraction of the cost of the rural water system. The benefits resulting from a WTP survey in terms of improved design, technology choice, site selection, and pricing practices can be many times the cost of the study. Perhaps most important, it enhances the possibility of people participation and the helps ascertain the preferences of the population.

5.3.3 VALIDITY AND RELIABILITY OF SURVEY

Two issues are important in CV research; validity and reliability. Validity concerns the plausibility of results, specifically the extent to which estimated contingent values reflect consumer demand theory and consumer surplus. Three types of validity are recognized: content validity, criterion validity, and construct validity. Content validity refers to whether a survey asks the "right" questions in an appropriate manner. Judgements of whether particular questionnaires achieve content validity are subjective and may be based, for example, on review of an instrument by experts. Criterion validity refers to the degree to which a survey's measure of a theoretical construct (e.g willingness to pay) may be evaluated against some other measure that is known to be a good gauge of the construct, and can thus serve as a criterion (Mitchell and Carson,1989). For most CV applications, market data or other such "correct" measures of WTP are not available as criteria against which survey results can be assessed. The third type of validity, construct validity concerns (1) whether the construct measured in the survey is comparable to other theoretical measures of the same thing, and (2) the relationship between the construct and other measures with which theory suggests it will correlate. The first of these is called convergent validity, the second is called theoretical validity. In CV applications, a method of assessing convergent validity would be to compare results from CV surveys with the results of travel cost or hedonic methods of estimating the value of the same good. Methods of

assessing theoretical validity include, for example, tests of whether WTP is correlated with income.

Reliability, a second major consideration, refers generally to the variability of estimated contingent values. Reliability is closely related to the notion of bias, which is defined as a source of systematic error in estimates of true WTP (Mitchell and Carson,1989). Three factors can affect the reliability of the responses obtained in CV questionnaires (1) true variation in the population to be surveyed, (2) biases introduced through procedures used in administering the survey or aspects of the survey instrument, and (3) biases stemming from sampling and aggregation procedures (Mitchell and Carson,1989). The first of these is not an issue because variability is expected. The second factor includes response-effect biases that result from incentives in a survey to misrepresent responses, cues that imply certain values are correct, or mis-specification of scenarios (Mitchell and Carson,1989). The third, and most relevant, concerns the representativeness of the sample, and how individual responses are aggregated or extrapolated to the population at large. Particular problems are sample non-response, including protest bids and outliers. Protest zeros are statements of zero willingness to pay from individuals who presumably value the public good positively; analysts typically cull them from their data sets. There is much controversy over what protest bids signify. To identify and differentiate protest zeros from valid zeros, researchers typically ask respondents who have bid zero, to state the reasons for their bid.

Outliers, are any bids that seem unlikely, given presumptions about the underlying distribution of the bids. These types of non-responses pose a major challenge to CV practitioners because they may account for 10% to 50% of a sample (Edwards and Anderson, 1987). Techniques used to treat these bids are important because they affect estimates of aggregate WTP significantly (Milon,1989).

Hoehn and Randall (1987), two proponents of the CV method, agree that designing and executing surveys that are valid and reliable, is difficult, but contend that CV studies convey useful information, and produce estimates reliable enough to be the starting point for policy discussions.

5.3.4 DESIGN OF CV QUESTIONNAIRE AND ELICITATION TECHNIQUES

The design of the CV questionnaire is extremely important, to elicit as far as possible, the consumers' WTP. There are several elicitation techniques which may be used in WTP studies. As Mitchell and Carson (1989) correctly point out, the choice of the elicitation technique involves tradeoffs on the researcher's part between (1) the need to inform the respondent about relevant features of the hypothetical market, and the need to avoid information overload, and (2) between the desire to measure benefits in a manner that offers policymakers the utmost flexibility in using the findings, and the difficulties respondents have with scenarios that are too abstract (in the sense that they lack concrete details about the service, and the conditions under which it would be provided).

The challenge facing the researcher in CV studies is essentially how to simulate a market for a good that is not sold under normal market conditions. Unlike a private goods market where consumers make informed purchases of familiar goods, a hypothetical market for public goods or quasi-private goods has to be created by the researcher, to get meaningful information about how the respondent values these goods. The CV researcher's objective remains, however, how to obtain the respondent's consumer surplus for the good; the maximum amount the good is worth to the respondent before he would be prefer to go without it. One simple way to do this might be to ask the respondent what maximum price he/she is WTP for the described good, and record the answer. However, respondents often have difficulty choosing a value out of the air, as it were, without some form of assistance.[6] The open-ended format has a tendency to produce an unacceptably large number of non-responses or protest zero

responses to the WTP questions (Desvousges, Smith and McGivney,1983).[7] To reduce the occurrence of this problem, researchers have experimented with elicitation techniques which attempt to facilitate the respondents' valuation process by simplifying the choice process, or by offering a context in which to value the good.

Table 5.4 identifies nine elicitation methods, which are categorized along two dimensions: (1) whether the actual maximum WTP for the good in question is obtained, and (2) whether a single WTP question or an iterated series of questions is asked (for a single level of the public good being valued). The properties of the different elicitation methods follow directly from the dimensions of the typology.

The first category refers to the amount of information collected from the respondent about her/his preferences. Some researchers advocate the use of the discrete-choice format because the technique makes it easier for respondents to give a meaningful value for the good. However, whereas the open-ended question obtains the respondent's maximum WTP, and lends itself to the use of simple statistical techniques, the logit or probit techniques used to estimate WTP from discrete-choice data, require the researcher to make strong assumptions which are difficult to verify, about the mathematical form of the valuation function.

Table 5.4 A Typology of Contingent Valuation Elicitation Methods

	Actual WTP obtained	**Discrete Indicator of WTP obtained**
Single Question	Open-Ended/Direct Question Payment Card Sealed Bid Auction	Take-it-or-leave-it offer Spending Question offer Interval Checklist
Iterated Series of Questions	Bidding Game Oral Auction	Take-it-or-leave-it offer (with follow-up)

Adapted from Mitchell and Carson (1989).

With regard to the second category, CV researchers argue that an iterated series of questions allows the respondent to search their preferences thoroughly (Hoehn and Randall,1987). Researchers such as Carson and Mitchell (1981) have argued against iterated questions, on the grounds that this type of probing tends to induce forms of compliance bias: the respondent gives higher values for a good or service, not because these values represent his/her true WTP amount, but because he/she feels pressured by the follow-up questions to give more than he/she really is WTP.

5.3.5 PRINCIPAL ELICITATION METHODS USED

There are four principal methods of elicitation used by CV researchers in the field. These are the bidding game, the payment card, the take-it-or-leave-it offer, and the take-it-or-leave-it offer with follow-up approaches.

1. THE BIDDING GAME

The bidding game is the earliest and most widely used elicitation technique in CV surveys. It imitates an auction, and is therefore most familiar to respondents. In the "bidding game", the interviewer asks a question such as "Would you be WTP $X per month for a yard tap?". If the respondent answers affirmatively, the enumerator raises the price in specified increments, and repeats the question. This procedure continues until the respondent says no; the last price to which the respondent answered affirmatively is then taken as the maximum WTP. The advantages of the bidding game are as follows:

1) The simple choice that respondents are asked to make; are they WTP a particular price for a good, yes or no?;
2) The likelihood that the bidding process will capture the highest price that consumers are WTP, thereby measuring the full consumer surplus; and
3) The likelihood that the process of iteration will enable the respondent to more fully consider the value of the good or service.

These advantages are, however, undermined by the limitations of the bidding game. The main weakness is, it implies a value for the good and may lead to strategic bias. Studies have shown that even if a respondent rejects the initial bid, starting points well above the respondent's true WTP amount will tend to increase the revealed WTP amount, while starting points well below it will tend to decrease it. The starting point bias affects the survey results, in so far as it is difficult for the researcher to know how much the respondent was indeed WTP for a good or service.

2. THE PAYMENT CARD

The payment card was developed by Mitchell and Carson (1981,1984) as an alternative to the bidding game. This technique seeks to maintain the properties of the direct question approach, while increasing the response rates for the WTP questions, by giving the respondents a visual aid which has a wide array of potential WTP amounts, ranging from $0 to some large amount. The advantages of this approach are:

* The procedure removes the need to provide a starting point thereby eliminating the chance of strategic bias;
* It provides the respondent with more of a context for bidding than the direct question method offers;
* In the benchmark version of the payment card, the context is enhanced by identifying some of the dollar amounts on the card as the average amount households of the respondent's income category are currently paying for other public goods.[8]

While the payment card poses less of an "anchoring" problem than the bidding game, the limitations of the payment card elicitation technique are: (1) possible biases associated with the ranges used in the card, if the ranges are too narrow or too wide and (2) the location of the benchmarks.

3. THE TAKE-IT OR-LEAVE-IT- APPROACH

This approach uses a large number of pre-determined prices. Each respondent is asked if he/she is WTP a single one of these prices for the good and its amenities on an all-or-nothing basis, with no further iteration. Prices are randomly assigned to respondents so that each price is administered to an equivalent subsample. The approach has several merits:

* It makes it easier for the respondent to select a price very much like the bidding game, without having the iterative properties of that method, since the respondent only has to make a judgement about a given price;
* The approach is also incentive-compatible, in that it is in the respondent's strategic interest to say yes if his/her WTP is less than or equal to the price asked, and to say no otherwise.

Drawbacks of the Take-it-or-Leave-it approach

* In comparison to other elicitation techniques the take-it-or-leave-it approach requires a large sample size for the same level of statistical precision in sample WTP estimates, because only a discrete indicator of the maximum WTP is obtained, instead of the actual maximum WTP amount;
* Starting point bias may arise also by giving the respondent a pre-determined price to choose from; and
* The most serious drawback is perhaps the assumptions which must be made about how to specify parametrically either the valuation function, or the indirect utility function, to obtain mean WTP.

4. TAKE-IT-OR-LEAVE-IT WITH FOLLOW-UP

This approach has been developed to overcome the limitations of the take-it-or-leave-it approach. The respondent answers yes or no answer about whether he/she would pay a specified price. If the respondent says yes, another WTP question is asked using a higher price randomly chosen from a pre-specified list. If the answer is no, the follow-up question proposes a randomly chosen lower

price. In spite of the potential for considerable gains in efficiency, all of the other problems with the take-it-or-leave-it offer still hold.

5.3.6 WHY CHOOSE THE PAYMENT CARD TECHNIQUE

The principal challenge facing the designer of a CV study is to make the scenario sufficiently understandable, plausible, and meaningful to respondents, so that they can and will give valid and reliable values, despite their lack of experience with one or more of the scenario's dimensions. CV researchers use a variety of techniques to elicit the WTP amount from respondents, namely the open-ended question, the bidding game, the payment card and the two take-it-or-leave-it methods. For most purposes the bidding game is not recommended because it is prone to starting point bias. Each of the other techniques necessitates that the researcher is cognizant of the potential limitations. The take-it-or-leave-it methods have gained popularity because they do not require visual aids such as payment cards and can thus be used in mail and telephone surveys, and have gained currency in studies based on the private goods model.

However, by nature CV studies are complex because they deal with the valuation of goods (Public and Quasi-public) that are not familiar to the respondent, and therefore require some interaction with the respondent to explain what the survey is about. For this reason also, mail or telephone interviews are not desirable. The payment card developed by Mitchell and Carson (1981,1984) offers the best opportunities to minimize starting point bias, and it has the ability to obtain the optimal amount of information through higher response rates because it can successfully simulate a market, by providing the context for the respondent's decisions with the help of a visual aid which contains a large array of potential WTP amounts, ranging from $0 to some large amount. This approach circumvents the need to provide a single starting point, yet offers the respondent more of a context for his/her bid than the direct question method provides. In the benchmark version of the payment card, the context is enhanced by identifying

some of the dollar amounts on the card as the average amount households of the respondent's income category are currently paying for other public goods.

5.4 SUMMARY

This chapter has examined consumer demand theory and the concept of WTP. It has emphasized that traditional models of consumer demand for water are not wholly applicable to developing countries because different conditions in water demand and supply prevail. As a consequence, a reconstructed consumer demand theory for water was explored in the context of less industrialized countries, which formed the basis for an examination of the WTP concept in relation to developing countries. Methodological challenges faced by researchers using the WTP survey approach were analysed, as well as the limitations and advantages of several WTP approaches. The CV technique was validated on the basis of its appropriateness to WTP studies which examine goods that do not operate under normal market conditions (ie public and quasi-public goods), of which water is an example. The importance of the design of the CV questionnaire and the use of appropriate elicitation techniques was stressed. It was concluded that the payment card technique offers the most advantages for a study of WTP for water improvements.

END NOTES

1. Pure public goods are characterized by the conditions of non-excludability and non-rivalry congestion between individuals who wish to use the good (Cornes and Sandler,1986). They may be seen as a special type of externality. In the real world, few public goods meet these strict conditions.

2. A closely related technique used by market researchers is conjoint analysis Green and Srinivasan (1978).

3. For a more extensive discussion of allocation games and the priority evaluation technique see Sinden and Worrell (1979).

4. Over the years the CV approach has been used in several studies which have attempted to value various recreational amenities; Hammack and Brown (1974); Cicchetti and Smith (1973, 1976a,1976b); Darling (1973); Hanemann (1978), and Binkley and Hanemann (1978).

5. A Pareto-optimizing policy change is one which moves an economy to a position which is Pareto-superior (preferred) from a position which is Pareto-inferior (less preferred). Such a change is sometimes referred to as an increase in relative efficiency.

6. In some cases the open-ended question works smoothly, as in a study (Mitchell and Carson,1986c) of drinking water risks, where the respondents were familiar with the concept of paying for drinking water quality through their water bills.

7. In protest zero responses, respondents give a $0 WTP amount even though the good does have some value for them.

8. It is important to avoid bias, by ensuring that the other goods are not directly related to the good a study is trying to value, otherwise the respondent's may base their values on the related goods without giving sufficient thought to the value held for the good in question.

CHAPTER 6
RESEARCH PROCEDURES OF SURVEY ON WILLINGNESS TO PAY FOR WATER IMPROVEMENTS

WASA's operational inefficiencies are manifested in water rationing, low pressure, in some cases lowered drinking-water quality, the slow pace of expansion of water services into new settlements, and upgrading in existing areas. In the light of these problems, an important question is if households are willing to pay the costs of an improved water supply, and how much are they willing to pay.

6.0 OBJECTIVES

Four research questions on WTP for water supply improvements in Trinidad were investigated through a survey:

(1) Are domestic consumers WTP more?;
(2) How much are they WTP?;
(3) Which variables explain the consumers WTP for improvements in water reliability, pressure and quality?; and
(4) What are the preferences of households regarding the management of water delivery?

An additional objective was to test and validate the contingent valuation method as a potential tool for planners and water agencies to improve their decision-making on appropriate levels of service, cost recovery policies, and water pricing.

6.1 RESEARCH DESIGN

The survey was conducted in the most urbanized zone of Trinidad known as the Capital Region which is a linear concentration of settlements stretching from west to east of Port-of Spain, in which 455,035 persons (113,759

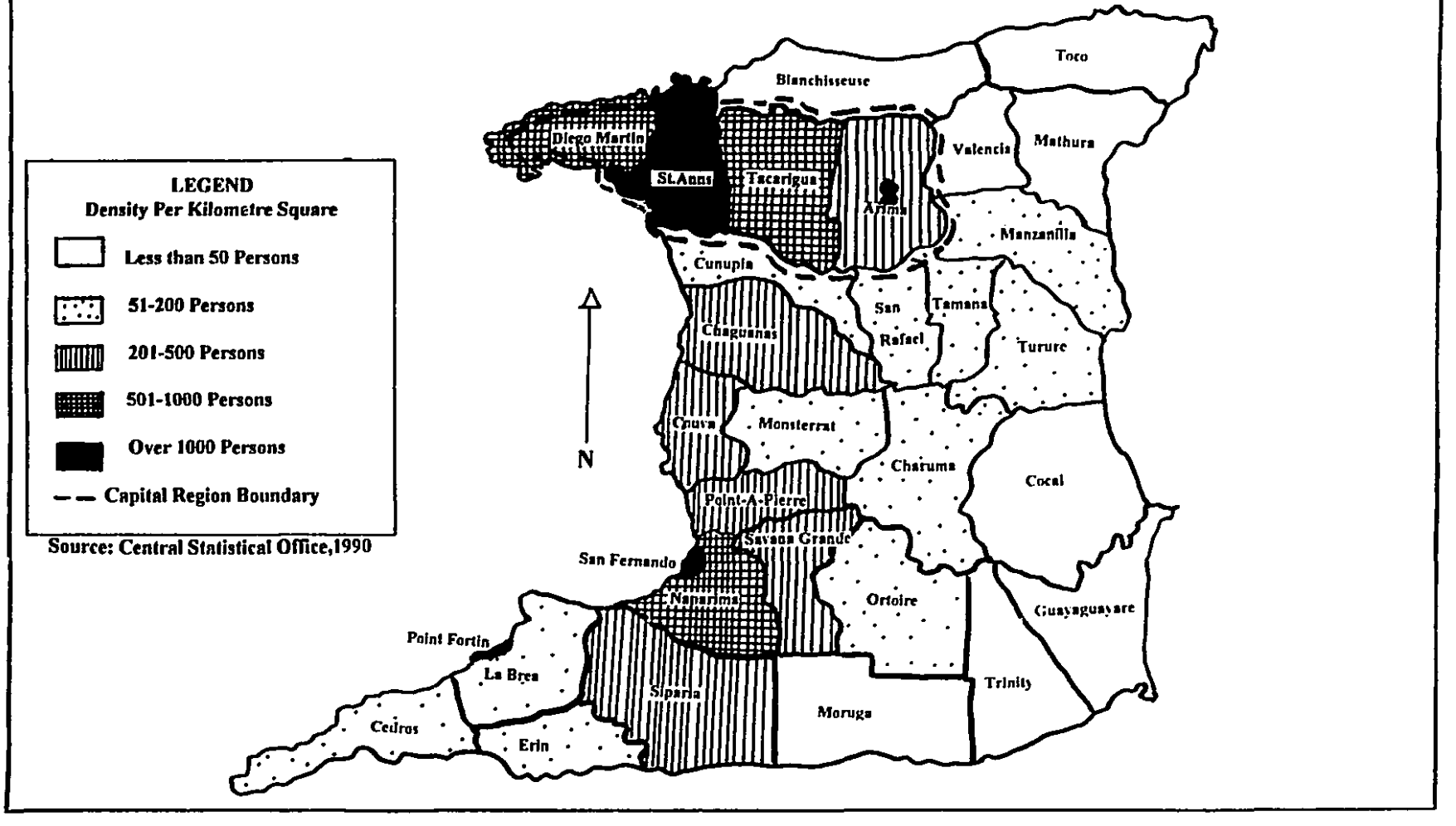
households) live or 41% of the population (CSO 1990, See Fig 6.1). It is also the area which has traditionally received the highest levels of infrastructure investments (including water). This region formed a large cluster which was further divided into six smaller clusters of settlements from west to east (described in Section 5 of this chapter). The aim of cluster sampling was to select clusters that were heterogeneous as possible, but that were small enough to cut down on travel costs.

Enumeration maps of each settlement were first obtained from the census office and were used as the sampling frame for selecting the strata of households in each area.

Stratified sampling was used to improve the efficiency of the sampling design. Slope, land elevation and income characteristics were the criteria for stratification. These characteristics are non-collinear because, both rich and poor urban households live in sloping, highly elevated areas.[1] Further, slope and land elevation were selected to differentiate settlements because such factors were expected to impact on water pressure and reliability (for definitions of these terms see payment card in Fig 6.2, and operational definitions in chapter 7). Booster pumps are required to deliver water in hilly steep areas, but their constant failure results in water rationing. The WTP for improvements by households in these areas (rich or poor) is likely to be influenced by these factors. Proportional stratified sampling was also selected to ensure that the sample was representative. The sampling fraction for each stratum was equal to one in every four houses.

The WTP survey used a sample size of 420 households which is equivalent to a sampling rate of 0.34%. Seventy households were interviewed in each settlement. The sample size was chosen because of limited time and high costs of hiring interviewers to conduct this expensive CV research which calls for face-to-face (not mail or telephone) interviews to achieve good results, as explained in the previous chapter on WTP surveys.

Fig 6.1 Map of Population Density by Administrative Area 1990



Source: Central Statistical Office,1990

6.2 QUESTIONNAIRE DESIGN AND SURVEY METHODOLOGY

The research design was developed to test whether WTP for improvements in the water supply was systematically related to variables suggested by economic theory. Economic theory suggests that an individual's demand for goods is a function of the price of the goods, prices of substitutes and complementary goods, the individual's income and tastes, usually measured by the individual's socio-economic characteristics.

A combination of three methodologies was used to determine WTP; *contingent valuation* (CV), *contingent ranking* (CR) and the *household production function* (HPF).

6.2.1 ELICITATION QUESTIONS

The WTP survey used hypothetical choice behaviour to investigate consumer WTP for improvements in water service. Respondents were asked to place a value on a set of possible improvements in the water service. The description of the hypothetical choice included a presentation of all relevant characteristics of a piped service (reliability, pressure and quality) and the prices under which the service should be available. The main elicitation technique used in the CV question on WTP was the payment card because, unlike the iterative bidding game questions, it offered the best chance of controlling bias in the survey (the preceding chapter discussed this in more detail). Respondents were shown a payment card of the prices WASA charged domestic users on a quarterly basis, and were instructed to use it to guide their responses. They were specifically told that they did not have to choose any of the amounts shown on the card, but to indicate the maximum amount they were WTP per month for improvements in supply.

Given that the respondents were unable to attach a monetary value to the various parameters of water supply (reliability, pressure and quality), they were

asked to rank in the order of priority, contingent upon those aspects of improvement for which they were WTP the most.

Additionally, the household production function (actual, observable choices) was used to examine how much households had actually invested to improve their water supply. Respondents were asked whether they installed water tanks, how many were installed, the size of these tanks, and the amount invested on the storage tanks. A copy of the questionnaire is to be found in Appendix 1.

6.2.2 QUESTIONNAIRE FORMAT

The first part of the questionnaire is an introductory statement read by the enumerator to the interviewee which explains the purpose of the survey, the type of questions which were to be asked, and the sequence of the questions. Respondents were specifically told that their answers would be completely confidential.

The questionnaire was divided into seven parts and information was sought in the following sequence (See Questionnaire in Appendix 1):

* Household socio-economic characteristics: Questions were designed to elicit the demographic characteristics of the respondent (gender, age) and the socio-economic characteristics of the household (household size and assets) and the respondents occupation and education.

* Housing characteristics: Questions were asked in relation to housing (type of dwelling, housing tenure, land tenure, access to electricity, telephone service and cable TV and expenditure levels on these services);

* Questions on water amenities and water consumption patterns of households were formulated to elicit information on the household's water consumption patterns, waste water disposal, and primary and secondary sources of water supply;

* Water quality (colour, taste, odour) and water treatment questions were asked to determine if problems existed;

* Questions on water sources were designed to extract information about the primary source of water, (house tap, standpipe, yardtap, truck, rainwater etc.) problems related to the level of service, user response strategies and water charges;

* Questions were designed to elicit information on household attitudes and perceptions of the existing water supply system as provided by WASA (water as a free good, level of satisfaction, the main problems perceived and the desired improvements); and

* Respondents were asked questions on contingent valuation and WTP for a *package of improvements (reliability, water pressure and water quality) in the water supply.* Users were asked if they had a preference to be upgraded to a higher service level. The payment card consisted of a number of prices which WASA currently charged domestic rate payers, and was used to guide and elicit a response (See Fig 6.2). Households were asked to first state their current monthly payment for water, and to then use the payment card as a guide to state the amount they were WTP per month for an improvement in a package of features ie. reliability, pressure and quality. They were asked if they wished to change this amount which would be considered the final price they were WTP.

Fig 6.2 PAYMENT CARD

Currently you are paying TT$.....per month, but experiencing constraints in your water supply. Using the **PAYMENT CARD** *below as a guide only, what is the maximum amount you are willing to pay per month for an improved service in terms of:*

1) **Better reliability: no disruptions and a 24 hour per day supply;**
2) **Better pressure: no drops in volume of water per second/minute in tap;**
3) **Better water quality: clear, odourless, good taste;**
4) **A service upgrade (relevant to standpipe and yard tap users)**

$ 0	25	50	75	100
125	150	175	200	225
250	275	300	325	350
375	400	425	450	475

In this section of the questionnaire, contingent ranking was used to ask the respondents which of the features; reliability, pressure and quality they valued most, and to prioritize for which aspects they were WTP the most, by using a ranking of 1 to 3.

6.2.3 EXPLANATION OF INDEPENDENT VARIABLES

In explaining household behaviour, either in terms of actual choices or WTP for hypothetical choices, responses were to be related to a set of independent variables representing both the household characteristics and the source characteristics. The following is a list of the independent variables used in the multi-variate analysis, and the reasons for their choices.

* **Personal Characteristics**

It is generally believed that younger and more educated households will express a greater WTP more for an improved water supply. It is also assumed that based on the division of household labour, women are affected by water problems more than men, and are therefore WTP more for improvements.

* **Household Characteristics**

The household size was expected to affect the level of water consumption and WTP. Additionally, the ownership of household appliances which use water (e.g washing machine) will influence WTP.

* **Existing Primary Source of Water and Problems**

It is assumed that households which experience water problems (unreliability, pressure and quality) will be WTP for improvements. Also, since households using standpipes spend some time fetching water from outside the house for drinking, cooking and personal hygiene, it can be hypothesized that WTP increases with the time spent collecting water.

* **Ability to Pay and WTP**

Household income, expenditure on other services, household wealth (land and property ownership) and ownership of household assets (stereos, cars, televisions etc) are indicators of ability to pay and thus expected WTP.

* **Attitudes of Respondents**

The attitudes of respondents about whether water is a free good, and perceptions about the performance of the supply agency were expected to influence WTP.

6.2.4 SEQUENCE OF QUESTIONS

The sequencing of questions ensured that the questionnaire flowed in a smooth transition from one topic to the next. The inter-relationship between the parts was perceived by the respondent to be logical, and the pace was varied to retain the respondent's attention. One particular sequence was that questions about payment for other goods was kept far away from questions on WTP for water, to reduce bias in the respondent's answer.

6.2.5 QUESTION WORDING

The questionnaire was designed to explain the meaning of words used to ensure that there was no ambiguity which would affect the responses. Ambiguity in question wording can contribute to guesses rather than considered responses, which can be a contributor to unreliable results. The WTP question specifically asked respondents the *maximum* amount they were WTP per month and *not the average amount*. Questions on the source and level of supply made sure to ask respondents what was their primary or main source of water, as opposed to their secondary supply of water.

6.2.6 OVERCOMING OFF-THE-CUFF ANSWERS OR ZERO RESPONSES

The principal challenge facing the designer of a contingent valuation study is to make the scenario sufficiently understandable, plausible, and meaningful to respondents so that they can, and will give valid and reliable values, despite their lack of experience with one or more of the scenario's dimensions. The CV method is so complex that considerable description is required to construct a plausible market and to depict the good in adequate detail.

Unless respondents are able to relate the scenario to their personal knowledge and experience in such a way that the market is genuinely meaningful to them, they will not be motivated to expend the effort necessary to determine their personal value for the good. Hence a detailed description of the market was provided and the respondents were asked to pay attention to the description of the market, search their preferences, take their income constraint into account, and determine a dollar amount which represented the most they would pay for each level of the good the survey attempted to value. The respondents were tempted to minimize effort by resorting to strategies that ease the burden of decision, such as giving an off-the-cuff answer. Interviewers were instructed to probe and motivate respondents to give an answer because initially they said they did not know the maximum amount they were WTP for improvements in water, or some indicated that they would pay whatever they were required to pay. To overcome the reluctance on the part of the respondents to give a reply, the interviewers were given strict instructions to comfort the respondents that there was no such thing as a correct or wrong answer. Checks with the interviewers revealed that this led to a greater cooperation in responding to the question on WTP for water. Moreover, the questionnaire allowed for non-answer options for questions on WTP and other questions. Interviewers were told to explore and record reasons for non-response.

6.2.7 CONTROLLING FOR BIAS

1. Starting Point Bias

Starting point bias was minimized by using the payment card method of measuring WTP (See Fig 6.2). Respondents were shown a payment card which covered the price ranges WASA currently used for charging on a quarterly basis. This provided a context and enabled respondents to relate to a pricing method that they are familiar with. The only difference was that the question used price ranges to ask respondents how much were they willing to pay per month instead of per quarter.

2. Hypothetical bias

Hypothetical bias arising from the respondents unfamiliarity with improvements in the water supply such as reliability, better pressure and water quality was unlikely because they are aware and familiar with the problems. Also, since people were unable to state a price for reliability, pressure and quality, in the Trinidad survey, contingent ranking was used whereby respondents were simply asked to rank how they valued reliability, pressure and quality in the order of priority.

3. Strategic bias

Strategic bias was controlled because it was carefully explained to respondents that it was research being conducted for a Ph.D thesis and was independent of WASA and the Government. In this way, respondents knew that they could not influence policy decisions; it eliminated the free rider problem among respondents who were likely to be unwilling to pay, and it ruled out fear of having to pay the admitted value. There was no incentive for respondents to answer the WTP question untruthfully, and they were given a chance to revise the initial WTP amount indicated, which was used to test their strategic behaviour. An estimated 8% of the respondents had zero or "protest bids" which is indicative of limited strategic bias. CV research runs the risk that respondents may not take the WTP questions seriously enough. However, the results showed that responses were not pulled out of the air or unrealistic.

4. Compliance Bias

Control of compliance bias was achieved in two ways. First, by assuring respondents that there was no such thing as a right or wrong answer. In this way respondents did not feel the need to comply with the expectation of the interviewer. Secondly, an iterated series of questions were asked to control for compliance bias. Respondents were reminded of budget constraints and asked whether they could afford the payment chosen, and if they wanted to change the amount first selected. This tended to make the respondent think carefully and

allowed him/her to then make a second more studied attempt to answer the WTP question.

It is suggested in the literature that iterated questions introduce compliance bias, by prodding the respondent who may feel the need to revise his WTP upward, which may not represent his true WTP amount. Respondents did not feel pressured by the follow-up question to give more than they were really WTP because many respondents in the survey thought more carefully, as confirmed by the results which showed that in the first attempt, the average amount respondents were WTP was $69 per month and the second selection yielded an average of $67 per month. These results show that there was no compliance bias because the differences were extremely marginal in both directions, and were lower rather than higher.

6.2.8 VALIDITY AND RELIABILITY OF SURVEY

As mentioned in Chapter 5, CV researchers conducting willingness to pay surveys should aim to develop plausible, valid and reliable surveys. Heeding this advice, steps were taken in designing the WTP questionnaire to achieve content, criterion and construct validity.

To accomplish **content validity**, the survey was subjected to peer review by economists familiar with CV at the World Bank, supervisors at the School of Urban Planning, McGill University, survey researchers of WASA, the Central Statistical Office, the Institute of Social and Economic Research, and the Town and Country Planning Division, and several engineers and planners familiar with the water sector. The consensus was that the survey was clear.

Criterion validity is difficult to achieve because of the lack of data on willingness to pay for water improvements in Trinidad. The only anecdotal criterion that may be used is the amount households spend on water tanks and payments for truck-delivered waters.

With respect to **construct validity**, travel costs surveys or hedonic methods of estimating the value of the same good are not available, hence convergent validity cannot be assessed. The survey therefore tried to accomplish theoretical validity by posing questions that might elicit relationships between WTP and variables such as income.

6.3 FIELD PROCEDURES

The survey was conducted in the dry season during the months of March, April and May when water problems were most severe in areas such as St.Barbs and Goodwood Park. Where a community is subject to distinct seasonal climate changes (rainy season or dry season), two surveys, one in each season might be more revealing than one. Households react in different ways to water needs in the dry season and the rainy season. Since two surveys were not possible, one was carried out, when conditions were the most precarious. Field administrators were given enumeration maps to record each household interviewed, to make call backs easier and to allow for a follow-up in the rainy season, if this were to be undertaken at a later date.

6.3.1 IN-PERSON INTERVIEWS

Three main survey techniques were considered in conducting the survey; in-person interviews, telephone or mail surveys. The choice of survey method depended on making a trade-off between cost and precision: the latter was a far more important objective of the fieldwork. In spite of the high costs of face to face interviews and the length of time involved (each questionnaire took an average of 45 minutes to administer), the field research used the in-person survey method because it offered a number of the advantages:

1) It allowed the use of the visual aid of the payment card which telephone interviews would not have facilitated (See questionnaire in Appendix 1);
2) Since the CV questions involved complex scenarios that required careful explanation, it gave the interviewer the opportunity to explain the questionnaire;

3) It allowed close control over the pace and sequence of the interview.

4) The need to obtain dollar values required a method which could motivate respondents to give an answer, which a face to face conversation can do with an experienced interviewer but which a telephone or mail survey cannot achieve, or at least not to the same degree;

5) The in-person survey allowed the interviewer to probe unclear answers and provided observational data which was extremely useful since the survey used observed behaviour (whether households had storage facilities, water pumps etc.) as well as verbal responses.

6.3.2 PRE-TESTING QUESTIONNAIRE AND TRAINING INTERVIEWERS

Considerable attention was devoted to pretesting the questionnaire and training the interviewers. Pre-testing the survey is equivalent to a test flight and it is absolutely necessary to rigorously test this very complex CV questionnaire. A total of 30 pre-test were done; five in each settlement. Apart from administering some of the questionnaires, it was also necessary to accompany the trained interviewers on the tryouts. The questionnaire had to be redrafted to ensure some of the wording was not ambiguous and to ensure that the order of the questions allowed for a smooth flow. Additionally, it was found that respondents could not attach a dollar value to water reliability, pressure and quality and the questionnaire had to be revised so that they were asked to simply rank these factors between 1 to 3 in order of priority and value. Moreover, the scenario or choice context in the WTP question was carefully reviewed before finally administering the final questionnaire.

6.4 OTHER PROBLEMS

Calls back were made to some households because in the questionnaire they indicated the house tap in their dwelling unit was not connected to WASA, but they did pay water rates. This is representative of attempts to conceal the truth. Therefore efforts were made to get as much accurate information as

possible by checking back with households if this occurred. In other cases (though few) very poor households indicated they were willing to pay large amounts, and the interviewers were requested to go back, and ensure that these respondents understood the questions. Independent call backs were also made to check that the interviewers had actually gone to households in the sample. Such random checks revealed that they did administer the questionnaires to the households. There were cases of housewives who knew that water rates were paid by the household head but did not know the exact amount. Interviewers returned to the respondents to get this information and to complete the willingness to pay question. In such cases the respondent had time to think about the question and may have had a biased response.

Households in Goodwood Park were difficult to survey because many were unwilling to answer their door bells. It was therefore necessary to obtain a list of names and telephone numbers of the residents from a community organizer of the area. Following this, residents were phoned and asked if they were willing to participate in the survey. They were told what the survey was about and that interviewers would be visiting them. Appointments were then set-up. In some cases very busy respondents asked that the interviewers return. There is a possibility that since the respondents knew about the survey and had time to think about the answers, they may have had biased responses.

6.5 STUDY AREA

The survey was conducted in the most urbanized zone of Trinidad known as the Capital Region which consists of 14 sub-regions, as delineated by the Town and Country Planning Division. A sample of six sub-settlements were chosen; Goodwood Park, Alyce Glen, St Barbs, Barataria, Valsayn and Malabar. Goodwood Park is located in the Western Main Road Urban Area; Alyce Glen in the Diego Martin Valley; St Barbs in East Port of Spain; Barataria in San Juan/Barataria; Valsayn in St.Joseph /Curepe/St.Augustine/Valsayn; and Malabar in Greater Arima as illustrated in Fig 6.3.

The criteria for selecting these settlements were location, topography (ie. elevation and slope), income, housing and land tenure, and different levels of water service (See Table 6.1). Three main criteria were used to establish the income classification of settlements: property value, household income and occupation of the household head.

Goodwood Park

The settlement of Goodwood Park is located in the western part of the Capital Region. Topographically the area is predominantly hilly and very steep. Several streams, springs and wells are found in the upper reaches of the settlement.

The population size of Goodwood Park according to the 1990 census was 850 persons living in 287 households. Using income criteria, Goodwood Park is categorized as one of the most affluent suburbs in Trinidad where properties are valued at over three quarters of a million dollars, many of which are owner-occupied houses built on land which is predominantly freehold. Unlike other settlements which have evolved into high-income settlements, historically Goodwood Park has been a high-income settlement from its inception. The occupation of the head of household is either professional or merchant.

All Goodwood Park households in the survey had access to a house tap service. By WASA's classification scheme, Goodwood Park has an unsatisfactory water supply which is available from 48 to 72 hours per week (See Table 6.1).[2] Although the residents of this area are paying the highest residential water rates charged by WASA, they have been plagued by water shortages. Several years ago, the residents formed a committee to fund the construction of a booster pump because WASA was reluctant to improve the water problem facing the area. After the booster station was built, it was turned over to WASA for operation and maintenance. Since then, the pump has broken down repeatedly leaving residents without water for several days because WASA is unable to do repairs as a result

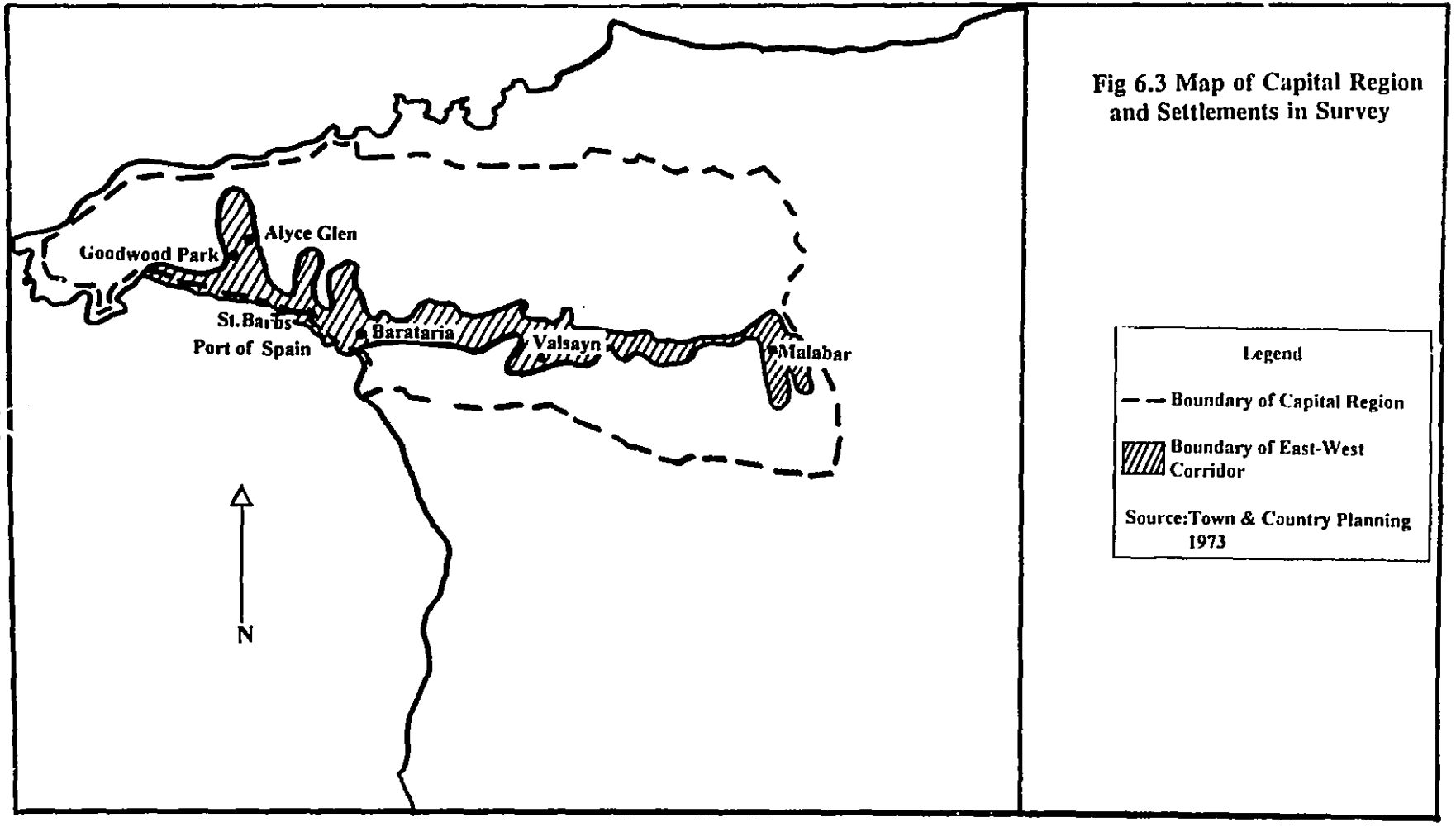


Fig 6.3 Map of Capital Region and Settlements in Survey

Table 6.1
Profile of Settlements in Willingness to Pay Survey

	Goodwood Park	Valsayn	Alyce Glen	Barataria	Malabar	St Barbs
Population Size	650	1558	550	6084	9498	1448
No of Households	287	494	173	2495	2332	381
Location	West	East	West	East	East	West
Elevation	High	Flat	High	Flat	Flat	High
Slope	Steep	Gentle	Steep	Gentle	Gentle	Steep
Income	High	High	Medium	Medium	Low	Low
Housing Provision	Private	Private	Private	Private	Government	Private
Land Tenure	Owned	Owned	Owned	Owned	Owned/Squatter	Owned/Squatter
Level of Service	Housetap	Housetap	Housetap	Housetap	Housetap/Standpipe	Housetap/standpipe
Hours of Water	48-72	120-168	48-72	120-168	72-120	72-120
Type of Service	Unsatisfactory	Good	Unsatisfactory	Good	Reliable	Reliable

N.B Type of Service is defined by WASA based on the number of hours of water availability

of budgetary constraints. Residents have alleged that WASA workers are part of a corrupt cartel responsible for sabotaging the booster station, so that residents would seek relief from private contractors who supply truckborne water at a fee, and then make kickbacks to the saboteurs. Some residents have developed an alternative water supply by tapping into a spring upstream which feeds into individual underground reservoirs by gravity.

Valsayn

The Valsayn settlement is located in the eastern part of the Capital Region. It is a flat settlement so no topographical constraints affect the supply of water.

An estimated 1558 persons live in Valsayn which consists of 494 households. It is a high-income area which was started by private land developers, although in the 1950s and 1960s it was considered middle-income. But with prices increasing significantly after the oil boom, today it is considered high income on the basis of land and property values which are over TT$500,000. Houses tend to be owner-occupied, but some are rental housing and the land is freehold. Valsayn consists predominantly of household heads who are businessmen or professionals, many of whom are university lecturers.[3]

Valsayn households have a house tap service. According to WASA (1994) it has a 24 hour service. The residents have not had persistent water supply problems, unlike their counterparts in other settlements. Three reasons may account for this; Valsayn is located close to the El Socorro wells, it is a flat area and the Executive Director of WASA in the 1980s lived in Valsayn, so that interruptions tended to be less frequent.

Alyce Glen

Alyce Glen is located in the western part of the Capital Region in the Petit Valley. Although flat in some parts, it is mainly hilly and very steep. The population size of Alyce Glen is 550 persons and there are 173 households. It is

a middle-income to high-income area with properties valued above $400,000. Dwelling units are owner-occupied and the land is owned. Mainly professionals and a few businessmen live in this area.

Households have a house tap service, but the settlement is affected by scheduled interruptions and WASA (1994) classifies its water service as unsatisfactory, that is water is available between 48 to 72 hours per week (See Table 6.1). Most residents have invested in water holding tanks and water pumps to deal with the shortages. Further, the area is adjacent to a warehousing company which uses large transport containers. Often, the trailers have broken the water mains on the road leading to Alyce Glen, causing water shortages for long hours, sometimes even days.

Barataria

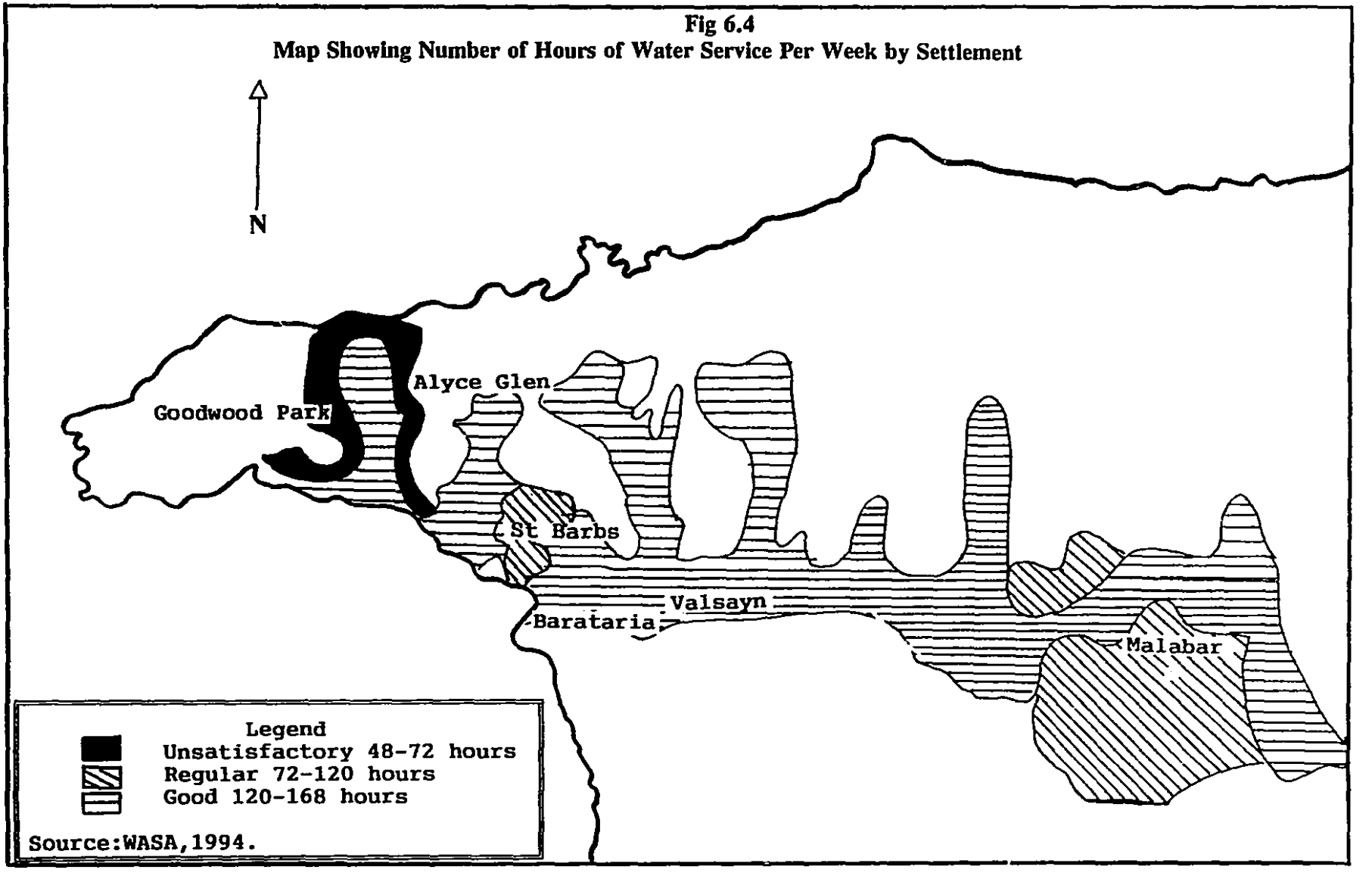
This settlement is located in the eastern part of the Capital Region on very flat land. An estimated 6,084 persons live in Barataria and there are 2,495 households. It is a middle-income settlement based on property value estimates of approximately $200,000. Dwelling units and the land are owned in the majority of cases, but some households live in private rental housing. There is a high mix of occupations among heads of household. Some household heads are proprietors, teachers, nurses, clerks, and retirees on pensions.

According to WASA, Barataria has a good water supply, that is 120-168 hours per week (See Fig 6.4). Most households have a house tap service.

Malabar

Malabar is located on the eastern side of the Capital Region in the Borough of Arima. It sits at the foot of the Northern Range on a very flat site. The settlement of Malabar had an estimated 9,498 residents in 1990 and there were 2,332 households. Predominantly low-income households live in this area, often labourers and public sector workers and unemployment levels are high.

Fig 6.4
Map Showing Number of Hours of Water Service Per Week by Settlement



Unlike the other areas surveyed, Malabar has a high percentage of public housing provided by the National Housing Authority. Most dwelling units are owner-occupied, while a few households live in public rental housing. The land has been transferred to persons building houses on a 199 year lease, for a downpayment of $4,710 and an annual rent of $1 (Wolfe,1994). Some squatters have built houses along the abandoned railway line, which is State owned.

Malabar receives a reliable water supply according to WASA's classification scheme. Most households have access to a house tap service, except for the squatters who use standpipes.

St. Barbs

St. Barbs forms part of the settlement of Laventille, which is located just east of the City of Port of Spain. St. Barbs is a steep area characterized by slopes which have gradients greater than 1:26, thereby making infrastructure installation such as water and sewerage facilities costly. The area is composed of ridges and the basin of the Laventille Hills.

The population size of St.Barbs in 1990 was 1,448 making up 381 households. Aerial photographs taken in 1986, confirm high levels of uncontrolled residential development between 1973 and 1986, which represents some part of the oil boom years. The level of owner-occupied landholdings is high, but chattel rental is also a significant feature of this area (that is land rental on a monthly basis with no legal agreement between owner and tenant). The unemployment level in 1990 was 31%. Many household heads are unemployed, self-employed in the informal sector or blue-collar workers.

According to WASA, St.Barbs has a reliable service of 72-120 hours of water per week. Most households in this area use standpipes. The area was seriously affected by water shortages at the time the survey was conducted in 1994. St.Barbs has at least three major problems which impact on the water

situation. These are topographic constraints, socio-economic problems such as high levels of unemployment, squatting and poverty, and infrastructure deficiencies.

END NOTES

1. Unlike most developing countries, with perhaps the exception of Caracas, Venezuela and Rio de Janiero, Brazil, the urban rich and poor live in hilly, steep areas of Trinidad.

2. WASA developed a classification of quality of water service based on the number of hours of water availability per week the household received water. The following description is used by WASA:

   48-72 hours of water: Unsatisfactory service;
   72-120 hours of water: Reliable;
   120-168 hours of water: Good.

3. The University of the West Indies is located close to Valsayn and it provides staff housing in this area.

CHAPTER 7

SURVEY RESULTS AND DATA ANALYSIS

The data analysis provides useful insights into consumer demand behaviour, attitudes and willingness to pay for water improvements. General survey results are presented, followed by an analysis of the data on consumer willingness to pay.

7.0 GENERAL SURVEY RESULTS

In this section general characteristics of households in the survey are introduced and compared with those of the national population and the Capital Region. For a summary of the main household characteristics see Table 7.1.

7.1 SOCIO-ECONOMIC CHARACTERISTICS

Approximately 53% of the respondents in the survey were female and 47% male. In terms of the Capital Region population between the ages of 20-60 and over, 27% were 20-29, 59% were 30-59 and 14% were 60 and over. An estimated 9% of the survey respondents were 20-29, more than half the respondents (67%) were between 30-59 years and under a quarter (21%) were more than 60 years of age. These differences between the Capital Region and the survey's sample population are explained by the fact that only heads of household or spouses were interviewed since they were likely to pay the household's bills.

The level of educational attainment in Trinidad is generally high as confirmed by both the World Development Report (1994) and the UNDP (1994) which showed that 96% of children of primary school age and 81% of persons of secondary school age were enrolled in a learning institution. Census data revealed that in 1990, 48% of the national population had a primary education, 34% had a secondary education and 2% had a university education. These figures are similar to those of the Capital Region (See Table 7.1). In the WTP survey

Table 7.1 Summary of Population Characteristics

	Study Area	Capital Region	Trinidad
Population Size	1440	455,035	1.12 million
No. of Households	360	117,095	288,881
Average Household Size	4	4	4
Proportion of Population With			
Primary Education	24%	45.76%	47.8%
Secondary Education	38%	42.59%	34.2%
Tertiary Education	38%	4.99%	1.9%
Type of Dwelling Unit			
House	89%	68.61%	76.59%
Apartment	7.5%	22.45%	17.02%
Townhouse	2.2%	3.84%	1.75%
Other	0.8%	5.1%	4.64%
Housing Tenure			
Owner-Occupied	81.7%	66.65%	74.3%
Rented Private	16.1%	18.83%	13.3%
Rented Government	1.1%	4.60%	2.58%
Other	1.1%	9.9%	9.85%
Land Tenure			
Owned	76.7%	37.13%	38.2%
Rented Private	11.4%	22.85%	26%
Rented Government	5%	5.66%	5.4%
Leased	3.6%	12.34%	7.9%
Squatter	1.1%	8.48%	7.2%
Other	2.2%	13.53%	15.3%
Level of Water Service			
House Tap	86%	66.6%	65%
Standpipe	8%	14.06%	14%
Yard Tap	3%	7.9%	7.6%
Other	3%	11.40%	13.4%
Ownership of Water Tank (% Households)	75%	50%*	71%*
Level of Sanitation			
Flush Toilet	76.4%	39.42%	22.64%
Septic Tank	12.5%	29.61%	35.33%
Pit latrine	11.1%	29.78%	41.07%
Other	0%	1.18%	0.96%

NB * Based on JICA survey (1991) of a sample of 313 households in the Capital Region and 650 households in the whole of Trinidad.

Data for the Capital Region and Trinidad based on 1990 Population Census.

24% of the respondents had a primary education, 38% had a secondary education, and 38% had a university degree. This phenomenon is explained by the fact that many persons teaching at the university lived in the settlement of Valsayn, and the high number of professionals living in Goodwood Park and Alyce Glen.

7.1.1 INCOME

In 1992, Trinidad's per capita gross national product was approximately TT$24,000 (US$3,940) (World Development Report,1994). Using CSO's classification, on a national basis, the average net monthly income of low, middle and high-income households was TT$1,009, TT$3,537 and TT$8,128 respectively (CSO,1990). Studies done by CSO (1992) show that an estimated 18%-20% of Trinidad's population lived below the poverty line. In the willingness to pay survey 31% of the households lived below the poverty line, 18.7% were low-income, 21.9% middle-income, 6% high-income and 22% were very high income earners (See Fig 7.1). The poorest households earned a net monthly average income of TT$1200 or less. Low income households earned TT$2150, middle income households TT$5251, rich households TT$9500 and very rich households earned TT$12000 or more per month.

On a national basis the level of ownership of consumer durables is quite high. Many of these items may have been obtained during the boom years. A survey of living conditions done by CSO (1992) which used a sample of 6220 and examined the percentage of households that owned at least one consumer durable, revealed that 40% of the population owned at least one car, 83% of households owned a freezer, 88% owned a TV, 43% owned a washing machine and 47% owned a stereo. Using ownership of household appliances and assets as a proxy for socio-economic status, the WTP survey revealed that there was a high ownership level of household appliances such as refrigerators, washing machines and home-entertainment technology such as radios, stereo-sets, video cassette recorders and televisions. Three quarters of the respondents owned a washing machine. Almost all (97%) of the respondents in the survey owned a television,

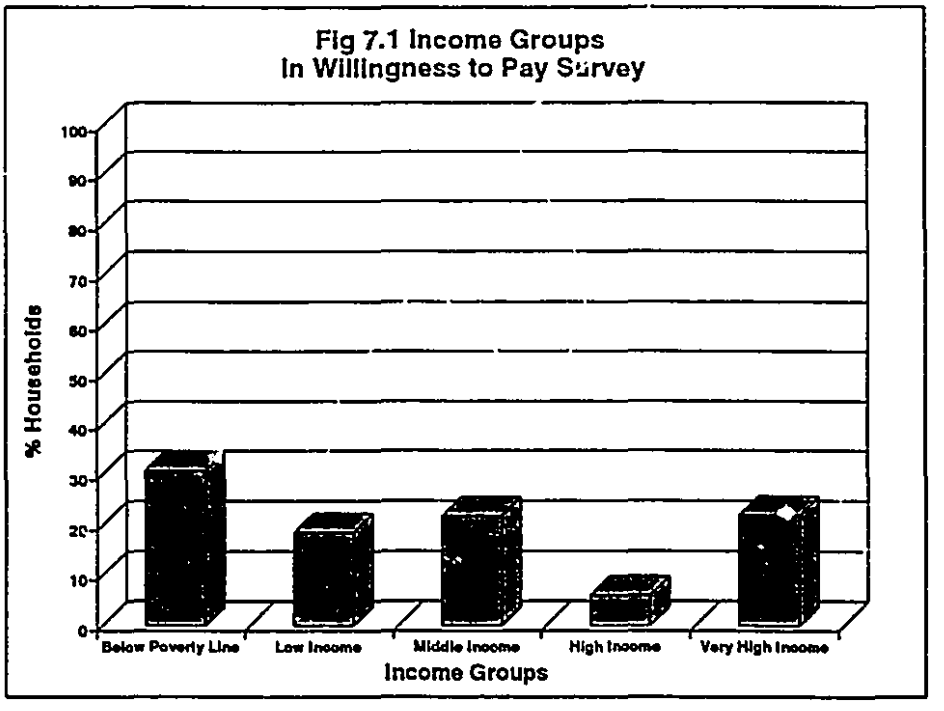


Fig 7.1 Income Groups
In Willingness to Pay Survey
% Households
100
90
80
70
60
50
40
30
20
10
0
Below Poverty Line
Low Income
Middle Income
High Income
Very High Income
Income Groups

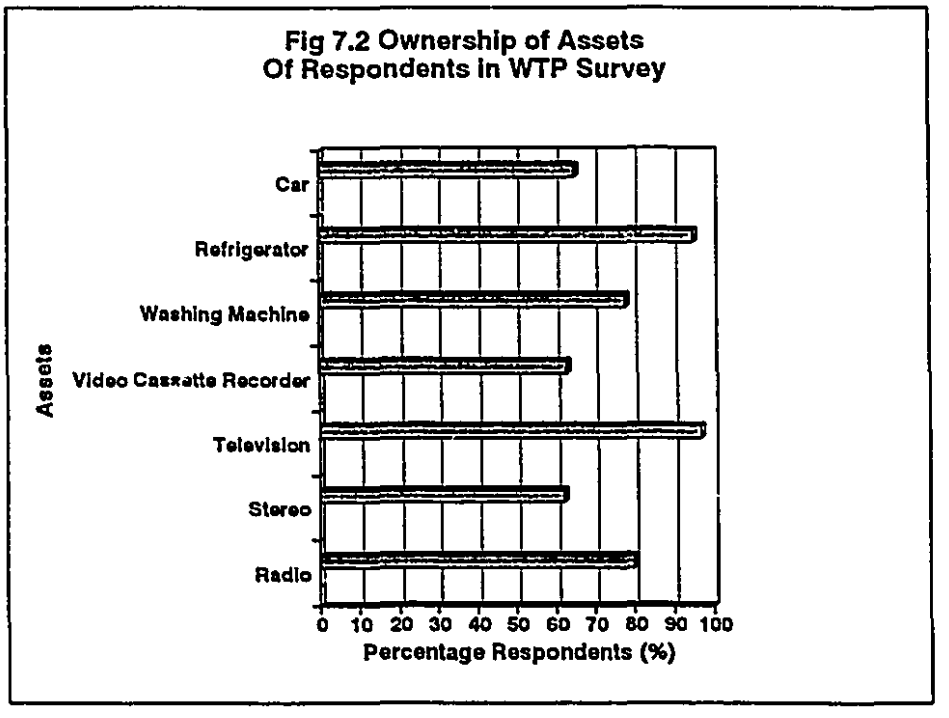


Fig 7.2 Ownership of Assets
Of Respondents in WTP Survey
Assets
Car
Refrigerator
Washing Machine
Video Cassette Recorder
Television
Stereo
Radio
0 10 20 30 40 50 60 70 80 90 100
Percentage Respondents (%)

of these 28% owned between 2 to 3 televisions. A fairly high percentage (65%) of households owned a car and of these 40% owned more than one car (See Fig 7.2 and Appendix 7.1).

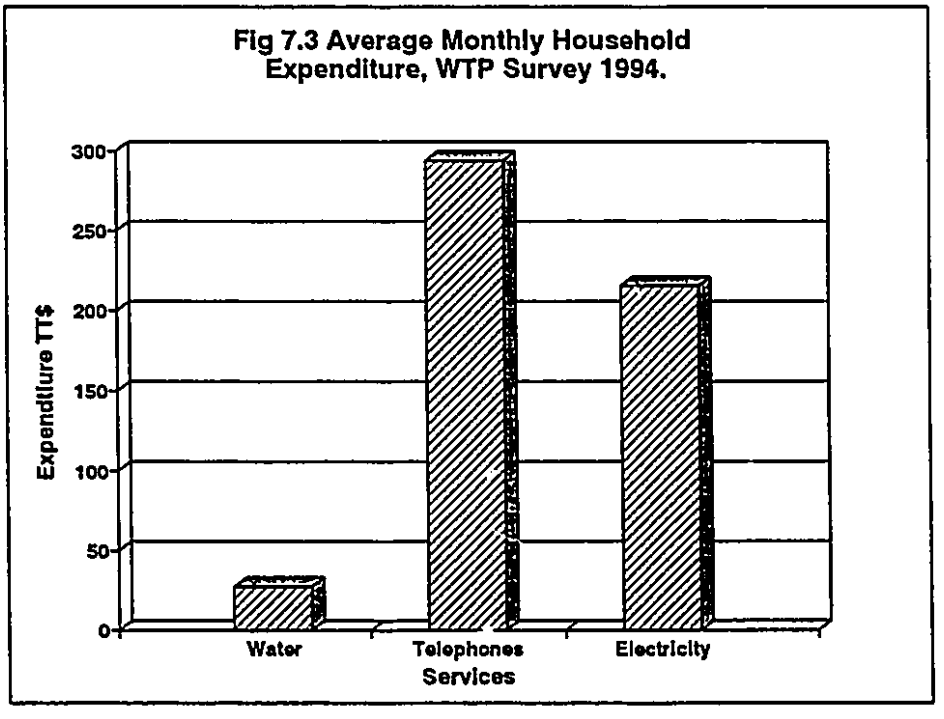
7.1.2 HOUSEHOLD EXPENDITURE

Households in the WTP survey were spending much more on electricity and telephone bills than on water. The average monthly amount spent on electricity, telephones and water was TT$215, TT$294 and TT$31 respectively (See Fig 7.3). These results were supported by similar findings of a survey conducted by the Public Utilities Commission in 1993. (See Table 7.2).

Table 7.2
Distribution of Average Monthly Expenditure of Trinidad Households

Service	Low Income Group $	%Income	Medium Income Group $	% Income	High Income Group $	% Income
Water	$31	3%	$38	1%	$50	0.6%
Electricity	$49	5%	$77	2%	$115	1.4%
Telephones	$114	11%	$155	4%	$171	2%

Source:Public Utilities Commission,1993.



7.2 HOUSING CHARACTERISTICS

Survey findings of the Central Statistical Office (1990), PADCO (1993) and the WTP Survey (1994) confirm that most households in Trinidad live in separate houses and housing ownership is very high (See Fig 7.4). Under 40% of Trinidad's households and those living in the Capital Region own the land on which their dwelling unit is built. In contrast, the level of land ownership is high (75%) in the willingness to pay survey.

7.3 WATER CONSUMPTION PATTERNS

One way in which the survey probed water consumption patterns was by asking questions about sanitation facilities and ownership of appliances which used water. Only 23% of dwelling units in Trinidad have a flush toilet, compared with (39%) in the Capital Region. More than three quarters of the households in the willingness to pay survey had flush toilets (See Fig 7.5). Differences in the level of sanitation is explained by the fact that the built-up settlements of Goodwood Park, Alyce Glen, Barataria and St.Barbs were located in the Port of Spain Sewerage Area, and Malabar was located in the Arima Sewerage Area which are all served by WASA. In other words five out of six settlements in the survey were connected to the public sewerage system.

Only 10% of the households in the WTP survey had a dishwasher. By contrast, 75% of households used a washing machine. Both these appliances use large amounts of water and cannot be used when there is a water shortage.

More than half (56%) of households had a lawn/garden and either a garden tap, sprinkler or water hose. A salient point is that potable (treated and therefore costly) water was being used for outdoor use, as opposed to recycled water.

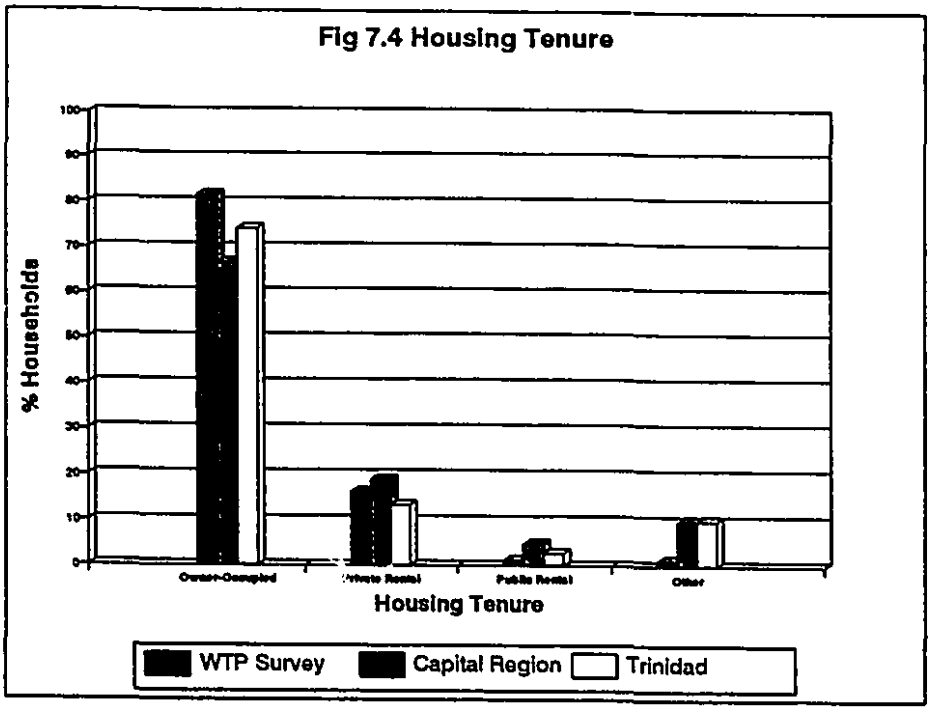


Fig 7.4 Housing Tenure
% Households
Housing Tenure
WTP Survey
Capital Region
Trinidad

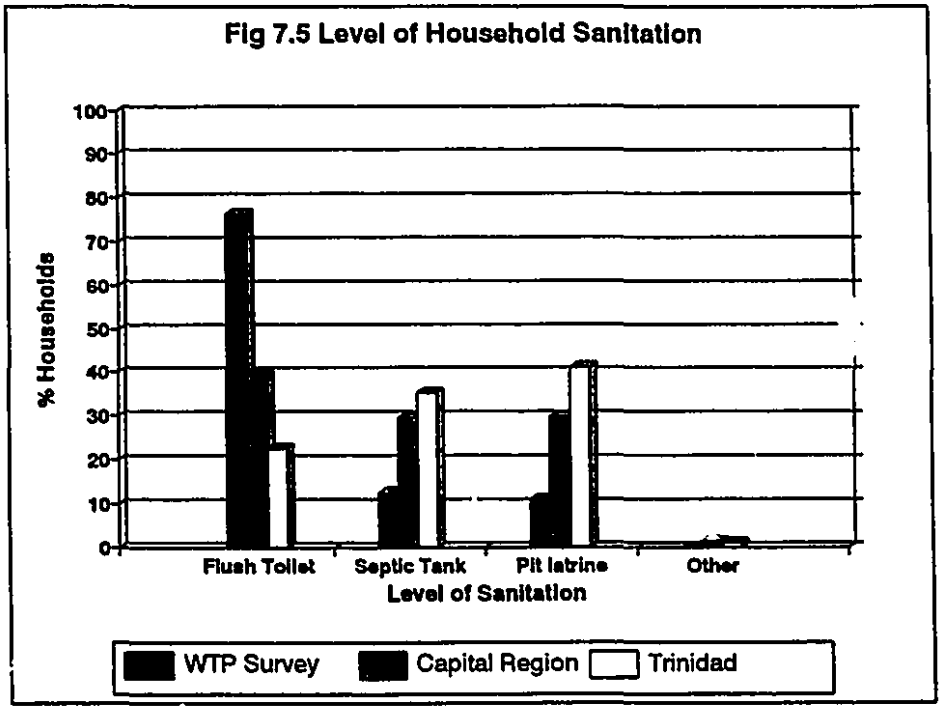
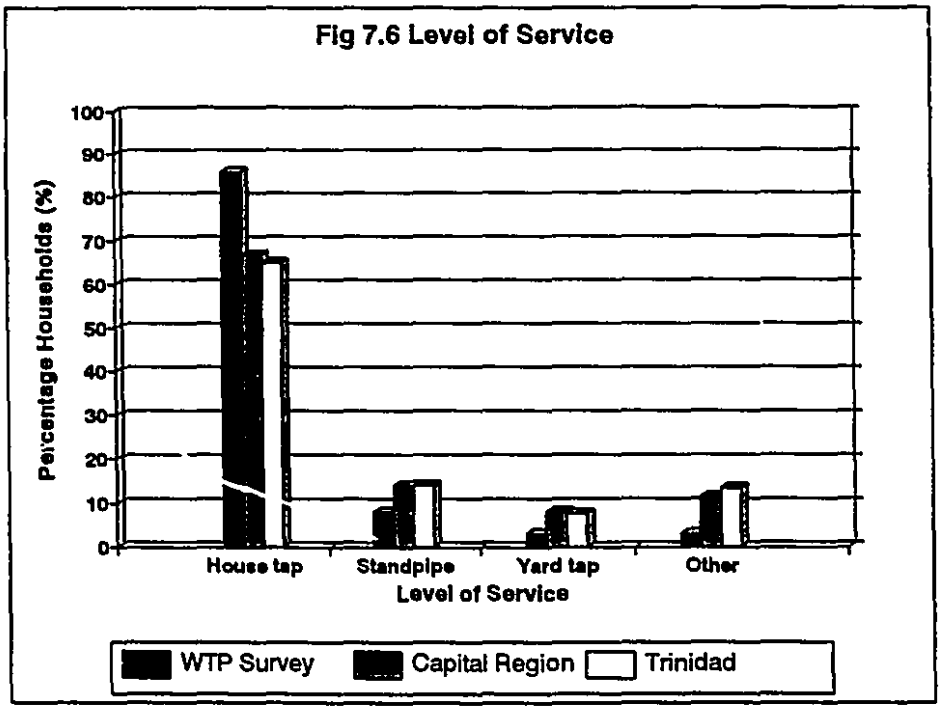


Fig 7.5 Level of Household Sanitation
100
90
80
70
60
50
40
30
20
10
0
% Households
Flush Toilet
Septic Tank
Pit latrine
Other
Level of Sanitation
WTP Survey
Capital Region
Trinidad

7.4 LEVEL OF SERVICE

A high percentage (85%) of Trinidad's population has access to piped water, but only 65% of households has a house tap service (CSO,1990) as illustrated in Fig 7.6. In the Capital Region, 66.6% of all households have a house tap service. In the WTP Survey 86% of the respondents had a house tap service. Differences between the WTP survey results, the Capital Region and the national figures may be explained by the fact that the areas in the sample were urban settlements which traditionally received the most investments for infrastructure improvements and expansion. These findings are also supported by the survey of living conditions by CSO (1992) that revealed that 68.9% of households in urban areas had a house tap service compared to 54.1% of their rural counterparts (See Appendix 7.2).



The survey of living conditions by CSO (1992) found that the level of access to a house tap service varied among income groups. The poorest 20% of the population used mainly a house tap service (33.7%) or a standpipe (31.3%).[1] Over half of the population (51.1% and 61.6%) in the second and third quintiles respectively, more than 75% of the population in the fourth quintile, and the richest 20% had a house tap service (See Appendix 7.2).

7.4.1 HOUSE TAP USERS

Most (98.6%) households with an internal tap were connected to WASA, while a few (1.4%) were drawing water from a private source such as springs, rainwater or a neighbour's yard tap . The average number of taps in most households was five. WASA gives domestic consumers the option to meter their water supply, but in the WTP survey only 10% had meters installed. Even less (4%) had functioning meters which were used as the basis for water charges.[2]

Under the WASA Act all households living in owner-occupied dwelling units are required to pay water rates. Not all house tap users were billed for water because some (26%) were living in rental accommodation and the rates were paid by the landlord[3]. The survey found that 68% of households living in owner-occupied dwelling units with a house tap service were billed for water. However, approximately 32% were not billed. A number of reasons account for such a high number:

* Households were pirating water from WASA;

* WASA's consumer data base is outdated and does not reflect the actual numbers of households that should be billed; and

* No threat of disconnection by WASA.

7.4.2 YARD TAP USERS

Only 3% of the WTP survey respondents had a yard tap service as their primary source of water which reflects the service level available in both the Capital Region and nationally (See Table 7.1).

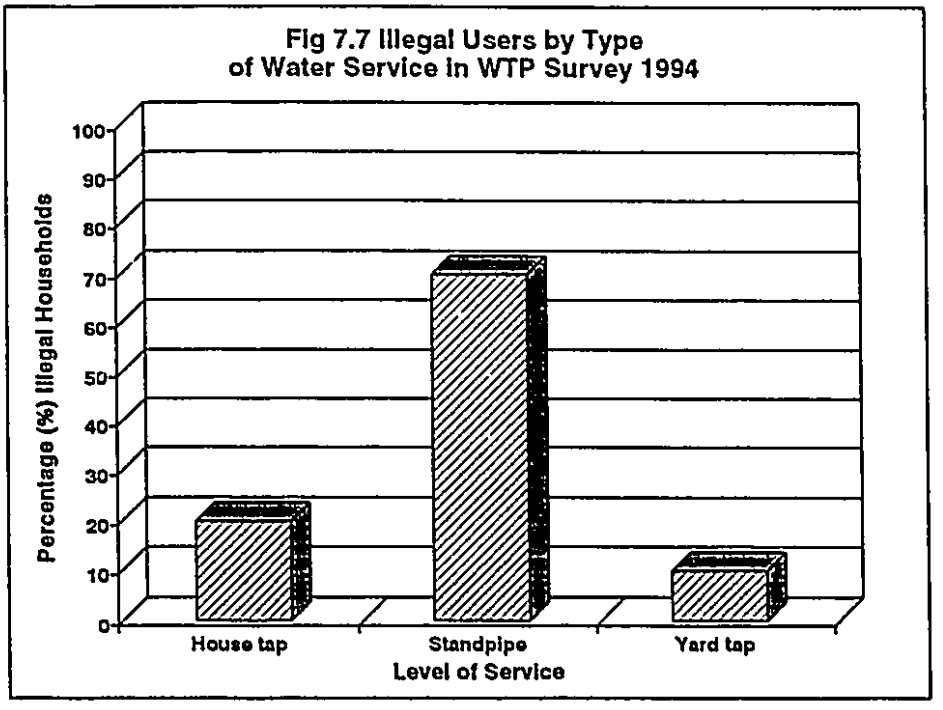
7.4.3 STANDPIPE USERS

Few households (8%) in the survey used standpipes as the primary source of water. In both the Capital Region and nationally 14% of households used standpipes. These differences are explained by the fact that the WTP survey sampled households in only two areas where the basic level of service was a standpipe.

The majority of standpipe users were not paying water rates, although according to the Water and Sewerage Authority Act Chapter 54:40, all standpipe users living within a quarter mile radius of a standpipe are liable to pay water rates. Due to the difficulties inherent in collecting rates for standpipe systems, essentially no attempt is made to collect the user fee.[4] Most standpipe respondents in the survey were therefore receiving free water. Further, respondents who said that they were paying water rates, when asked to indicate if bills were paid annually, quarterly or monthly did not give a response, which was suggestive of hijacking and delinquency on their part or improper collections on WASA's part.

7.5 ILLEGAL WATER USE

An estimated 11% of the users in the survey (40 households) were pirating water through illegal connections or they may not be billed because of WASA's outdated cadastre, inadequate commercial records and addressing problems. The main hijackers are standpipe users (70%), but house tap users are still significant (20%) and yard tap users account for 10% of the ghost consumers (See Fig 7.7). In spite of water hijacking, the overwhelming majority of respondents (79%) did not view water as a free good.



7.6 WATER PROBLEMS

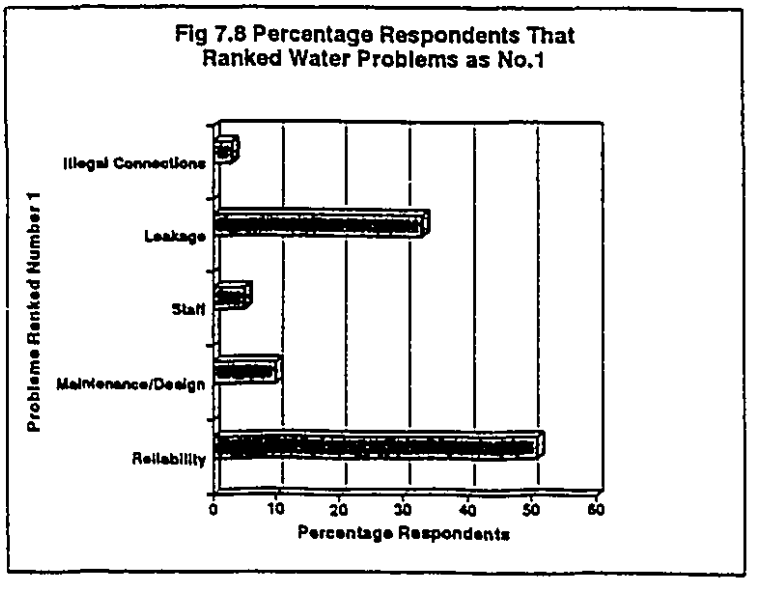
Service users are affected by water problems such as unreliability, low pressure and water quality regardless of income as illustrated in Table 7.3. The very poor seem to be most affected by water shortages. Among the poorest 20% of Trinidad's population about 51.6% receive water daily and 22.6% have a service less than twice per week. Only 66.8% of the richest 20% have a 24 hour water supply. More than half the survey's respondents indicated that reliability was the major shortcoming of the water supply system (See Fig 7.8). A high percentage of persons indicated that leakages along distribution pipelines was a serious problem and spoke of the enormous waste of water seen on the streets, that went unattended by WASA for several weeks. Many persons interviewed did not see illegal hook-ups to WASA as a cause of water problems. Respondents identified the problems which affected them frequently and those that were visible as the main deficiencies of the water service, hence the high rankings given to reliability and leakages.

Table 7.3 Availability of Water by Quintile Groupings 1992 (% Households)

Quintiles	Daily	More than 3 times per week	Twice Weekly	Less than two times per week
Poorest 20%	51.6	20.6	5.3	22.6
II	58.4	18.7	5.3	17.5
III	60.8	18.5	6.4	14.3
IV	59.4	15.0	8.6	17.0
Richest 20%	66.8	16.8	7.6	8.8

Source: Survey of Living Conditions CSO,1992.

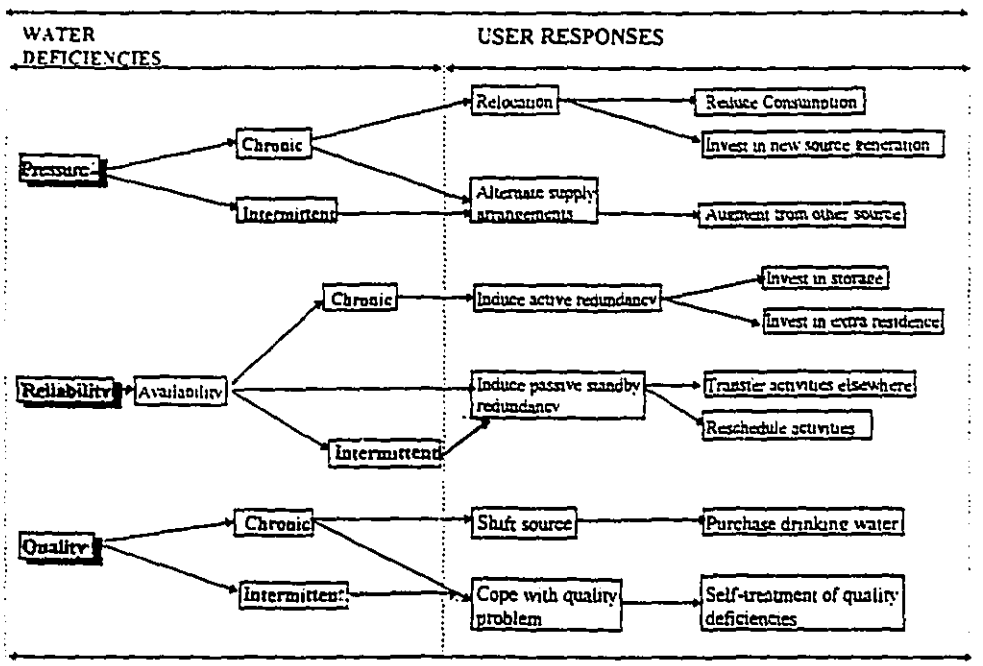
JICA (1991) reported that 71% of all domestic users in Trinidad and 50% in the Capital Region had private water storage tanks. Approximately 75% of households in the WTP survey owned water tanks which is also consistent with findings that 75% placed reliability as the most desired improvement. They argued that while pressure and water quality could be improved by resorting to purchasing water pumps and boiling the water, when there was no water not even the reserve tanks could be filled-up. Many households often purchased water from water trucks to fill up their tanks at times when water had been interrupted for several days. The results are not surprising given the high percentage of households that have invested in water-holding facilities.



Work done by Humplick, Kudat and Madanat (1993) on modeling household responses to water supply, found that households have two generic response strategies to cope with water rationing; the "exit alternative" and the "voice alternative". "Exit" refers to seeking a solution independently of the water utility such as rescheduling activities, investing in storage tanks, or relocation. "Voice" refers to the use of political influence, bribery, organized demonstrations, and the media, to protest against the water utility or the Government.[5] The sequence of the strategy appears to be "exit" first then "voice" as last resort (See Fig 7.9). Households pursue a low cost strategy which is day to day behavioural adaptations, such as relocating or rescheduling water usage activities (passive redundancy). This trend is very common among households in Trinidad which relocate to do laundry at the homes of family and friends, or reschedule washing depending on the availability of water.

Over time affected households move to the next stage, in that they adopt higher costing strategies such as invest in fixed storage tanks (active redundancy). The next stage and at the extreme level, they may relocate to new neighbourhoods (See Fig 7.9). In Trinidad "bank on a tank" seems to be the watchwords of households affected by the unreliability of the water service. Households that could afford investments in small scale water storage facilities purchased several tanks. An estimated 37% of these respondents owned tanks which stored between 100-440 gallons of water, over a quarter stored 450-880 gallons and another 25% of households stored as much as 1000-1800 gallons, many of whom were more affluent households. It became obvious from the survey that households had taken individual action to improve their water reserves and to avoid the inconvenience of water rationing. The importance of this phenomenon is that households in the survey invested in assets to produce other assets and were joint consumers and producers, installing water storage tanks to address the problem of unreliability.

Fig 7.9 Water Deficiencies and User Responses



Source:Humplick,Kudat and Madanat 1993

If private investments in water holding facilities fail to bring about a relief from water shortages, Trinidadian households adopt the "voice strategy", that is public protests and complaints to Parliamentary Representatives, the Minister of Public Utilities, Public Utilities Commission and WASA. When all efforts fail, households resort to bribing WASA personnel or private water trucks to deliver water to their area, which further suggests a WTP for water and the growth of a hidden water economy (See Fig 7.9).

7.6.1 WATER PRESSURE

Low water pressure affected households living in hilly areas such as Goodwood Park, Alyce Glen and St. Barbs. Some households (46%) have invested in water pumps to fill private water tanks.

7.6.2 WATER QUALITY

Most households are satisfied with the water quality. Households at both the national level (76%) and in the Capital Region (90%) considered the water clear according to JICA (1991). Respondents in the WTP survey indicated that the water quality is good, which was to be expected because as indicated by the World Health Organization (1994), Trinidad has high drinking water quality standards. Most respondents indicated the water quality was clear (82%) and were satisfied with the taste of the water (86%). Only 21% of the households were dissatisfied with the water quality. About 68% of the respondents treated the water mainly by boiling and 4% used water filters, following advice issued by the Ministry of Health in light of the 1991 cholera outbreak in Peru.

7.7 KNOWLEDGE AND ATTITUDES TO METERING

Many respondents were aware that metering measured the amount of water consumed and was used as a basis for billing water charges. Many persons interviewed knew that water metering was used in some countries, and nearly three quarters (73%) favoured its use in Trinidad. This reflects a change in attitudes to metering, in that a survey conducted by the Public Utilities

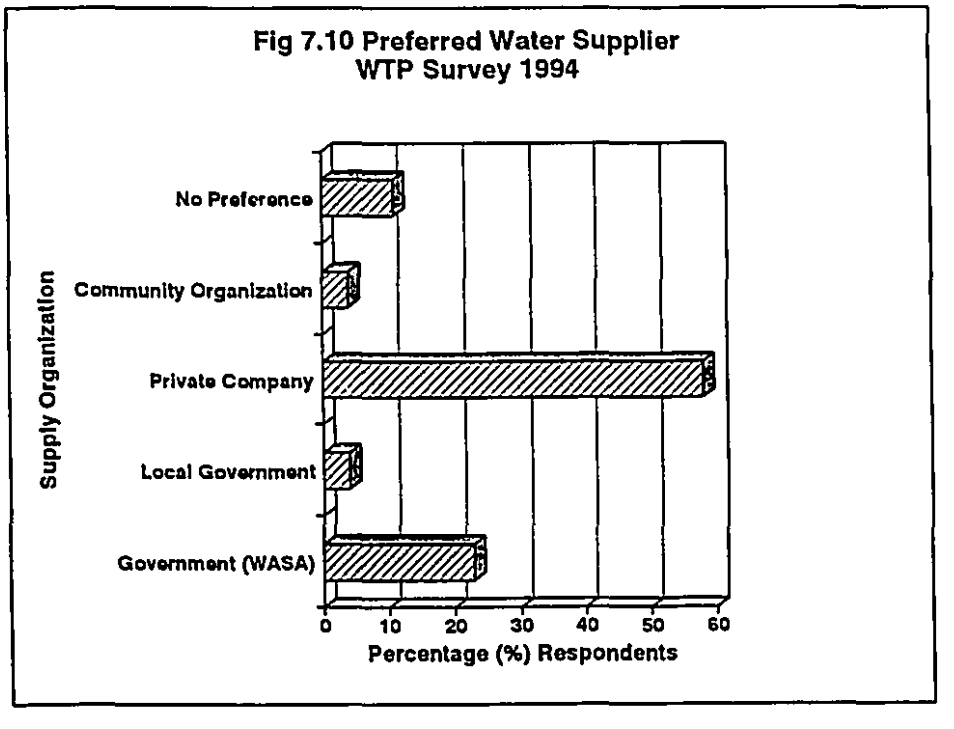
Commission in 1985, showed that 33% of the respondents preferred a consumption-sensitive price mechanism.

7.8 ATTITUDES TO ORGANIZATIONAL ISSUES

A majority of the respondents indicated that they believed that the labour unions representing WASA workers were asking for unreasonable salary increases, and were trying to preserve workers jobs, while the workers themselves were unproductive. Many (63%) thought that the unions were to be partly blamed for the inadequate water service in the country.

7.9 PREFERRED WATER SUPPLIER

Most respondents (58%) preferred a private entrepreneur to undertake the supply of water. Although the second choice of a supplier was WASA, only 23% of the respondents indicated that it should continue to supply water (See Fig 7.10). The reason given by households for favouring a private entity over WASA, was that the telephone, cable television, and electricity companies were operated privately, after years of government monopoly, and services improved.



7.10 DATA ANALYSIS ON WILLINGNESS TO PAY SURVEY

The conceptual model tested assumes that a household's willingness to pay for an improved water supply depends on: (1) the characteristics of the water supply system such as the existing levels of service and sources of supply, (2) the price currently charged for water, (3) perceptions of water problems (reliability, pressure and quality), (4) the price of other goods and services, (5) household socio-economic characteristics (gender, age, household size, education, occupation, income, assets and expenditures), (6) housing characteristics, (7) household water consumption patterns, and (8) attitudes of the household which may serve as proxies for taste (See Whittington et al, 1993). This implies that an individual's willingness to pay for an improvement in water services will be a function of the proposed change in the attributes of the service, and of all other factors which influence the individual's valuation of that change.

7.11 STATISTICAL ANALYSIS

It is worth reiterating that 0.34% of all households in Trinidad and 0.36% of all households in the Capital Region were sampled because of time and budget constraints. Further, of the 420 households in the sample, 35 households gave incomplete responses because spouses did not know the water bill. A decision was made to reject these and an additional 25 households from the data analysis, to avert possibilities of sampling bias in the various settlements. In the end 360 households were used in the analysis.

A correlation analysis was carried out for all the variables in the questionnaire in order to identify the few key variables with relatively strong inter-dependencies. This provides some insights into how each variable impacts individually on willingness to pay (dependent variable) but, more importantly, intercorrelations between the independent variables themselves can substantially affect the results of multiple regression analysis so these correlations must be noted and accounted for. Pearson correlation coefficients for some of the most closely related variables are given in Table 7.4. Income is highly interdependent

with the age and education of the respondent, household size, and number of water tanks owned. The Pearson correlation coefficient between income and these variables is above or equal to 0.85 and the significance probability of the correlation under the null hypothesis that the correlation is zero is 0.0001 to 0.0003. The number of tanks and hours of water service were also highly correlated.

Table 7.4 Summary of Pearson's Correlation Coefficient for Highly Interdependent Variables

Variables	Pearson's Correlation Coefficient	Probability > R Under HO: RHO=0
Age of Respondent and Income	0.38	0.0001
Education of Respondent and Income	0.85	0.0001
Household Size and Income	0.86	0.0003
Number of tanks and Income	0.88	0.0001
Number of Tanks and Hours of Service	0.85	0.0001

NB Probability > R is the significance probability of the correlation under the null hypothesis that the correlation is zero.

A reduced data set for multiple regression analysis was formed from the total set of all variables in the questionnaire by using the interdependencies listed in Table 7.4 to exclude all but one variable of any group of highly correlated variables. Further, variable selection was obtained by using the "forward selection" technique to identify a subgroup of the reduced set of variables that are good predictors for willingness to pay.

In "forward selection", the first explanatory variable entered into the model is that with the largest positive or negative correlation with the dependent variable, namely the monthly amount the household is willing to pay for improved service. Then, the F test for the hypothesis that the coefficient (in the regression equation) of the entered variable is 0 was carried out. The calculated value of the F statistic itself (or of the probability, p, associated with it) for the

entered variable is compared with some established criterion (F=3.84 or p=0.05). The variable is not entered into the model unless "F-to-enter" >3.84 or the probability of "F-to-enter" <0.05. Once one variable is entered, the statistics for the variables not in the equation are used to select the next one. The partial correlations between the dependent variable and each of the independent variables not in the equation, adjusted for those already in the equation, are examined. The variable with the largest partial correlation (or largest F value) is next entered. The procedure stops when there are no variables that meet the entry criteria. The results are summarized in Table 7.5

A least squares multiple regression analysis using SAS procedure GLM was performed on the subset of predictor variables, obtained from the "forward selection" method. In Table 7.6 are listed the "t" values for all the variables in the reduced set examined which were not found to be statistically significant from "forward selection" and so were not entered into the regression model. These variables and their possible impact on willingness to pay are discussed in general terms later through semi-quantitative, non-statistical comparisons of their median values for different socio-economic groups in the survey. Each value of "t" is calculated for a test of the null hypothesis that the partial regression coefficient for the variable of interest is equal to zero. As a rule-of-thumb, values of the "t" statistic greater than or equal to 2 indicate that the corresponding variable has significant explanatory power. The "t" values of household income (4.65), water price (4.57), number of hours of water service (2.49), and housing and land tenure (2.16) are very significant. In addition, the probability>t values also indicate that these independent variables contribute significantly to the model. Variables such as household expenditure on electricity and telephones did not have any significant effect on the model.

Table 7.6 contains information on the explanatory variables actually included in the model. The regression model is given by the equation:

Willingness to Pay=24.9+2.51 Income+0.34 Current Price+6.65 Hours of Service+5.26 Housing and Land Tenure.

Table 7.5 Summary of Stepwise Regression Model
Using Forward Selection Technique

Dependent Variable:Willingness to Pay

Independent Variable	Number in	Partial R^2	Model R^2	Probability F	Probability >F
Household Income	1	0.2040	0.2040	91.76	0.0001
Price of water	2	0.0483	0.2524	23.08	0.0001
Hours of water	3	0.0126	0.2649	6.07	0.0003
Housing and land tenure	4	0.0025	0.2674	4.92	0.0013
Expenditure on Telephones	5	0.0011	0.2685	3.87	0.0020

Note:
F: The F value for testing the hypothesis that all parameters are zero except for the intercept. This is formed by dividing the mean square for the model by the mean square of the error. It tests how well the variable accounts for the dependent's variable's behaviour.

Probability >F: This is the significance probability of getting a greater F statistic than that observed, if the hypothesis is true.

Table 7.6 Summary of GLM Regression Model
for Household Willingness to Pay

Dependent Variable: Willingness to Pay

Independent Variables	Parameter Estimates	T for HO: Parameter=0	Pr>T
Intercept	24.9	4.59	0.0001
Household Income	2.51	4.65	0.0001
Price currently paid for water	0.34	4.57	0.0001
No.of Hours of Water	6.65	2.49	0.0003
House and Land Ownership	5.26	2.16	0.2724
Expenditure on Electricity	-0.0	-0.05	0.9634
Expenditure on Telephones	0.03	0.73	0.4673
Summary Statistics Number of observations 360 Mean of the dependent variable $67 Percentage predicted correctly 27%			

NB* Parameter Estimate gives the intercept estimate and regression coefficients for each independent variable.
T for HO:Parameter=0 means the t value for testing the null hypothesis that the parameter equals zero.
PR>T is the probability of getting a larger value of T
T values at 0.5000 significance level

The results show that the willingness to pay information obtained from the contingent valuation survey, is related to the socio-economic characteristics of the household and the respondent, in ways suggested by consumer demand theory. The four explanatory variables with consistently significant effects on willingness to pay have clear economic interpretations: *household income, the price of water, number of hours of service (reliability problems), and housing and land tenure* (See Table 7.6). *The main findings were:*

* For every TT$1000 rise in household income, there is a willingness to pay an average of TT$2.51 per month more in water rates for service improvements;

* Willingness to pay is influenced by whether households were paying water rates and the price they were being charged. For every additional TT$1.00 households currently paid, households are inclined to pay TT$0.34 more for a better supply;
* Water problems affected the household's willingness to pay for improvements. With every extra hour of reliable service that a household is currently enjoying, the monthly amount that it is willing to pay for an improved service is increased by a mean value of TT$6.65 per month; and
* Households that were home-owners and land-owners were willing to pay a base value per month of TT$5.26 more than tenants and squatters.

The R^2 value for the model was 0.2684. Although the R^2 value indicates that much (73%) of the variation in willingness to pay cannot be explained by the model, this value is high for data from contingent valuation surveys and compares favourably with the results of contingent valuation studies carried out in the US, Western Europe, Ghana, Haiti and Pakistan.[6] For example, Mitchell and Carson (1989) suggest that the reliability of a contingent valuation study which fails to show an R^2 of at least 0.15, using only a few key variables, is open to question. Despite a relatively low R^2, the survey results thus pass Mitchell and Carson's proposed standard.

7.12 HOUSEHOLD WILLINGNESS TO PAY

Contingent valuation surveys are usually vulnerable to outliers, in particular because the summary statistic of central tendency most commonly used in these surveys is the mean, which is more sensitive than others (mode, median, etc.) to outliers. In this study, there is an additional problem because willingness to pay amounts are unbounded at the upper end. To mitigate the effect of outliers, one approach is to delete them on an adhoc basis. A more defensible approach, however, is to use the median. As Mitchell and Carson (1989) have advised, the reliability of results from contingent valuation surveys are often enhanced by use of the median rather than the mean. In this section, median values of the monthly

amount that a household is willing to pay for improved service, are discussed The differences in these median values for households with different socio-economic characteristics are examined. An attempt is made to assess these disparities, in order to identify possible key areas where policy changes might lead to improvements in the system that are most valued by the population studied.

The majority of households (80%) in the survey were WTP for improvements in the water supply. Households were WTP twice the amount they were currently paying if an improved water supply is delivered in the future. Presently, these households are paying a median value of $31 per month. The median amount households were WTP per month for a house tap water supply with the full package of benefits (reliability, pressure and quality) was approximately $67. These results show a dramatic change in attitude to WTP for service improvements since 1985. In a survey conducted by the Public Utilities Commission in 1985, 56% of residential consumers were not willing to pay higher rates.

7.12.1 INCOME

Income impacts strongly on WTP more for a better water service. The forward selection technique identified household income as the first variable which affected WTP. The partial regression coefficient revealed that for every unit change in income of $1000, households are willing to pay $2.51 for improvements.

As illustrated in Fig 7.11 residents of the high income settlements were willing to pay more than those in medium and low income settlements. The higher the household income, *in absolute terms*, the more households are willing to pay for improvements. The poorest 20% got water free but they were willing to pay $28 per month. Households in the second quintile (low income) were paying TT$0-$17 but were WTP $50 per month. Households in the third quintile (middle-income) households spent approximately $28 per month on water, and were WTP a value of $55. Households in the fourth quintile (high-income)

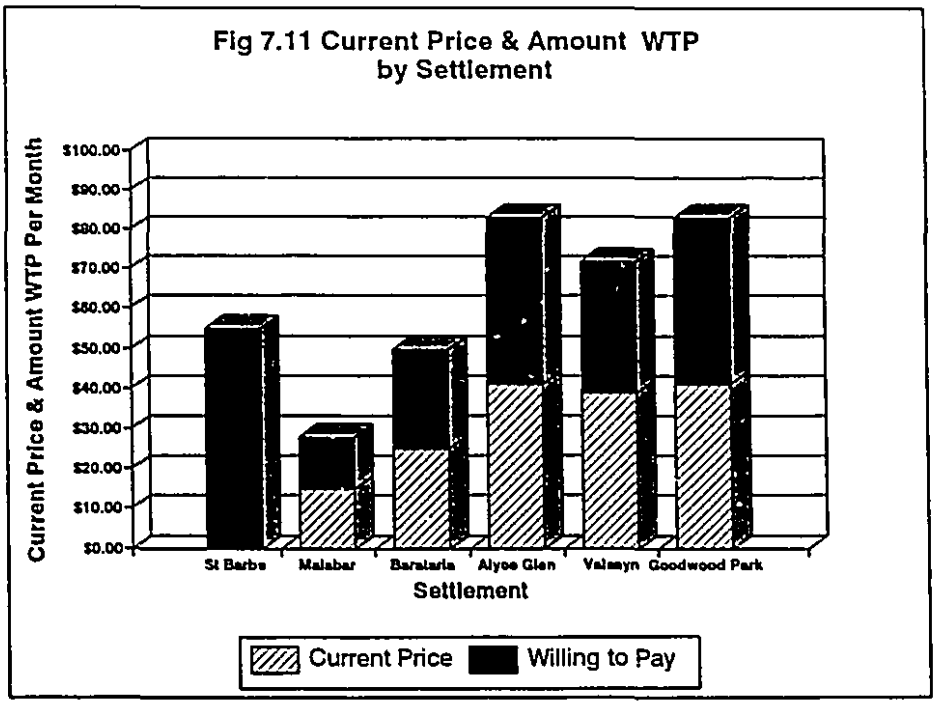


Fig 7.11 Current Price & Amount WTP by Settlement
Current Price & Amount WTP Per Month
$100.00
$90.00
$80.00
$70.00
$60.00
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
St Barbs
Malabar
Barataria
Alyce Glen
Valmyn
Goodwood Park
Settlement
Current Price
Willing to Pay

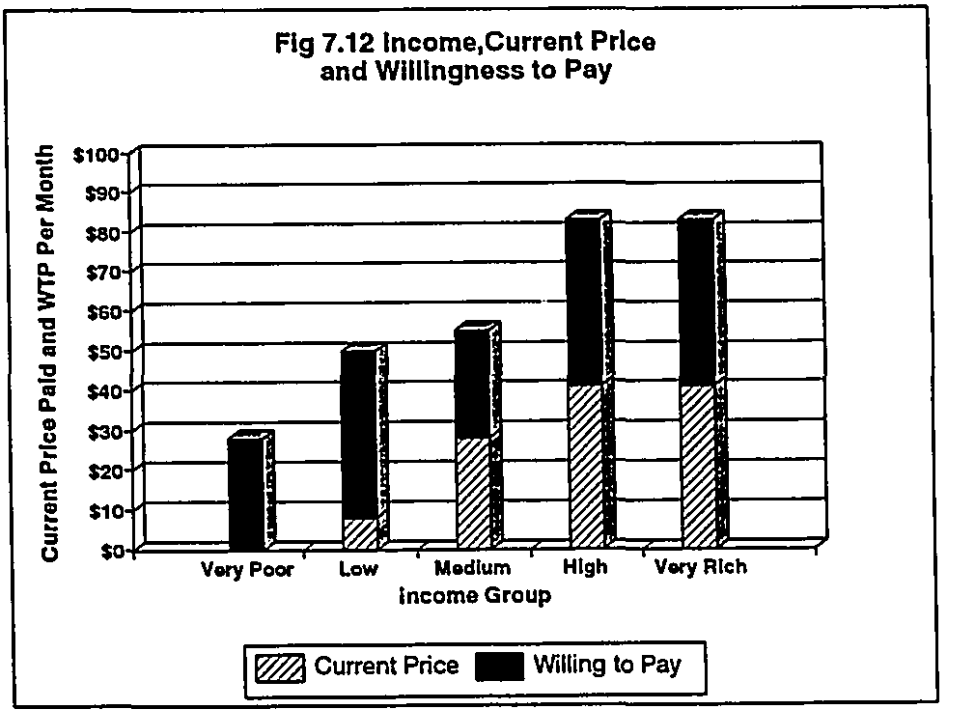


Fig 7.12 Income,Current Price and Willingness to Pay
Current Price Paid and WTP Per Month
$100
$90
$80
$70
$60
$50
$40
$30
$20
$10
$0
Very Poor
Low
Medium
High
Very Rich
Income Group
Current Price
Willing to Pay

households and the richest 20% paid $41 per month, and were WTP a median value of $83 per month (See Fig 7.12).

However, *in relative terms*, or as a percentage of income currently paid and percentage of income WTP more for water improvements, the poorest households and low income households were WTP a higher percentage of their income than middle-income and high-income households. This shows a negative income elasticity (See Table 7.7).

Table 7.7 Amount Currently Paid and WTP for Water Improvement as Percentage of Household Income

Income Groups	% Income Currently Paid	% Income WTP
Poorest 20%	0%	2.23%
2nd Quintile (Low income)	0%-0.79%	2.33%
3rd Quintile (Middle Income)	0.53%	1.05%
4th Quintile (High Income)	0.43%	0.87%
Richest 20%	0.34%	0.69%

7.12.2 PRICE OF WATER

The results of the regression analysis indicate that in accordance with economic theory, WTP is dependent on the price of water. Households that paid water rates were WTP 36% more than those that got free water (renters and households illegally connected to WASA).

An examination of the amount above current expenditure that households were willing to pay, revealed that those households willing to pay more, included those which were paying, as well as those not currently paying. Households that were WTP more, were currently spending on average $40 per month and were WTP $83 per month, while those receiving water free were willing to spend $50 per month. In contrast, households unwilling to change the amount they were

paying at present, paid an average of $41 per month. Households that preferred to spend less, were spending on average $55 per month but were WTP half that amount ($28) (See Table 7.8).

TABLE 7.8 Amount Currently Paid and WTP for Water Improvements

	%Respondents	Median CP	Median WTP	WTP-CP Difference
WTP>CP				
Where CP=0	21	0	$50	+$50
Where CP>0	60	$40	$83	+$43
WTP=CP	11	$41	$41	0
WTP<CP	8	$55	$28	-$27

* WTP is Willingness to Pay; CP is Price Currently Paid

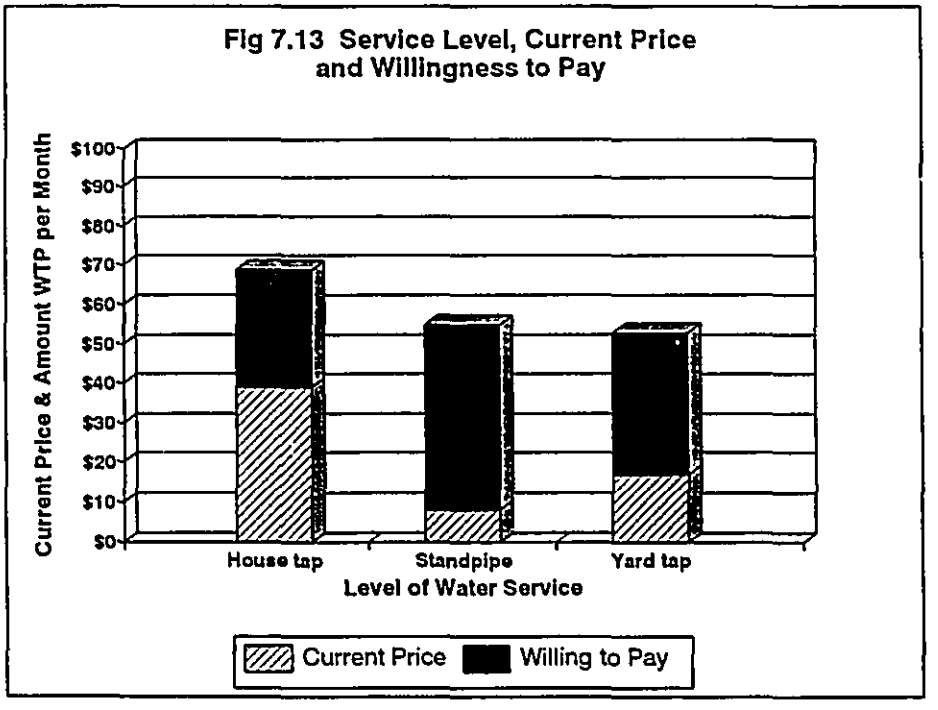
In addition, the level of price subsidization determines WTP. The survey found users that were most subsidized were less willing to pay. Based on questionnaire surveys of standpipe and yard tap consumers, Delcan (1992) found that standpipe users consumed approximately 55 cubic metres per year and paid $25 per quarter. Yard tap users consumed 580 cubic metres per year and paid $200 per year. After installing meters as part of a study of house tap users consumption Delcan (1992) established that consumption was 575 cubic metres per year and the average annual rateable value charges was $115 per quarter. Based on these estimates standpipe, yard tap and house tap users are charged $1.80, $0.35 and $0.80 per cubic metre respectively (Delcan 1992). An analysis of the survey data showed that yard tap users were being subsidized the most, and were willing to pay 30% less than house tap users.

7.12.3 LEVEL OF SERVICE AND WATER PROBLEMS

In absolute terms house tap users are willing to pay more than other users of the service. The median amount house tap consumers were WTP per month was $69, standpipe users $55 and yard tap users $53. But as a percentage of the amount currently paid, standpipe users are willing to pay 588% more for an improved service, yard tap users 212% and house tap users 77% (See Fig 7.13).

The percentage difference of standpipe users WTP may reflect a strategic response. Such users may be attempting to influence WASA to provide a house tap service to their area for reasons discussed in more detail in a later section. Indeed, both standpipe and yard tap users wanted to be upgraded to a house tap service level.

WTP for service improvements is influenced not only by the level of service but also the water source characteristics (regularity of supply, pressure and quality). All three methods of investigation; the contingent valuation, contingent ranking and the household production function support this finding as elaborated on in the following sections on service levels.



1. HOUSE TAP

RELIABILITY

Reliability (the number of hours of service in a day), influences WTP among house tap users, particularly since it is a major problem encountered even the regression value is not strong. The contingent valuation results showed that WASA's unresponsiveness to user demand for reliability has influenced investment decisions in the private augmentation of the public water system. Investments have been made in small scale infrastructure such as water tanks and pumps (active redundancy). Still respondents are willing to pay more for a better supply. One possible explanation for this phenomenon is that water storage tanks cannot be filled when there is an interrupted supply. Indeed, it is a no-win situation. Consequently, households still suffer from water shortages and are prepared to pay more if this would result in an improved service. The trend among house tap users in Trinidad is consistent with consumer demand theory in that if few alternative sources of water supply exist, households are WTP more for the publicly provided piped water. The case study of Gujrawala (Pakistan) yielded different results (Atwal et al,1994). There households were WTP 50% less than the price they were currently paying because they were not convinced that they would be relieved of private expenditures on supplementary devices, if they agreed to a higher tariff on the promise of an improved water supply. This reaction was understandable because private wells were an alternative supply to the public water system there.

A second reason that households are willing to pay more despite high capital outlays (including higher electricity and water treatment costs), is that unreliability impacts on the household's time. As an example, households that owned washing machines were generally willing to pay more for water, because they were severely affected by water shortages which upset the household regime, causing them to reschedule activities, and in extreme cases, to relocate these activities to the homes of family or friends (passive redundancy). Residents also complained that the scheduled interruptions were inconvenient because water was

taken when they needed it most, namely between 6pm to 5am. This is usually the time when households had after-work chores such as cooking, washing and cleaning. The inconvenience suffered and loss of time resulting from the inability to do household chores, impacts on WTP more. Goodwood Park and Alyce Glen were affected more than other areas in the survey by interruptions in water supply because they received fewer hours of water supply than other settlements (See Table 6.1) and this has resulted in a WTP more for a service improvement.

Tests were run using contingent ranking to ensure that the results on reliability and WTP were consistent. These tests all confirmed that households valued reliability highly and were WTP more for this aspect of the water supply. Households which ranked reliability as the major water supply problem, indicated a WTP more for an improvement in reliability.

Additionally, use was made of the household production function (described more fully in Chapter 5) which observed how much households actually spent to offset water problems, because the private expenditures incurred to mitigate water problems, indicate the actual consumers' WTP for a reliable water supply.[7].[8] Households have privately replicated a water storage and distribution system. Seventy five percent (75%) of the respondents in the survey purchased tanks and water pumps on the open market and contracted private companies to install tanks. Many households owned several tanks varying in size from 100 gallons to 2500 gallons, but the most popular tank size is 420 gallons. On average, the capital cost of a 420 gallon water tank is TT$4,343 for the installation (See Table 7.9) and on-going maintenance cost is approximately TT$368 per annum (change of filters, servicing or pumps, tank cleaning). Assuming that the economic life of a 420 gallon tank is 10 years and 10% interest rate (foregone income), capital and maintenance costs come to TT$66.86 per month which is equal to the median amount of TT$67 per month households are willing to pay for an improved service.

TABLE 7.9
COSTS OF PRIVATE WATER TANKS (TT$)

Tank Size (Gallons)	Retail Price $	Installation Costs $	Total Costs $
420	375	3968	4,343
500	525	3968	4493
600	700	3968	4668
800	1150	3968	5118
1000	1450	3968	5418
1200	4500	3968	8468
2500	5000	3968	8968

Source: Fieldwork,1994.

NB Installation costs include water tank, horse power pump, foundation blocks to place water tank, pressure lines, plumbing fittings (elbows, unions, bushings).

Another useful measure of how much households are WTP for service improvements, particularly reliability, is the amount households paid water vendors, namely private water truck owners contracted by WASA to deliver water.[9] Customers paid private water trucks approximately TT$150 per trip to fill-up the tanks when there was a water shortage for several days and their private water reserves were exhausted. Allegations of malpractice were made by respondents, in that WASA personnel failed to turn-on stopcocks according to schedule so as to stimulate artificial demands for truckborne water.[10] Despite these allegations of corruption, residents are paying for water delivery and in some cases go so far as to pay "grease money" to water truck operators during periods of chronic water shortages, which is indicative of a WTP for reliability. Although the Public Utilities Commission makes provisions for households to submit receipts paid to water vendors to receive rebates, many households do not exercise the option.

WATER PRESSURE

Water pressure problems are not as ubiquitous as unreliability, occurring instead in predominantly hilly areas. Households in Alyce Glen, St.Barbs and Goodwood Park suffer from water pressure problems because of the high

elevation and steep slopes on which they are located, and the failure of WASA's booster pumps. The survey found that respondents who desired better water pressure were WTP more for an improved service. House tap users that had invested in water pumps were also WTP for an amelioration of the water supply conditions such as low pressure.

WATER QUALITY

Another important source characteristic which affected WTP was the overall perception about the water quality. Respondents who were dissatisfied with the water quality in terms of colour and odour were WTP more for improvements. Boiling water involves a cost to households as shown by a study of Peru, where residents were urged to boil drinking water for 10 minutes because of the cholera, and the cost of doing so amounted to 29% of the average household income in squatter settlements (World Bank,1992).

2. STANDPIPE

Households collected water from standpipes which was then transported to the house to be used for drinking, bathing, cooking and cleaning. The survey found that standpipe users were WTP more for an improvement in the water delivery because of the ***costs, inconvenience and the time lost*** which included travel time, queue time and fill time.[11] Additionally, some standpipe users were paying $15 per trip to hired water carriers to deliver water to their homes, but were WTP more for a better service. As Churchill (1987) argues, the amount households pay, can offer additional insights on the value of the water hauling time which could take 15% of women's time.

A positive correlation existed between WTP and the ***time spent collecting water from standpipes.*** The data showed that households using standpipes as the primary source of water, spend on average 25 minutes per trip from the tap to the house, go twice daily to the public taps and thus spend at least a mean time of an hour per day collecting water. This is consistent with the findings of Churchill

(1987) that the time spent collecting water is an hour or more per household, per day in developing countries. Survey work conducted by Whittington, Mu and Rouche (1989) also confirm that the time which households assign to the time savings affects WTP.

The ***frequency of standpipe usage*** affects WTP. In particular, households which used the standpipe more frequently and, therefore, spent more time journeying to and from the public tap, spent time waiting in the queue and filling up at the source, were WTP more than those who used it less often. The majority of respondents who went to the standpipe to obtain water everyday were willing to spend an average $75 monthly to be upgraded with the full package of benefits that comes with the improvements in supply. By contrast, most households visiting the standpipe once per week were WTP $50 per month.

The ***time of day*** that public taps are used also affects WTP for service improvements. Most standpipe users collect water at the taps between 5 am and 8 am, and must rise very early in the morning to catch water before they can go off to work and school. Loss of time very early in the day is related to WTP. This factor also explains why piped water distribution was the level of service upgrading for which standpipe users were WTP more.

The mode of travel used to get to and from the source of water, also affects the household's WTP for water supply improvements. Most standpipe users in the survey walked to the source of water, and were WTP more on water improvements, than those with access to motorized transport. The inconvenience of walking with heavy water containers, and the longer time spent travelling on foot, influenced WTP more for upgrading and supply improvements. The cost of transporting water manually is expensive and results in high cost per unit of water consumed (Churchill,1987).

WTP is also affected by the costs incurred by *distance from the source* of water.[12] The price increase associated with distance affects WTP as shown by the Trinidad survey results, in that the further away the standpipe was located from the house, the amount households were willing to pay for a better water supply increased. Households that were located 15 minutes from the standpipe were willing to spend an average monthly amount of $75 per month for a service upgrade and improvement. In contrast, those located 10 minutes and 5 minutes away from the public taps were WTP $50 per month for an enhanced service.

7.12.4 HOUSING TENURE

The permanency of housing tenure influences willingness to spend more on water improvements. Households living in owner-occupied properties indicated they would spend an average of $69 per month if they would get a more reliable water service, with better water quality and pressure. Households living in public and private rental housing were WTP $28 and $55 per month respectively (See Fig 7.14). Households living in government rental properties were WTP 50% less for a better water supply than their counterparts living in owner-occupied housing and private rental properties. Even squatters were WTP 21% more than occupants of public rental housing. This reflects the "culture of dependency" among beneficiaries of low-income government housing schemes. While there may be some influence between the income of public rental housing occupants and WTP for water, there is evidence that such tenants have experienced increases in income but have not had rental increases by the National Housing Authority. The tendency to subsidize such households spills over into attitudes toward acceptance of user charges.

Four factors account for the difference in WTP among households with various forms of housing tenure:

1) Owner-occupants want to increase their outlays for the greater enjoyment of their properties in which they have already invested considerable amounts of capital;

2) Households that are renting or squatting are not billed by WASA which influences the amount they may want to spend on water in the future;

3) The level of subsidization in housing and water supply received by beneficiaries of public housing affects attitudes toward user charges; and

4) Squatters appear WTP more than households living in public rental housing because they do not have a house tap service. Their willingness to pay for an upgraded service level, namely a house tap service, is related to the value placed on time and costs associated with standpipe or yard tap usage.

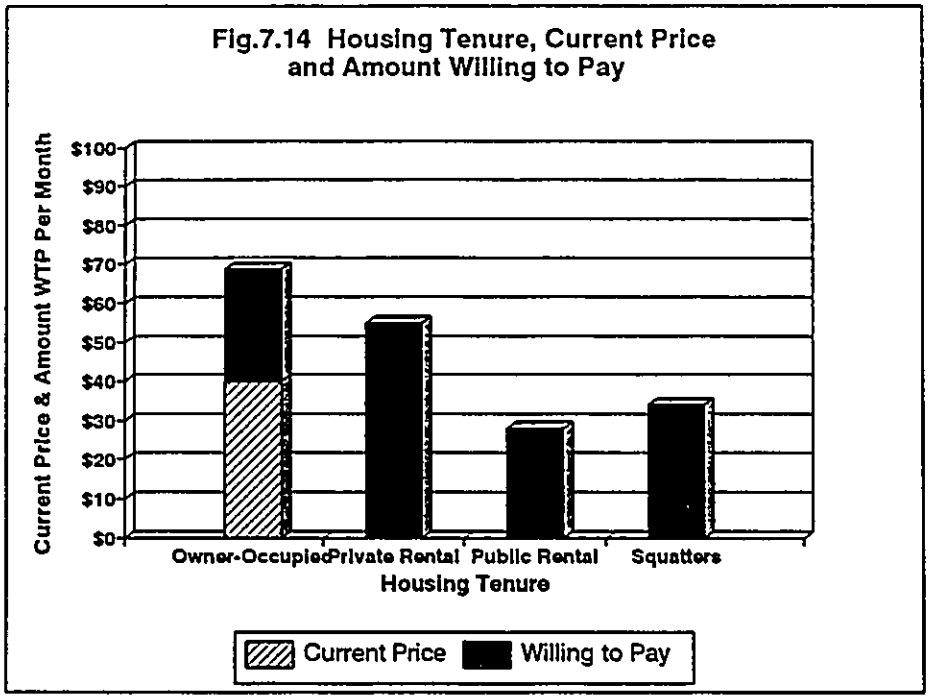
7.12.5 LAND TENURE

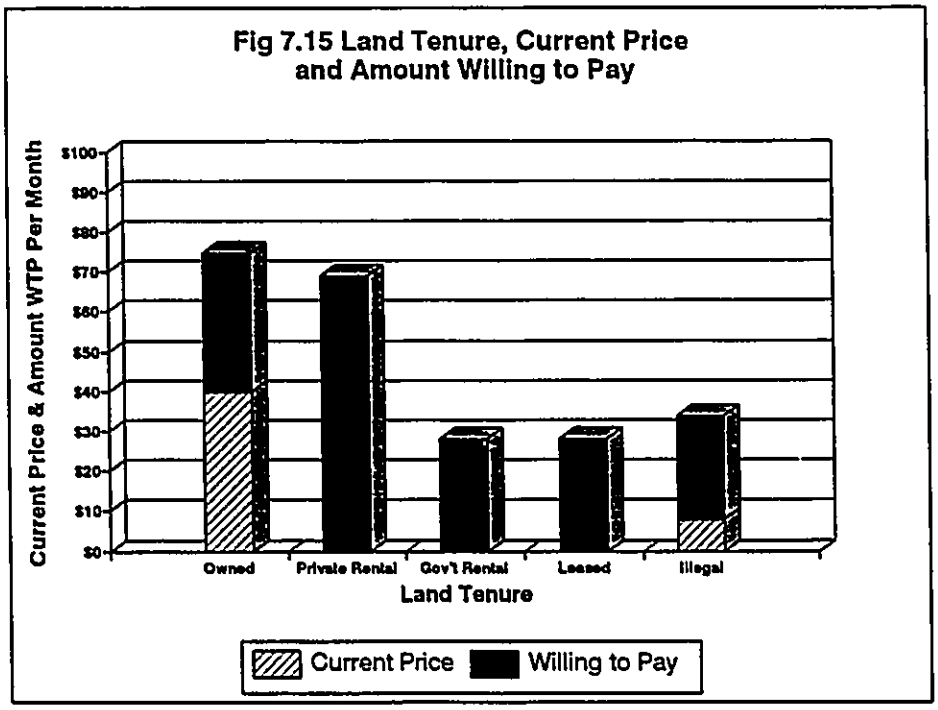
Households with more secure land tenure show a WTP more for water supply improvements. Landowners were willing to pay more than households that were involved in land rental, lease agreements or squatting. Most landowners indicated that they would pay $75 per month, whereas the majority of households with impermanent tenurial arrangements were prepared to pay $25-$35 (See Fig 7.15). Security of title has been demonstrated to be an important factor in encouraging improvement to land and buildings.

7.12.6 SOCIAL CHARACTERISTICS

Social factors such as gender had an insignificant effect on WTP for water improvements. The differences in the amount men and women are willing to pay are marginal, which suggests that gender does not significantly determine WTP.[13] While it was expected that women would indicate a higher value of the amount they were willing to spend on water service improvements than their male counterparts, because of the gender distribution of household labour (they conduct more household activities which involve water consumption such as cooking, washing and cleaning), this was not the case. Also age did not significantly impact on WTP. Work by Altaf et al (1992) on willingness to pay for water in rural Punjab, Pakistan, and Whittington et al (1992) on household demand for

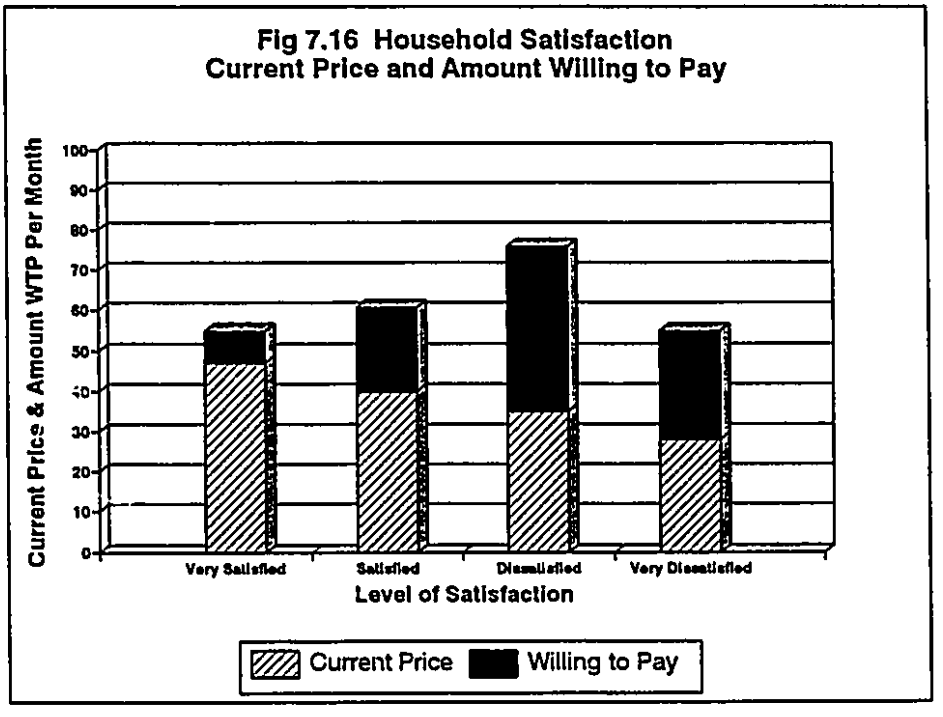
improved sanitation services in Kumasi, Ghana also found that gender and age did not influence willingness to pay for improvements.





7.12.7 PERCEPTIONS OF WATER SUPPLY AGENCY, SATISFACTION AND WTP

The level of satisfaction with the water service influences WTP. Respondents who were very satisfied or satisfied were WTP an average of $55 and $61 per month respectively. In contrast, respondents who were dissatisfied with the water supply were WTP approximately 25% to 38% more ($76) than those who were very satisfied or satisfied (See Fig 7.16). Not surprisingly, respondents who were very dissatisfied were not WTP more than $55 per month. Satisfied households would not pay more than $55 because they do not want any more improvements. Dissatisfied residents questioned WASA's request for a rate increase, although rate paying consumers affected by water shortages had to pay private trucks for water delivery.



7.13. TESTS OF RELIABILITY, ACCURACY AND VALIDITY OF SURVEY RESULTS

The research design was tested for several threats to the reliability of the survey results (strategic bias, starting-point bias and hypothetical bias). but little evidence of any of these biases was found. WTP amounts indicated by individuals were meaningful and not simply numbers "pulled out of the air", thus making the survey results reliable and accurate.

A major concern of the survey was whether respondents answered the WTP question honestly and that there was no strategic bias. The form of strategic behaviour which most contingent valuation researchers check for is "free riding", where someone pays less than a public good is worth to him in the expectation that others will pay enough to provide it nevertheless. If applied to the survey on WTP for water improvements, it follows that free-riding respondents would have underbid if they believed that there was a good chance the service would be provided, even if they understated their true WTP amount. However, only 8% of the respondents were WTP less than the amount they were currently paying, confirming that there were very few free riders. According to a review of empirical evidence by Mitchell and Carson (1989), free riding is the exception rather than the rule. Additionally, overall comparisons between true payment conditions and those which encouraged free riding suggest that under the experimental conditions used, free riding accounts for a modest downward bias in the WTP amounts of about 10% to 30%. Mitchell and Carson (1989) emphasize that these experimental findings come from a growing body of very consistent results, obtained under a wide array of circumstances.

Further testing for strategic behaviour among the survey respondents in the Trinidad survey revealed that respondents did not change their WTP amounts significantly. They were asked to give the amount they were WTP and then given a second chance to revise the initial amount. Approximately 57% of the respondents did not revise the initial WTP amount which is an excellent indicator

of the absence of strategic bias. Another test of strategic bias used by CV researchers is the number of protest bids or zero responses. The data analysis revealed that there were only 8% protest bids of zero and 8% of respondents that were unwilling to pay more and that strategic bias was not significant (16%).

The main reasons that people bid zero are familiar: they were already paying too much, but the service was poor; they were already paying the government taxes; the government was wasteful; an improved service had been promised before but this had not materialized, and there were no guarantees that paying more would lead to a better service; they were paying more than other households although they used less water, which meant water charges were inequitable; and they were unemployed and unable to pay for the service (See Table 7.10).

Table 7.10 Reasons for Zero Bids

Reasons for Zero Bids	No.of Respondents	% Respondents with Zero Bids
Paying too much already	18	62
Dissatisfied with service	5	18
Cannot Afford	3	11
Inequitable charges	1	3
Government wasteful	1	3
Already paying taxes	1	3
TOTAL	29	100

Five major reasons users gave for a reluctance to pay higher rates were: (1) They were already paying too much (2): WASA workers were discourteous when they phoned in to report broken mains, leaking pipelines and the shortage of water, (3) WASA crews did not respond quickly to the interruptions in supply and it took days before they could arrive to address the problem. As one resident succinctly put it " WASA's excuses just don't hold water," (4) Rate increases were to reward WASA staff for low levels of productivity and to save WASA

workers from retrenchment and the Government was asking rate payers to subsidize inefficiency, and (5) WASA's workers were involved in graft and corruption.

The contingent valuation results on WTP for water improvements in Trinidad were also valid. Convergent validity is found when the results are compared with the household production function (the actual expenditure on water tanks) and payments made for truck-delivered water, in that WTP more for improved reliability is evident. Evidence of its theoretical validity exists in the form of the regression model which shows the positive relationship between income and WTP. The high Pearson's correlation results between WTP and income also shows that there is theoretical validity in the contingent valuation study. An R^2 square of 0.2685 is strong for contingent valuation studies. The results presented in Table 7.6 show conclusively that the willingness to pay information obtained from the contingent valuation survey is systematically related to the socio-economic characteristics of the household and the respondent, in ways suggested by consumer demand theory and prior expectations.

END NOTES

1. The Survey of Living Conditions (1992) ranks the sampled households from the poorest to richest using quintiles, according to their household's per-capita expenditures.

2. WASA gives consumers the option to meter, but does not insist on metering because WASA is unable to bear the costs of installing meters and therefore prefers consumers to pay such costs. Throughout Trinidad, most households that do have meters, prefer not to be charged on the basis of metered consumption.

3. Unlike other utility charges (electricity and telephones) whereby the tenant pays for usage, landlords pay water rates which are recovered from the rent.

4. A study of willingness to pay for water in rural Punjab, Pakistan also found that the water agency made no effort to collect user fees from standpipe users (Altaf,Jamal and Whittington,1992).

5. During the time of the survey in 1994, there were numerous organized protests which captured media attention, and calls for the Minister of Public Utilities to investigate the water shortages which affected communities all over the country. The newspapers also reported incidents of residents bribing water truck owners to deliver water to them.

6. Whittington et al (1992) had similar results for their survey of household demand for improved sanitation services in Kumasi, Ghana. The R^2 values ranged from 0.32 for sewer to 0.47 for water. Altaf and Hughes (1994) in their study of household willingness to pay for improved sanitation services in Ouagadougou, Burkina Faso had a model R^2 of 0.35 for water, 0.44 for on-site services and 0.37 for off-site services.

7. The economic costs of compensating for unreliability and investments in water storage and booster pumps are also substantial in Pakistan, India, the Philippines and Ghana according to surveys conducted on WTP for supply improvements.

8. In the World Development Report (1994) examples of public failures and their impact of private costs were cited. In Jamshedpur (India) for example, the connection charges for piped water vary between US$1.66 and US$16.66. The residents of peri-urban areas, served by the local municipal authorities, incur capital costs of US$50 to US$65 in installing tubewells and US$150 to US$300 in digging wells to avoid dependence on the unreliable public water supply. Despite the existence of a piped water system, at least 17% of the population meets 90% of its water needs from wells and handpumps.

The pattern of private augmentation of the public water supply at substantial private costs to consumers is observed also in Faisalabad, Pakistan. Less than 20% of households with piped water use this source exclusively (World Development Report,1994:30).

9. WASA enters into annual contractual arrangements with private individuals to supply water to residents in various designated areas throughout Trinidad.

10 Complaints of corruption among private water truck vendors were reported in 1975 to the Commission of Inquiries into WASA and in Order 54 (1986) of the Public Utilities Commission.

11. Whittington et al (1989) found the same trend in their study of the value of time spent on collecting water in Ukunda, Kenya.

12 A study in Surabaya, Indonesia conducted by Shugart (1989), of the relationship between water prices and distance from a standpipe, showed that 1 kilometre generally added US$0.35 per cubic metre to the price of water.

13. A survey conducted in Zimbabwe revealed that women were willing to pay 40% more than men for an improved water supply. (Ministry of Energy and Water Resources Development,1985).

CHAPTER 8
POLICY IMPLICATIONS OF SURVEY RESULTS

The study of WTP for water supply improvements in Trinidad showed that the Contingent Valuation (CV) Method can be used as a practical tool for planning water supplies in developing countries. Like other studies done by Whittington, Briscoe et al (1992), the survey found that the CV method provides valuable information which can be helpful in (1) determining cost recovery potential and thus projecting revenue (2) determining prices and connection fees for improved water services, (3) determining the appropriate level of service, and (4) identifying communities which could meet specified cost-recovery targets.

The purpose of this chapter is to lay out the main policy implications of the survey's findings. While some of the policies of water pricing, cost reduction and institutional strengthening are briefly discussed in this chapter, they are expanded upon in the chapters which follow.

8.0 WTP MODELS AND FORECASTING REVENUE

WTP models coupled with more accurate demand estimation models, provide a far more feasible basis for tariff designs and projecting revenue, than the practice by water utilities of using expected increases in connections and sales volumes (where water is metered) to guide rate setting and forecast revenue earnings. These extant assumptions of growth in the number of connections and consumption volumes are often over-optimistic and inaccurate (World Bank,1990). At worst, the use of unrealistic assumptions, runs the risk of significant revenue shortfalls even if tariffs were adjusted, and threatens the financial survival and self-sufficiency of water agencies. The ratios of actual to projected sales values were less than 1.0 in 84% of World Bank water projects and less than 0.75 in 35% of them (World Bank,1990). Earlier research by the World Bank showed that over-estimation of rates of new connection and per capita demands are on average, about 20% (World Bank,1990). In Trinidad's

case, it is even more difficult to project revenue on the basis of the growing number of connections. WASA reported that connection rates are not necessarily increasing significantly because there are 40,000 illegally connected households, and the numbers are growing.

WASA applied to the Public Utilities Commission in 1993 for a rate increase of 50%, but only a 35% rate hike was approved in 1994. A WTP survey based on contingent valuation may have provided stronger justification for WASA's rate increase.

8.1 COST RECOVERY POTENTIAL

Cost recovery remains an important objective of water supply agencies. Unless users (the ultimate beneficiaries) of water investments bear a larger share of the costs, expanded coverage and adequate service are unlikely to occur. Higher cost recovery, by helping to generate more revenue, increases the likelihood that a programme will be affordable and replicable. Relying mostly on government subsidies is unrealistic in the majority of cases. The amounts required are too great to permit other than token programmes, which result in little more than token improvements. Far from hurting the poor, evidence from many developing countries shows that cost recovery can help them, by producing the financial resources necessary to expand the supply of the basic service.

Although some policymakers argue that they cannot raise water tariffs because of macro-economic adjustment difficulties and their impact on the poor, less pressure on internal cash generation to finance improvements in water delivery also discourages financial discipline and domestic resource mobilization. The public generally accepts charges for specific tangible service, and in so far as consumption includes an element of choice, charges are understood and met with reasonable willingness. According to McKinley and High (1988), people make appropriate decisions to protect their health and welfare, and are WTP a fair price for something they value. It is the level of charging which is most

sensitive politically. The ability to impose higher water tariffs depends on the users' WTP which is enhanced through good service delivery that is reliable and consistent with users' demands.[1]

It is clear from the survey findings that WASA can aim for a higher level of cost recovery than has been sought in the past. Households are spending on average $31 per month and are WTP $67 per month (over twice the price currently paid) for improvements in the water supply. Water rates can be increased across the board. The demand for water consumption is moderately price elastic, although less so for low than for high-income groups.[2] According to Delcan (1992), the price elasticity for Trinidad is an estimated -0.7.

WASA's total recurrent costs of providing water (production, distribution, transmission, administrative costs, common services and depreciation) was TT$316 million in 1993. If WASA were to apply the amount households in each settlement indicated they were willing to pay per month, it would recover about 10% of total annual operating costs (TT$3.14 million) (See Table 8.1). Areas which have the greatest cost recovery potential should be targeted by WASA. In absolute terms WASA could collect the most from Barataria and Malabar because these have a high number of households. However, subsidy issues will need to be considered because some households in these areas are poor.

Table 8.1 Summary of Existing and Projected Revenue Based on Willingness to Pay By Settlements

	Goodwood Park	Alyce Glen	Barataria	St. Barbs	Valsayn	Malabar
No. of Households	287	173	2495	381	173	2332
Current Price	$41	$41	$25	$0	$39	$15
Amount Willing to Pay per Month	$83	$83	$50	$55	$72	$28
Existing Revenue Per Annum TT$ '000	$141,204	$85,116	$748,500	0	$80,964	$419,760
Projected Revenue Per Annum TT$ '000	$285,852	$172,308	$1,497,000	$251,460	$149,472	$783,552

In 1994, it cost WASA TT$1.23 to provide a cubic metre of water. Based on Delcan's (1992) estimates from a pilot survey of metered households in its sample, the average consumption of house tap users in Trinidad is about 575 cubic metres per annum or 47.9 cubic metres per month. House tap users should therefore be paying TT$60 per month in water rates. But as Table 8.2 shows households with internal taps in all settlements are being subsidized. Those receiving the largest subsidy are found in Barataria, Malabar and St.Barbs. If the stated amount of households willingness to pay in each settlement is taken into account, these three areas will not cover the cost of water provision. In particular, Malabar house tap users are willing to pay TT$32 less than what it cost per month to meet their average consumption. About 50% of the respondents in Malabar were squatters and the other half were living in low income public-housing. There may be some resistance to large increases in water prices from households in this area. This suggests that subsidization may need to be factored into revenue forecasting.

Table 8.2 Differences in Prices, Subsidies, Willingness to Pay and Cost Recovery Potential by Settlements

House tap users	Goodwood Park	Alyce Glen	Barataria	St.Barbs	Valsayn	Malabar
Current Price	$41	$41	$27	$0	$39	$29
Amount Should Actually Pay	$60	$60	$60	$60	$60	$60
Subsidy	$19	$19	$33	$60	$21	$31
Amount Willing to Pay	$83	$83	$50	$55	$72	$28
Difference between Amount Should Pay and Willing to Pay	$23	$23	-$10	-$5	$12	-$32

8.2 CROSS-SUBSIDIZATION OF LOW INCOME HOUSEHOLDS

The willingness to pay survey found that poor and low income households were spending more income on water than middle and high-income households. The results as a percentage of monthly household income were as follows:

* The poorest households were spending 0% and were willing to pay 0.23%;
* Low income households were spending 0-0.79% and were willing to pay 2.33%;
* Medium income households were spending 0.53% and were willing to pay 1.05%;
* High income households were spending 0.43% and were willing to pay 0.87%; and
* Very high income households were spending 0.34% and were willing to pay 0.69%.

The survey results show that middle and high-income households are willing to spend less of their income on water improvements than low income groups (negative income elasticity), but their demand for water is inelastic regardless of price increases according to Delcan (1992). Assuming that metering is implemented and a rising block rate is charged, medium and high income households will pay more in absolute terms because of the price inelasticity of demand. This will help cross-subsidize poor households.

8.3 ABILITY TO PAY AND WILLINGNESS TO PAY

Policymakers need to recognize that ability to pay for water is as important as WTP for water. If low income households cannot afford higher water rates they may be unable to access the service, and negative externalities such as public health risks may rise. Affordability and cost recovery are important interdependent concepts in both theory and practice, since affordability is the key to cost recovery, and cost recovery is instrumental in providing an affordable service to users. The effect of a 200% increase on low income households would not be damaging since they would pay 5% of their monthly income on water, which is equivalent to paying $50 per month (the amount they also indicated they were WTP).[3] Internationally, it is accepted that the poorest households should not spend more than 5% of their income on water, so that even after higher fees, low income households would still be paying below this percentage (McPhail,1993). Middle income households and high income households would still be spending a small fraction of income of about 2.2% and 1.5% respectively, after a 200% hike was implemented. An estimated 89% of the respondents in the survey indicated that they could afford the payments they choose.

Although cross-subsidization of low-income households is recommended, they should not be exempt from paying water rates because not all low-income households are living below the poverty line (an estimated 18%-20% of the total population Henry,1993). Special attention must therefore be focused on the ability

of low-income households to pay for better water services, and initial connection costs which are expensive. This will be discussed in more detail in Chapter 9.

Hard data on ability and WTP for service improvements by poor households is generally scarce. However, some policymakers argue that the incomes of poor households are denominated not in cash but in kind, and based on this assertion, water services should be made available at little or no charge. As Saunders and Warford (1976) note, the general lack of any hard evidence on ability to pay and WTP has resulted in the politically expedient assumption, which has been made in most developing countries, that poor households cannot pay the full cost of water. The data findings of the Trinidad survey revealed that earlier assumptions are out of step with reality, and that poor households are willing to pay and can afford to pay more for water. Further, cash is far more prevalent if policymakers were to examine strong indicators of ability to pay, such as the allocation of income on telephones and electricity, high expenditures, absolutely and proportionally, on social activities such as celebrations and gifts, and expenditure on consumer items such as televisions, radios, stereo sets and even cars. A survey by the Public Utilities Commission (1993) of Trinidad found that low income households spent an average of TT$49 on electricity, TT$114 on telephones and TT$31 on water per month.

Poor households have much more demonstrated ability to pay than is generally recognized by most policymakers, who use indicators borrowed from the industrialized countries to establish ability to pay in Trinidad. Two questions which policymakers must therefore address on the question of ability to pay are: (1) Do poor households have enough income (or resources) overall to be able to contribute toward covering the costs of water supply services and (2) Is a large enough fraction of their income (or resources) available in a form that can be accepted in payment (for example, cash, labour or materials) for constructing and maintaining service improvements?[4]

The urban poor often have income from several sources which allows them to make a small contribution to recover water provision costs. In urban areas of Trinidad, the poor have short-term employment through the public works programme (DEWD), unemployment assistance, public assistance and old age pension schemes, informal sector jobs and many poor persons receive remittances from relatives living overseas. A study of poverty and unemployment in Trinidad done by the World Bank (1995) reported that only 12% of households received remittances from relatives living abroad, but this number was twice as high for poor households. There may also be some under-estimation in these numbers due to the sensitive nature of the question as perceived by respondents. Additionally, like many developing countries, Trinidad's non-governmental agencies are increasingly involved in harnessing community resources (labour and construction materials), while WASA provides technical assistance. One good example is the work of the National Self-Help Commission in water provision programmes.

8.4 TARGETING THE POOREST OF THE POOR: ANTI-POVERTY POLICIES

While most low-income households show a WTP more for service improvements, *the poorest of the poor* (18-22% of the population) will require interventions such as the provision of special subsidies because of their inability to pay.[5] Water tariff increases may severely affect poor households whose real wages have fallen in the face of spiralling inflation, and dislocations in the job market, brought about by the structural adjustment package prescribed by the International Monetary Fund. New ways of ensuring equal access and equity in water provision are needed, such as the novel *voucher system* approach which ensures universal access, while linking cost recovery with better targeting of relief for lower income customers. The Government can provide very poor households with a voucher for water (like food stamps), and these households will be required to go to the water agency and pay the bill. In this way also households may recognize that water consumption involves a cost which should be paid.

Government interventions should also try to involve people in solutions rather than treat them as passive recipients of relief. Such anti-poverty policy interventions to ensure equity does not mean that efficiency will be compromised. Subsidies for low income households will serve as a social safety net and alleviate potential negative externalities such as public health risks. These subsidies must be well targeted to disadvantaged members of society such as the poor and elderly pensioners so that they are not hijacked by other better off groups. The poor include the large number of single-mother or female-headed households which are common among low-income households in the Caribbean (Henry,1992). In Trinidad 28% of all households are female-headed, and make up 35% of the poorest households (CSO,1990 and 1992).

8.5 PRICE DIFFERENTIAL BY LEVEL OF SERVICE

A pricing policy which differentiates by the level of service and type of user is appropriate. There are three justifications for a price differential based on the service level:

* Firstly, the survey results show that house tap users indicated a willing to pay more than standpipe and yard tap users;
* Secondly, metered house tap users were charged less per cubic metre ($0.80) than standpipe users ($1.80), which provides real evidence that the poor are paying more;
* Thirdly, higher water rates for house tap users may also improve the recovery of production costs. Previously metered house tap users were subsidized by paying $0.80 per cubic metre, compared with an average water production cost of $1.23 per cubic metre (WASA,1994). A rate increase (as long as water consumption is metered) may result in house tap users paying close to $1.20 per cubic metre and assuming that production costs are unchanged, this may lead to almost full cost recovery.

The pricing policy used by WASA to charge different classes of users is also appropriate. Newly revised rates for commercial and industrial users have improved WASA's cost recovery potential. Commercial and industrial users now pay TT$3.50 per cubic metre. The removal of subsidies will help cross-subsidize poor domestic consumers.

8.6 PRICE DIFFERENTIAL USING SPATIAL LOCATION

Policymakers have the opportunity to charge households living in hilly areas high water rates that reflect the impact of location on supply costs, as will be expanded upon in chapter 9 on water pricing. The introduction of a price differentiation policy should not meet resistance because households living in such settlements (Goodwood Park, Alyce Glen and St.Barbs) are willing to pay more as a result of the problems of unreliability and low pressure encountered.

8.7 HOUSING AND LAND TENURE

Illegal connection is not always indicative of an unwillingness to pay for water. Trinidad's law governing the connection of squatters to the water supply system and very high connection fees charged on a lump-sum basis, act as a disincentive to legal connections. Free riders, illegally accessing water services must be encouraged to connect to WASA's services. There are two ways of achieving this. One is legislative reform that allows squatters and other non-propertied households connections to WASA. Another is that the water supply agency may meet connection costs up-front for poor households, and then recover costs through amortization over a period of time.

Numerous studies prove that poor households with illegal housing and land tenure have demonstrated a willingness to pay. Mooleedhar (1995) reported that squatters in Trinidad are organizing themselves into communities which seek assistance from the National Self-Help Commission (NSHC). The squatters provide labour and materials along with the NSHC and WASA provides technical assistance. After WASA connects the squatters they pay water rates. Work done

by Lauria and Whittington (1989) in Latin America, proved that squatters are willing to pay for improvements in their water supply situation because of the economic, health and social benefits, and even pledge to donate labour and construction materials, including pipelines and water meters. A study of the city of Juarez (Mexico) conducted by Dillinger et al (1992) also revealed a high willingness to pay for water by squatters. Historically, Juarez's water utility did not concern itself with the tenure status of its customers, a policy which has tended to facilitate revenue collection. By extending lines to irregular settlements, the water utility forestalled illegal connections, and provided a means to recover water service costs. Uncertain tenure status also tends to encourage the payment of utility bills, as bills constitute proof of long term occupancy, a key to tenure regularization.

The Government announced in 1994, that with the assistance of an Inter-American Development Bank loan, the upgrading of infrastructure and security of tenure for squatters located on 1,200 lots, including a settlement at Malabar would be embarked upon.[6] Increasing the pace of tenure regularization could lead to WTP more for water, while simultaneously achieving a substantial improvement in the coverage of piped water to poor settlements. Further, speeding up the process of ex-post infrastructure provision to informal settlements, can in part be achieved by exploiting residents' willingness to pay.

8.8 WILLINGNESS TO PAY FOR HOUSE TAP SERVICE

In developing countries there is abundant evidence that most people want on-plot water supplies of reasonable reliability, and are willing to pay the full cost of these services (World Bank,1992). A striking finding from a recent World Bank study of Brazil, Haiti, India, Nigeria, Pakistan, Tanzania and Zimbabwe is that this category of households is larger than is commonly assumed (World Bank,1992). The Trinidad survey results also revealed the types of interventions necessary to provide the desired level of service, what is valued the most by consumers, and how much they are willing to pay to have these improvements.

Almost 86% of the households surveyed had house taps (which mirrors the national figures on access to house taps), but the remaining households using standpipes and yard taps desired upgrading to a house tap service.

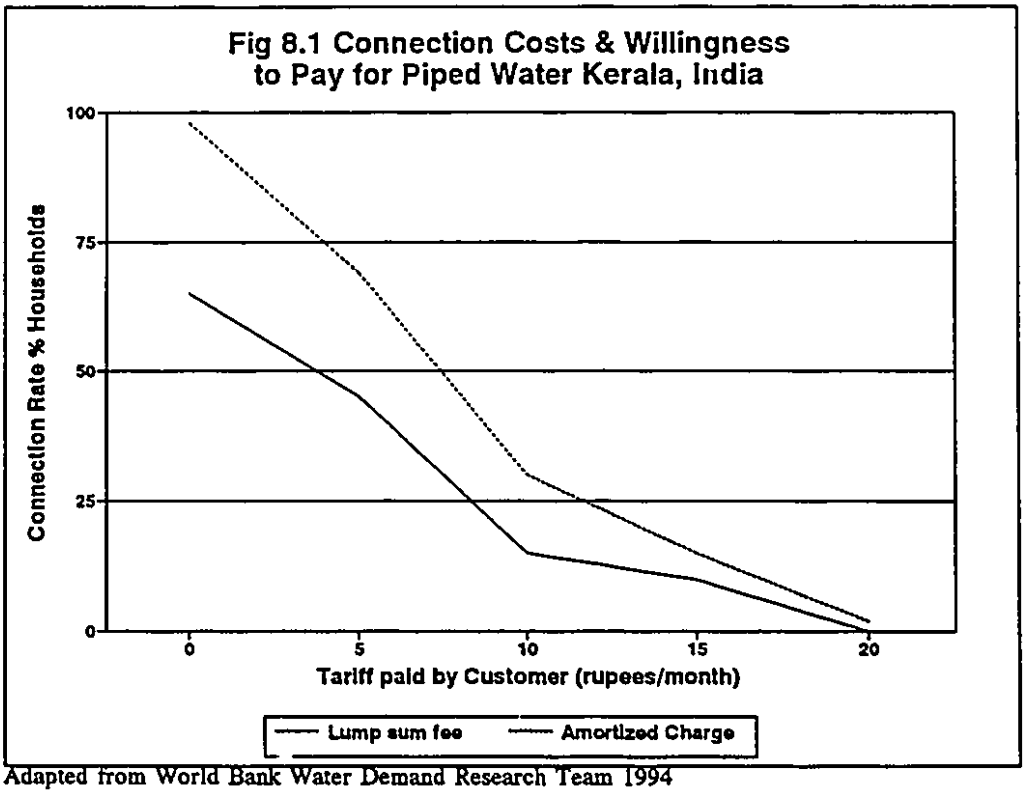
A number of factors account for the desire to have access to a high service level. Firstly, it is clear from observed behaviour that households use standpipes for collecting water, but the water is transported to the house where it is used for drinking, cooking and bathing. Water usage in the house and not at the source, suggests that standpipe users prefer to be upgraded to a house tap service. Secondly, this study showed that the time spent collecting water has significant economic costs and thus standpipe users are WTP more for a house tap service. Time savings from service upgrading could be an hour or more daily for each household using standpipes. Thirdly, the desire for a higher service level reflects that the urban poor have high aspirations. As the Orangi Pilot Project in Karachi (Pakistan) on household WTP for sanitation services revealed, after primary needs are met ie. water supply, a second generation of needs arise (higher service level) such as piped water into the dwelling unit (Briscoe and Garn,1994).

The policy implication is that piped water distribution systems may be an economically attractive technology in low-income settlements. USAID (1982) reported that planners in Thailand discovered the hard way, what can happen if they underestimate WTP for a higher level of service. The Thai piped water project, with 250 systems serving 600 communities, had been a failure when it supplied water only through communal taps. By 1972, three years after completion of the project, only one quarter of the system was working. In 1979, at the time of the evaluation over 80% of these systems were operating and self-sufficient. The change resulted from the conversion from communal facilities to individual metered connections. The private connections provided more convenient sources of supply than communal water sources.

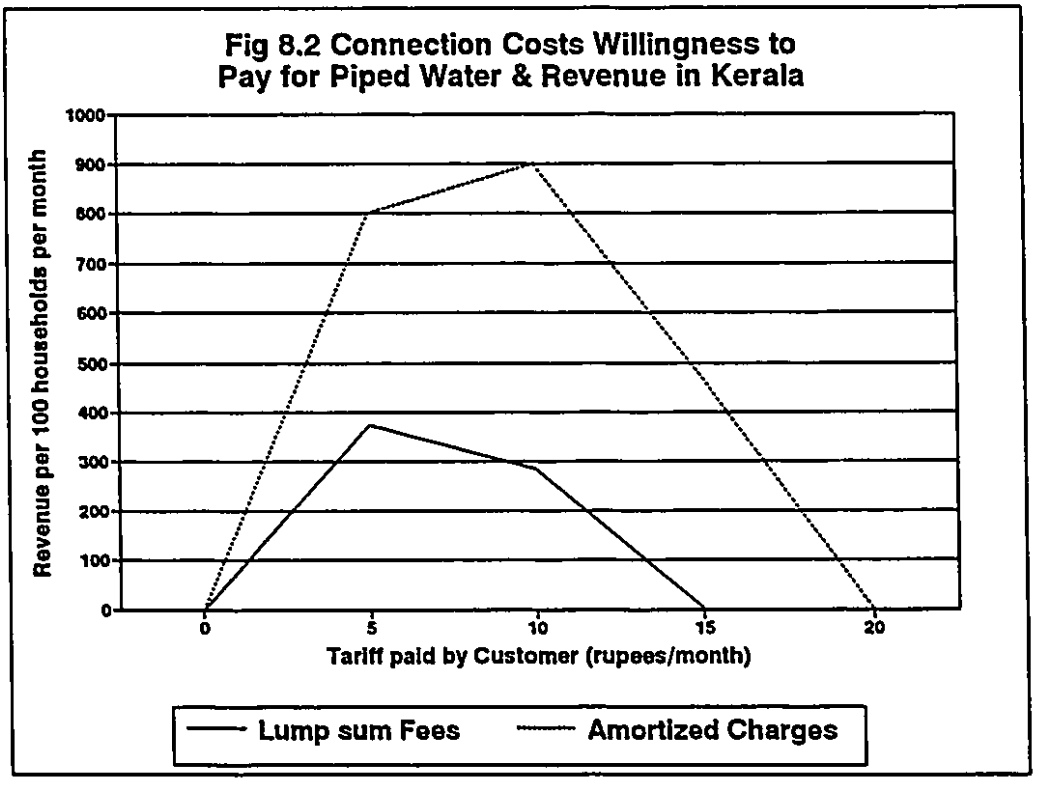
Flexible financial arrangements are, however, needed to encourage households to connect to the public water system because poor households are unable to bear the high lump-sum connection charges and in-house plumbing costs, resulting from cash flow problems. In Latin America and more recently in Morocco, utilities have helped poor families to install a connection and in-house plumbing, by giving them the option of paying over several years (World Bank,1992). More people will make use of a higher service level and are willing to pay more if innovative financing mechanisms are used to spread connection costs over time. This is in fact the experience in Kerala, India where the connection rate for piped water increased and the supplier's revenue expanded when connection costs were amortized (See Figs 8.1 and 8.2). In Trinidad, an affordable financing option may not result in a higher connection ratio because some squatters and other hijackers are already receiving free water with internal plumbing, and will not come forward to avail themselves of these new flexible arrangements. WASA may first have to declare an amnesty for all existing illegal users, and then follow this up with an active disconnection policy to deter new ones. Once this is done, the offer of amortizing connection fees over time may be feasible for WASA and its customers.

8.9 WATER PROBLEMS, RESPONSE STRATEGIES AND WILLINGNESS TO PAY

The case study reveals a dynamic process of individual attempts to rectify service problems, with households no longer waiting for public provision of adequate water supply. Investments associated with improving reliability are large and often, as with masonry holding tanks or pre-fabricated plastic tanks, irrecoverable. The individual initiative observed in the household production and the willingness to pay a substantial premium for improved reliability is a strong signal to the water agency that reliability is a crucial element in cost recovery. Trinidad's households have stated that they are willing to pay more if the service is reliable. As illustrated in Figs 8.3 and 8.4 households in the Punjab, Pakistan



Adapted from World Bank Water Demand Research Team 1994



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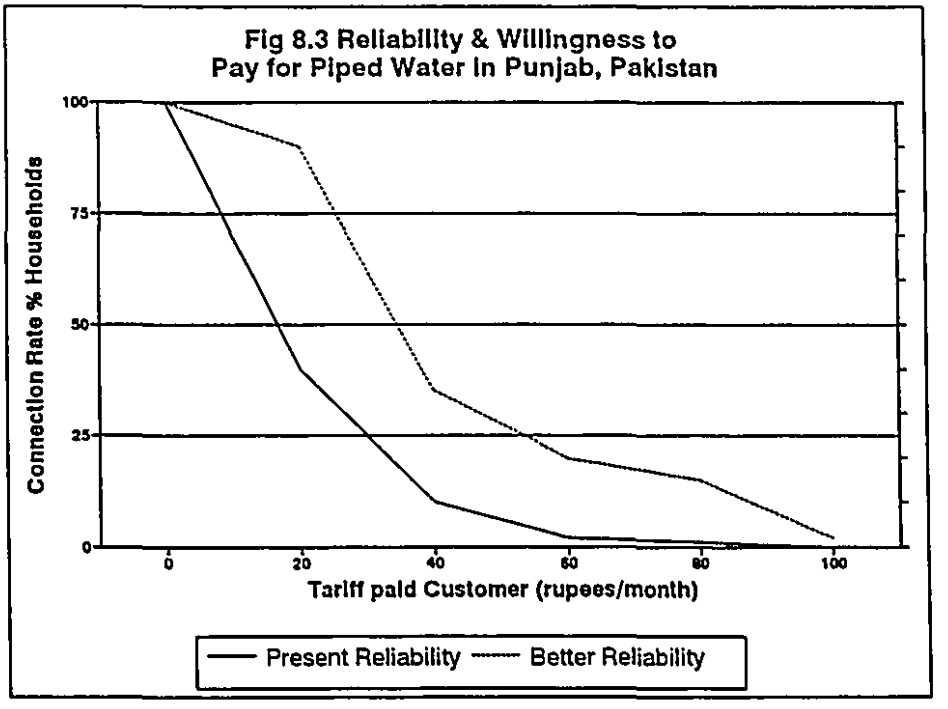

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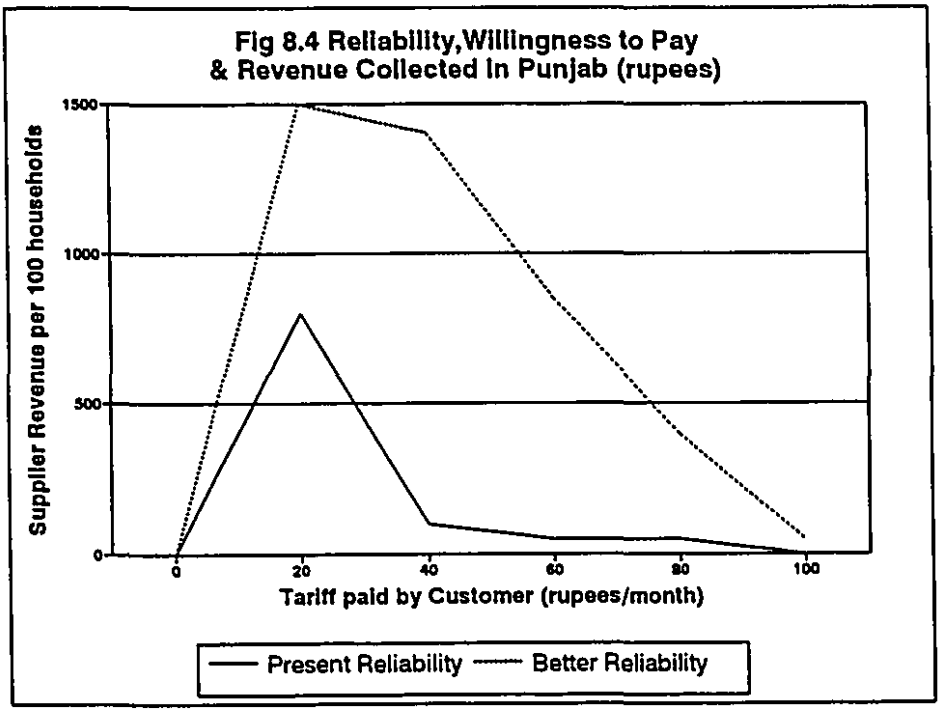

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are willing to pay more for a piped water service if the service is reliable and suppliers are able to expand their revenues.

8.10 PUBLIC AND PRIVATE SUPPLY SERVICES

Traditionally, water supply is considered a public service and largely the prerogative of the Central Government monopoly. Given WASA's difficulty in providing this service, increasing attention must be focused on alternative supply mechanisms that rely more on the private sector and non-governmental agencies. Privatization of water services was recommended by almost 60% of the survey's respondents. While households indicated a willingness to pay more for improvements in water delivery, there was no confidence that paying higher water rates would ensure that WASA provided a better service. The uncertainty and loss of credibility is supported by trepidation in dismantling their tanks which would mean being totally reliant on WASA. Some respondents perceived that a rate increase would reward WASA for its inefficiency and save the utility's workers from retrenchment. Households complained that WASA staff was slow to respond to water shortages and was generally discourteous. Many persons have come to regard it as an inefficient public monopoly with high administrative costs and overstaffing. Moreover, where public employees are paid less than market wage, there is a temptation for them to work less diligently than those in the private sector, and it is more difficult to prevent graft and other forms of corruption which has tarnished WASA's public image. Many consumers will have to be convinced to alter firmly entrenched viewpoints on WASA's inefficiencies, and WASA will have to work hard at "damage control".

8.11 PAST PERFORMANCE,PRICING STRATEGIES AND TIMING REFORM

Past and present performance and pricing practices influence the household's WTP for improvements. Further, a failure to operate services efficiently and to charge effectively for them, often makes the agency providing the service financially weak, which in turn leads to poor service. In these

circumstances it is a vicious circle, in that it is difficult to introduce an effective charging system because users' WTP is likely to be seriously eroded by bad service. The ability to impose higher water tariffs depends on the users' WTP which is enhanced through good service delivery, that is reliable and consistent with consumers demands.

In the 1990s consumers must be given a better service if charges are raised, since many of them want *more bang for their bucks*. The research findings show that consumers distrust WASA's ability to provide improved water services, which is consistent with their counterparts in other developing countries such as Pakistan and Nigeria.[7] The willingness to pay survey showed that 88% of the survey respondents distrusted WASA and said that they would keep their tanks forever. The water supply agency needs to strategically phase projects so that benefits of reliability, pressure and quality can be observed more or less simultaneously with increases in tariffs, which would build support and WTP for services. Timing is important because WTP increases only if WASA is able to generate quick results in efficiency. Additionally, there is a need to introduce transparent commercial practices into water provision, based on public consensus and stakeholder support. More transparency will improve public confidence and dispel anxieties about politicization.

Apart from technical and economic considerations, socio-cultural factors and WTP should be examined. Continuing education programmes and community involvement in policy formulation will encourage WTP for service improvements. The water agency (whether WASA or a private company) should show a serious intent to improve the quality of service. It should improve its credibility, raise WTP, and demonstrate a concerted effort to lower costs contributing to easing the burden of future financing.

Finally, the political economy of adjustment must be understood by policymakers. With a 50 year period of no water rate increases, a policy up to

1985 that water rates were a deductible expense for personal income tax purposes, with no serious disconnection policy for customers in arrears to WASA, much will need to be done to change entrenched attitudes to subsidies. Effective adjustment can ease the burden on the poor in the short run, and reduce poverty in the long run. Yet adjustment in charges for basic services such as water provision poses a dilemma for political leaders. Adjustment policies often impose costs on consumers, for example when transfers are cut. They also involve a trade-off between present and future---a trade off that politicians, with elections to win, interest groups to satisfy, and coups to deflect, find awkward (World Bank,1990). The success of price adjustment measures may depend on the feasibility of building coalitions of those who benefit, and on careful sequencing with respect to political, as well as economic objectives. The temptation to delay adjustment always exists. If people and the workers' Unions think rate increases in water and other essential services are externally caused and adjustment policies externally imposed, there is a high risk of losing political support. Weak or divided governments and those facing electoral challenges procrastinate as is so often the case in many developing countries. Not only was structural adjustment delayed by the Trinidad Government in 1986, but the Governments of Costa Rica and Ghana in the late 1970s and early 1980s, Brazil in 1986, and the Philippines in 1984 all delayed because of political uncertainties which increased the costs of adjustment (World Bank,1990).

A mix of swift action to reform water policies and efforts to cushion consumption is often justified on welfare grounds. The political case for this approach may also be strong. But there is an important difference between the two lines of reasoning. Concern with welfare puts the emphasis on the poor, whereas pre-occupation with politics dictates that impacts among politically powerful groups such as the business sector and civil servants be moderated. In designing programmes to compensate the poor, some subsidies to such groups may be both economically unavoidable (if the truly disadvantaged are to be reached) and politically advisable. As painful as it may be, the crisis in Trinidad's

water supply may strengthen support for policy change, weaken anti-reform groups, and increase politicians' willingness to rely on the technocrats advice on major issues of financing and managing water provision.

END NOTES

1. The Research Team on Building National Consensus on Local Policy for Trinidad and Tobago (1993), in Volume 1, p.14 of the Final Report sponsored by the Inter-American Development Bank, noted that it is unfair to expect the population to pay increases unless the quality of service improved.

2. Perhaps the most careful study of demand-elasticity of water use in developing countries was done by Hubbell (1977). On the basis of a stratified random sample of 400 households, a linear regression equation was estimated for pooled cross-section data to determine the effect on the demand for water of a change in water tariffs and differences in user rates at any particular time, holding constant other determinants such as household income, site value of property, family size, and ethnic background. The results show a price elasticity of -0.5. Another study estimated the effect of a water price change in Penang (Malaysia) on the basis of inter-temporal changes in quantity demanded of between -0.1 and -0.2 (Katzman,1977). Hubbell's elasticity estimate fall within the estimates for the United States which is roughly -0.5 (Gorman,1980).

3. A 200% price increase may seem like a dramatic change, but in 1988 Bogor,Indonesia increased prices by 200% to 300% in different consumer groups because previous prices were very low and greater revenue was needed to improve the water service (IWACO-WASECO,1989).

4. Willingness to contribute resources also is demonstrated in many other countries, including China, Paraguay, Nepal, Zimbabwe, Mali and Tanzania. These countries have high rural populations with water needs for agriculture and domestic purposes. What is similar, however, is that poor households whether they are from rural or urban communities, show a willingness to contribute resources for water service improvements.

5. An estimated 18-22% of Trinidad's population is living below the poverty line according to a Survey of Living Conditions conducted by the Central Statistical Office of Trinidad and Tobago in 1992 based on a sample size of 1,450 households. Henry (1993) estimates that it is in the region of 18-20%.

6. According to an article in Newsweek dated 17th March (1994), the Government announced that with the assistance of the Inter-American Development Bank squatter settlements at Bon Air, Couva, Harmony Hall, Blitz Village, Zone 8, New City, Valencia, Point Fortin, Union Hall, Calder Hall and Buen Intento would be regularized and infrastructure would be upgraded.

7. Whittington, O'Korafor and McPhail (1990) reported that consumers in Anambra State, Nigeria distrust the Government's ability to provide a better water service because of past failures, and are therefore less willing to pay for improvements in the public water system.

Altaf et al (1994) found that in Gujrawala, Pakistan households were willing to pay 50% less than the price they currently paid for water because they were not convinced that they would be relieved of private expenditures on supplementary devices, if they agreed to a higher tariff on the promise of an improved water supply.

CHAPTER 9
PRICING OF WATER SERVICES

Massive Central Government subsidies and transfers were injected into WASA to finance its operations for more than two decades, reflecting what Briscoe and Garn (1994) call an "old view" of the water sector policy, derived from the central planning model, which dominated development thinking between the 1950s and the 1980s. An inevitable consequence of excessive government was that cost recovery and revenue generation were not a priority. Central Government's recent squeeze on subventions, and the liquidity crisis faced by WASA, requires a "new view" of pricing policies which may allow WASA to perform its mandate. Indeed, the willingness to pay survey showed there are opportunities for the internal generation of funds through cost-related tariffs.

9.0 OBJECTIVES

This chapter seeks to provide a framework for cost recovery and structuring water tariffs with the objective of exploring pricing techniques which may be applied to water provision in Trinidad. Specifically, this chapter undertakes the following:

1) It evaluates various forms of user charges and water tariff design principles using the criteria of economic efficiency, equity, administrative feasibility and political acceptability;
2) It provides a critique of the prevailing system of flat water charges used in Trinidad;
3) It examines various types of pricing techniques which facilitate the full recovery of costs;
4) The advantages of self-financing water supply agencies are discussed;
5) The political acceptability of water pricing is explored; and
6) The conclusions on a framework for structuring water tariffs are presented.

9.1 EVALUATION CRITERIA FOR USER CHARGES

User charges present opportunities for cost recovery. They may be broadly defined as all charges and levies imposed on the user of a service, if such charges bear some direct relation to the provision of the service (Linn,1983). Bahl and Linn (1992), Tate and Lacalle (1989) and others, suggest that evaluation criteria used in setting user charges include economic efficiency, equity, administrative feasibility and political acceptability.

9.1.1 ECONOMIC EFFICIENCY

Economic efficiency in resource allocation is usually the dominant objective of pricing policy. The point occurs when the price equals the cost of supplying the next additional unit of usage, that is price should be equal to the marginal cost for a system to be deemed economically efficient. Theoretically, all users, regardless of category, face this same price. Under such conditions, service occurs at minimum costs, customers are treated equally, system repair and upgrading costs are adequately covered (assuming all costs are considered), and system expansions occur only when required by demand conditions. The pricing mechanism is designed to ration demand (on the basis that those who value the item or service most will be prepared to pay most); provide incentives to avoid waste; give signals to the supplier concerning the scale of production; and provide resources to the supplier to increase supply.

To ensure economic efficiency, user charges such as water rates should be adequate. Charging should be responsive to population growth, and increases in income, since these changes inevitably result in higher water demand. But in many developing countries fees are based upon fixed tariffs per unit of service, and a discretionary decision is needed to increase them, when costs rise. The unpopularity of increases in charges, translates into lower revenue because charges frequently fall behind the rate of inflation.

9.1.2 EQUITY

Another primary objective of water pricing is often that of equity. Equity refers to the burden of maintaining public expenditure which is borne by sections of the community, in proportion to their ability to pay (McMaster,1991). Charges are good if they are progressive (that is, if the percentage of a person's income paid in user fees increases with the level of that income). If fees are proportionate (that is if the percentage of income paid is more or less in keeping with rates) then they are tolerable. Fees are bad if they are regressive (that is if the percentage of income paid in fees, declines with rising income levels).

In terms of water pricing, the question of equity is seen in two dimensions. First, there is *vertical equity* whereby the incidence of water tariffs should be equitable between people of different income levels. Secondly, there is *horizontal equity* whereby the price is equal between people earning the same income.

There is considerable confusion over the use of the concept of equity because it is difficult to implement in practice. Situations which may appear equitable at first sight may prove inequitable on closer examination. For example, a few large users may dictate the system design capacity, one of the most important and costly design parameters for water systems, which makes it inequitable for smaller users who must share water costs. Large users may also have high usage rates, high peaking requirements, or both. In both these cases, the majority (small users) are actually subsidizing the needs of a few large users, and an apparently equitable charging system is actually inequitable. The same criticism is even more serious in instances of flat rate systems. Another example of an equity objective which may turn into an inequity, is the case of not recovering debt service costs from current users, which causes a deterioration of infrastructure for which future generations must pick-up the price tag. This is a form of inter-generational inequity. But there are ways of dealing with such inequities which are discussed in more detail later on in this chapter.

9.1.3 ADMINISTRATIVE FEASIBILITY

Administrative feasibility is an important criteria in applying water charges, and it is advisable that it is not neglected. It is senseless to adopt a system of charges which is difficult to implement. For instance, marginal cost pricing which charges on the basis of each additional unit consumed, is administratively unfeasible in the absence of metering.

9.1.4 POLITICAL ACCEPTABILITY

The acceptability of water rates is an equally important criterion often overlooked by policy-makers, particularly those of international agencies which have cost recovery as their main agenda. Gains from a good system of user charges are compromised if there is adverse public reaction to it. The utilization of user fees is a sensitive matter for most governments which want to control the rate of price inflation, and fear the political repercussions of price increases for basic services, since consumers are often quite emphatic in their opposition, at times even endangering political stability through riots (Bahl and Linn,1992).[1]

9.2 TYPES OF WATER TARIFFS

There are two main categories of water tariffs; flat rates and volumetric based charges. Flat rates bear no relationship the quantity of water consumed whereas volumetric charges do.

9.2.1 FLAT RATES

The simplest rate schedule, from both a customer and administrative view point, is the flat rate which may be defined as a fixed levy imposed in each billing period and is unrelated to the volume of water used. In return for this levy, the customer is given unlimited access to water services. Flat rate charges take into account the cost of providing service, and in some cases, expected consumption, and may vary among user classes. Examples of water charges based on flat rates are those calculated on the assessed property value or lot frontage, pipe diameter and the number of taps (this may have some relation to usage).

The principal disadvantage of flat rate pricing is that it results in higher water use than volume based pricing, because the price of an additional amount of water (ie, the marginal cost of water) is zero.[2] Customers pay a fixed price per billing period for an unlimited water supply and, accordingly, have no incentive to monitor or control their use (Kindler and Russell 1984).

1. WATER RATES BASED ON ANNUAL RATEABLE VALUE OF PROPERTY

Property tax valuations are used frequently as a base for charges to meet the costs of individual services such as water supplies. In many former British colonies and in Quebec, Canada, water rates are calculated from an assessment of property values or lot frontage (Bahl and Linn,1992:Tate and Lacalle,1992). As mentioned earlier, 99% of Trinidad's residential consumers are billed on the basis of the annual rateable value of property.[3] Households do not pay water rates based on actual consumption (volumetric charges) but on a proxy measure, whereby the value of the property is used as a barometer of income and potential household water consumption.

The criteria of economic efficiency, equity, administrative feasibility and political acceptability, as suggested by Bahl, Linn, Tate et al, are used to evaluate the annual rateable value of property as the basis for water charges.

Economic Efficiency

A good pricing mechanism attains economic efficiency, both in terms of generating maximum revenues to meet the costs of the services which they are intended to finance, and in rationing consumption patterns. But Trinidad's system of water tariffs is economically inefficient, in that there is no relationship between water consumption and the costs of water provision. Subran and Staples (1994) expressed the opinion that economic inefficiency has to do with the level of the water rate, not the type of rate.

To ensure that higher demands for water can be met, one of the criteria which revenue sources should satisfy is responsiveness to increasing costs. However, the growth in WASA's revenue has lagged behind the growth in income, and the general price level. Although property values have increased since the mid 1970s especially after the oil boom, the majority of annual taxable values in the assessment rolls have ceased to bear any relation to rental or market values, as required by the Land and Building Taxes Act (Chapter 76:04) (Public Utilities Commission,1992).

Administrative and legal shortcomings make Trinidad's annual rateable value system inadequate as a basis for WASA's cost recovery and revenue generation. One reason for the low buoyancy of water rates based on property tax assessments is that the consumer base for newly improved properties is not being added to the tax role. Trinidad's law states that properties should be reassessed every five years. In the major cities of Port of Spain and San Fernando, assessments are done triennially, annually for the Arima Borough and every 15 years for counties. The shortage of assessors and other difficulties in doing assessments regularly, make the cycle much longer, sometimes every ten years (Beddoe,1991).

Political interference also affects the reassessment of properties. The Valuation of Land Act Chapter 58:02 was passed in 1969, and the referencing and valuation of all lands was started. But the next year, the Government instructed that residential buildings were not to be reassessed, unless they had been improved since they were last assessed. In effect all values of domestic properties reverted to 1968 values. This instruction was widened in 1978 to cover all types of properties and all values reverted to December 31st,1977 values (Public Utilities Commission,1992). Moreover, the Rating Act was not enacted and work on the cadastre was suspended. Beddoe (1991) argued that the Government failed to reform the property taxation system, since it was under no

pressure to seek new sources of revenue, because of windfall profits made from the quadrupling of oil prices in the 1970s.

When taxes are not adjusted as incomes increase, then there is no expansion in revenues collected. Bahl and Linn (1992) argue that if the property tax responds less than proportionately to income growth, and the demand for public services increases with income, it may force frequent and politically unpopular adjustments to rates. In fact this is precisely what happened. There were three rate increases within a seven year period (1986, 1991 and 1993).

Equity

A major objective of the system of property taxation and water charges in Trinidad is equity. Consumption charges are linked to property values so as to vary consumption charges with the income of the consumer.

In theory, stratifying water consumers by property value may be appealing from the equity perspective, since the relation between property value and income tends to be more sensitive than the relation between water consumption and income. In other words, generally income changes more significantly with an increase or decrease in property value, but the quantity of water needed for essential human activity vary little with a growth, or decline in earnings.

However, this method of achieving equity has difficulties in practice, as borne out by the Trinidad case study. WASA's fee structure is highly regressive, in that the percentage of income paid in water rates, declines with rising income levels. The survey on willingness to pay showed that low income households spent 0% to 1.7% of their income on water, while middle income and high income households spent 0.7% and 0.5% respectively. Moreover, the impact of Trinidad's ARV based water charges on domestic customers is that 50% are billed according to the minimum $80.00 per quarter and only 7% pay the maximum rate. Current rates do not reflect ability to pay.

Apart from irregular re-assessments, inequities also result from preferential treatment for owner-occupied properties through under-assessments. Further, owner-occupants receive personal income tax reductions on mortgage interest payments, which is a Government policy aimed at encouraging home-ownership. By paying lower personal income tax and property taxes, house owners receive dual preferential treatment, and do not bear the full burden of paying for water.

Geographical inequities also occur if lower taxes are charged for properties located in suburban locations. They are generally rationalized on the grounds that these properties receive fewer services than inner-city properties, and their owners should therefore not be required to pay property taxes at the inner-city rate. The tax is unfair, in some cases, as low income groups living in the inner city are forced to bear the cost of infrastructure provision. In Trinidad for example, some property owners living in high income residential areas in the suburbs pay a lower rate than their counterparts living in the main cities of Port of Spain and San Fernando. More problematic in the implementation of differentiated property tax rates, is the fact that some areas with lower rates actually have equal or better services than some areas with higher rates. This situation occurs because of inadequate property tax administration; that is, it takes considerable effort to reclassify particular areas from low-to high-tax status, even after most, or all of the public services have been provided (Bahl and Linn, 1992). McMaster (1991) makes the point, that if the property tax is viewed primarily as a benefit charge for services provided, it must be linked explicitly and directly with the quantity and quality of services provided, rather than being levied on the basis of an outdated urban-rural classification (as in the case of Trinidad, Colombia and Taiwan) or on outdated central-periphery dichotomy (as was the case in Hong Kong).

Another reason for inequity of the property tax system, is that the market value of properties are not approximated by their appraised values, again because

of poor assessment techniques, and failure to update assessment rolls. The main relevant effect of poor assessment practices is that there generally is less correlation between income and assessed property value, than between income and market value.

The lack of political will in Trinidad to implement a revised property taxation system when translated into a time perspective, means that residential properties which have undergone no improvements since the 1930s, have not been reassessed in the last 60 years or so, while new and improved residential buildings are subject to reassessment and increased taxation. There are many cases of small dwellings being rated at higher levels than others with much higher rental values and which are being charged higher water rates (Subran,1994). It is clear that the use of the property value system as a basis for calculating water tariffs is very inequitable and discriminatory, and that a more "level playing field" is needed (Hosein,1994).

Administrative Feasibility

The use of the property tax system as the basis for calculating water charges is not administratively feasible in Trinidad. Since water rates are based on assessed property values, in the absence of a full fiscal cadastre, many households are not paying water rates which WASA estimates is about 40,000 households.

Inadequate tax records plague the administering of property tax systems and affect the current billing system for water. Dillinger's (1992) research on the urban property tax system in developing countries, done for the Urban Management Programme, found that the problem stems from incomplete tax rolls, inadequate ownership information, dated information including on improvements, duplicate records, and poor methods of maintaining and filing the information. Staples (1994), argues that for Trinidad, the largest problems in administering assessments fall under the headings of inadequate staffing, the poor quality of

basic information for the valuation process, and the political obstacles to regular reassessment.

Chung, Glenn and Wolfe's (1992) study of Trinidad revealed that underlying these problems is a lack of coordination among all levels of government offices involved. They note a common deficiency is the lack of coordination between the office of the assessor, the registrar of deeds, the building permits department, the public utility departments and the office handling property transfer stamps. Information on change of ownership, sale prices and new construction is not recorded promptly by the assessor.

Updating records is also performed inefficiently. Some records are handled manually by clerks who are unskilled or who have no incentive to carry out the procedure more efficiently (Bahl,1992). In Trinidad, land records are kept in handwritten ledgers, and are entered chronologically as they arrive at the Registrar's Office under two different systems. There is no unique parcel identification system, consequently it is impossible to key into the system through the cadastral maps, and searches can only begin from the deed reference number of the present owner. Cross-referencing is not possible: all title has to be traced from the present owners name back through a series of numbers (Chung, Glenn and Wolfe,1992).

WASA's performance in generating revenue and cost recovery is dependent on the performance of another public agency (i.e the Valuation Division), itself hamstrung by deficient resources and political intervention.

2. NUMBER OF TAPS

Before 1986, WASA used the number of house taps as the basis for charging water rates to unassessed properties. Water supply costs were recovered by approximating consumption through linking the periodic charge to the number

of house taps. The case for charges based on the number of taps, used the assumptions that the existence of a high number of taps encouraged more extensive water usage and that, the greater the number of taps, income was higher and therefore the ability to pay. From an equity perspective, large households in low income communities with high consumption levels were favoured by low charges based on a single tap, but small wealthy households with several taps paid higher water rates. The use of house taps as the basis for charging has an equity and redistributive effect, but it is economically inefficient in that it encourages wastage because there is no relationship between the quantity of water used and the price charged. Furthermore, from an administrative perspective, a pricing system based on the number of taps, warrants constant monitoring of the number and type of fittings per household, to ensure reasonable equality. This is especially difficult in low-income areas, including squatter settlements, where incremental upgrading of the dwelling unit such as internal plumbing is not unusual, and takes place over time.

3. PIPE DIAMETER

A flat periodic rate calculated from the expected level of water consumption which is based on the diameter of the connection pipe, is sometimes used as a water charge especially in countries where the water supply is unmetered. For instance, in Colombia and Thailand water fees rise with the diameter of the pipe. By setting charges for unmetered connections, the different levels of expected consumption are reflected by linking the periodic connection fee to the pipe size of the connection.

In short, flat user fees do not generate sufficient revenue for water companies, because fees are set well below the marginal cost of the service. In particular, as a surrogate water pricing mechanism, the outmoded annual rateable value is weak. Outdated property assessments also means WASA's customer data base is outdated. There are insufficient economic returns for WASA's capital investments, and operation and maintenance works. Further, the current system

of charges does not modify economic behaviour in terms of efficiency in water consumption, because there are no price penalties for excessive use, which is the same for the number of taps or pipe diameter. Moreover, the ARV based charges are inequitable. The only apparent advantage of flat rates is that they are politically acceptable. Table 9.1 shows that the application of the ARV based rates in Trinidad meets only the criteria of political acceptability, number of taps meets equity and political acceptability, and use of the pipe diameter may meet all criteria except economic efficiency. Volumetric charges meet the criteria of efficiency and equity. However, they may not be politically acceptable, and may be administratively difficult as will be discussed later on in relation to volumetric charges based on marginal cost pricing.

Table 9.1 Comparison of How Different Water Rates Meet Evaluation Criteria

TYPES OF RATES	Economic Efficiency	Equity	Administrative Feasibility	Political Acceptability
FLAT RATES				
Rates Based on ARV	No	No	No	Yes
No.of House taps	No	Yes	No	Yes
Pipe Diameter	No	Yes	Yes	Yes
VOLUMETRIC RATES				
Marginal Cost Price	Yes	Yes	?	?

9.3 A FRAMEWORK FOR COST RECOVERY

The first goal water pricing practices should fulfil is that of cost recovery (Tate and Lacelle,1992). According to the American Water Works Association (1983), the costs of operating, maintaining, upgrading and expanding the water system should be recovered through water charges, if they are not subsidized by Governments. In some water systems, depreciation costs and debt service are recovered, the latter being spread over the long term. The debt service portion may be allocated on the basis of use, or apportioned equally among all

consumers, each of which pays an equal share. The latter approach assures the availability of sufficient capital to retire outstanding debt since it is not affected by fluctuations in consumption. In many developing countries physical deficits have developed because of the failure to introduce user charge financing for regular replacement of infrastructure (United States Agency for International Development,1991).

Policies differ from country to country, regarding whether the full cost, or part of the cost, or more than the cost of providing infrastructure is recovered. Urban consumers in most industrialized countries pay all the recurrent costs (operations, maintenance and debt service), and most of the capital costs (more than 50%) of water supply (Briscoe and Garn,1994). For example, Canadian municipalities with populations over 10,000 recover 82% of water distribution costs through direct user charges, and the remaining 18% are covered through lot levies, general property taxes, transfers from other levels of Government, and increased debt (Federation of Canadian Municipalities, 1985). Tate and Lacelle (1992) argue that there is some evidence however, that the current crisis in infrastructure deterioration, upgrading backlog, and a substantial funding problem in Canada may be the result of shielding users from the full costs of maintaining water systems, probably through general property taxes, and through the provision of long term debt financing, which may not appear in water bills.

Research findings reveal that among public utilities in developing countries, on average, the ratio of revenues to costs is 0.3 for the water sector, which performs the worst in contrast to other sectors. The price charged for water is about 35% of the average costs of supplying it. Briscoe and Garn (1994) are of the view that the gap between tariffs and costs is usually created by Government subsidies to users which are as high as 70% and can be detrimental. For example, in Latin America, annual financial losses for public utilities resulting from the fiscal gap, represent 15% or more of the investments needed to supply the entire population with adequate services by the year 2000 (World

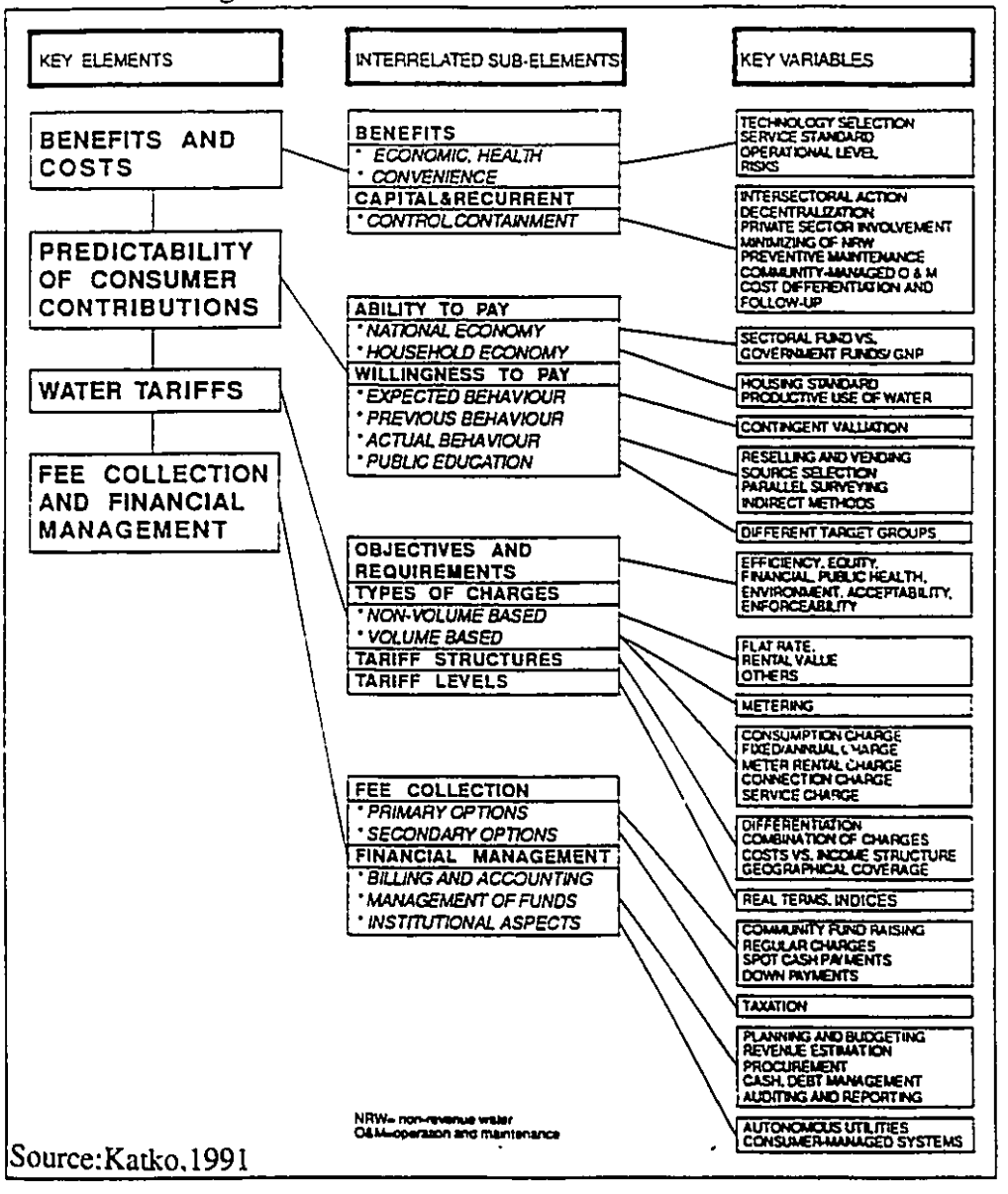
Bank,1994). The overall cost recovery performance of public water authorities in developing countries is generally poor.

Clearly, the best way of reducing the gap between costs and revenues is to cut costs and achieve productive efficiency. Once costs can be controlled, well-established pricing principles are then introduced to help recover costs, generate revenue, and reduce distortions in resource allocations. A cost recovery framework is important in this regard, argues Katko (1991) who has attempted to develop a cost recovery model for water supply, with an emphasis on developing countries, shown in Fig 9.1. The Public Utilities Act of Trinidad and Tobago and the Act governing WASA also state that cost recovery is a major aim of the water agency.

The first step in deciding on a charging policy is to define and calculate the full costs of the service under consideration. However, true economic, environmental and social costs are difficult to determine, thus making full costs troublesome to calculate. Developing countries generally lack experience in using analytical tools, baseline data, and scientific knowledge to improve environmental valuation and quantification of costs. Socio-cultural and psychological costs (mutual support, social cohesion and sense of community) associated with human settlement relocation for the construction of major water facilities such as dams, are equally hard to measure quantitatively.

The next step in developing a framework for cost recovery and revenue generation is to identify current costs on such items as labour, material, and debt servicing, and to determine whether these costs are fixed or variable. *Fixed costs do not vary in the short run*, and costs are fixed because a temporary reduction in the amount of water supplied does not affect their cost level. They include payments on current debt, administration, regularly scheduled maintenance, and replacement of equipment due to obsolescence. *Variable costs vary according to the amount of water delivered to customers in the short run*; energy costs of

Fig 9.1 A Cost Recovery Model for Water Supply



Source:Katko,1991

pumping, treatment costs, repair and maintenance of equipment. The primary practical difficulty in estimating these costs is separating fixed and variable costs. Some of the items have to be apportioned between fixed and variable costs. The rate maker must make a reasonable allocation between variable and fixed costs, relying on judgement, experience and knowledge of the system.

The next step is to decide what costs may be charged to the consumer. Chargeable costs may include operation and maintenance only; amortization of capital costs at full market rates of interest; amortization of capital costs on "soft" terms such as interest free or on submarket interest rates; depreciation of the value of capital assets over their estimated life; a commercial rate of return on the value of the investment in capital assets; the marginal cost of investment (the unit capital costs of providing more than the present supply).

A decision may need to be made as to whether costs are calculated according to the actual expense of a particular unit of service, or on a pooled average basis. Amortization of capital costs will vary with the age of the capital assets because of inflation, and fluctuations in interest rates attached to any loans involved.

The arguments about how to calculate costs are conflicting. It is argued that if chargeable services are seen as purely *private goods* and charging as a market-pricing instrument, each unit of service should be charged according to its own marginal cost. A consumer is provided with a service, only if he or she is prepared to pay the supplier's true cost of providing it. Economists argue, this encourages a more rational use of a service and an optimal location of settlement. To illustrate the point, if the elite consumers choose to live in the suburbs, then they should the bear the heavy costs of supplying water to them.

The opposite argument is that the circumstances which vary the cost of the service are not necessarily of the consumer's making; the service might meet a

basic human need, and therefore the consumer should not be penalized if these costs are above average. For example, if the poor live on the periphery of an urban area, the locational choice may have been determined by the unaffordability of land and shelter at the city centre. Some policy-makers advance the argument that the burden of a peripheral location should not be exacerbated by charging above-average unit costs for essential services such as water, which are important to meeting basic needs and protecting public health.

Another issue in cost estimation is whether capital costs are included, and on what basis (McMaster,1991). Examples abound of services which are meant to be self-financing, but only the operation and maintenance costs are charged to the consumer, and the capital costs are met out of general public revenues, or from loans which are fully discharged.

If debt charges are still current, these are included in the chargeable costs of a service unless it is being deliberately subsidized. There are arguments for including capital costs in the estimation of charges, whether the authority administering the service is currently discharging them or not. Capital investments are regarded as having an opportunity cost; the monies could have been used to finance some other form of public expenditure (McMaster,1991). If this argument is accepted, investing capital in a particular service can be justified only if it earns a rate of return comparable with alternative forms of public or private use. The public's willingness to buy a service at the resulting level of charging is comparable to its readiness to buy goods or services from a commercial operator using the same amount of capital. This willingness to pay the charges is the essential market test of viability.

A counter-argument is that because the capital costs of assets have been covered by another generation, or public body, then no charges should be imposed on present consumers (Katko,1991). Infrastructure, for example, will wear out in time and will require replacement at current costs. By not paying

toward capital costs, consumers will be living off the sacrifice of previous and future generations. Charging may therefore include the amortization of capital assets at their current rather than historical value, that is, the cost of acquiring or constructing them now, which may also ensure inter-generational equity.

An important decision that water utilities in developing countries may consider is whether to incorporate opportunity costs in the price tag for water. The World Bank (1993) argues that economic efficiency would be obtained by setting water charges equal to the opportunity cost of water which it defines as the value of goods and services foregone, including environmental goods and services, in satisfying the demand for water. Determining the opportunity costs of water requires information about, and analysis of, future demand, supply options, investment alternatives, and the economic and social costs of pollution and other environmental damage. A proper evaluation of costs is now facilitated by models developed for this purpose, but careful interpretation and judgement concerning modeling results are stressed (World Bank,1993). However, the inadequacy of data in developing countries such as Trinidad makes it too early to incorporate these costs into water rates. Additionally, immediate adoption of such prices often proves to be politically difficult. Thus, given the low level of cost recovery at present, and the extent of underpricing, fees that establish the water entity's financial autonomy, would be a good starting point, to allow the entity to achieve independence and the sustainability of operations.

9.4 A FRAMEWORK FOR STRUCTURING WATER TARIFFS

There are two ways of structuring water tariffs; average cost pricing and marginal cost pricing. Variations of these include average incremental cost pricing and marginal social cost pricing. In applying them to water provision, they may need to be modified to reflect concerns in water pricing policy such as economic efficiency, equity, externalities, administrative feasibility and political acceptability.

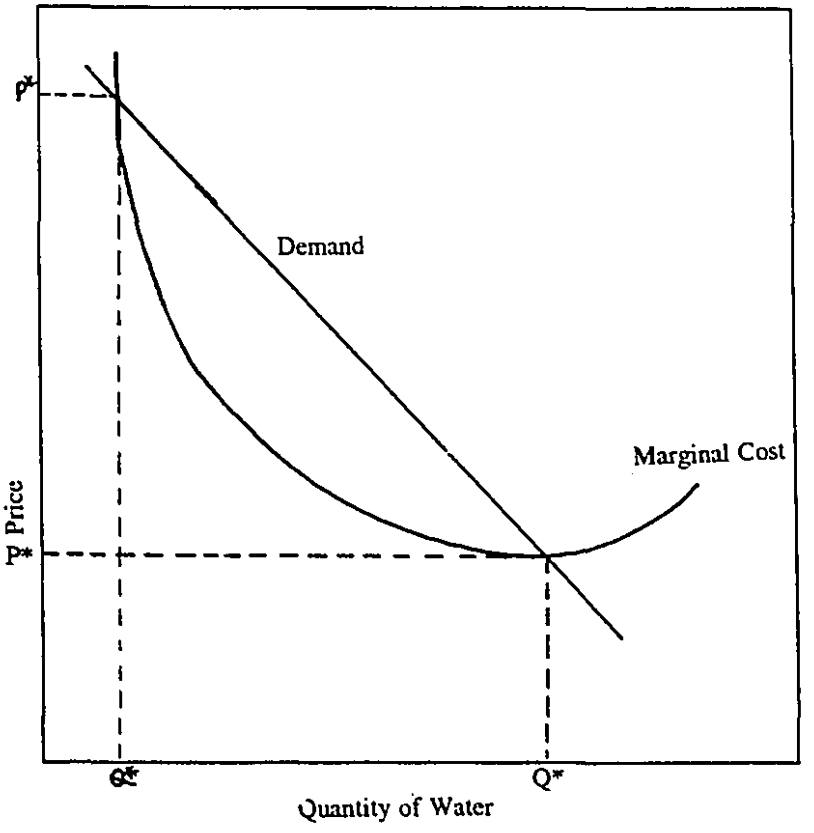
9.4.1 AVERAGE COST PRICING

WASA uses average cost pricing which is defined as the total cost divided by the number of units of water produced. The price charged is substantially below the average incremental cost, that is the change in cost resulting from a change in water output, and the construction of new facilities. This practice results in the need for Government subsidies and cross-subsidies: it is economically inefficient as a method aimed at reducing consumer wastage, and it creates a serious risk for acceptable cost recovery. Average cost pricing does not alert individual customers to the cost consequences of his/her decisions. It is also inappropriate to the environment in which the water utility operates, that is one characterized by rapidly rising prices. The most serious indictment of average cost pricing is its insidiousness, in that it lulls consumers into a level of consumption which makes added capacity essential, and then the added capacity results in a substantial increase in water rates, by which time it is too late for consumers to change demand. Average cost pricing, during a time of changing cost relationships, understates the cost of adding generating and other capacity to the system, and provides unpleasant surprises to water consumers by way of rate increases after capacity expansion (Carrigan,1982). The consequence of the inefficiencies of average cost pricing is the frequent and substantial rate adjustments made by WASA.

9.4.2 MARGINAL COST PRICING

Marginal cost pricing charges all consumption at the unit cost of meeting any additional demand (See Fig 9.2). The justification for this rule is that welfare is maximized when the benefit of an additional unit of the service to the consumer, is equal to the cost of producing this additional unit. If prices are lower than the satisfaction (economists call this utility) derived from consuming larger quantities, demand will increase. Conversely, if prices exceed the marginal utility, demand will fall. The rule thus allocates resources efficiently, in that it identifies the level of output that produces the greatest net benefit from service provision.

Fig 9.2 Marginal Cost Pricing



The marginal cost concept of relevance is the short-run marginal cost, that is the cost incurred by producing an additional unit, while keeping productive capacity constant. To the extent that capacity can be expanded in small installments, long run costs will equal short-run marginal costs in an efficiently managed plant. This is because the plant will always operate at the level at which the cost of producing an additional unit with existing capacity, is equal to the cost of expanding capacity to provide the additional service.

Frequently, however, existing service capacity of water facilities is fully utilized in developing countries. In the case of Trinidad supply utilization is very close to effective capacity with a total daily water demand of 669,000 cubic metres and average daily production at 712,000 cubic metres. As Garn (1993) notes if water agencies fail to curb over-consumption, the capital costs of expanding facilities may be quite high, and water shortages occur due to capacity

constraints. He points out there is growing evidence in some developing countries that real costs of water per cubic metre, in second and third generation projects are doubled between the first and second projects, and then doubled between the second and third. The principle which then applies is that whenever capacity is fully utilized, the price should be set so that it will cause demand to adjust to equal the capacity to supply it. This prescription is based on the principle that using price to ration a scarce commodity is more efficient than other means of demand management. However, negative externalities such as diseases may occur, which calls for a modification of the marginal cost pricing rule. This is the subject of more discussion later on.

The application of the marginal cost principle has three main implications. One is that the marginal cost principle does not take into account historical costs, but the opportunity costs incurred by greater use of a service. Opportunity costs do not equal historical costs, and in many cases they will not, because economies or diseconomies of scale, technological advances, natural resources constraints, shifting factor prices, and changed service standards, alter the marginal costs of service provision over time.

The second implication is that marginal costs need to be adjusted frequently during inflationary periods. If the cost structure does not change over time, and if a user charge has been correctly set at a particular time, rapid inflation means that after two or three years, the nominal user charge may diverge considerably from the efficient charge.

A third implication is that, only if the demand for water shows some price-elasticity will efficiency be affected by whether or not the service is priced at marginal cost. If the demand for a service is perfectly or almost perfectly inelastic, the quantity consumed will not change in response to a change in price. Therefore, the use of economic resources will not be affected by the price, and no loss or gain in efficiency will result from setting prices above or below

marginal cost. Demand does not have to be very price elastic, however, before the effects of price setting on resource allocation become important.

9.4.3 REFINEMENTS TO MARGINAL COST PRICING

In applying the marginal cost pricing rule, water services need to be unbundled by asking the question "what aspect of service provision is being considered; the consumption of water, access or connection to water, or the opportunity to use or to connect to the water service"? The marginal cost pricing principle also requires refinement in relation to equity, externalities, and variation in costs across space, time and consumer classes. Each of these are discussed separately.

1. CONSUMPTION COSTS

The decision to demand or not to demand an additional unit of a publicly provided good, such as water, involves consideration of the short-run marginal costs of public production and distribution. For example, the consumption of an additional unit of drinking water may involve marginal costs of treatment, energy costs of pumping, maintenance costs of wear and tear on machinery and pipes, and of the depletion of storage tanks during operation, and labour costs. The use-related price should therefore reflect marginal costs of production and distribution, which are relatively easy to estimate from the financial data of a water enterprise.

More difficult in charging for consumption is the treatment of incremental capacity costs of water production and transmission, for which investments are generally lumpy. One method of estimating incremental capacity costs in the water supply sector is average incremental cost, which is calculated by discounting the incremental costs which will be incurred in the future to provide the estimated additional amounts of water which will be demanded over a specified period, and dividing that by the discounted value of incremental output over the period (Saunders, Warford and Mann,1976).

A consumption charge based on the marginal cost pricing rule also requires water metering to measure consumption, although for small residential consume . particularly if only one tap is installed in a dwelling, the costs of metering may well outweigh the benefits. A cost benefit analysis of metering is advised. The Water and Sanitation Division of the World Bank argues that from its project experience, water usage costs incurred by the consumer is easiest to recover when metering is available to measure use, and charges are based on actual consumption. As an example, the widening of meter coverage in Ghana in 1988 from under 30% to 53% in 1993 led to an increase in revenue collections from less than 50% to 91% of billings (World Bank,1994).

2. *EXTERNALITIES AND SUBSIDIZATION*

The basic marginal cost pricing rule assumes that there are no benefits or externalities associated with the private decision to consume or seek access to water services. "Externalities" are defined as the unintended (non-monetary) side effects of one party's actions on another party, that is ignored in decisions made by the party causing the effects. A common example of a positive externality is the health benefit to a community connected to a treated water system, thereby reducing the incidence of water-borne diseases. Examples of negative externalities include groundwater contamination, and the lowering of the water table by over-pumping aquifers. To achieve positive externalities price may need to be below marginal cost, so that consumption is stimulated to a socially optimal level, at which the marginal social valuation of using the service equals the marginal cost of producing it.

A case for subsidization and social equity occurs where the water service primarily benefits the individual user, but its consumption needs to be encouraged for public benefit or saving. Research by the World Health Organization (1980) showed that 20-40 litres of water per person per day (lcpd) are sufficient to meet essential needs and attain the main health benefits of water use. Consumers should

be given an incentive to consume at least this amount of safe water, if they are not willing or able to do so, at their prevailing incomes and marginal cost price.

Subsidization is regarded by some policy-makers as inefficient because resources are squandered on a provision which is not cost effective, or because it benefits all consumers whether they need to be subsidized or not. One remedy is to charge only certain categories of users and subsidize low income users. A second option is to subsidize up to a minimum level of consumption above which market pricing should apply. For example, the first 40 litres of water supplied to a person daily might be charged at a low rate below cost; consumption above this level is priced at full marginal cost. This is described by the World Bank as the "lifeline" approach.

Rising block rates which may be defined as progressive increases in unit prices in relation to successive blocks of consumption, are often used along with lifeline tariffs to achieve equity. But if block rates are formulated to charge high rates to high volume consumers above the marginal cost, and low-volume consumers less than what would reflect the external benefits of their consumption, then the losses in efficiency that are incurred at both ends of the scale must be balanced against the redistributional benefits.

The redistributive effect of rising block rates is subject to three limitations. The first is a behavioural limitation, and the other two are related to implementation. The first limitation is the income elasticity of the demand for water. If water demand has a zero income-elasticity, then rising block rates will have no systematic redistributive effect, but will result in inefficient patterns of consumption. In practice, water has a very high income-elasticity. Studies of income elasticity and water consumption revealed that the average income elasticity is approximately 0.40 (Garn,1994). Therefore the scope for redistribution through rising block rates without serious losses in efficiency is limited. In Kingston, it was estimated that the proportion of household income

spent on water was more than twice as high for the poorest 30 percent of the population, than for the richest 10 percent. This situation prevailed despite highly progressive block charges, which meant that the block consuming the most was charged five times more per unit of water, than the block consuming the least (Bougeon-Maassen and Linn, 1977). Two important questions need to be asked when introducing lifeline tariffs; who benefits and are lifeline tariffs equitable. If large, poor households use more than 20-40 lpcd, they end-up paying the higher tail block rate for amounts consur. J that exceed the lifeline threshold and are charged more than high income households. Special subsidies are suggested for affected households.

The second limitation is that the per capita income of the connecting household is not the only variable influencing consumption per connection. Variables such as family size and the number of families per connection, may offset the income effect. Rising block rates may therefore be more burdensome for larger rather than richer households. To the extent that household size and incomes are negatively correlated, the redistributive intent of rising block rates may be thwarted.

The third limitation is the fact that in many developing cities more than one household is frequently drawing water from a single residential connection. In Bombay, the average number of persons per connection in 1976 was thirty because of the large proportion of apartment buildings and single-room tenements. Whittington (1990) noted that in Kumasi, Ghana rising block rates penalized rather than helped low income households living in high density, multi-family dwellings with a shared meter. Policymakers need to be sensitive to how pricing policies, which appear reasonable on the surface, affect low income households.

3. *CONNECTION COSTS*

Some economists argue that connection costs such as material and labour costs, and recurring administrative costs associated with a water connection (meter reading and maintenance, record keeping and billing), should not be charged on the basis of marginal cost pricing or average incremental cost pricing.

Connection fees are common in many countries, but the basis for charging varies, as shown in Appendix 9.1. In most countries a flat charge related to installation costs is imposed, while in other cases (Bangkok and Jakarta), the diameter of the connecting pipe determines the connection fee. USAID (1993) recommends that the collection of the connection fee must be a precondition to connection, and therefore serve as an up-front mechanism for cost recovery. The method of charging adopted depends on the specific circumstances of the country.

The connection charge imposed by WASA on each user should capture the cost impact of each connection to the existing infrastructure. The fee should reflect the marginal capital costs of connection, including administrative functions such as meter reading (when introduced), billing and collection. Also, Trinidad uses lump-sum connection charges which are extremely high by developing country standards. Since 1994 WASA charges an up-front fee of TT$687.50 (US$118) per household connection which is not affordable by low income households. A lump-sum charge upon initial connection (installation costs) and a fixed regular fee for the recurrent costs of maintaining the connection is appropriate for high to middle income households who can afford this charge. In the case of Trinidad it is recommended for rich households because their connection demand is less price elastic. One exceptional case where this principle does not apply, is Cameroon where very high connection fees discouraged water connections even by high-income users in some areas (World Bank,1975a).

Special consideration may have to be given to poor families because WASA's connection fees are regressive, in that a high lump-sum payment for

initial installation is required which frequently prevents poorer households from getting a service at all. The price elasticity of water connection is high for poor households, and needs to be taken into account because of the ease with which illegal connections are made. In Caracas and Mexico City 30% of connections are not registered (Briscoe and Garn,1994) and in Bogota and Jakarta, illegal connections are quite common in poor neighbourhoods, apparently in response to the size of connection fees (Linn,1979c,; Linn et al,1976).

Briscoe and Garn (1994) have recently been arguing in favour of *new financing approaches* to allow low income households to connect legally to the water supply system. A high lump-sum connection fee which needs to be paid out of savings or borrowing presents an insurmountable barrier to the poor, who have extremely limited access to capital markets. The experience of Kerala, India suggests that initial connection costs for low-income households should be borne by the water company which deducts the amount from monthly bills over a period of time. Poor customers may be able to afford the equivalent of the lump-sum charge by drawing on their earnings and a recurrent charge is preferable to a capitalized, high lump-sum connection fee. A fixed regular fee should still be charged for the recurrent costs incurred by maintaining the connection.

4. DIFFERENCES AMONG USERS

In many cities in the developing world, different prices do not follow cost or demand differential. This may be explained by the equity goals of the public service agency or by other political objectives (Bahl and Linn,1992). However, in aiming for efficiency, the marginal pricing rule may be modified by charging different rates for residential consumers based on the level of service. Different user groups are also sometimes charged differing prices relating to the users' varying elasticities of demand. Rich households have a perfectly inelastic response to an increase in water rates, in which case a high fixed charge on these users may not result in significant losses. The water supply agency may act as a discriminating monopolist, and extract a higher price from high income users by

applying the principle of charging "what the traffic will bear". However, some policy-makers and regulatory agencies regard this as an unfair practice.

5. *DEVELOPMENT CHARGES*

A development charge is sometimes applied to cover the marginal cost of the distribution (reticulation) system. This charge is prorated for each plot (even though it may not be immediately connected to the system) depending on the incremental capital costs of installing the system. In the US, charges are levied against new development as payment for capital facilities so that it imposes on incoming residents their fair share of these capital costs. The development charge may be levied on all residents at the time the system is built and when expansion is needed, whether or not the residents choose to connect to the system at that particular time.

6. *SPATIAL COSTS*

The marginal cost pricing rule requires that each individual pay the marginal cost generated. Hence, differences in service costs across space should be reflected in a refined pricing structure. Three kinds of spatial (or geographical) costs differences are distinguished by Bahl and Linn (1992); sectoral (rural and urban areas compared), inter-regional (one region or city compared with another), and intra-regional (neighbourhood within a region or city compared). In Trinidad, these spatial differences are not taken into account in water prices.

Sectoral differences may occur because the marginal cost of providing a water services to a rural consumer may be higher than for urban consumers. This may be so because rural areas have lower population densities, and thus higher distribution or collection costs. The smaller scale of operations in rural areas may also have higher unit costs of distribution for certain services because they do not have economies of scale.

Inter-regional differences in the costs of water supply occurs as a result of variations in water resource endowment, geologic conditions, input costs, technologies, or size of operations. Intra-regional or intra-city differences result mainly from variations in density of population, topography (elevation, soil conditions), accessibility, and distance to the distribution main. In Kingston, Jamaica, surcharges of 50% to 75% over the base charge were in the past applied to consumers living in areas requiring supplementary pumping (Bougeon-Maassen and Linn 1977). Trinidad tries to prevent residential development above the 300 foot mean sea level contour line, but a substantial amount of development occurs above this height restriction. Surcharges may be reflected in water prices to signal to households that their choice of location impacts on water provision costs.

Water companies and researchers generally do not explore the variations in costs resulting from locational differences (Rogers,1992). However, professionals in the water sector argue that if marginal service costs are not reflected in service prices, and are instead averaged across locations, then use and extension of the service will be overly encouraged in costly areas, and discouraged in cheaper areas.

7. MARGINAL SOCIAL COST PRICING

Economists usually argue that a major objective of public policy should be to achieve efficient use of existing water resources. Facilities are used inefficiently if some users are not willing to pay the *marginal social cost* of using water, that is the marginal cost of an alternative use of water that is foregone. To prevent users from using more water which they value at less than marginal social cost, economists argue that marginal cost pricing should be modified so that users are required to pay the marginal social cost of their water usage.

Users may be charged for three categories of costs which increase with the over-use of water facilities: (a) drops in water pressure or water rationing due to over-consumption; (b) environmental impacts such as saltwater intrusion of

groundwater due to over-extraction, (c) wear and tear on water production, transmission and distribution facilities. Some of these charges are discussed is more detail in the next chapter, under the section which deals with reducing the costs of negative externalities.

8. TIME OF DAY RATES

On the demand side many water services are characterized by daily peaks in consumption. The basis for price setting during peak demand periods is the long-run marginal cost. This price applies to the peak period only, since it is the peak demands that place a strain on capacity over time. In India, Korea and Colombia, these charges are borne by large industries and commercial users because they tend to be the main source of peak water demand (World Bank, 1994).

A failure to charge differential prices over time may cause not only efficiency losses from over or under-consumption, but also poor investment decisions. Excess demand is commonly taken to mean that it is time to invest in new capacity, but if this demand is due to a failure to apply peak-load pricing the investment is likely to be premature. The extension of capacity is appropriate only if the discounted expected benefit of the new capacity exceeds the cost of providing it.

Information is needed to initiate intelligent action of peak load pricing. It includes the time, date and amount of the system peak; the times, dates and amount of secondary peaks, and their probability of becoming primary peaks and the contribution of each class of consumer to the peaks or potential peaks.

9. SEASONAL PRICES

The key point about seasonal demand variations is that although excess capacity exists, during peak periods demand typically runs into capacity constraints beyond which supply cannot be expanded. It is more efficient to ration

available supplies through price increases rather than permit pressures to drop, or to provide water only intermittently.

Another reason to charge different prices at different times is to reflect changes in costs.[4] This phenomenon is usually linked to seasonally changing climatic conditions. Water, for example, is expensive during the dry season in Trinidad when additional pumping is needed, and in the rainy season excessive soil erosion, run-off and sedimentation in reservoirs requires additional water treatment.

The need to reflect seasonal cost differentials in designing water tariffs depends on the extent of cost differences, and on the administrative feasibility of applying differential rates at different times of the year. For non-metered connections, it is inefficient to vary charges seasonally. So as in the case of Trinidad, unless a water metering system is introduced, it is ludricous and administratively unfeasible, to impose water prices which vary with seasonal demand. Further, even if water supply is metered, difficulties are encountered in timing meter reading to accurately reflect the switchover from one season to another. A cost-benefit analysis is recommended before adopting such a pricing policy. There are few examples of seasonal differences in water prices in developing countries.[5]

10. "SECOND BEST PRICING"

Another modification of the marginal pricing rule is the use of "second best" pricing. The primary rule and classic "first-best" solution to achieve economic efficiency is that the marginal price of water should be set equal to its marginal cost. Distortions in input and output prices, however, confound marginal cost pricing and result in "second best" pricing. Some analysts argue that distortions in all economies, but especially developing ones, give no clear guidance to policymakers on how to price public services such as water.

Where there are distortions in input markets, the methods of *shadow pricing* which have been developed extensively for cost-benefit analysis apply to setting user charges. Shadow pricing requires adjusting the relative prices of all tradable commodity inputs by eliminating any tariff and tax distortions to which they may be subject and evaluating non-tradable inputs (in particular primary factors of production such as land, labour, and capital), in terms of the opportunity cost of output forgone by their use in the context of the provision of the service.

9.5 CLOSING THE FISCAL GAP

The application of the basic marginal cost pricing rule may still cause deficits for at least three reasons (Bahl and Linn,1992). First, because average costs decline with service growth, marginal costs of service expansion lie below average costs, particularly for those services for which economies of scale are important such as water supplies. The second reason is capital indivisibility, that is lumpiness of investment, which means the short run marginal cost falls below average financial or accounting costs during periods of excess capacity, and therefore creates a fiscal deficit. Production capacity and the distribution network of most public services can generally not be extended in smaller increments to meet changes in demand for the services. Rather, larger units of production and distribution capacity need to be built, frequently meeting existing backlogs in demand while building ahead of the growth in demand expected in the foreseeable future. The reason for this capital indivisibility is frequently technological; that is, the existence of technological economies of scale for many aspects of water service provision make the continuous addition of capacity in small increments uneconomical. A third reason, is the natural tendency of actual and potential users, or their political representatives, to clamour for service charges below marginal costs.

Multipart tariffs may be used to finance deficits that result from marginal cost price. The primary idea of multipart tariffs is that the marginal costs incurred

as a result of service use, may be charged by the appropriate application of short run marginal cost prices related to service use. Any deficit may be covered by levying fees or charges which fall exclusively on the users, but which are unrelated to the extent of their actual use of the services, for instance, flat monthly fees and lump-sum access charges (See Appendix 9.1).

Experience of water companies which have successfully closed the fiscal gap suggests that a three-part water tariff consisting of a consumption charge, a connection charge and a development charge, is required for the efficient pricing of water. The success of countries such as Singapore, Chile and Botswana is attributed to a multi-part tariff policy which is aimed at cost recovery sufficient to guarantee the financial independence of the water utility (World Bank,1993).

9.6 ADMINISTRATIVE AND TRANSACTION COSTS

Administrative considerations are also important in the design of water tariff structures. Water utilities incur administrative and transaction costs associated with measuring (metering) consumption according to location, time, and type of consumer, as well as the costs of billing and collecting charges under a highly complex pricing scheme.

An efficient water pricing structure may achieve its defined objectives, only if administered effectively. In other words, the administrative capacity is as important, as a well designed water tariff structure. If a large percentage of all meters are malfunctioning or tampered with, tariffs based on metered consumption are not likely to be very effective. If a proper metering system is in place, but charges are not collected effectively, then the benefits of metering are eroded. Also, as in the case of Bogota and Cartegena, if infrequent price adjustments allow inflation to erode the real value of user charges, an initially efficient charge can quickly become a considerable subsidy to water users (Bahl and Linn,1992). Jakarta, Indonesia and Kingston, Jamaica employ a system of

regular rate adjustments so that the real value of water charges does not slide (USAID,1992). One way to avoid the erosion of user charges is to make regular adjustments in water rates.

Public water taps present special problems for administration, not only in pricing, but also because of the difficulties encountered in preventing vandalism and wastage. Flow-limiting devices are subject to tampering and vandalism and often lead to greater wastage if malfunctions are not quickly corrected. Community participation and a sense of community responsibility for maintaining a well functioning, wastage-free system of public water taps is useful.

McMaster (1991) notes that charges are theoretically easy to assess and collect. The facility with which charges are assessed is attributed to the fact that liability is based upon measurable levels of consumption, and easy to collect because consumers receive only what they pay for, and if water bills are not paid supply can be disconnected. In practice, however, difficulties arise such as technical constraints particularly where there are problems of controlling illegal water connections and meter bypassing. As stated in chapter three, disconnection costs WASA more than if it were to ignore customers in arrears. Moreover, the political will to impose sanctions is very weak, for instance when politicians intervene to stop disconnections of water supplies to their supporters. Evictions rarely win votes.

A number of devices may be used to ensure administrative efficiency in user charges. One method is to estimate what income should be received and then impose target revenues upon collectors. Another approach is subcontract billing to commercial collectors who tender lump-sum revenues competitively. Both methods have the advantage of stabilizing revenues but can exploit the consumer. Subcontractors become monopoly suppliers and can often make exorbitant profits, standpipe water selling being a notorious case in some countries. A third practice is to engage small neighbourhood groups in the collection of charges and pay

these jointly to the service authority. This has been adopted for plot and water charges in the upgraded squatter areas in Lusaka; prompt payment is rewarded by a discount in the form of some communal improvement. It requires the selection of community leaders who have an established reputation as responsible citizens (church leaders, community organizers).

9.7 SELF-FINANCING WATER SERVICES

Financial autonomy is the ability of an entity to operate and sustain its activities for a long period based on the revenue it collects from the users of its services. Earlier chapters have made reference to the fact that WASA's financial autonomy has been undermined by political interference in rate setting and disconnection policies. The lessons of experience suggest that an important principle in restructuring water supply agencies is their conversion into financially autonomous entities, with effective authority to charge and collect fees, and with freedom to manage without political interference. Such entities need to work under a hard budget constraint that enhances incentives for efficiency and revenue generation. Of greatest importance, budget constraints unlock incentives to collect fees and to provide services that consumers want.

Self-financing water services without Government subsidies have considerable appeal for several reasons:

* There is a sense of fairness in having people pay for what they get, it avoids the need to raise revenues from other sources, and the risk of the distortions in resource allocation associated with most fees;
* It avoids the need to encroach on the taxing territory of higher levels of government and thus lays the foundation for autonomy and immunity from political interference;
* The need to rely on uncertain transfers from higher levels of government is circumvented and thus provides greater certainty and efficiency in planning investments and in operating and maintaining waterworks; and
* It encourages appropriate standards in service provision because the

beneficiaries' ability to pay cost-covering charges needs to be taken into account in designing investment programmes.

9.8 CONCLUSION

The main goals of water financing are cost recovery, revenue generation and financial autonomy. The appropriate pricing of water supply in developing countries is of importance, not only to achieve these goals, but also for economic efficiency, equity, administrative feasibility and political acceptability. In this rate debate, flat fees, which bear no direct relationship to the amount of water consumed and provision costs, are not recommended. A water rate system based on assessed property values is flawed, and as a method for cost recovery and revenue generation tends to be weak. Legal, administrative and political difficulties associated with regular reassessment of properties make the water rates insensitive to income growth and inflation. Also, even though WASA's rate structure has been devised to ensure that high income households pay more, irregular assessments and practices have made the water tariff regressive at this point. Further, consumer demand behaviour has not been modified by the current method of charging.

Five modified rules apply in attempting to reform water pricing according to Bahl and Linn (1992):

1) First, consider the design of an efficient pricing structure. Then modify this preliminary structure in a way that pursues the other goals with the least possible inefficiency;
2) Second, estimate the marginal or incremental costs of providing a service, adjusted to reflect negative externalities and social costs, and apply shadow prices if market prices are distorted;
3) Third, consider the entire structure of service charges (development, connection and user fees). When a departure from efficient pricing appears desirable for reasons of financial viability or equity, that part of the tariff structure should be selected where individual demand response (elasticity)

is likely to be least;

4) Fourth, regularly update the tariff structure to reflect changes in the general level of prices caused by inflation, as well as changes in the underlying cost structure of the service. During a period of inflation a simple monthly adjustment may be made to keep tariffs approximately unchanged in real terms. Small monthly adjustments are easier on the household budget than larger quarterly adjustments. This could be supplemented by more in-depth reviews of the structure of real tariffs at less frequent intervals, say, once a year; and

5) Fifth, collect water tariffs effectively from all users and compare costs of administration and collection against expected benefits from service charges when selecting a particular method of charging, for example metering.

It is possible to develop a framework for achieving the main goals of cost recovery, and an appropriate tariff structure. The first decision to be made in re-designing water tariffs is whether to meter consumers. Cost reductions in providing water must be measured against the cost of metering. For small settlements or those located in poor topographical conditions, it may be inappropriate to use metering because of the difficulties which may be encountered in reading and maintaining meters in these areas.

For metered residential users, a four-tiered (multi-part tariff) charging system based on a modified application of marginal cost pricing, average incremental cost pricing and the unbundling of services, is likely to be most efficient. First, a use-related charge may be set equal to the average incremental cost of water production and transmission to overcome the problem of uneven investments and price fluctuations. This charge may have a life-line tariff for the initial consumption block equivalent to a daily consumption of 20-40 lpcd to mitigate negative externalities such as public health risks. The life-line tariff may

be used along with a rising block rate to discourage over-consumption. Households with swimming pools may be charged a surcharge.

Second, residential water users may be charged a regular fee for connection that does not vary with water use. For low-income consumers this charge may be set equal to or below the sum of the marginal recurrent costs associated with a connection (meter maintenance and reading, billing etc) and the amortized cost of installing the connection, to avoid illegal connections. The extent of the subsidy to low-income households depends on the strength of the redistributive goal and on whether an internal cross-subsidy is possible. It also depends on alternative claims on the financial resources, especially for standpipes. To generate the financial resources that are needed to permit cross-subsides (such as standpipes) the regular connection fee for middle- and high-income consumers may be set at or above the marginal recurrent costs of connection. This may permit cross-subsidies, and maintain the overall financial self-sufficiency of the water operations, as the use-related charge varies over time with changes in average incremental costs. Installation costs may be charged to high-income groups on a lump-sum, capitalized basis.

Consumption charges at public taps should be free but the taps must be supervised to avoid wastage. The funds to operate the taps must first come from users with individual connections. A hierarchy of uses of funds that are extracted from high-income users for purposes of cross-subsidies should be in effect. These subsidies may be targeted first to meeting the installation of taps and providing water free of charge. Once taps are provided, the cross-subsidies can be extended to households with connections. The reason for this sequence is that in Trinidad public tap users are the poorest households, while house tap users are excessive consumers as noted in chapter 2. Subsidization of taps and of water consumption at public taps is therefore very equitable and has very little, if any, leakages to middle- or high-income beneficiaries. To reflect concerns for equity, a lifeline tariff, rising block rates and cross-subsidization may be introduced to safeguard

poor, large families from inequities, without violating economic efficiency, water conservation goals and undermining political stability.

Subsidies for water are usually based on three criteria: they are transparent, they should not create price distortions and they should be direct and focused. A water voucher may be given to poor households which would allow them to pay for water once they have been upgraded to a house tap service level. In this way households may recognize that water use involves a supply cost which must be paid. Particularly, given Trinidad's history of the water riots in the 1930s, the uprising of the economically marginalized groups culminating in the Black Power Riot in the 1970s, and the sensitivity of the poor to the structural adjustment medicine of the 1990s, special relief measures may have to be targeted to bona-fide households living below the poverty line.[6]

Third, a one-time development fee may be designed to recoup the capital cost of the reticulation network in proportion to the front-footages of privately subdivided properties. (This fee can be avoided if private developers install the network themselves). In areas of predominantly low-income property owners, it may be equitable to reduce the fee below cost and impose higher connection charges on high-income owners. A way must be found to differentiate owners according to income. If the property valuation system is accurate, a proportional property tax on residential lots with water connections may work. If property valuation is inaccurate, differential connection fees may be charged in different parts of the city.

Fourth, if prices are to reflect spatial costs differences and to serve the purpose of channeling development to where it may be efficiently accommodated then a surcharge may be implemented across areas within the city or costs may be reflected in the connection fee.

To administer the system of charges, cost benefit analysis research should be conducted and comprehensive information gathering on costs, household demand patterns and price elasticities.

One aspect of water pricing frequently overlooked by international lending agencies is the "politics of water". A lesson from many developing countries undergoing structural adjustment is that the political ramifications of the recommended tariff structure must be considered. Often, the opaqueness of pricing policies (particularly water), and the failure to prepare the population for changes in tariffs result in protests. The way to accommodate political goals and promote efficiency is to work strategically, phasing projects so that benefits can be observed more or less simultaneously with increases in tariffs. This builds support and lessens resistance to rate hikes. The importance of timing also needs to be stressed. If officials decide to increase fees, they can only gain public acceptance if they show quick results. Much charging is highly sensitive, but if users see a necessary connection between price and quantity and quality of service, they are likely to accept the system of user charges and moreover, will exert pressure on managers and politicians to increase production efficiency.

A number of other problems must first be addressed by WASA, if a newly designed tariff is to be implemented:

* Many people have come to accept past practices as a norm, particularly if services have been free or highly subsidized. Subsidized services may have come to be accepted as a right people are not willing to give up easily. Matters are often complicated because subsidies have been capitalized into property values, or because people expect continued subsidies, and have locked themselves into location or investment patterns which may difficult to be reverse in the short term;

* The perception of unfairness, which occurs when a new pricing system requires payment for services which were free or heavily subsidized; and

* Failure to operate services efficiently and to charge effectively for them, often makes the agency providing the service financially weak, which in turn leads to poor service.

It is necessary to work simultaneously at all aspects of water service provision: to introduce measures that improve production efficiency, including those that improve the institutional framework, and incentive system for managers, and gradually to implement a pricing system which provides a reasonable balance of efficiency, equity, financial and administrative feasibility, and political acceptability. Such intervention is not easy; the fact is that it is not always possible to know the most desirable trade-offs.It may entail difficult matters of judgement. Even when these steps are taken, implementing the "right" decisions may be painful and call for political will of a high order.

END NOTES

1. Riots have occurred in Venezuela, Brazil, Jamaica and other developing countries which have increased tariffs on "public goods" as part of structural adjustment measures recommended by the International Monetary Fund.

2. Evidence of the inverse relationship between price and water demand is well documented by Hanke (1978), Grima (1972), Kellow (1970) and Howe and Linaweaver (1967). Kellow (1970) for example, found that water use in the unmetered, flat areas of Calgary was substantially higher than water use in the metered areas of similar size and geographic characteristics where prices were based on volume of water usage.

3. WASA gives domestic consumers the option to meter, but many do not accept metering, fearing that it may lead to higher prices.

4. In Cali, dry period declines in the water source serving high-lying areas led to seasonal pumping requirements and doubled short run marginal costs (Linn,1976b). In Lahore, additional pumping requirements during the peak season caused marginal peak consumption costs to exceed marginal off-peak consumption costs by about 40% (Turvey and Warford,1974).

5. In the 1970s, severe drought in Kingston, Jamaica required water rationing by charging higher water prices.

6. A study on the percentage of Trinidad's population living below the poverty line was conducted by Dr.Ralph Henry in 1993 and should form a useful basis for formulating and targeting lifeline tariffs and special assistance programmes.

CHAPTER 10
COST REDUCTION IN WATER PROVISION

Although, the Water and Sewerage Act Chapter 54:40 states that WASA's mission is to "provide an adequate, reliable, potable water supply, to effectively collect, treat and dispose of wastewater and to promote conservation and effectively manage the country's water resources--all at reasonable costs", it has almost ignored ways of lowering costs, because it has always received grants from Central Government. However, the issue of cost reduction is as equally important as cost recovery. Indeed, many critics of WASA are of the view that there is no justification for raising water tariffs, if efforts are not first explored to reduce water provision costs.

10.0 OBJECTIVES

This chapter has a three-fold objective; (1) it identifies water provision costs; (2) it discusses the use of costs minimization approaches, and (3) it examines the policy implications of their adoption.

10.1 WATER PROVISION COSTS

The four main costs of water provision are those associated with capital, operation and maintenance, distribution, and the environment.

10.1.1 CAPITAL COSTS

The leading contributors to high capital costs are excessive demand and inaccurate demand forecasting. Some agencies try to meet growing usage through capacity expansion, but it has become more difficult and expensive to develop new sources, or expand supply from existing sources. As earlier noted, research by Bhatia and Falkenmark (1993) revealed that the real costs of water per cubic meter, in second and third generation projects are doubled between the first and second project, and then doubled again between the second and third.

The conventional determination of "demand" is also a major contributor to rising capital costs (Garn,1994). The two central ideas which drive the definition of demand, as it is customarily used in the sector, are "requirements" and "need". The assumption is that if certain activities are to be effectively undertaken (for agricultural, industrial and household purposes), they will need a more or less fixed quantity of water, of a fairly well-defined quality, at a certain time. Although it is recognized that ese parameters differ by type of user and, to some extent, within user categories, the current demand for water is assumed to be largely determined by the number of users of different types, and future demand by the projected rates of growth of each type of user, allowing for increases in per capita use. The usage requirements are then derived from these estimates. In practice, the estimated capacity requirements for the supply organization include an additional allowance for water that is not accounted for in sales, or other recognized deliveries to users ie UFW. The resulting total is described as the aggregate demand for water.

Demand estimates using these procedures, very frequently exceed the actual pace of growth of sales, plus unaccounted for water (UFW), for a much longer period than expected. Garn (1994) believes that if investments were closely tied to more accurate demand forecasts, the investment cost saving may be in the order of 20% on average. Further, he contends that if new investments were more closely tied, in addition, to effective UFW reduction programmes, the investment cost savings may be in the 25% to 30% range; while still taking into account the legitimate need for advance planning, and the likelihood of periods of excess capacity, due to the lumpiness of investment.

10.1.2 OPERATION AND MAINTENANCE COSTS

Fox's (1994) research on managing urban infrastructure revealed that maintenance tends to be under-provided by many public agencies. His argument is that, because officials prefer to concentrate on visible construction, user demand is not always the focus. Furthermore, he takes the position that political

leaders are often short sighted, focusing on agency costs during their tenure in office, rather than on life cycle costs of the facility. WASA is the classic case where a poor history of proper operation and maintenance, imposes higher long-run costs. Chapter three also provided detailed information on how poor pipe laying techniques contributed to UFW.

As stated in chapter three, operation costs are also high due to overstaffing, with an estimated 59% of total operating costs accounted for by wages and salaries. WASA has a very high ratio of 16 to 18 workers per 1000 connections. Recent efforts to downsize its labour is a step in the right direction, but it also awarded salary increases for workers kept on board, which may keep costs high.

10.1.3 DISTRIBUTION COSTS

The United Nations Centre for Human Settlement (1984) reported that the cost of a water distribution system normally accounts for between 50% and 70% of total water supply costs. Studies done in the 1980s by Lauria and Herbert (1984) discovered that it is the length, rather than the diameter of the pipe, which is a major determinant of distribution cost. Urban planners have also long contended that the cost of distributing water is affected by urban sprawl, low population density, topographical constraints, and inappropriate service standards, and technology.

* **URBAN SPRAWL**

Urban sprawl refers to the development of urban peripheries characterized by scattered low-density development. In adjusting to the untamable land market in the Capital Region, residential development has sprawled out to new areas which are outside the water distribution network, and are expensive to service. The new sources of water supply needed to meet the demands of these growing urban areas are located at increasingly farther distances and/or more difficult

abstraction sites. The large distances between urban centres and major sources of water supply increases long-run marginal costs of water services.[1]

Inefficient property tax policies have also encouraged urban sprawl. For example, the annual rental value property tax system used in Trinidad does not discourage landowners from keeping vacant land. At present, local municipalities impose a low tax on vacant land and buildings. The reasons given for favourable treatment of vacant land are that land not yielding income should be exempted from property taxation, and that since vacant land receives no services, it should have no liability. However, neither of these arguments stands up to scrutiny. Patches of vacant land increase the costs of infrastructure that must bypass them, and the value of vacant land represents capitalized income (Bernstein, 1994).[2] For example, a vacant lot in an area which is provided with infrastructure unavoidably imposes costs on the service facilities; distribution networks need to extended to and beyond the property, and excess capacity must be created to allow for future demand resulting from the expected development of empty lots.

Another contributor to sprawl is the land registration and transfer system which is so convoluted and costly in Trinidad, that it encourages low-income households to squat in peripheral areas.[3] The transfer of land rights is a very unwieldy procedure and the registration and recording systems make the establishment of title very difficult. The registration of land in Trinidad is achieved through a 16 step process, and to transfer a single plot of land costs about TT$6000 to TT$8000 (Chung, Glenn and Wolfe, 1992).

* **POPULATION DENSITIES**

Density makes a tremendous difference in the distribution costs of water. Densely populated areas are cheaper to service than low density areas because less needs to be spent on the distribution or connection network, per consumer or per connection. Subdivision layout and lot size have measurable effects.

In three case studies (India, US and Jamaica) there was almost a one for one reduction in cost with reductions in the per dwelling unit land requirement; 50% less land per dwelling unit, implied 50% reduction in overall cost (USAID,1991).

* **TOPOGRAPHICAL CONSTRAINTS**

Topographical constraints increase water provision costs, especially where urbanization occurs on steep slopes. The National Physical Development Plan of Trinidad and Tobago (1984) and the Capital Region Plan (1975) prohibit development above the 300 foot mean sea level contour line and on slopes steeper than 1 in 6, to ensure watershed protection through the containment of settlement expansion into the Northern Range. Both plans also recommend reafforestation of hillsides above the 700 foot contour line in some valleys. However, the 300 foot regulation is largely ignored, and thus expensive capital outlays and operating costs are incurred, because booster pumps are required to raise water to settlements located in the steep Northern Range.

* **DEVELOPMENT STANDARDS**

Unrealistic, rigidly applied development standards also make water provision costs higher.[4] Hosein's (1989) study of Trinidad shows that the cost of providing water in an informal development of 450 lots (each lot is 500 square metres) is TT$406,000 compared to TT$635,000 in a formal development where conventional standards are adopted. Another study by the Trinidad Task Force on Housing and Settlements (1992) also suggests that a 50% reduction in the average lot size (from 5000 to 2500 square feet) reduces the development costs per lot by about 40%, and narrow lots are less expensive to service than square lots.[5] Further, standards for squatter regularization projects are too high, resulting in high infrastructure costs. Wolfe and Glenn's (1994) study of land provision for housing in Trinidad noted that the minimum lot size in a squatter regularization programme is 5000 square feet and water charges are $83.33 per month ($250 per quarter) (See Appendix 10.1).

TECHNOLOGICAL CHOICES

Appropriate technology may be defined as a method that provides a socially and environmentally acceptable level of service with full health benefits, and at the least economic cost (Kalbermatten et al,1980). The operational definition incorporates long-run benefits and costs by using life-cycle costing, and paying particular attention to the technical potential for upgrading each alternative as the incomes and aspirations of users grow over time.

In 1984, three separate studies were commissioned by the World Bank to reduce the costs of using inappropriate technologies for water distribution. In the case study done by Lauria et al (1980), the cost of designing a full network, but delaying house connections until needed was US$158,700 compared with US$32,500 for laying an initial network to serve standpipes, which could later be extended to serve house connections. They concluded that laying the whole network from the beginning increases expenditure significantly, without achieving corresponding benefits to the undertaking in the form of increased revenues.

10.1.4 ENVIRONMENTAL COSTS

One of the serious environmental and economic costs of excessive urban development is saltwater intrusion resulting from the over-extraction of groundwater.[6] Once saline waters intrude, deterioration of water quality may persist for years, long after the initial cause is removed (Baldwin,1985). As little as 2% saline intrusion may make an aquifer unusable, and an even lower percentage may place the future use of an aquifer as a drinking water supply source seriously at risk (Parker,1992). The groundwater quality in Trinidad is generally within the limits set by the World Health Organization for potability, and in many instances, notes the Water Resources Agency (1990), water from groundwater sources requires only disinfection before being put into the distribution system. Coastal aquifers are especially well-managed and closely monitored by use of coastal observation wells, from which quarterly water quality analyses are effected, in a continued effort to prevent sea-water contamination of

the aquifers. But some wells in the Northwestern Peninsula of Trinidad (specifically the Diego Martin Valley) were affected by saline intrusion due to over-extraction to meet the rapidly growing population needs of the area. The wells have had to be abandoned to eradicate the problem (Water Resource Agency, 1994). Moreover, there are threats from the use of agricultural chemicals and wastes from poultry and livestock which if unregulated may leach into the groundwater. Eutrophication of water courses is accelerated by the run-off of fertilizers from agricultural land. These pollutants are hard to remove from drinking water with standard purification facilities. It requires more investment in water purification facilities and makes water supply more costly.

Other threats to water sources arise from urbanization. Urbanization, manifested by squatting in steep areas results in the destruction of vegetation causing rapid surface run-off, decreased recharging of groundwater aquifers and increased sedimentation in surface water. Water treatment plants located along river courses are subject to a high sediment load which causes fouling of water pumps and other equipment, thereby interrupting supplies. It seems ironic that at a time of increased availability of water in the wet season, production of potable water from various water treatment plants is at a low, as a direct consequence of a high sediment content. To combat this, costly chemicals and equipment are purchased for the treatment of turbid water. The Water Resources Agency points out that while much of Trinidad's watershed area is "in-tack", as is seen from aerial photographs of the area, slash and burn agriculture is spreading. If uncontrolled, it has the greatest effects in the shortest time on the watershed and water supply.

Piped sewerage systems in urban areas greatly reduce the risks of groundwater pollution, but lead to increased pollution of surface water, unless the sewage is treated. The existing sewerage system serves only 30% of the total population, and covers limited parts of urban areas in Port of Spain and adjacent suburbs, as well as Arima and San Fernando. Package wastewater treatment

plants were constructed in housing developments in the Capital Region. However, most of these are without regular maintenance, and wastewater from these communities is discharged without treatment into surface water courses, which drain into the Caroni River and result in water pollution (WASA,1994). Further, the use of septic tanks and pit latrines by most of the remaining population (70%) may cause contamination of groundwater aquifers which have a limited self-cleansing capacity, making purification costs higher.

Scientific testing done by Chan Yeng (1993) showed that some lead contamination does exist in some river courses close to the Caroni Arena Dam. A toxic substance such as lead persists for quite a long time.[7] As noted by Nurse (1994), there are critical gaps in Trinidad's legislation governing pollution control. She points out that the Pesticides and Toxic Chemicals Control Act No.42 of 1979, as amended by Act No.11 of 1986, is still incomplete.

Additionally, the construction boom of the 1970s and early 1980s placed high demands on building materials. However, the growth of the quarrying industry operating mainly in the Northern Range led to poor practices of washing gravels in the river beds and no rehabilitation of the quarried sites with vegetation. Consequently, excessive surface run-off and accelerated sedimentation have destroyed some water catchment areas in the Northern Range.

While the quality of raw water at the majority of the large and medium scale production facilities is adequate, the quality of the raw water diverted to the Caroni-Arena treatment plant is less desirable, since it is pumped to the plant from a contaminated reach of the Caroni River. The multi-media filtration bed at the Caroni plant includes a layer of activated carbon, whose function is removing toxic organic micro-pollutants, but the activated carbon bed in the filters has not been regenerated. Sammy (1993) in an interview stated, that it is most probable that the treated water contains elevated amounts of toxic organics and bacteria, over and above acceptable standards.

Large dams built to serve rapid urbanization also have major environmental impacts that cannot be mitigated, such as the loss of habitat, loss of fertile bottom lands, destruction of forests, and sediment trapping, in addition to the social impacts of moving large numbers of people from their homes and farms. Sammy (1993) revealed that the building of Trinidad's Caroni Arena Dam to meet accelerated demand arising from urbanization, involved resettling landowners and farmers in new areas with compensation, and that the social costs of relocation were high. However, Sammy contended that it was a matter of *"dammed if you do, dammed if you don't"* where building the dam was concerned.

10.2 POLICY APPROACHES

Some of the costs identified above are the result of poor management decisions made by WASA, while others are related to factors external to WASA. There are three approaches to cost minimization; traditional supply management; regulation (command and control), and the market-based (incentive) approach. These are discussed in the following section.

10.2.1 TRADITIONAL SUPPLY MANAGEMENT APPROACH

The costs of unaccounted-for-water may be tackled internally by WASA through appropriate traditional supply management approaches.

A traditional approach which may be used to reduce the size of future capacity expansion and costs, is the introduction of programmes to reduce unaccounted-for-water (UFW). Where 50% of the water produced is not sold, the potential savings are enormous. World Bank (1993) studies showed that a reduction in UFW from an average of 35% to 20% could result in a reduction of new capacity requirements of about another 10% to 12%. A feasibility study to determine methods of leak detection in Trinidad conducted by Thames Water International (1991) revealed that the average unit operating cost of leakage was TT$0.1260 per cubic metre and the average unit capital cost of leakage was

TT$0.1102 to TT$0.1554 per cubic metre. The estimated total unit cost of leakage was TT$0.2362 to TT$0.2814 (See Table 10.1).[8] The study revealed that with an assumed level of 50% leakage, WASA loses TT$33 million per annum. The introduction of a 10 year (from 1991 to 2001) leakage control strategy was expected to result in a total net present value saving compared with the present practice of TT$190 million. The potential gains from reducing UFW, with existing capacity, are not only in reducing the size and extending the timing of new capacity; but also in providing the utility with additional revenues and the ability to extend service to new customers.[9]

Table 10.1 Costs of Leakage in Trinidad

Unit Operating Cost of Leakage	TT$0.1269 per cubic metre
Unit Capital Cost of Leakage	TT$0.1102 to TT$0.1554 per cubic metre
Total Unit Cost of Leakage	TT$0.2362 to TT$0.2814 per cubic metre

Source:Thames Water International 1991.

Another supply management approach is reductions in water pressure, which may be made by selecting and isolating a pilot area, and monitoring the effect by meter. Pressures and resulting leakage frequently increase at night and reductions in night pressures may be achieved by simply installing in-line pressure reducing valves, without significantly reducing daytime pressure necessary to ensure continuous supplies.

10.2.2 REGULATORY APPROACHES

The regulatory approach is another way of reducing total water costs. According to Garn (1993) regulatory approaches mandate altered behaviour, and backs them up with enforcement procedures, usually implemented by government (mandated, command and control, or compulsory incentives). The most commonly used mandated or compulsory instruments are: (1) user quotas and other rationing devices, for example universal metering; (2) required installation of water-saving technologies; (3) land use zoning regulations; (4) development

standards; (5) pollution control through effluent standards imposed at the household or firm level.

* METERING

Compulsory universal metering coupled with a well-designed tariff structure achieves the following:

* Reduces water production, operation and maintenance costs by lowering demand;
* Improves the capacity to monitor water production, consumption and sources of leakage;
* It reduces costs associated with non-price rationing when capacity constraints cause service interruptions and low pressure; and
* Defers investments in the expansion of the water supply system.

Studies of water savings associated with metering in the United Sates have found that households in metered single-family residences use from 20 to 45% less than those paying a flat rate (Brown and Caldwell,1984). In Canada, Loudon (1986) found that metering alone reduced municipal water use by 15% to 20% over pre-metering levels. A pilot survey of 46 metered domestic users in Trinidad over two year period also revealed that average consumption decreased (JICA,1991).

Metering is very politicized in many countries and it is one of the reasons for deferring its introduction in Trinidad. Katko (1993) argues strongly for water metering, using the line of argument that the introduction of comprehensive metering is expensive, but its share of investment costs of the total water system is quite small. Even where metering is carried out, however, inadequate testing, meter reading and maintenance continue to be severe problems in many developing countries.[10]

The cost of introducing meters may need to be evaluated against the

lowering of production costs and demand reduction. Delcan (1992) estimates that the total cost of installing a residential meter per household in Trinidad is TT$900 (See Appendix 10.2). The total cost of metering all households in 1992 would have been TT$2.6 billion. The projected cost of meter testing, maintenance and repair is TT$3 million per annum.

The study of metering done by Delcan (1992) showed that if metering is not implemented, expansions of 150 mega litres per day (mld) would be required immediately, and 100 mld by the year 2000 to meet projected demand of 581 by the year 2010. With metering, domestic demand was expected to decrease and is projected at 336 mld by the year 2010. Deferred investment in expanding supply capacity is an estimated TT$12 million if these expansions can be delayed due to metering. Using metered charges for residential users in 1992, Delcan projected that net revenues would be TT$1.55 billion over the period 1992 to 2010. For WASA to make enough revenue to cover the cost of metering, water tariffs would have to increase.

* **LAND USE REGULATIONS**

The enforcement of land use regulations which discourage spatial fragmentation (vacant spaces) between neighbourhoods (ie sprawl) is recommended because a reduction in the lengths of distribution networks lowers water provision costs. The National Physical Development Plan of Trinidad and Tobago (1984) and the Capital Region Plan (1975) promote high residential densities in newly developing areas and existing built-up areas. The NPDP (1984), for example explicitly states that the adopted spatial development strategy for Trinidad is one of "dispersed concentration". The aim of such a strategy is to decongest the Capital Region, alleviate diseconomies of scale, and secure the economies of agglomeration by developing selected growth poles outside of the major zone of concentration (See Fig 10.1). The Capital Region Plan also promotes in-filling and intensification in urban areas which increases the density of development, and lowers the costs of infrastructure provision. The strict

enforcement of regulations governing the density of development is recommended.

Focusing urban expansion in zones whose physical features permit lower development costs (i.e avoiding zones with steep/rugged terrain, bad natural drainage, or bad access to water sources) is also suggested. Stronger land use zoning laws are needed to protect Trinidad's watersheds and to prevent contamination which would obviate the need for high costing purification techniques.

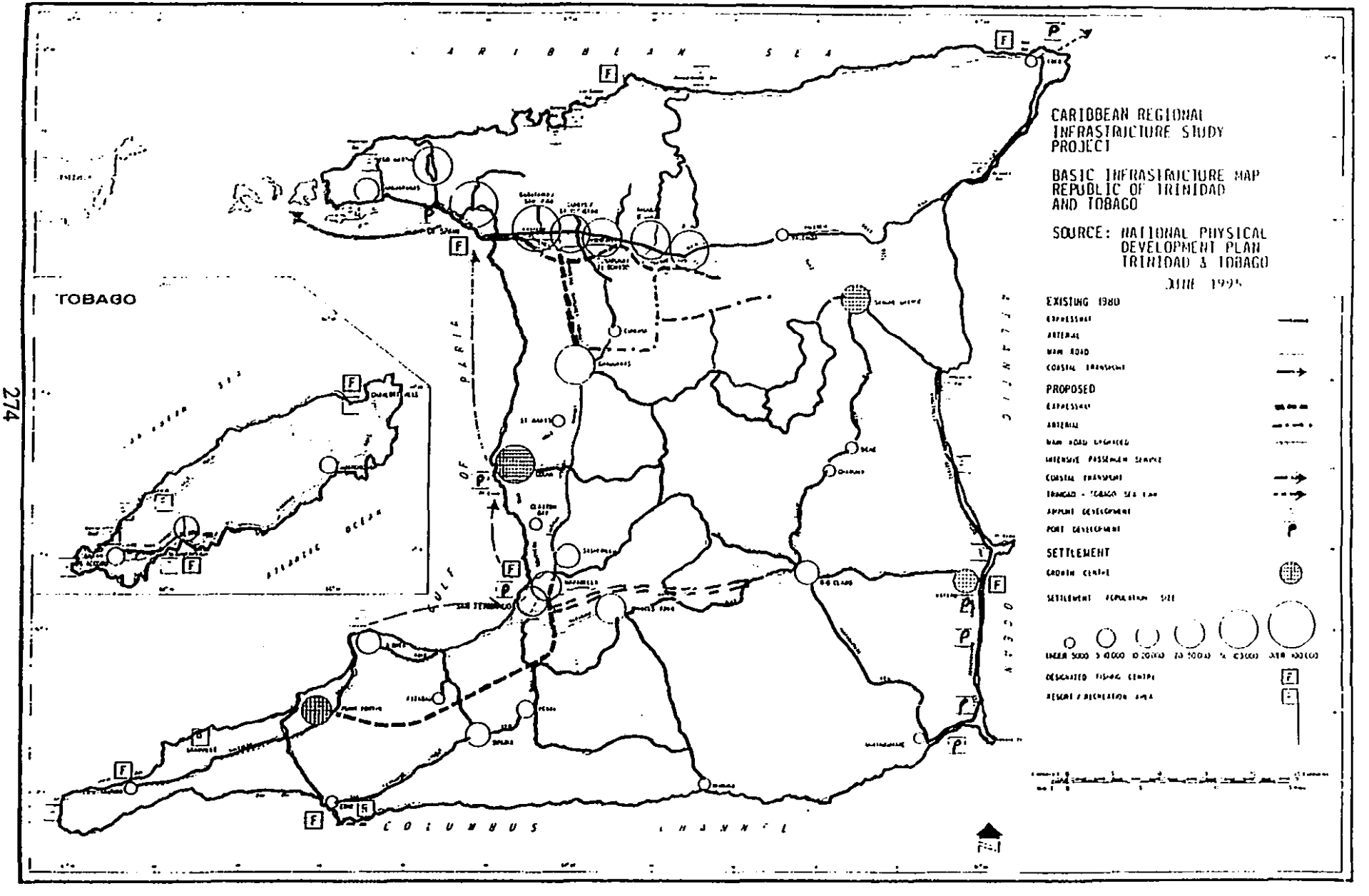
* **LAND TENURE REFORM**

Providing land title to residential and agricultural squatters may also help reduce damage to the forests and watershed areas of Trinidad's Northern Range. There is a need for policy reform of inappropriate land tenure systems that hinder effective land use or lead to over-regulation of land markets which force the urban poor to occupy marginal lands. A critical assessment of procedures and mechanisms for access to land, land registration and land development is important.

* **DEVELOPMENT STANDARDS**

Service standards in poor areas are unrealistically high. The first strategy in bringing the costs of service provision within the payment capacity of the poor is to lower their economic cost. A study in Jamaica found that bringing water to the lot line where access is shared by four homes, and reducing standards for depth of water pipes, lower costs of finished sites for low-income development by more than a third (USAID,1992). The number of people queuing to purchase such sites was much greater, indicating that the cost savings were worth more to purchasers than the reduction in service standards.

FIGURE 10.1 GROWTH CENTRE STRATEGY OF TRININDAD AND TOBAGO



The objective of appropriate standards is to avoid on the one hand an unsatisfactory service or failure of service, and on the other hand to forestall excessively expensive equipment, design or procedures imposed by misdirected efforts to produce a high quality service. An overriding consideration is to decide upon ones which take into account questions of affordability "while not compromising on the function, purpose and serviceability of a development" (Quadeer,1989).

* REGULATORY INSTRUMENTS TO CONTROL ENVIRONMENTAL COSTS

A plethora of regulatory instruments exist to reduce water pollution. These include effluent control standards, environmental performance zoning, subdivision regulations, planned unit development regulations, buffer zones, density bonuses, housing codes, construction permits, transferable development rights, hillside development regulations, grading regulations, soil erosion and sediment control ordinances, septic tank ordinances, land conservation policies and discharge permits (See Table 10.2).

Common regulatory instruments for ground and surface water pollution control include specifically ambient water quality standards (AWQS), effluent standards, product standards, and permits and licenses. AWQS sets the designated use of the water and identifies the maximum concentration of various pollutants that would not interfere with that use. However, the enforcement of AWQS may be very difficult where there are multiple polluters and no one source emits enough pollutants to cause a violation. Water pollution by industries may be controlled by imposing effluent standards. Effluent standards use such parameters as biological oxygen demand (bod), chemical oxygen demand (cod), ph, temperature and heavy metals, and take into account factors such as age of industrial equipment, facilities involved, process employed, process changes, engineering aspects of control techniques, environmental impact, and the balance between total cost and effluent reduction benefits. Failure to comply with

Table 10.2 Water Problems, Impacts and Mitigation Measures

Surface Water Pollution	Problems/Impacts * Health Problems * Economic Costs (additional treatment, new sources of supply, health costs) * Amenity Losses	Causes of Problems * Pricing Policies * Unclear Property Rights * Poor Regulations and/or enforcement * Industrial waste disposal practices * Run-off from urban areas * Irrigation practices	Mitigation Measures * Marginal Cost Pricing * Regulations, standards,licensing, charges * Improve monitoring and enforcement * Demand management and wastewater re-use * Appropriate Technology * Land Use Controls
Groundwater Pollution and Depletion	* Reduced water quality from saline intrusion, biochemical seepage * Health impacts * Economic costs (health costs, increasing marginal costs of supply, land subsidence)	* Pricing policies * Unclear Property Rights * Poor Regulations and/or enforcement * Industrial waste disposal practices * Run-off from urban areas * Irrigation practices * Poor demand management	* Marginal cost pricing (sustainable extraction,aquifer recharge costs) * Regulations, standards,licensing, charges * Improve monitoring and enforcement * Demand management and wastewater re-use * Appropriate Technology * Land Use Controls and sources of contamination

Source:Adapted from Bernstein,1994.

specified effluent standards should result in legal action to fine or close the plant. However, a lengthy judicial process, manpower and equipment shortages to monitor violations would need to be resolved.[11] Product standards may also be used to limit the amount of toxic substances and polluting products that may be discharged into surface water such as detergents, fertilizers, insecticides and pesticides. Permits and licenses are also useful in regulating potential water pollution. In Trinidad, the Water Resources Agency issues water permits and licenses for groundwater extraction by industrial users, which are subject to renewal annually. This allows for pollution discharges and the rate and total

extraction to be monitored. Moreover, discharges should be required to maintain records and to carry out effluent monitoring activities.

10.2.3 MARKET-BASED APPROACH

The market-based approach creates incentives for users and others to take appropriate actions to conserve water voluntarily and help reduce costs. The most important of the market-based instruments are: (1) water pricing and surcharges, already discussed in previous chapter; (2) financial incentives for the adoption of water-saving technologies; (3) pollution charges; (4) extraction fees for groundwater exploitation; (5) land and property taxation; and (6) rules to encourage utilities to become commercially viable (See Table 10.2).

* FINANCIAL INCENTIVES AND WATER SAVING TECHNOLOGIES

Water conservation, is now considered by water agencies and the World Bank as a major alternative to supply expansion, and one of the most economical ways of meeting increased demand. Many supply expansion projects offer only temporary and expensive solutions and, more often than not, much of the additional water supplied is lost, wasted, or polluted.[12] A new water conservation ethic may need to be encouraged which adopts the golden rules of reduce, reuse, repair and retrofit.

Wastewater recycling is one way of minimizing water costs. The main sources of water for recycling come from stormwater, sewage and industrial wastewater. Recycling water for irrigation is widely promulgated by conservationists. It however, begs the question of water quality control standards. Since the reuse of water has environmental and health implications, effective monitoring and quality control is essential.[13] Sewage use for irrigation in Trinidad may be met with some public resistance because culturally it may be unacceptable. However, recycled stormwater may be appropriate for irrigational purposes.

In the case of industrial water use, water savings are achieved by recycling industrial waste, by reusing some of the wastewater, and through the replacement of water-cooling processes in industrial operations with air cooling. Studies in China showed that a variety of conservation strategies resulted in saving 33% of total industrial water use (Hufschmidt et al ,1987). Israel has also been particularly been aggressive in the reuse of wastewater, with about 65% of total municipal and industrial effluents reused, primarily for irrigation of limited industrial crops (Schwarz,1992). The cost of saved water would be substantially less than the incremental cost of water from the next planned expansion--with most of the saving coming from activities which would only cost about half of the expansion cost.

Water saving devices also reduce domestic consumption and lower costs. Robinson (1980) reported a 20% drop in water use in households using water-saving devices in Waterloo, Ontario. Research conducted by Friedman et al (1993) shows that a 45% reduction in water consumption per person in Canada leads to an average saving of $37.37 per year per person. Off-the-shelf technology exists in developed countries to reduce household water consumption by 50% with no detectable changes in lifestyle for the users. For instance, inside the home, the main area of consumption is the bathroom, which accounts for 70% of domestic use (See Table 10.3). It is estimated that flush toilets use 175 litres of water per day. As Table 10.4 shows new, efficient low-flush toilets are available which use between 50% and 80% less water per flush. If old toilets cannot be retrofitted, then the installation of commercial "toilet dams" may reduce water by 25% to 40% (Environment Canada,1992). One toilet already in use in Western Europe uses 6 litres for each flush, against the usual 19 to 27 litres (Urban Edge,1991). Singapore has also introduced water-saving technologies such as regulators on taps that reduce flow, pressure regulators, automatic taps and specially designed toilets.

A more important question is whether these technologies are affordable to households in developing countries. If asked, the majority of builders would say that water efficient fixtures are prohibitively more expensive, and impact on affordability. But Cook (1993) claims that this is no longer the case, in the light of a variety of water efficient fixtures and equipment now available at little additional cost. However, Cook's appraisal is based on the Canadian experience, and may not hold true for developing countries, because the technology may have to be imported and paid for in hard currency.

Tuscon and Los Angeles offer incentives in the form of $100 for each standard toilet replaced by the water-saving type of toilet. The Slow the Flow Programme in Tuscon was successful, cutting water used for toilet flushing by 30,400 litres each day. However, conservation sometimes impacts negatively on water costs, as illustrated by California, where because usage dropped so dramatically in many places, each litre had to bear a much larger share of fixed costs, and ardent conservationists often found that all their efforts earned them was higher water bills (National Geographic,1994).

Dual water systems and "grey water" systems offer other alternatives for reducing domestic water demand. Dual water systems are made-up of two separate sets of piped water supply:one potable for drinking, cooking, and other functions that require the highest water quality; the other sub-potable to serve system that collects wastewater from clothes washer and showers for use in flush toilets or lawn irrigation that may operate on low water quality. Examples, of dual-supply systems serving domestic purposes are known in Hong Kong, Japan, Singapore, and California. Haney and Hagar (1985) reported a 39% water saving in a house retrofitted with a grey water system. In the case of Trinidad rainwater from roofs may also be used as a dual water system for lawn irrigation, house cleaning and washing cars. Tax reduction incentives may be offered to households keen on reducing demands on the supply system through the use of recycling water.

TABLE 10.3 WATER USE IN CONVENTIONAL SINGLE FAMILY HOUSE

Toilet @ 20 litres per flush * assume 5 flushes per person per day	=300 litres per day
Shower @ 20 litres per minute *assume one 6 minute shower per person/day	=360 litres per day
Bathroom Faucet @ 13.5 litres per minute * assume 2 minutes of use per person/day	=81 litres per day
Kitchen Faucet @ 13.5 litres per minute *assume 5% of indoor use for cooking and drinking	=54 litres per day
Dishwasher @ 40 litres per load *assume 2.25 loads per person per week	=39 litres per day
Clothes Washer @ 225 litres per load *assume 2.25 loads per person per week	=216 litres per day
TOTAL INDOOR USE PER DAY (with conventional fixtures)	=1050 litres per day

Sources: Friedman et al (1993) & Gates (1993)

Table 10.4 Water Saving Devices For Homes

Device	Consumption per Unit (litres)	Water Saved litres per day per capita
Standard Toilet	20-28 litres per flush	
Water Saving Toilet	6 litres per flush	70
Standard Shower Head	20 litres per minute	
Flow Restricting Shower Head	10 litres per minute	63
Standard Kitchen faucet	14 litres per minute	
Water Saving Kitchen Faucet	8 litres per minute	4
Standard Bathroom Faucet	14 litres per minute	
Water Saving Bathroom Faucet	2 litres per minute	23

Source: Friedman et al (1993).

* REDUCING POLLUTION COSTS

Tate (1990) is of the view that at the root of water pollution is an economic problem, the result of a legacy of failing to recognize the value of water resources to industry for waste removal and to price these resources accordingly. He advances the argument that economic incentives against industrial

pollution may be established so that companies have an incentive to control their effluent at the source. Effluent charges such as the use of the performance bonds may be effective in the management of surface and groundwater pollutants, help lower demand, and reduce administrative monitoring costs.[14] Tate is of the opinion that the well-entrenched viewpoint, that effluent charges constitute a "licence to pollute", is no more true than it is for any other administratively mandated control scheme, and public agencies will continue to be hamstrung in the industrial control field if they give continue to give credence to this myth. Revenues collected from these charges may be used for treatment facilities and to defray administrative costs associated with enforcement. Industry may choose to pretreat its waste, improve housekeeping, change either the production process or products, or it may choose to pay the effluent fee. Tate (1990) takes the position that pollution control costs are mere fractions of one percent of the value of industrial shipments, and as such constitute largely insignificant considerations in corporate balance sheets.

10.3 SUMMARY AND CONCLUSION

While cost reduction strategies have been deferred in Trinidad due to a lack of political will, the crisis of water rationing warrants greater attention. Three main management approaches in terms of costs and effectiveness are relevant to Trinidad's local conditions at this point in time; (1) the traditional **supply management** aimed at the reduction of unaccounted for water; (2) demand management through marginal cost pricing, which (a) uses for domestic consumers a combination of lifeline tariffs, increasing block rates and universal metering, in tandem with public education on water conservation, and (b) uses for industries effluent charges, permits and licences for groundwater extraction; and (3) regulation of land use and development standards (particularly those which accommodate incremental upgrading in low-income settlements), land tenure, and land and property taxation reform. Later on, when capacity building is well in train, other more sophisticated measures such as financial incentives for the installation of water saving technologies may be introduced. However, agencies

involved in the process of cost reduction may require legislative empowerment to do so.

A combination of approaches which may be undertaken simultaneously is needed to resolve the deficiencies and liquidity problems encountered. Garn (1993) puts it very succinctly in one sentence "It is good to be able to respond quickly to crisis, but it is even better to have some institutionalized means of averting them". The agenda for reform is a large one. Accepting the challenge to accelerate cost reduction may involve substantial shifts in policies and priorities, and may be costly. Failing to accept it, may be more costly still.

END NOTES

1. Several Asian Megacities are located great distances from water sources which incur heavy costs to supply agencies. Water must be pumped over a distance of 1,000 metres into the Valley of Mexico, to supply Mexico City.

2. Dillinger's (1992) research revealed, that the opposite treatment of vacant land is found in Latin America, where land is taxed more heavily if it is vacant, than if it is built upon. In the state of Yucatan, Mexico, for example, the rate on vacant land is 2.5 times the rate on built property. In Rio de Janeiro, the rate on vacant land in the wealthier southern zone of the city is 7% of market value, or 26 times the rate on built property. Such surcharges on vacant land appear to be designed to discourage speculation and to induce landowners to develop property they would otherwise hold vacant.

   In Quebec's municipalities, a surtax equivalent to 50% of the total municipal real estate taxes levied, can be imposed and collected annually on serviced vacant land (Ministry of Municipal Affairs, Government of Quebec,1993). For municipalities located in the territory of the Communaute urbaine de Montreal, this surtax may represent up to 100% of the total real estate taxes and be levied on vacant land (serviced or not). Under these conditions, the tax rate on serviced vacant land must exceed the rate applicable to unserviced vacant land.

3. An estimated 13% of Trinidad's population is made up of squatters according to PADCO,1993, while the Ministry of Housing's figure is 20% for the whole country.

4. For details on infrastructure costs associated with conventional and alternative development patterns in the Canadian context see Appendix 3 which provides cost comparisons of residential developments which differ by density and layout.

5. Quadeer emphasizes that the issue of the appropriateness of standards is not limited to developing countries. In 1976 Ontario, Canada sought to reduce land costs by reducing the average single-family lot size from 5490 to 3014 square feet (510 to 280 square metres) and trimming water, sewers and drain requirements accordingly.

6. According to REIC (1991), in a number of regions in Canada, the rate of water withdrawal has outstripped of groundwater aquifers' natural recharge rates, a situation that threatens to become commonplace in the coming decade.

7. The dumping of car batteries on sites close to rivers in Trinidad poses a serious threat in the form of toxic lead pollution according to an interview with Dr.Ivan Chan Yeng, Chemistry Lecturer at the University of the

7. The dumping of car batteries on sites close to rivers in Trinidad poses a serious threat in the form of toxic lead pollution according to an interview with Dr.Ivan Chan Yeng, Chemistry Lecturer at the University of the West Indies, St.Augustine.

8. According to Thames Water International (1991) a reduction in leakage levels would result in a reduction in the quantity of water pumped, treated and boosted. The methodology used in the Trinidad study calculated costs for each of the treatment works and pumping stations by summarizing their energy and chemical costs for a 12 month period and dividing by the quantity of water supplied over the same period. Operating costs were calculated by assigning electricity charges for 1990 direct from the electricity company's invoice to each cost entry, and by allocating the annual chemical costs for 1990 for liquid chlorine, hydrated lime, aluminium sulphate, liquid alum, and activated carbon to each supply source. The unit capital cost of leakage was calculated by summing the discounted costs of capital works schemes to obtain discounted cost. The unit capital cost is then the change in this total brought about by delaying these schemes by 1 year, expressed in TT$ per cubic metre of 1 year's demand growth. Two discount rate scenarios 6% and 8.5% were presented in the calculations of unit capital costs of leakage.

9. A dramatic example of what can be achieved is provided by Toulon, France where from 1979 to 1984, UFW was reduced from 40% of production volume to 21%, saving about 5 million cubic meters of water. Similarly, impressive results have been achieved in Sao Paulo, Brazil. The water utility initiated a comprehensive UFW reduction programme in 1980 which consisted of installing meters, leak detection programmes, updating system mapping to discover which users had legal and illegal connections, improved maintenance, and renovating old installations. This resulted in reducing UFW from 35% to 31%, saving enough water on annual basis to supply a city of 2 to 3 million people. In Bangkok, Thailand a reduction of UFW from 45% to 34% saved 110 million cubic meters of water and resulted in net cost saving to the utility of about $4.2 million a year.

10. Xie, Kuffner and Le Moigne (1993) report that even where metering significant losses occur. For example, in Jordan, the municipal supply systems serve more than 440,000 recorded residential, commercial and light industrial users. The urban demand in 1990 was 210 million cubic metres, with per capita water use of 190 litres per day. The losses in the municipal and industrial sectors were 25% (Abu Taleb,1991), due to aging pressure pipes and inaccurate meters. The illegal diversion of water to bypass meters was significant.

11. Tate (1990) argues that the regulatory approach or supply management approach involves the negotiation of schedules for compliance with the

12. China's experience with supply expansion is revealing. Although new water supplies were created through expensive diversion schemes and complex pumping systems, urban water demand remained unmet. Therefore, in 1983, the Chinese government embarked on a national water conservation programme to create "additional" supplies out of previous water losses.

Since that time, Chinese authorities have actively promoted urban water conservation through various legislative and administrative measures, such as The Water Act (1988), The Management Stipulation on Urban Water Conservation (1989), and the Water Consumption Quota Measure (1989). The savings have been significant. Since 1983, Chinese cities have saved almost 10.2 billion cubic metres of water, reduced wastewater 900 million cubic metres annually, and reduced annual electricity consumption by 5.1 billion kilowatt hours. Appropriate technology has contributed to this success. Recycling of cooling water is now at 50% nationally, up from 20% in 1983, and industrial water consumption per 10,000 Yuan RMB produced has decreased to 270 cubic metres, from 459 cubic metres in 1983."

13. In India, cities such as Ahmedabad, Madras and Delhi have begun to use sewage for irrigation. But there are no standards determining the levels of treatment of domestic and industrial effluent and their use for irrigating crops.

14. The Washington-based research institute, Resources for the Future, has led the campaign for fees on effluent discharge into waterways for over 20 years with little success; it has been mainly opposed by those who think it improper to sell the right to pollute the environment.

CHAPTER 11
INSTITUTIONAL STRENGTHENING

Efficient public water companies exist, but they are rare in developing countries due to institutional constraints. There are varying perspectives on how these problems may be resolved through institutional strengthening. It is strongly argued by some practitioners in the field of water delivery, that endemic organizational failures and poor performance, are compelling arguments for abandoning efforts to reform water utilities, and for relying instead on the private sector to provide these services. International lending agencies are foremost advocates that private participation serves as a catalyst to pursue better cost recovery, improved efficiency, and attract commercial sources of investment finance. According to Kikeri, Nellis and Shirley (1992) in their research on privatization and the lessons of experience, the benefits of private sector involvement if properly executed include improvements in domestic welfare.[1]

In Trinidad, several perspectives are also held by stakeholders, about private sector involvement as a route to institutional strengthening of the water sector. As summarized in chapter 4, within WASA there are divergent points of view. The Head of the Institutional Strengthening Unit who was contracted by the Government to manage WASA felt strongly that a private entity was needed to bring about improvements, and that an independent Water Committee should be set up to oversee its operations. There were also those WASA Board Members who felt that privatization of operational work was a good alternative. On the other hand the Deputy Head of the Commercial Department did not favour privatization.

However, some local policymakers and politicians have strong reservations about private participation. Local critics claim that international lending agencies see private involvement as an antidote to all the symptoms of mismanagement in public utilities (Suite,1994). They contend that higher prices which may result

from commercialization is "bitter medicine" for the poor, in that water will become inaccessible to them. Such sentiments have some merit and come in the light of experiences of structural adjustment and privatization of the telephone and electricity companies prescribed by the donor agencies, and its severe impacts on poor households.[2] As noted by Cook and Kirkpatrick (1988) many developing countries appear to adopt privatization objectives more out of dealing with lending agencies such as the World Bank and the IMF than out of any genuine ideological convictions. It is also feared by trade unions and opposition parliamentarians that divestment, and a partnership with a foreign private water company is a form of neo-colonialism, and is tantamount to selling out the "crown jewels", in which the country has invested tremendous resources from the oil boom. The position taken by the unions and the opposition comes after several decades of heavy Government involvement in infrastructure provision which was linked to State paternalism and nationalism, as described in chapter 1 on shifting paradigms in water provisioning policies. A growing number of consumers, on the other hand, favour privatization because of the on-going problems of water shortages, judging from the information collected from the Willingness to Pay Survey (1994).

11.0 OBJECTIVES

This chapter seeks to examine the following issues regarding institutional strengthening:

1) Should WASA remain as a public utility, but be reformed?; and
2) What other institutional options exist for water provision?

11.1 INSTITUTIONAL SCENARIOS

There are three major institutional scenarios which may offer solutions to WASA's economic inefficiency and administrative problems; (1)invoking market competition into the public water utility (corporatization), (2) promoting competition for the water market through public-private sector partnership, and (3) privatization.

11.1.1 OPTION 1:INVOKING MARKET FORCES INTO PUBLIC WATER UTILITIES

Practitioners in the field of water provision strongly advocate that through market forces and competition, it is possible to achieve economic efficiency and overcome administrative problems, without changing WASA's public utility structure. Competition among a few rival providers, some economists argue, may lower costs and prices. The theory of contestable markets says that even where economies of scale and scope favour a single provider, the existence of potential rival suppliers that may contest the market, limits the risks of monopoly abuse. The new consensus is based on re-evaluation of the sector's experience, technological change, and new insights into regulatory designs. This replaces the old view that water services are best produced and delivered by a monopoly. The old view was based on the fact that the unit costs of water provision decline as service output increases, making provision by a single entity logical (economies of scale), the lumpiness of investment, and the need to keep undesirable market effects under control, by being the sole provider.

Three core instruments which introduce commercial principles into public utilities are corporatization, management and service contracting, and a pricing strategy which allows financial autonomy (See Table 11.1) Some of these instruments have been used in one form or another, to transform WASA into a commercial entity, but without much success. The pricing strategy has been discussed at length in chapter 9, and will only be mentioned where relevant in this chapter. Under option 1, corporatization, management and service contracting will be analysed in the following section.

Table 11.1 Contractual Arrangements for Private Water Supply

Contract	Applications	Incentives
Service	Meter Reading, Billing and Collection	Permits competition among multiple providers, each with short and specific contracts
Management	Operation and maintenance of water supply system	Contract renewed every one to three years, and remuneration based on physical parameters, such as volume of water produced and improvement in collection rates
Lease	Extended operational contract	Contract bidding, with contract duration of about 10 years; provider assumes operational risk
Concession	All features of the lease contract, plus financing of some fixed assets	Contract bidding, with contract period up to thirty years; provider assumes operational and investment risk

Adapted from Triche 1993.

1. CORPORATIZATION OF WASA

Corporatization of WASA was pursued in several ways. These are described as follows:

* Its establishment as a quasi-independent public entity (statutory agency) which insulated it from non-commercial pressures and constraints, but made it subject to standard commercial and tax law;

* The new Government in 1987 placed WASA's commercial practices under intense scrutiny. It was reported that there was a general inefficiency, little or no commitment to achieve solvency, lack of pressure from within and without to publish the statements of account, and that normal business practices were thrown overboard (Budget Speech,1987:6). It announced that performance auditing would be made a statutory requirement, and reports would have to be laid before Parliament on an annual basis, and subjected to the scrutiny of the Public Accounts Enterprises Committee. Despite instructions to make WASA a commercial entity, to date, it suffers from a poor accounting system as pointed out in chapter 3.[3] Professionals interviewed revealed that WASA is unable to accurately estimate its costs, cash flow and accounts receivable because of its inadequate consumer data base. As Yepes (1990) notes, preconditions for good financial management is a cost accounting and financial forecasting system, that provides timely and reliable information; and

* Attempts by the Government to reform WASA between 1992 to 1994 through an institutional strengthening team of local managers, a 25% staff reduction, and a proposed increase in water tariffs, did not halt the deterioration of the water operations. Even after the substantial reductions carried out in 1992, the utility continues to be overmanned, which according to the index of employees is 18 workers per 1,000 customers (2 to 3 times the ratio in well-run utilities in the developed and developing world). As shown in chapter 3 WASA was used by the Government to provide employment to party supporters, and the Government was reluctant to stop overstaffing. One of WASA's Board Members felt that downsizing the labour force was necessary to improve WASA's economic performance.

The World Bank (1994) found that in practice, a transformation to corporatization is not always complete, because public water supply organizations

do not face adequate competition, or do not have solely commercial objectives. Research by Ryan and Brown (1992) on the nature, role and financing of public utilities in Trinidad and Tobago, highlighted that the social nature of the services provided by the utilities meant that they could not be judged on purely on economic performance, but in terms of the services which were delivered, many of which were subsidized.

The World Bank also explains that its field experience suggests that organizational changes are always simpler on paper than in practice. Much time and effort to convert a public utility into a true corporate entity is needed. The introduction and full implementation of standard accounting practices may take up to five years, as many Eastern European policymakers have discovered. Ghana's utilities have been undergoing transformation for seven years and still have a long way to go.

WASA's slow progress may only be explained by institutional inertia. The key actors argue that corporatization has yielded few benefits. These beliefs were stated very clearly in interviews with local professionals in 1993 and 1994 (See Box 11.1). The Executive Director of WASA, the Head of WASA's Institutional Strengthening Unit, WASA Board Members and the Commissioner of Valuations spoke of too much political interference which undermined corporatization efforts.

Other approaches are used to restructure water utilities along with corporatization, such as performance agreements and service contracts. Can WASA use these to restructure its service, without changing its organizational structure?

Box 11.1 Actors Views About Corporatization
Governments: argue that public utilities are already run on commercial principles, but this has not helped managers to be more effective.
Managers: argue that the autonomy they do get, is too limited to be effective, and that it is too easily revoked.
Workers:argue that they have little incentive to be effective because good and poor performances are treated equally.
Users:argue that corporatization has not given access to improved or expanded services.
Source:World Bank,1994.

2. PERFORMANCE AGREEMENTS

Another approach to commercialize WASA is through the use of performance agreements. The World Bank (1994) notes that they are aimed at increasing the accountability of employees and managers, and to improve the focus of operations by clarifying performance expectations, and the roles, responsibilities, and rewards of all those involved. The main focus is to provide incentives to improve performance.[4] For performance agreements to work effectively, managerial autonomy and rewards for workers and managers, are usually built-in incentives, in exchange for fulfilling agreed performance targets. Several approaches are used to provide incentives to workers and managers in public utilities. Some agreements in India, Korea and Mexico include bonuses of up to 35% of total wages. The Koreans consider non-pecuniary benefits such as award ceremonies or press coverage as rewards for good performance. Firing non-performing staff is one of the sanctions available in Korea. A second incentive element is to use shorter agreements (one year as in Korea and Mexico) because they allow for more frequent assessments of performance. A third approach is to weight managers and workers performance, using specific criteria such as efficiency, service quality, productivity, and administrative and financial performances, which if met, results in a reward.

The difficulty in using performance agreements is that firing non-performing staff (as is the case in Korea) from WASA has been always difficult, according to the Commission of Inquiry Report (1975) and Ryan (1992) because WASA managers do not enjoy decision-making autonomy.

3. CONTRACTING OUT SERVICES

A third way of reforming water agencies without changing their public utility structure is contracting out services. Triche (1993) has argued that the advantages of contracting out services have made it popular with water utilities. The line of reasoning adopted by Triche (1993) is that contracting out services provides a flexible and cost-effective tool for increasing responsiveness to users, and taps expertise too expensive to maintain permanently on public payrolls. She argues that it is also ideal for introducing competition among multiple providers, either with short or specific contracts. It also tends to be more cost-effective than using public employees to handle maintenance.

Meter reading and fee collections in the water supply sector is a common form of service contracts, and so far it has worked well in Chile (World Bank,1994, Triche,1992).[5] (See Table 11.1) WASA has also used contracting for rehabilitation of its distribution pipelines, and the delivery of truck-borne water (Suite,1994). However, this approach has not worked effectively because the award of contracts were not always transparent and fair, and the judicial system was unable to enforce contracts fairly, or to deal with the corruption among water truck contractors.[6]

Which of these three core instruments for introducing commercial principles into water utilities discussed above is the "right" one, depends on the specific cause of poor performance in providing water services. Since the performance of the water utility depends on the key actors; government, managers, and workers, the "best" contract depends on which of the three actors perform least well. WASA has encountered performance problems from all three

actors, which brings into question whether reforming it, using corporatization may really work.

The World Bank (1994) suggests that if the problem is with the government, the performance agreement may be the preferred instrument. A performance agreement between the government and the water utility, to achieve financial autonomy, is one example of the arrangement between the two entities. However, if the problem is one of weak commitment by the government to raise tariffs, then no remedial instrument short of privatization is likely to be effective. Previous chapters have shown, that over the years, the Government and the Public Utilities Commission have been reluctant to raise WASA's water tariffs, which provides good reason for rejecting this approach. Togo's water utility is an interesting lesson of where the performance agreement with the government, failed to attain results because the government faltered in keeping its side of the bargain. The utility managers wanted an explicit performance agreement, to commit the government to tariff increases. Although it was able to improve the number of connections in just five years, its financial performance did not improve, because the government did not authorize needed tariff increases.[7] It was only after the firm commitment of the government to raise tariffs, that the cost recovery ratio increased (World Bank,1994).

If the problem is with management, the choice of the contract depends on whether staff abilities or staff incentives are in question. Performance agreements with incumbent public managers, assume that their capabilities are adequate. Thus, as in the case of WASA with weak management skills, management contracts based on performance are more effective in the short run, but not in long haul. If the problem with management is one of incentives, performance agreements need to make a clear link between performance, and pecuniary and non-pecuniary rewards to managers.

In instances where the problem resides among the workers of the water utility, incentives must go beyond managers. Governments and managers may agree to build into a performance agreement a clear link from employee performance to salaries and non-pecuniary rewards. But the labour laws governing WASA and trade union activism, make it difficult to dismiss workers. Where workers are protected, neither performance agreements nor management contracts may suffice. The World Bank (1994) observes that under these circumstances, a more effective method is to rely systematically on service contracts. But, the point made earlier is that corruption in the award of service contracts does little to help WASA provide a reliable, efficient service.

11.1.2 OPTION 2:COMPETITION FOR THE MARKET

In view of the failure to corporatize WASA, the difficulties of using performance or service contracts, and very strong evidence of political interference, an alternative institutional strengthening scenario well worth exploring is that of a public-private partnership.

A public-private partnership (PPP) transfers to the private entity, the responsibility of managing the water utility (usually operation and maintenance), but the government does not relinquish ownership of capital assets. Triche (1993) who has done considerable work on the water sector in developing countries, argues that experience in PPP arrangements reveals, that the benefits appear to be a reduction in the risks of political interference in the day-to-day operations of the entity, a more innovative management structure than previously existed under the public utility system, more imaginative decision-making that is demand-orientated, and higher levels of operating efficiency, in the absence of a lethargic bureaucracy, and inordinate procrastination.

Triche (1993) believes that ownership of capital assets is likely to remain unattractive to the private sector because the irreversible, industry-specific nature of water, compounds the riskiness of operating in these countries. Private

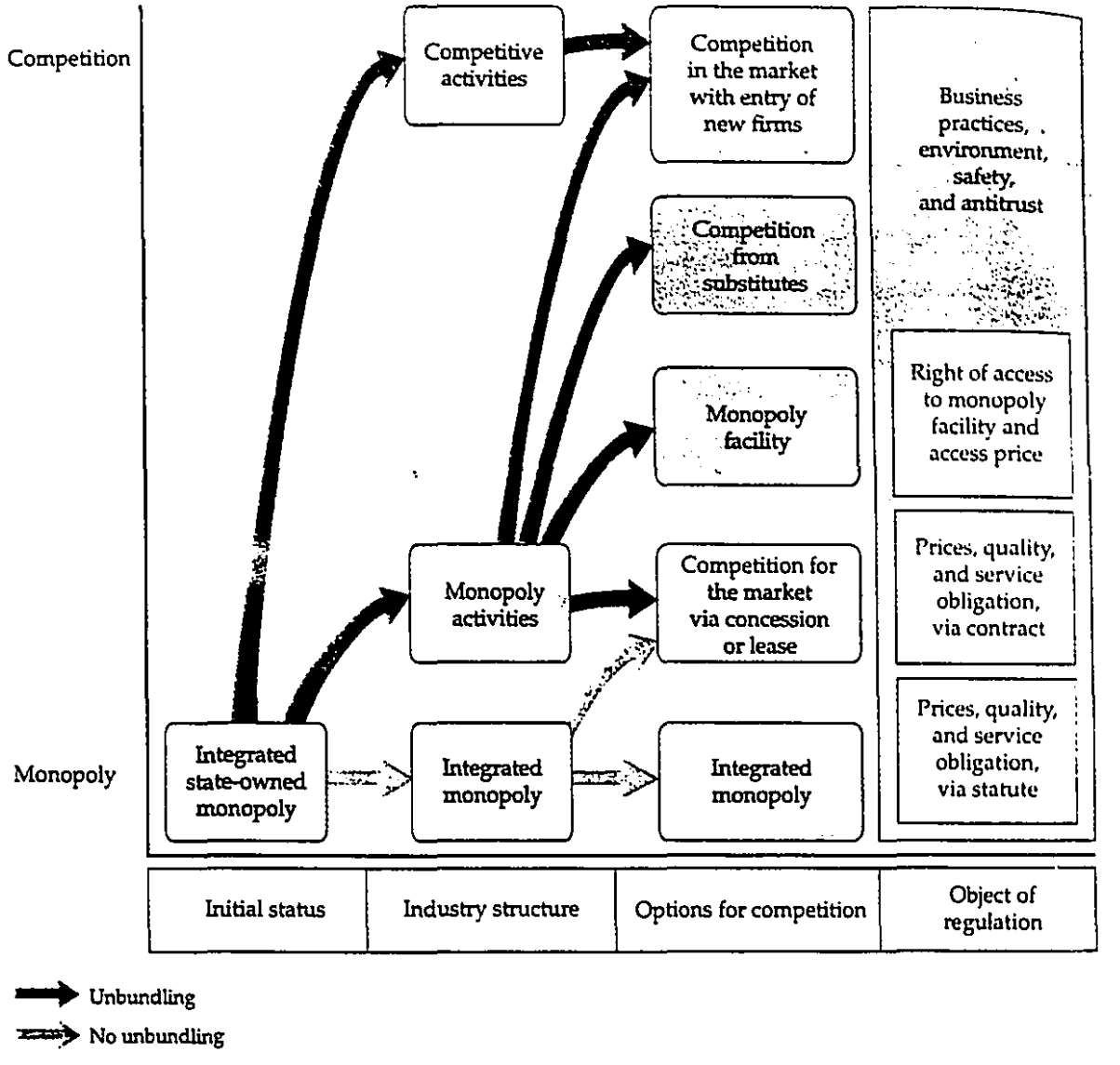
ownership is likely to carry high costs that may undermine most of the benefits it entails (Triche,1993). She argues on the other hand, public ownership poses no insurmountable barrier to private participation, since some of the responsibilities may be assigned (investment planning and maintenance) to private operators, without transferring ownership itself. Kessides (1993) and Israel (1992) suggest that private sources of finance may also be tapped under concessions and Build, Operate and Transfer (BOT) arrangements. In the water sector, Triche argues, the real linchpin is the overall institutional and regulatory environment. An appropriate sector framework, not private ownership, makes the transfer of responsibility to autonomous private enterprises possible, institutes accountability and encourages efficiency.

There are two main steps in adopting the PPP arrangement; unbundling activities and creating competition (See Table 11.2). Experts argue that the first step to be taken before proceeding with the public-private partnership is to unbundle the water sector. By isolating, the natural monopoly segments of the water industry, unbundling promotes new entry and competition in segments that are potentially competitive, and leads to economies of scope. Unbundling allows cost-minimizing behaviour by suppliers under competitive pressures. Additionally, unbundling is desirable because it makes cross-subsidies between different lines of business more transparent, identifies more precisely the subsidies needed to deliver services to the poor, and improves management accountability.

Two types of unbundling exist; vertical and horizontal unbundling. Vertical unbundling is defined as separating production from transmission and distribution. To facilitate competition in distribution, transmission and distribution may be separated in the water sector. Transmission is best left as a natural monopoly, as well as the physical distribution network because it is economically irrational to run more than one distribution line to a home or business. However, alternative suppliers may and do compete for the right to supply over the single distribution line, in countries which have opted for unbundling their water sector.

Horizontal unbundling separates activities by markets either geographically, or by service categories.

Table 11.2 Unbundling Activities Increases The Options for Competition



Source: World Bank 1994.

Unbundling is not without its constraints, which are both technical and economic. In the technical sense, having a proliferation of water companies or companies undertaking core activities such as billing and collection, or production and treatment from distribution, is difficult unless coordination and control may be guaranteed. It also may impose higher transaction costs as greater coordination is required between the various entities. Further, having vertically linked monopolies, each charging a markup over costs, may result in higher charges than with a single, vertically integrated firm, which policymakers often fear.

The next step after unbundling is to introduce competition for prospective private partners. Where direct competition for private water companies is not possible, efficiency may be increased by means of competition managed through contractual arrangements that require operation, maintenance, and facility expansion. Although there is a single supplier of the service at any point in time, competition occurs before the contract expires and is due for renewal. In other words, there is competition *for* the market even though there is no direct competition *in* the market during the term of the contract. The commitments entered into through the contract may then, within limits, provide an alternative to relying on a full-blown independent regulatory apparatus. Governments create competitive conditions through leases or concessions, and firms compete not for individual consumers in the market, but for the right to supply the entire market (Israel,1992).

1. LEASES

Under a lease, the government supplies the major investments for production facilities, and a private contractor then pays for the right to use the public facilities in providing service. It is customary for leases to be awarded from six to ten years, giving the contractor exclusive rights to the stream of revenues during this period. The contractor bears most or all of the commercial risks, but not the financial risks associated with large investments. These arrangements are best suited to activities where investments come in infrequent

bursts, so that the responsibility for operations may be separated from responsibility for investment (Triche,1993). In France, leasing has been used successfully for decades in urban water supply, and more recently the model has been adopted in Guinea.

2. CONCESSIONS

Concessions incorporate all the features of a lease, but give the contractor the added responsibility of investments such as for specified extensions and expansions of capacity, or for the replacement of fixed assets. The private water company in Cote d'Ivoire and Buenos Aires, have a well-established and successful contract based on the French concession model (World Bank,1994). In the case of Buenos Aires, the private company is responsible for operating, maintaining and investing in fixed sector assets, which nevertheless remain the property of the public sector, and must be returned in good condition at the end of the contract period, which is 25 to 30 years (Triche,1993). During this time, the concessionaire assumes all the commercial risks and most financial risks. In France, concessions tend to extend into perpetuity. The incumbent enjoys significant advantages in re-bidding, which must be factored into efforts to make the market contestable.

Triche (1993) is of the view that although there are advantages to giving responsibility for investments and operations to a single autonomous company, this may not be a feasible solution, particularly during the initial stages of a sector reform programme. Her research found that if the country environment is risky, costly investments may have to be separated from operations, in order to attract private involvement in the latter. This was the solution adopted in Guinea where a state enterprise owns and invests in sector assets, while a mixed enterprise is responsible for operations under a lease contract.

A number of conditions are needed to ensure the effectiveness of a concession arrangement (Triche 1993):

* Transparency and accountability which are specified in detail in the terms of the operation;
* How the contract is awarded;
* Strong commitment from Government authorities;
* Good technical and financial preparation;
* Attractive initial tariffs; and
* Lower economic risks to investors.

Researchers acknowledge that there are problems with leasing and concession arrangements. One such problem is that they may not provide sufficient incentives to maintain, and expand the facilities in their charge. A private supplier that does not own the production facilities, or is uncertain of contract renewal may depreciate assets rapidly for short-run gain and cut corners or skimp on routine maintenance. These problems may be avoided by explicit maintenance requirements which are written into contracts, and compliance which may be monitored. Private suppliers may be held responsible for documented deterioration of the capital stock, and eligibility for renewal may be made contingent on the observed state of the capital stock.

Case Studies

Triche (1993) looked at case studies of Caracas and Buenos Aires to provide guidelines on how to work out concessions in the water sector. She argues that the technical and financial feasibility of the concession should be adequately studied prior to issuing the bids. The preparation process may take up to two years, including one year to prepare bidding documents and draft the legal documents. It is important to gather information about the condition of the water utility prior to the bidding stage, as the case studies of Buenos Aires and Caracas done by Triche (1993) revealed.[8]

The next step is the selection of the bidders through a two-phase process. Bidders must be subjected to a technical evaluation. For the technical phase,

service quality and coverage targets are established, and bidders are invited to present technical solutions to meet the target goals. A mandatory basic investment programme is to ensure that the private entity is committed to upgrading water facilities. Some flexibility in the negotiations regarding technical details may be built into the contract.

The financial selection criterion is the proposed consumer tariff. The Buenos Aires example of the concession arrangement is instructive. In Buenos Aires the average charge of US$.40 per cubic metre covered all operating and maintenance costs. Since it was assumed that the private operator would be more efficient, bidders were expected to offer initial rates lower than the existing tariff. The winning bid was about 20% lower. Further, the Government will allow the proposed water rate to be revised every five years, based on updated investment plans and cost estimates submitted by the operator, and approved by the regulatory agency.

The private company may be allowed to indicate the staffing levels which it considers appropriate for its operations as was done in Buenos Aires. Permitting a new arrangement unencumbered by excess staff and liabilities is likely to be preferable. This involves laying off staff where there is over-staffing.

The bidding documents may state in broad terms the proposed regulatory regimes and the membership of the proposed regulatory agency. The structure and operational procedures of the agency need not be detailed in advance as the example of Buenos Aires illustrates.[9] The regulatory agency will inevitably evolve and develop the capacity to fulfil its functions at the level of expertise and efficiency required to confront the private sector.

The two case studies of Caracas and Buenos Aires also illustrate how important the stability of the rate of exchange is to private investors. Under Argentine law, investors are protected against exchange rate changes. In

Venezuela, all risks associated with the exchange rate devaluation would have been assumed by the operator, and was a major deterrent to foreign investment.

The main lessons of attracting private investors may be found in these two case studies. The Caracas example shows that very low tariffs, inadequate technical preparation and rigidity of the contract terms, an unstable currency, and the lack of strong political commitment of the highest levels of central government are major deterrents to foreign investors. Buenos Aires however, had a number of favourable conditions for attracting private investors; previous experience in privatizing a large number of state enterprises, higher water tariffs and lower overall riskiness. Triche (1993) admits however, it is still too early to judge the outcome of the Buenos Aires concession until it has operated for several years.

11.1.3 OPTION 3:PRIVATIZATION OF WATER MONOPOLIES

An alternative institutional arrangement to corporatization or the public-private partnership is that of full privatization, which invokes market forces into water services, by transferring assets out of the public sector.[10] While many developing countries have privatized industries over a long period of time, privatization of public utilities is more recent. The model adopted in the United Kingdom in 1989, of full privatization of water services through the sale of assets, is not likely to pursued in the near future in developing countries (Triche,1993). There are many reasons for this. First, sensitivity about foreign ownership exists in all countries. For political and social reasons, governments are generally reluctant to cede to foreign investors control over assets, especially strategic ones such those of the water sector. Secondly, Triche (1993) argues that private investors do not appear willing to buy water supply distribution assets, given their poor condition, the lack of good information, and the political riskiness of the sector. Thirdly, in unfavourable country settings where the existing private sector is small, capital markets are thin, and the interest of

external investors is limited, the sale of enterprises is difficult according to Kikeri, Nellis and Shirley (1992). While local investors are preferred for WASA, as with so many other Caribbean countries there is trouble finding locally the capital necessary to make significant investments in the water sector because of the magnitude of the capital flight noted by Bennett (1991). As pointed out by Price (1994), the low levels of local savings which was one of the justifications for creating nationalized industries, render the potential for involving local investors very small.

Full privatization of WASA may also be difficult because of what is referred to by Galal and Shirley (1994) as the "privatization trap". This takes place when a Government with a history of nationalization of industries and a history of dramatic policy shifts tries to privatize an enterprise, odds are that potential investors will be timid because they perceive high risk of Government interference in the investment. If the Government does not interfere, then the buyer can realize a potential windfall profit on the purchase. If that happens, the Government can then come under political pressure to intervene to recapture some of the windfall profits thereby confirming the fears of the investors.

Another reason full privatization may not be the course taken by the Trinidad Government, is that consumers may have to face high prices if the water company is not properly regulated. Jones (1994) in his paper "Winners and Losers in Privatization" points out that one of the arguments against the private sector is the fear that it will exploit consumers where there is a monopoly or oligopoly power. He argues that the fear follows from the concern that divesture may lead not only to more efficient operation, but also to more efficient exploitation of consumers. Jones, however, goes on to argue that although the rise in prices from uneconomically low levels hurt consumers in the first round, in most cases this loss is offset quickly by increased investment and expansion that reduce rationing.

The U.K experience from privatization is instructive however, because one of the main tensions was a deepening hostility toward the water industry from consumers, who saw bills rise at two and a half times the rate of inflation over a four year period while water companies turned in conspicuously high profits during recession and awarded senior directors average salary increases of 16% over the same period (Manson,1994). In July 1994 a price review was undertaken by the regulatory agency Office of Water (OFWAT) taking a decision that for the next ten years the average annual increase would be pegged at one percent above inflation.

The full privatization of WASA does not seem appropriate at this point in time. A public-private partnership appears to be a better interim measure for resolving WASA's problems, and improving service delivery to consumers. Besides "gains in efficiency performance are more likely to result from an increase in market competition than from a change in ownership" (Cook and Kirkpatrick, 1988:22). It may also have political acceptability.

11.2 REGULATION

A concern of many policymakers in Trinidad is whether unbridled market forces are harmful to consumers, particularly poor ones. The World Bank (1994) admits that where extreme under-provision of services is common, as in many developing countries, concerns about a private monopolist restricting output to boost prices, and profits are justifiable. The role of regulation is therefore important in the water sector.

The regulation of WASA takes place through the Political Directorate which establishes broad principles, such as economic efficiency and cost recovery, and sets goals such as universal access. The authority to make the detailed rules and procedures necessary to implement policies and enforce these rules is assigned to an "independent" regulatory entity such as the Public Utility Commission (PUC). The PUC is charged with responsibility for "determining

rates for public utilities and to perform certain other functions respecting public utilities". With respect to WASA, the functions of the five member commission specifically involve determining rates for water services, conducting research of immediate relevance to its rate making function, and responsibility for initiating and conducting investigations into the operations and standard of service of WASA.

The current regulatory approach has its limitations. It is costly because of lengthy public hearings requiring the participation of various parties. The tribunal process entails substantial lags between the application for rate increases and the final decision by the PUC on the request. The Report by the 1993 Cabinet Appointed Task to Review the Public Utilities revealed that it took an average of eight and a half months for an application for a rate increase to be settled. Further, the PUC is not immune from political interference.

The involvement of the private sector in water provision may thus require reforms within the PUC, to allow it to set performance standards and indicators, and establish mechanisms for their monitoring. In this way, its role in rate making may be enhanced, and it may be able to perform a watchdog function on behalf of the public's interest.

More recent research by Richard and Triche (1994) on four water and sewerage companies in Latin America found that there were nine regulatory conditions that private companies look for in deciding to participate in a bid for water companies:[11]

* Specify key terms and conditions of regulation in the contract, leaving little discretionary power to the regulating authority. In particular, specify the key aspects of regulation such as price, quantity and water quality standards are specified in the contract;
* Spell out credible procedures for the fair resolution of disagreements about contractual or regulatory matters;

* Carefully specify credible technical objectives which the contractor will be expected to achieve under the contract such as water quality and level of service standards sought, including specification of levels of flow and acceptable levels of leakage;
* See that government tariff policies support the principle of cost recovery of water services-- and that tariff adjustment formulas adequately reflect changes in costs, inflation, and the exchange rate. Great importance was placed on official commitment to the principle that water is not a free good;
* If historical collection rates do not indicate consumers' willingness to pay for services at tariffs that reflect the cost of service, allow an adequate period of time to phase in higher tariffs-- and give the operator adequate protection from nonpayers (either the right to cut-off service although operators want to avoid that, or recourse to another source of payment);
* Review public works laws, contract law, and accounting practices and, if necessary amend them in advance to ensure that they accommodate and protect any long term investments foreseen under build-own-transfer or concession type arrangements;
* Eliminate unnecessary and bureaucratic administrative requirements that make bidding expensive;
* Make a contract and expected profits big enough to warrant the high fixed cost of bidding;and
* Provide education and outreach needed to inform consumers and secure the support of labour interests.

Many of the respondents in Richard and Triche's (1994) survey also argue that signing a long term contract requires a significant display of "goodwill" on the part of a host government, to assure the private company that the letter and spirit of the contract and related laws will be complied with in a consistent and credible way, with the effect of reducing actual and perceived risk.

Meeting these onerous conditions will require large amounts of resources. The World Bank (1994) argues that there are three considerations which influence the regulatory task that accompanies the introduction of private sector involvement: (1) providing sufficient resources, autonomy, and credibility for the regulator; (2) where price regulation is necessary, choosing instruments that encourage cost efficiency in the regulated entity; and (3) creating constituencies in the regulatory process.

11.2.1 REGULATORY RESOURCES, AUTONOMY AND CREDIBILITY

Like all institutions that have a regulatory function, detailed knowledge and continual monitoring of the activity concerned are required. The regulatory menu includes problem identification, fact finding, rule-making, and enforcement. The dynamics of water provision and changing conditions in the industry make it imperative that the regulatory agencies are able to shift course and to anticipate change. To do this involves not only having access to resources to gather information and to monitor change, but operational autonomy. Jackson and Price (1994) believe that the principal problem facing the regulator is information asymmetry. In particular, the regulator does not have accurate information about the firm's production or cost function.

Given the broad policy mandate, regulatory agencies may need to be specialized and autonomous, rather than function as bureaucracies. On the other hand the question of who guards the guard arises because specialized agencies are vulnerable to capture by the industry and may favour incumbents. It is clear that considerable ambiguity exists regarding the independence of regulatory agencies from ministerial or political interference.

Regulation of private providers is very new to developing countries because traditionally water provision has been publicly provided.[12] A difficulty in creating effective regulatory capacity may be attracting experienced

professionals to staff such agencies. Experience in Argentina shows that salary restrictions and tight budgets result in weak regulatory agencies. As noted above, resources are important to allow a regulatory agency to be effective because even though steps are taken to develop a well-defined regulatory framework, regulatory practices lag behind when faced with inexperienced staff. For example, a shortage of staff equipped with experience to deal with service complaints may lead to a backlog of decisions. Capacity-building of the regulatory agency is an important step in the process of using market forces for the provision of water services.

Allowing a regulatory agency autonomy while maintaining its accountability may require a delicate balance. If regulators are easily replaced, directly elected at frequent intervals, or easily influenced by special interest groups, they may be unwilling to introduce policies that are socially desirable, but politically inexpedient.

The World Bank (1994) has offered a few guiding principles of regulation that it considers useful for water agencies. It believes that it is important for a regulatory agency to report directly to the legislature rather than solely to a Minister of Government. The assumption is that is allows for legislative scrutiny of regulators. The Bank emphasizes that regulating the regulators is an important principle, particularly when it comes to an essential service such as water delivery. Additionally, it contends that the head of the regulatory agency should be appointed for a fixed term, preferably out of cycle with political elections. It also argues that scrutiny should be regular and should systematically assess an agency's performance in achieving its goals, and whether regulation is well focused. The Bank believes strongly, that transparency is critical to regulatory accountability, because the process and policies must be known and published to permit an effective evaluation of regulation.[13] Saunders and Harris (1994) are of the view that one benefit of all of this regulation and monitoring of the water sector in the U.K., is that more information is available on water quality and the adequacy of the service, and there is greater publicity about it.

11.2.2 INSTRUMENTS OF REGULATION

Any private entity that undertakes to provide water would inevitably want a guarantee of adequate profit which is not subject to the vagaries and vicissitudes of political risk or uncertainty. The ubiquitous instrument of regulation used in all sectors (from transport to water) is the rate-of-return regulation. In essence, this regulation ensures that the financial return received by the provider covers all costs, encompassing operations and maintenance, depreciation, taxes and guarantees a negotiated return on investment.

However, a number of pitfalls are associated with the rate-of-return regulatory instrument. Practitioners argue that it is difficult to implement the rate-of-return rule because obtaining accurate information on costs of production and the allocation of such costs between alternative services is a formidable task. Much controversy surrounds how an appropriate rate-of-return is determined. This encourages mis-representation of information and the adoption of inefficient technologies that inflate the base on which rates of return are calculated. "Most important, because all costs are covered and a rate-of-return is guaranteed, private management may become complacent about making the right investments and keeping costs down" (World Bank,1994:70).

The design of new "incentive" regulations may be the way to go in overcoming the shortfalls of the rate-of-return regulation. The general idea is that the price the water entity is allowed to charge, may not hinge on the costs incurred. In other words, if the costs increase, profits are lowered; if costs decline, the provider and investors enjoy greater profits. The incentive regulation therefore seeks to motivate providers to use their superior knowledge of operating conditions to lower costs and introduce new services.

Apart from the traditional rate-of-return regulation, the new types of incentive regulation are price caps and yardstick competition. The price cap formula as a mechanism for determining permitted increases is becoming

increasingly popular even in the water sector, although its main application has been in telecommunications. The United Kingdom has led the way with the use of the price cap formula in the water sector. The price cap formula or the "RPI-X" is the percentage increase in service price. RPI is the percentage increase in the retail price index, and X is the expected percentage increase in the provider's productivity. The water company has the incentive to lower costs, since gains in productivity greater than the expected X percent contribute to increased profits. To maintain incentives for efficient production, the X-factor should remain unchanged for a period of several years (Jones,1987).

The main advantages of price caps is that, from the United States experience, they lead to lower prices than does the rate-of-return regulation and they do shift a greater part of the financial risk onto providers of infrastructure services, who cannot be sure that the regulator will allow them to recoup excess costs. This threat encourages tighter self-monitoring of performance. The use of the price cap formula in its pure form rarely exists, however, unless profits made by the providers are under the control of competitive forces. Most regulators still see the need to assess the rate-of-return and so set caps on the estimates of profitability, once again increasing the information requirements for effective regulation. If the main supplier is subject to open competition from several other suppliers, as is so often the case in the telecommunications industry, then price caps on the dominant provider are the only instruments needed because competition will limit the amount of profits to be made by competing suppliers. However, where a local monopoly is present as is expected to be the case in the water sector in Trinidad on account of the small size of the country, then the rate of return may be used, because there will be an absence of competition to limit the profit made by the main supplier.

Another instrument of regulation is yardstick competition. If direct competition or competition from producers of substitute products is not feasible, competitive forces may be replicated through comparisons with performance

elsewhere. Its use has practical application where the performance of utilities in different regions may be compared and used to motivate utilities to perform better and to be rewarded on the basis of performance (Yarrow,1989).

The two best known examples of the use of benchmarks in water utilities performance to regulate the water industry are France and the United Kingdom. In France, the contracts of the local water company often depend on the quality of services and their production costs relative to those of other French water companies. The water sector regulator in the United Kingdom relies explicitly on cost comparisons. For Trinidad, where experience in privatization is short, and there has been a single water utility, yardstick competition is limited by the need for sufficiently refined and comparable information. This constraint may be overcome by using either a "hypothetical efficient" firm and comparing international cost and price trends to estimate the performance an efficient firm may achieve, and prices may be established based on this estimate. Specialized industry organizations and international development banks are also an alternative source of data on production costs in the water sector. However, the universal applicability of this data has shortcomings because water production costs vary according to many different supply conditions of climate, topography and, economic and industrial practices. Wright (1992) has doubts about yard stick competition because such comparisons are impractical even in the U.K. Even the possibility of comparing Caribbean data is problematic because of differences in climate, geology and topography. For instance, Jamaica has suffered from severe drought and Barbados has predominantly limestone topography with numerous groundwater aquifers. In contrast, Trinidad receives abundant rainfall and has both groundwater and surface water sources. Such differences make data on water utilities in the Caribbean incomparable.

A number of new instruments are being experimented with and designed for use in developing countries, but it is too soon to say how effective they are in fulfilling the principles of regulation. One new regulatory approach offers a

provider a choice of regulatory options; a stiff price cap but no monitoring of profits, or larger price increases with closer monitoring of profits. The general idea is that the provider, through its own choice, will reveal its ability to undertake significant cost reductions, and determine its own price, as well as its attitude toward risk.

Another new instrument of regulation is one known as "potential regulation". It does not actually regulate the supplier if consumers are satisfied with the service. It is less restrictive in that it gives the supplier as much latitude in its activities. However, regulators monitor the suppliers, and stand ready to intervene should problems arise.

11.2.3 CREATING A CONSUMER CONSTITUENCY

In the regulatory process an essential feature is the creation of consumer constituencies. Although households and businesses have a critical input to make in ensuring that services are efficient, particularly since regulators have a limited means of acquiring information, their involvement in the process of regulation is often overlooked. However, regulated private water companies have incentives to chisel on quality so as to reduce their costs. As Vickers and Yarrow (1988) point out, in a more competitive market this might lead to sharp reductions in volume sold as customers switch to other products, but the revenue penalties from volume reductions tend to be less where substitutability in demand is limited. The later condition is satisfied in the water industry case, and quality reductions can therefore be expected to have relatively small effects on quantity demanded at the relevant price. Hence the quality problem is potentially a serious one. But final consumers are the best monitors of service quality and consumer feedback may be used directly to motivate suppliers to provide high-quality service. As an example, returns to suppliers may be directly linked to consumer ratings of performance. For this to have any practical relevance, however, consumers must have some awareness of how to rate performance. Consumer involvement also strengthens accountability. In addition, giving people a voice helps create

acceptance of the higher tariffs that often accompany sector reform and private participation and builds public confidence in changes (See Box 11.2).

Like most developing countries, historically public participation in policy formulation and decision-making is low in Trinidad. This is so even though the PUC was established to facilitate participation, and demonstrations and other forms of protest are not uncommon in periods of severe water scarcity. A serious handicap faced by individual consumers of developing countries in dealing with a public utility is the lack of knowledge of the "rules of the game" and the right to an adequate service. Expectations are often low and incentives for collective action are often limited. A legal and regulatory system is important to protect consumers. Moreover, the regulatory role of consumers is extremely important especially in the water sector if the private company has considerable market power and displays monopolistic behaviour in the absence of competition.

Box 11.2 Consumer Participation in Regulation
In the U.S., rules and rates are established for privately owned and operated services in the context of a public hearing process by which all relevant information is made public and in which all legitimately interested parties may participate. In the U.K., the Office of Water Services, which regulates service standards and tariffs, has established Customer Service Committees to represent the concerns and needs of consumers in each of the ten service jurisdictions. In France, consumer input is also important though less formal (Triche,1993:4).

11.3 TACKLING MARKET FAILURES

Regulation via agencies may not be sufficient to enure that the poor are served. The experience of other developing countries provide important lessons in how to go about taking care of the poor. Attahi (1992) has some interesting insights into the problems associated with concession agreements in Africa. He notes that the installation of water networks is undertaken by concessionary companies in charge of these services, when the development of the area has reached a sufficiently high level so that they may anticipate profit on their investments. As a result, only 25% to 30% of urban households are connected to water networks. The servicing of vast squatter settlements, representing often

more than 20% of the urban area in African cities, is only considered by concessionary companies at the end of painful restructuring processes.

To guarantee that basic needs are met the Government may retain the role of rate setting, and may structure prices so that subsidies reach the poor. Some policymakers argue that subsidizing access to water services is more useful for the poor than price subsidies. Richard and Triche (1994) found that in Chile, the private operator preferred a direct subsidy programme in which subsidies for low income groups are paid to the operator, rather than to subsidized households.

11.4 SUMMARY

Strong justification for WASA as a single water supplier originated from the concept of a natural monopoly, according to which one supplier is able to serve the market at a lower cost, than two or more providers because of economies of scale. Some local economists (Theodore, 1992) are in favour of keeping WASA as a public utility on the grounds of social equity. The argument used by Theodore is that the concept of efficiency that is most relevant, is not that of economic efficiency, but social efficiency which gives recognition to water as a merit good, and the associated negative externalities if water is inaccessible to all members of society. He and others argue that only the public sector may guarantee that social welfare objectives are met, since market failures often occur. Theodore (1992) recommends that WASA should have managerial autonomy in areas such as technical and manpower decisions, it should be self-financing, and consumers should pay the full cost of water production. Except, that past reform efforts have had limited results because more than ever, the political will just does not exist and WASA's monopolistic position has made it inefficient, owing to its protection from competition and accountability to users. There are always possibilities of "government failure" especially if public agencies are more responsive to political pressure than to consumer preferences. As Roth (1987)

observes, the private market may be faulty, but the government "remedy" may be worse.

Past failures by WASA warrants the need to explore innovative ways of opening up this monolithic sector to market forces, a sentiment echoed by some consumers that are frustrated by water shortages. Competition and unbundling of activities in the water sector offer unprecedented benefits of an improved water service. It is argued that the threat of competition leads to lower prices and substantial cost reductions. In the Trinidad context this requires a strong regulatory framework especially since two years after the electricity company was privatized prices have not declined.

A major obstacle to improvement in water delivery is the lack of creditworthiness. In search of investment finance and economic efficiency many developing countries are turning their attention to private equity financing. The public-private partnership approach in the water sector has been more recently hailed as the new way forward. Basically, the Government transfers to private providers, the responsibility for managing a water utility. These types of contracts are attractive to governments because they do not involve relinquishing public ownership of capital assets. Under this arrangement, the private sector is given responsibility for operation and maintenance (O&M) of the water utility, and the contract is renewable depending on performance in O&M. As investors, private firms provide debt or equity capital, and as service operators, their presence allows governments to distance themselves from increases in water tariffs. The public-private partnership is the best model for Trinidad. Through concessions or leases, the public sector can delegate the operation of water facilities (along with the commercial risk) and the responsibility for new investment to the private sector. Leases and concessions permit private sector management and financing without the dismantling of existing organizations or the immediate crafting of an entirely new regulatory framework (World Bank,1994). It is a good interim measure to allow water services to be put on a sound footing.

Tailoring contracts to attract specific investments has been the most common means used to balance the public interest and private initiative. Contracts have been an essential mechanism for risk-sharing. Contracts agreements are not trouble-free: by their nature they imply compromise. However, care must be taken to ensure that contracts are not misused, particularly since consistency and transparency in contract terms are not all that easily achieved. A necessary condition to ensure that competition leads to healthy results is that contracts between the Trinidad Government and the new market entrant (s) in water delivery must be enforceable. This is required to balance the interests of various parties in specific projects, and to provide the stability needed for long-term investment.

Competition does not necessarily mean that unbridled market forces are allowed to work without regulation. As Paul (1985) observes the replacement of a Government monopoly by a private monopoly does not increase the public welfare if there are no other suppliers. Monitoring and regulation of price and profits is needed to protect consumers from private water companies which may become monopolies during their contracted period, and may grow complacent in the absence of competition. What is needed is a regulatory system that is comprehensive, transparent, and defines the rules of the game, and openly enforces them. Although the possibility of abuse cannot be totally eliminated, it may be minimized through a system of checks and balances that reinforces the incentives for all parties to act in a manner consistent with the social good. Consumer feedback is of critical importance in the regulatory process. Any regulation passed by the Trinidad Government should also be subject to criticism from trade unions and the opposition.

Two political concerns of private sector involvement in water provision need to be tackled. The unions representing WASA workers have resisted labour shedding as part of the restructuring process. But since personnel costs are too high and productivity levels are too low, downsizing the labour force is a

necessary precondition to private sector involvement. It is best handled by the State, argues Kekeri et al (1992) because it is able to better mediate union demands and to design measures for alleviating the social costs through retraining, severance pay, unemployment insurance, and other elements of the social safety net. Private investors are seldom willing to deal with potentially messy, highly visible labour disputes. Perhaps the support of workers may be elicited by undertaking public awareness campaigns explaining the costs and benefits public-private sector ventures, and by granting adequate severance packages. The other political concern is transparency of the transaction with the private company. No matter how strong the political resolve for institutional reform, a lack of transparency may lead to a perception of unfair dealing and to popular outcry that may threaten private sector involvement and institutional strengthening in general. Competitive bidding procedures and clear criteria for evaluating bids are important steps for achieving transparency.

The costs of delaying institutional strengthening are high, including potential deterioration of assets, poor customer service, loss of investor interest, and opportunities for opposition to coalesce. The choice of institutional reform which is appropriate for Trinidad is the private-public partnership arrangement. It should be able to deliver what consumers want and are willing to pay for as long as a strong regulatory and legislative framework is developed. Last but not least the success of reforming WASA will depend on Government commitment to the process.

END NOTES

1. Domestic welfare is measured by changes in costs and benefits for all the economic actors affected by private sector involvement, that is buyers, governments, consumers, workers, and competitors. In eleven of twelve cases analyzed by the World Bank in Chile, Mexico, Malaysia and the United Kingdom privatization improved domestic welfare (Kikeri et al, 1992). Studies and data from outside the World Bank also show that forty one fully or partially privatized companies in fifteen countries (most of them industrial, but the list includes Chile, Jamaica, and Mexico) grew more rapidly, returns on sales, assets, and equity increased and internal efficiency improved because of better utilization of physical and human resources. The firms improved their capital structure and increased capital expenditures and their work forces also rose slightly. Kikeri et al (1992) point out, however, that most privatization success stories come from high-or middle-income countries.

2. Privatization is broadly defined as deregulation, new private sector entry, or private sector financing through build-operate-transfer (BOT) arrangements.

3. In Ghana, for example, an attempt to reform the main utilities began with the development of a good set of accounts for costs. The government's move to suppress transfers to public utilities that could achieve financial autonomy, created a need for the enterprises to use proper cost-accounting techniques.

4. This type of agreement originated in France, where the main purpose was to spell out reciprocal commitments of governments and managers. Korea has also successfully experimented with performance agreements, by developing explicit performance-based incentives for both managers and employees.

5. Chile has used contracting since the 1970s and it has apparently worked well. The public water company in Santiago encouraged employees to leave the company and form private companies that would bid for one or two year service contracts for meter reading, billing, maintenance and vehicle leasing. Contract periods of a short duration subjects contractors to frequent competition and eliminates the need for fee negotiation. As a result, Chile's public water company has one of the highest staff productivity rates among water companies in Latin America.

6. It was alleged that water was dumped on occasions by truck drivers contracted by WASA. Several enquiries have been held but the problem continues unabated and without legal prosecution (Suite,1994).

7. After entering into a performance agreement with the government in 1984, Togo's water utility had a 73.5% increase in the number of connections in just five years, but the cost recovery ratio was poor. The utility and the government needed an additional performance agreement to engage in steps to attain financial autonomy. In 1989, the government agreed to raise tariffs which led to a cost recovery ratio of 16% higher than its 1984 value.

8. The Caracas Water Company was unsuccessful in attracting private interests because the quality of existing operational and commercial information was very poor. Revenues could not be audited; financial projections and estimates of water consumption and demand were based on rough calculations; and maintenance had been inadequate and little was known about the actual condition of the assets and requirements for rehabilitation and new investments.

9. In Buenos Aires, where the assets belong to the Federal Government, equal representation from federal, provincial and municipal governments, has been well established. The processes by which it will carry out its regulatory functions remain to be defined, and will inevitably evolve over time.

10. Privatization has gone the furthest in telecommunications. Data provided by Sader (1993) show that Argentina, Chile, Hungary, Jamaica, Trinidad, Barbados, Belize, Malaysia, Mexico, and Venezuela have all undertaken substantial privatization of telecommunications services. The power sector too, has recently seen several large privatization, including the Trinidad and Tobago Electricity Company in 1994. Argentina, Malaysia in 1992 privatized the water sector.

11. Five European water companies participated in the research effort. All five are currently active in Latin America and expressed interest in expanding their activities there. These included from the United Kingdom; Thames Water Plc, and Seven Trent Plc; from France: Compaignie Generale Des Eaux, and Layonnaise Des Eaux Dumez, and from Spain: Sociedad General de Aguas de Barcelona. Company representatives were interviewed in Buenos Aires, Caracas, Mexico City and Santiago.

12. North America has the most experience in statutory regulation, where the private (although often monopoly) provision of infrastructure services has been the norm. The United States has relied on a sophisticated system of federal and state commissions, which have a significant capacity for autonomous regulation. Although the process is remarkably open, it is also characterized by adversarial relationships and litigation. Europe has less experience with explicit regulation, since they rely on public monopolies, combined with regulatory instruments such as price controls, technical standards and entry licensing and operational responsibilities all governed

by inter-ministerial committees.

13. A good example of the use of such guiding principles of regulation is that of the telecommunication sector in the Philippines. In order to make the regulatory process more transparent and accountable, a draft bill clearly defines the role of the national Telecommunications Commission more clearly, increases the number of commissioners, assigns a fixed tenure, and increases the commission's access to operational funds.

CHAPTER 12
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

12.1 SUMMARY

The expansion of Trinidad's water supply system in the 1960s and 1970s resulted in almost universal population access to potable piped water. However, the neglect of routine maintenance has led to a deterioration of the transmission and distribution facilities. As a consequence, half the water produced is lost through pipeline leakages, and at least 55% of the population has daily interruptions in water supply.

Given the poor quality of water service, a survey was undertaken to determine if households' were willing to pay more if the water service was improved in terms of reliability, pressure and water quality. A case study was conducted in the most urbanized zone of Trinidad known as the Capital Region. A sample of six settlements were selected from this region using the criteria of location, elevation and slope, income, housing and land tenure, level of service and the number of hours of water received. A total of 420 households were interviewed, 70 from each settlement.

The three methodologies used for measuring if households were willing to pay were contingent ranking, contingent valuation and observed behaviour of the household in producing water (the household production function). The contingent ranking method asked respondents to rank in the order of importance that feature of the water service they valued most. In the contingent valuation question, respondents were shown a payment card of water rates and were asked to use it as a guide in indicating the maximum amount they were willing to pay for improvements in the water service, namely an upgrade in the level of service, reliability, pressure and water quality. In addition, household investment in water

storage tanks and electrical pumps was observed because this was indicative of a willingness to pay more for reliability and pressure.

All three methods revealed that consumers were willing to pay more for a better water service. The survey results on contingent valuation showed that the majority of households were willing to pay slightly over twice ($67) the amount they were currently paying per month ($31). Willingness to pay was contingent upon a guaranteed service improvement, especially reliability. The Water and Sewerage Authority's cost recovery potential therefore depends largely on its ability to provide a more reliable service.

A general linear regression model revealed that there were four main variables which influenced willingness to pay; household income, the price of water, hours of service, and housing and land tenure. The main findings were as follows:

1) Not surprisingly income is the main variable which affects willingness to pay. For every TT$1000 rise in household income, there is a willingness to pay an average of TT$2.51 more per month in water rates for service improvements. In absolute terms rich households living in the affluent suburban areas were willing to pay the most for improvements in all aspects of water provision. But in relative terms low income households were willing to pay a higher percentage of their income than medium and high income ones. This proves that the demand for a better water supply has a negative income elasticity. Even though a household's income may be low, it is still willing to pay more if this would lead to improvements.

2) The current price of water is the second most important determinant of willingness to pay for improvements. For every additional TT$1.00 currently paid, households are inclined to pay on an average TT$0.34 more for a better supply. Households that received free water were willing

to pay $50 per month. Moreover, the majority (60%) of households that paid water rates were willing to pay more. Such households were paying approximately $40 per month and were willing to pay double the amount ($83). An estimated 11% of the respondents were willing to pay only the same amount they paid for water ($41). Those 8% of households that were unwilling to pay more, already paid the highest water rates of $55 per month.

3) The next most important factor influencing if households were willing to pay more is the level of service and problems associated with the level of service. Most of the households in the survey had a house tap. However, households with yard taps and standpipes show a demand for house tap service, and are willing to pay for it. Unreliability in the service is a strong determinant of willingness to pay for improvements. With every extra hour of reliable service that a household is currently enjoying, the monthly amount that it is willing to pay for an improved service is increased by a mean value of TT$6.65 per month. The survey found that households showed a willingness to pay based on the large amounts of investments in water storage tanks and the ranking of reliability as the number one feature for which they were willing to pay the most.

4) Only households living in owner-occupied dwelling units are required to pay water rates according to the WASA Act. Households that were home-owners and land-owners were willing to pay a base value per month of TT$5.26 more than tenants and squatters. In terms of the median values most landowners were willing to pay $75 per month for an improved service while squatters were willing to pay $34 per month.

There is a need to increase financial resources to meet the high demand for a reliable service. However, the balance between the cost of improved reliability and revenues generated from increased prices will also need

to be determined. But the provision of an improved service should not impose a heavy strain on the national budget and future generations. Cost recovery and water pricing policies are therefore imperative.

In terms of setting water tariffs, marginal cost pricing is more useful as a method of calculating user charges than flat fees based on the annual rental value of property. It meets the criteria of economic efficiency, administrative feasibility, and if modified can fulfil equity considerations and gain political acceptability.

Equity and negative externality concerns should also be incorporated in the pricing policy by using a "lifeline" tariff which provides up to 20 to 40 litres per person at a low rate below costs. Beyond this amount, the consumer should pay rising fees in accordance with a rising block rate.

Decision-makers are still faced with making a pricing decision to discourage excessive consumption which leads to negative externalities on the environment. For example, high consumption may influence over-extraction of groundwater supplies, destruction of habitats and social dislocation resulting from the construction of dams to meet high usage. These marginal social costs should be reflected in a surcharge to consumers.

Despite the application of the marginal cost pricing rule, a fiscal gap may occur. The fiscal gap is best closed through the introduction of multi-part tariffs which unbundle charges into consumption fees, connection charges and development charges. The survey results showed that it is possible to use price differentials based on the levels of service and spatial locations with difficult topography for water delivery. A regular updating of water rates to reflect changes in the general level of prices caused by inflation, as well as changes in the underlying cost structure of the service, is important.

Cost reduction efforts by WASA should start with the traditional supply management approach of rehabilitating transmission and distribution pipelines to reduce the high levels of leakage, along with a market-based approach of water pricing and metering to provide incentives to reduce excessive consumption. The balance between the cost and savings from improvement will need to be determined. A public education programme on water conservation should also be embarked upon. Later on other incentives for retrofitting bathrooms and toilets with water saving technologies can be introduced. While recognizing that achieving cost reduction may be costly, failing to accept it, may be more costly still.

An agenda for reform is incomplete without addressing institutional weaknesses in the water sector. Reshaping public water utilities involves creating an incentive environment for strategic reforms to have any effect. The public-private sector partnership seems to be the most feasible option for rebuilding Trinidad's water sector at this time. Basically, the public-private partnership (PPP) allows the government to maintain the ownership of the capital assets of the water company, and transfers responsibility for investment planning and maintenance to the private operator because it is unlikely that the private entity wants to undertake ownership of the capital assets, since they are in need of serious rehabilitation. The Government has already successfully negotiated with the World Bank and the Inter-American Development Bank capital financing amounting to US$60 million for system rehabilitation. On-going dialogue between the joint venture partners will be needed to inform decisions regarding a scheduled programme of system rehabilitation. Ultimately, however, such decisions should remain the sole responsibility of the Government given that it remains the owner of the capital assets.

While a PPP may lead to greater economic efficiency in water provision, there are some fundamental concerns held by all stakeholders. The success of the PPP depends on a statutory regulatory system that provides clear and open

enforcement of the terms of the contract. The Government, in drawing up the contractual agreement needs to ensure that monopoly power, social welfare, service quality, safety, environmental protection, service obligations, and the right to network access, are controlled through regulation. The regulatory agency also requires sufficient resources, autonomy, and credibility. Further, a consumer constituency is necessary; final consumers are after all the best monitors of service quality.

12.2 CONCLUSION

The common excuse of politicians for not raising water rates is that human welfare is placed at risk, and they speculate that there may be strong resistance to such a course of action. However, in failing to raise tariffs, the development impact of past investments in the expansion of water production capacity is lowered by inadequate revenues, poor maintenance, low operating efficiency, and a lack of attention to user needs.

Contrary to the opinion of politicians, households have indirectly signalled that they are willing to pay more for water improvements, through expenditure on private water storage tanks and pumps, and directly through their stated willingness to pay based on the contingent valuation survey. However, they are willing to pay contingent upon guarantees of a better service.

A number of problems may need to be addressed by WASA before implementing a newly designed tariff. Several generations of consumers did not experience water rate increases for almost half a century (1937-1985), and public tap users received free water. Many consumers may have come to accept past practices as a norm. Although there appears to a willingness to pay more for improvements, higher rates may cause anxiety, resentment and political protest from very poor households. Such possibilities may need to be addressed although lifeline tariffs should take care of this.

The second problem which calls for attention is a perception of unfairness, which occurs whenever a new pricing system requires payment for services that were previously free, or were charged, but rates were never collected, such as public taps.

A third issue is that through its failure to operate services efficiently and to charge effectively for them, the agency is weak and unable to provide a reliable service to as many consumers as possible. In the absence of an effective pricing mechanism to regulate excessive demand, water rationing measures have become necessary, raising concerns among consumers of inegalitarian and corrupt practices. A vicious cycle emerges in which the water agency finds itself in a trap; increased charges seem unjustifiable if service provision is inadequate, and the service is inadequate because of unrealistic charges. To address this issue, WASA needs to simultaneously improve water services and charge more, ensuring that consumers see the benefits and accept price increases. It is clear that in the 1990s, consumers want more bang for their bucks. WASA should start by introducing new tariffs and improved services on an area by area basis.

Political authorities have made the mistake of controlling day-to-day management of water services rather than concentrating on results. This is not to say Governments do not have a role to play in water provision. Given the externalities associated with water supply, Governments have a legitimate role in establishing policies and regulating key matters: water quality and service standards, access by low-income population to services, management of water resources, environmental protection and financial and fiscal policy that affect investment decisions.

However, Governments over-extended themselves in the decades of the 1950s to 1970s, and even up to the 1980s. In the face of economic recession and mounting debt, they are unable to keep up with the massive amounts of spending required to operate and manage water facilities, with the result that extensive

rehabilitation work has become necessary. A search is on for new ways of running public water companies. One approach is that of the public-private partnership, for which Governments have the key role in selecting a private partner, and in making sure that appropriate regulation and protective legislation is in place.

The new role of Governments is to provide an incentive environment, in which water agencies perform more like a business and less like a bureaucracy, and through which the main stakeholders--- the end users-- have an input into the level and quality of service provided.

12.3 OPERATIONAL RECOMMENDATIONS

In the face of such a complex array of problems, it is complicated to know where a public authority should begin to endeavour to solve them. Several steps are proposed as a guide to improve water provisioning, cost recovery and minimization, and institutional strengthening. These need not be sequential but may be undertaken simultaneously (See Fig 12.1) and are as follows:

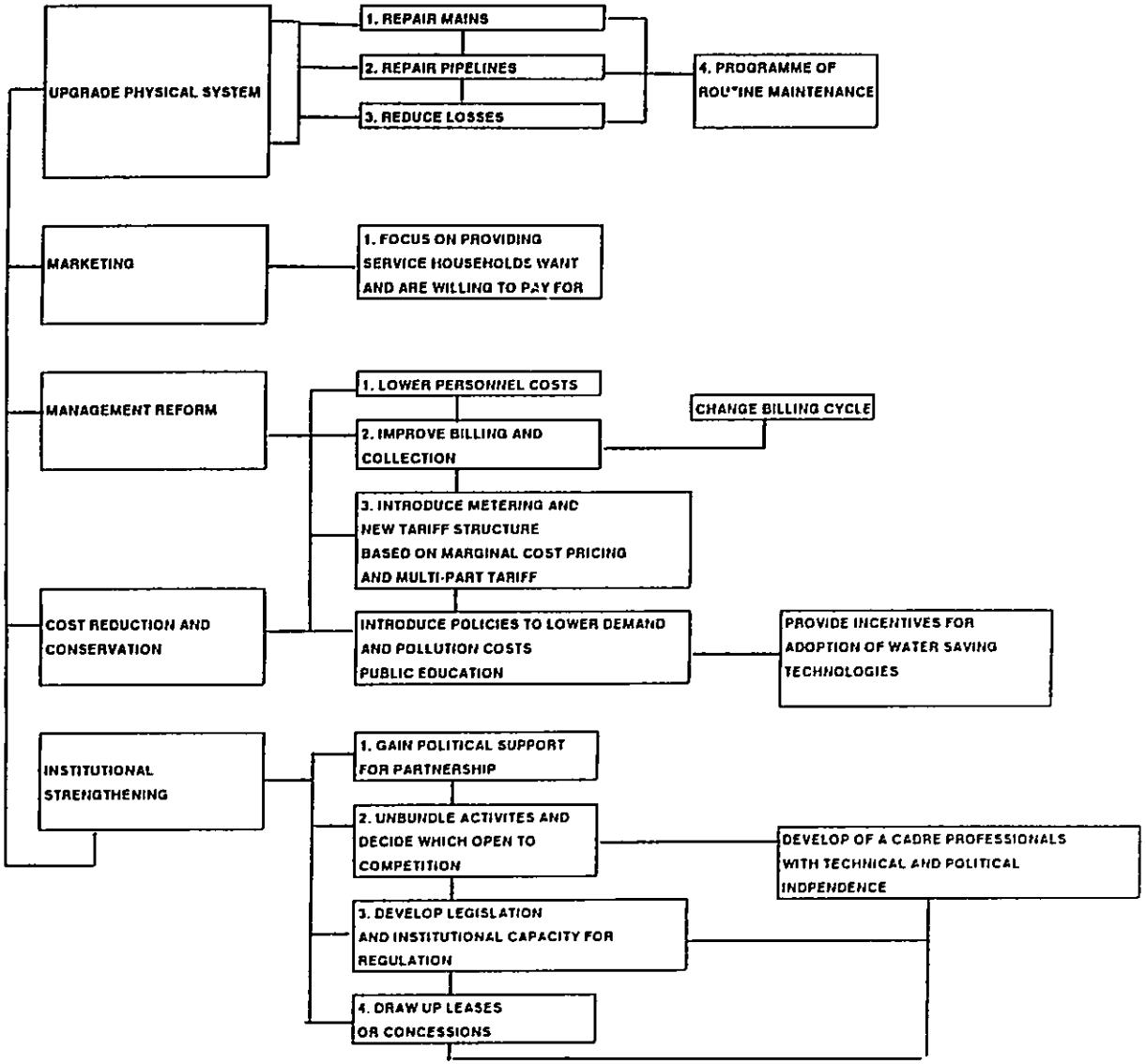
Upgrade Physical System

Step 1: Map leaks to facilitate leak repair in transmission and distribution pipelines. Prioritize repair schedule. Start with repair of mains.

Step 2: Rehabilitate transmission and distribution system to reduce losses. Establish targets. For example reduce losses to below 30% in the next 10 years. Start by doing this on a neighbourhood by neighbourhood basis;

Step 3: Introduce programme of routine maintenance and rehabilitation of water supply system (booster pumps, pumping stations, water treatment plants, service reservoirs, existing wells) to minimize long term costs;

FLOW CHART OF OPERATIONAL RECOMMENDATIONS



Marketing

Step 4. Focus on demand orientation policies. The specific components are:

* Providing services people want and improvements they are willing to pay for such as service reliability;
* Accountability to consumers.

Management Reforms

*Lowering Personnel Costs

Step 5: Undertake organizational restructuring through downsizing labour force and emphasize labour productivity to lower operating costs. Reduce the ratio of personnel costs to total operating costs to below 30% over the next five years. Encourage employees to leave WASA and form private firms that would bid for service contracts for meter installation, reading, billing, and maintenance, and new service connections;

*Billing and Collections

Step 6: Update consumer data base with the use of a Geographic Information System. Aggressively seek out and eliminate illegal connections to the system;

Step 7: Change quarterly billing cycle to a monthly billing cycle. Reduce accounts receivable from 11 months to 2-3 months. Consider contracting out billing and collection of overdue accounts. Implement a consistent disconnection policy for customers in arrears;

*Cost Recovery and Pricing

Step 8: Develop a framework for identifying and quantifying main water

production, transmission and distribution costs to determine what costs should be recovered.

Step 9: Press on with the installation of metres. Abandon water charges based on the annual rateable value of properties and replace with marginal cost pricing and universal metering. The structure of the new transparent pricing policy should be a four tiered (multi-part tariff) charging system based on a modified application of the marginal cost pricing. The four charges should be as follows:

Consumption charges

* To achieve social equity and to avoid public health risks start with a "lifeline tariff" which provides the first 40 litres of water per person per day at a low rate below costs;
* Along with the lifeline tariff use a rising block rate which incorporates the marginal cost price so as to discourage over-consumption;
* Provide the 18-20% of the population living below the poverty line with water vouchers which would allow them to pay for the service.

Connection Charges

* Charge a regular fee for connection that does not vary with water use.
* For low-income consumers this charge should be set equal to or below the marginal recurrent costs associated with a connection (meter maintenance and reading, and billing). Amortize cost of installing the connection to avoid illegal connections;
* High and medium income households should be charged a periodic connection fee set at or above the marginal

recurrent costs of connection. High income households should be charged installation fees on a lump-sum, capitalized basis.

Development Fee

* A one-time development fee should be designed to recoup the capital cost of the reticulation network in proportion to the front-footages of privately subdivided properties. If the private developer installs the network themselves no fee should be charged.

Spatial costs

* Impose a surcharge which reflects spatial cost differences due to topography or remoteness so that development is channelled to areas where it can be efficiently accommodated, or reflect costs in the connection fee or development fee.

Cost Reduction and Conservation

Step 10: Lower costs through appropriate land use and land tenure reform, development standards and technology. For environmental costs, especially ground and surface water pollution, set effluent standards, product standards, and use permits and licences.

Step 11: Establish a water demand-management unit to reduce consumption and thus save on future capital expenditure.

Political Support and Institutional Strengthening

Step 12: Gain political support from the public before allowing a private water company to be involved in water delivery.

Step 13: Consider joint ventures in the water sector. The first step is to unbundle activities, that is separate production from transmission and distribution, and examine the possibilities of splitting up services by geographic region. Then decide which of these will be opened up for competition from prospective partners, which might be private sector, community, cooperative, worker buy-out, or even a mixture.

Step 14: Develop the legal instruments and institutional capacity to regulate water services so that consumers are protected in terms of access to good water quality and a reliable service with adequate water pressure.

Step 15: Draw up either leases or concessions to create competitive conditions for partnerships.

Step 16: Develop a cadre of well-qualified professionals with technical and political independence that have the capacity to evaluate the work of partnerships and to ensure their activities are the public interest.

12.4 FURTHER RESEARCH:

The general field of infrastructure provision, and especially water utilities management, is changing very rapidly as old assumptions are being questioned and new techniques are being introduced. There are a number of technical, institutional and political issues raised in this thesis which merit further investigation, either because of their intriguing intellectual nature, or because they would lead to a solid instrumentation of reform in the sector. Briefly these are:

Technical Issues

1) Developing minimum service standards for level of service, reliability, pressure and quality;

2) Developing methods of costing improvements in reliability, water pressure and water quality;

3) Cost benefit analysis research on the administration of different systems of charges, which would require comprehensive information on costs, household demand patterns, and price elasticities of demand.

4) The development of a conceptual framework for management policies, for example performance indicators which are basic tools for monitoring the activities of a water agency;

Institutional Framework and Legislation

5) On-going studies should be conducted on the institutional ways of extending competitive markets in water delivery and their limitations because this is new to the water sector;

6) Research on legal instruments and on contract drafting for the purposes of regulating public-private partnerships; and

Public Participation and Political Responses

7) Research ways of accommodating stakeholder involvement in regulating the supplier, particularly the end users of the water service.

8) Research impact of changes on various social groups and their reactions to these changes.

Government commitment to restructuring the financing and management of water provision is the key to success. Reforms should lead to reduction in Government subsidies and the drain on the national treasury. More important, users may get a more reliable service and higher levels of access to the service if the public-private partnership is well regulated. However, derailment of a public-private partnership by forces of resistance such as senior civil servants, management, workers and trade unions must be taken into account. It is important to remove suspicions about private sector involvement by making the bidding transparent to the public and by appealing to the mutual interests of the various

stakeholders. Moreover, public education on the benefits of metering, volumetric based user charges and water conservation will be necessary to avert resistance to reforms.

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APPENDICES

Appendix numbering relates to chapter numbers

APPENDIX 1

SURVEY OF HOUSEHOLD WILLINGNESS TO PAY FOR WATER IMPROVEMENTS IN THE CAPITAL REGION, TRINIDAD

Name of Enumerator.....
Date.....

Enumeration Area.....

House No.....

Time Start..... Time Finish.....

[ENUMERATOR:PLEASE READ THE FOLLOWING INTRODUCTORY STATEMENT]

My name is..... and I have been hired by a student doing her doctorate on urban water provision in Trinidad. The student is based at Mc Gill University, Canada and is currently conducting research for her thesis in Trinidad.

We would like you to answer some questions about your water supply. The survey is divided into 7 parts:

1. Household socio-economic characteristics;
2. Housing characteristics;
3. Water amenities of each household;
4. Water quality;
5. Details on water sources (tap in house, standpipe, truckborne water);
6. Your household's perception of water supply;
7. Household Willingness to Pay for improvements in the water supply.

Your responses will help us to better understand your need for water and what improvements you would like in your water supply. Your answers will be completely confidential.

HOUSEHOLD QUESTIONNAIRE ON WILLINGNESS TO PAY FOR WATER IN TRINIDAD

PART 1 HOUSEHOLD SOCIO-ECONOMIC CHARACTERISTICS

1. Sex of respondent: 1 MALE 2 FEMALE

2. Age of Respondent [Respondent must be over 18 years]
   1. <20 years[] 3. 30-59 years[]
   2. 20-29 years[] 4. >60 years[]

[NOTE TO ENUMERATOR: RESPONDENT SHOULD BE EITHER HEAD OF HOUSEHOLD OR SPOUSE]

3. Is the person being interviewed:
   1 head of household[] 2 Spouse[]

4. How many persons contribute to the bills?.....

5. How many persons live in this household?.....

6. [Enumerator: Please give the occupation and income of all members of the household who work as follows: (If member does not work, record none)].

Members	Age	Occupation/Studying	Pay Period
Head			
Member			
Member			
Member			
Member			

7. Does the household own any of the following appliances and how many?

   1 Radio[] 2 Cassette Player[] 3 Stereo[] 4 TV[]
   5 Video[] 6 Fan[] 7 Sewing machine[]
   8 Washing machine[] 9 Refrigerator[] 10 Car[]

8. Number of years of education of the household head?
   .....

PART 2 HOUSING CHARACTERISTICS

9. What kind of dwelling unit is this?
1 Separate House[] 2 Apartment/Flat[]

3 Townhouse/Condominium[] 4 Other[]

10. Which of the following categories does this property belong to?

1 Owner occupied[] 2 Rented Government []
Go to 11 Go To 12

3 Rented Private[] 4 Squatted[]
Go to 12

5 Rent free[] 6 Other[]

11. If house is owned, how much do you pay in mortgage?
TT$ permonth.....

12. If house is rented, what is your monthly rental?
TT$ per month.....

13. Is your rental unit under rent control?
1 Yes[] 2 No[] 3 Don't know[] 4 Not Stated[]

14. Land Tenure:Is this land
1 Owned[] 2 Private Rented[]

3 Government Rented[] 4 Leased[] 5 Squatted[]

6 Don't know[] 7 Not Stated[]

15. What year was this house constructed? .....

16. Does the household have electricity?
1 Yes[] 2 No[]Go to 18 3 Don't know
4 Not Stated[]

17. How much is the household's monthly electricity bill?
TT$----------

18. Does the household have a telephone?
1 Yes[] 2 No[]Go to 20
3 Don't Know [] 4 NotStated[]

19. How much does the household pay per month for the telephone? TT$----------

20. Does the household have cable TV?
1 Yes[] 2 No[]Go to 22 3 Don't Know[]
4 Not Stated[]

21. How much does your household pay per month for the cable TV? TT$----------

22. How do you consider the rate you pay for water to be in relation to those of electricity, cable television and telephone?

1 High[] 2 Moderate[] 3 Low[]

PART 3 WATER AMENITIES

23. What type of toilet facilities do you have?
1 Flush linked to private system[]
2 Flush linked to public system[]
3 Septic Tank[]
4 Pit Latrine[]
5 None[]
6 Not Stated[]

24. For personal hygiene which of the following do members of your household use and how many times per day?

1	Shower[]	2	Bathtub[]
3	Bucket[]	4	Standpipe[]

25. Does the household own any of the following?

1	Shower []	6	Washing machine[]
2	Bathtub []	7	Pond/fountain []
3	Bidet []	8	Lawn []
4	Dishwasher []	9	Garden tap sprinkler/hose []
5	Swimming pool[]		

26. What is the household's source of water?
Code: Primary=a Secondary=b

1 Tap in house[]	6 Spring[]
2 Tap in yard[]	7 River[]
3 Standpipe[]	8 Bottled water[]
4 Truck[]	9 Private wells[]
5 Rainwater[]	10 Other

27. What do you use water to do and what source of water is used with these uses?

[Note to Enumerator: Please use the following coding to correspond with source of water]

a=Tap in house	f=Spring
b=Tap in yard	g=River
c=Standpipe	h=Bottled water
d=Truck	i=Private wells
e=Rainwater	j=other=specify

ACTIVITIES	SOURCE OF WATER
1 Wash clothes[ ]	6 Clean yard,driveway
2 Cook[ ]	7 Car cleaning[ ]
3 Bathe[ ]	8 Recreation[ ]
4 House cleaning[ ]	9 Other (specify)[]
5 Wet garden and lawn[ ]	10 Not Stated[]

28. How do you dispose of your waste water?
1 Surface drain/canal
2 Other specify.....

Part 4 WATER QUALITY

29. What is the quality of the water your household receives now?
1 Clear[] 2 Discoloured []
3 Distinct odor[] 4 Odorless[]

30. Is your household satisfied with the colour of the water?
1 Yes[] 2 No[] 3 Don't Know[]
4 Not Stated[]

31. Is your household satisfied with the taste of the water?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

32. Does your household believe that the water quality is
1 Very Good[] 2 Good[] 3 Fair[] 4 Poor[]
5 Very Poor[] 6 Don't Know[] 7 Not Stated[]

33. Does your household treat water for drinking purposes?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

34. If yes, how is the water treated?
1 Boil[] 3 Use other method (specify)
2 Filter [] 4 Tablets[]

35. If yes, why do you do this?
1 Unsafe[] 2 Habit[]
3 Don't Know[] 4 Read about it []
5 Heard on TV/radio[]

PART 5 WATER SOURCES
[ENUMERATOR SAYS: "Now I would like to ask you some questions about your water situation."]

SOURCE NO 1: Tap in House Water Connection

[Enumerator read : You indicated that your primary source of water is a tap in the house].

36. Is your house connected to an existing supply of water?
1 Yes[] 2 No[] 3 Don't know[]
4 Not Stated[]
----------Go to 38----------

37. If Yes, what is the water system?
1 WASA[] 2 Private[]
3 Local Government[]
4 Other Specify[].....

38. Have you ever requested WASA to connect you to the water system?
1 Yes[] 2 No[] 3 Don't Know[]
4 Not Stated[]

39. How long ago did you request a connection?
1 Weeks..... 2 Months.....
3 Years.....

40. How many taps do you have in your house?.....

41. Are the taps in this house working?
1 Yes...GO TO 43 2 NO....CONTINUE

42. IF NO, why isn't it working?
1 Technical problem (bad plumbing in the house)-----

2 Financial: water cut off because water bill hasn't been paid------

3 Management problem with WASA (lock-offs) ---------

43. Does the tap have a meter?
1 YES 2 NO 3 Don't Know
GO TO 46

44. If YES, does the meter work?
1 YES 2 NO 3 Don't Know
GO TO 46

45. If YES, how often is the meter read?
1.Once a month [] 2.Every 3 months[]
3.Don't Know[]

46. Which days of the week and times of the day you don't have water or water pressure is low assuming some degree of regularity?

Code 1=No water Code 3= ok/fine

Code 2=Low pressure

Times	Sun	Mon	Tues	Wed	Thurs	Fri	Sta
6-8am							
9-12am							
1-5pm							
6-8pm							
9-5am							

47. How is your water pressure on the whole?
1 Very good[] 2 Good[] 3 Fair[] 4 Poor[]

48. If this is an owner-occupied dwelling units, is your housebold billed for water?

1 Yes[] 2 No[] 3 Don't Know[]
4 Not Stated[]

49. If you do pay your water bill, when is it paid?
1 Annually[] 2 Quarterly[] 3 Monthly[]

[ENUMERATOR, IF THIS IS AN OWNER-OCCUPIED DWELLING UNIT, GO TO Ques 54, OTHERWISE, CONTINUE.]

50. Who is billed for water?
1 Landlord[] 2 Tenant[]

51. If landlord, how does the landlord charge ?
1 Fixed monthly fee[] 2 As part of the rent[]

52. Is there more than one tenant in this building?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

53. If yes, do you pay separate water bills?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

54. Do you own a water tank?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

----------GO TO 61.....

55. If yes, how long would you keep it?
1 Until piped supply is regular[]
2 Forever[]
3 For up to 5 years[]
4 Dismantle immediately[]
5 No response[]

56. What is the size of your tank?.....

57. How much did the tank and other fixtures to operate the tank, cost initially? TT$.....

58. How much does the tank cost you to maintain per annum?
TT$.....

59. Do you own a water pump?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

60. If yes, what is your electricity bill since you have installed the water pump? TT$ per Month.....

61. Would you prefer to have your own water tank?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

[Note to Enumerator: Allow respondent to explain reason for selection made]

SOURCE NO.2 PUBLIC TAPS/Standpipe

[Note to Enumerator: Ask respondents who use standpipes as main source of water]

[Introductory statement:You indicated that your primary source of water is that of public standpipes. I would like to ask you a few more questions about your household's use of standpipes]

62. Has your household ever request ɜ WASA to connect it to the water supply system?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]
---- Go to 65----------

63. How long ago was a request for a connection made? Note to Enumerator: put number of weeks, months, years in brackets.

1 Weeks[] 2 Months[] 3 Years[]

64. What was the reason given for not getting connected to the water supply system.----------
---

---

65. Is the public tap which your household uses, working now?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

66. How often does your household use the standpipe?
1 Daily..... 2 Weekly..... 3 Monthly.....

67. If daily, what times of the day does your household use the standpipe?
1 5-8 am[] 2 9am-12am[] 3 1-4pm[]
4 5-8pm[] 5 9pm-4am[]

68. Does your household use the standpipe for any of the following?

ACTIVITIES	FREQUENCY (No. of times per day)
1 Bathing[]	----------
2 Washing Car[]	----------
3 Washing clothes[]	----------
4 Bathing dogs etc[]	----------
5 To catch water[]	----------

69. How much time do members of your household spend collecting water from tap to house per trip (including lining-up)?.....

70. How does your household transport your water?
1 Truck/Pick-up[] 2 Walk[]
3 Car[] 4 Other[]

71. Do you connect a hose to the standpipe which then brings water into to your yard or inside your house?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

72. How far is the nearest public tap from this house?
1 No. of Houses ----------
2 From tap to house (in minutes)------
3 No. of yards (meters)----------

73. Which days of the week and times of the day does your household not have water from the public standpipe or water pressure is low?

Code 1=No water Code 3= ok/fine

Code 2=Low pressure

Times	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
6-8am							
9-12am							
1-5pm							
6-8pm							
9-5am							

74. Where does your household get water from when the pressure is low or there is no water in the standpipe nearest to you?
1 Tank[] 2 Water truck[]
3 Other Standpipe[]
4 Rainwater[]
5 Spring[]
6 From neighbour's house tap or yard tap[]
7 Other specify[]

75. Does your household pay water rates for the use of the standpipe?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

76. If YES, when does your household pay the bill?
1 Annually[] 2 Quarterly[] 3 Monthly[]

77. Do you know if the landowner pays water rates?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

SOURCE 3 TRUCKBORNE WATER

[Note to Enumerator: If the primary source of water was truckborne water ask the respondent the following questions]

78. Is your household connected to the WASA supply system?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

79. Has your household ever requested WASA to connect it to the water supply system?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]
.....Go to 82.....

80. How long ago was the request for a connection made?
1 Weeks[] 2 Months[] 3 Years[]

81. What was the reason given for not getting connected to the water supply system?

---

82. What does your household use when there is a water shortage?
1 Tank[] 2 Standpipe[]
3 Bucket/Barrel[] 4 Private Well[]
5 Neighbour's in-house tap/yard tap[]

83. How often does the truck come to your area?
1 Daily[] How many times.....
2 Weekly[] How many times.....

84. Is there a charge for truckborne water?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

85. How much money do you pay for truckborne water?-----

86. Does your household get an official receipt when truckborne water is delivered?
1 Yes[] 2 No[] 3 Don't know[] 4 Not stated[]

87. Does your household get a refund from WASA?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

88. Which of the following delivers truckborne water?

1 WASA..... 2 Private Company.....
3 Local Government..... 4 Other.....

Source of Water: Tap in Yard

[Enumerator read to respondent: You indicated earlier that your primary source of water was a tap in the yard. We would like to ask you some more details about your households water supply]

89. Is your household connected to the WASA supply system?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

90. Has your household ever requested WASA to connect you to the water supply system?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

91. How long ago did you request a connection?
1 Weeks[] 2 Months[] 3 Years[]

92. What was the reason given for not getting connected to the water supply system
.....
.....

93. Which days of the week and times of the day does your household not have water from the tap in yard or water pressure is low?

Code 1=No water Code 3= ok/fine
Code 2=Low pressure

Times	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
6-8am							
9-12am							
1-5pm							
6-8pm							
9-5am							

94. Where does your household get water from when the pressure is low or there is no water in the yard tap?
1 Tank[] 2 Water truck[] 3 Other Standpipe[]
4 Rainwater[]
5 Spring[]
6 From a neighbour's house tap or yard tap[]
7 Other specify[]

95. Does your household pay water rates for the use of the yard tap?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

96. If YES, does your household pay your bill by the due date?
1 Annually[] 2 Quarterly[] 3 Monthly[]

Part 6 PERCEPTIONS ABOUT WATER SUPPLY SYSTEM

[Note to Enumerator:Ask all respondents the following questions]

97. How do you feel about the water supply system?
1 Very satisfied.....
2 Satisfied.....
3 Somewhat satisfied.....
4 Dissatisfied.....
5 Very dissatisfied.....
6 No response.....

98. Please rank from 1-5 what are the major shortcomings of water provision?

a Reliability (frequent interruptions)

b Maintenance/design (substandard material, poor distribution layout and lack of cleanliness)

c Interaction with staff (irresponsible, uncooperative, and corrupt staff).

d Leakage in WASA's supply system.

e Illegal connections by households which do not pay water rates.

99. Please score from 1-5 (1=most 5=least) which improvements in water provision you desire in each category.

a	Greater pressure	d	More competent staff
b	Cleanliness	e	Change in price
c	Improved billing procedure	f	Reliability

100. Rank from 1-5 what you would like to see as an improvement in WASA's operations?

1 Smaller work teams[]
2 Quicker response rates to complaints[]
3 Repairs to potholes resulting from water repairs[]
4 Reduction of leakages[]
5 Illegal connections to WASA's pipelines[]

101. Do you think that the workers labour unions are part of the reason for the inadequate water service?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

102. Which one of the following do you believe that water supply should be managed by

1 Government Agency (WASA)
2 Local Government
3 Private Entrepreneur
4 Community Organization
5 No preference

103. If you are paying for water, are you satisfied with the way in which you are currently charged for consuming water?

104. Do you understand how the water you use is priced and charged to you?
1Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

105. Explain how you think the water rates are calculated.

---

106. What is your normal water bill?
(i.e., how much do you usually pay per month or per quarter for water?)
Average water bill ..... TT$ per month
..... TT$ per quarter

107. Do you pay your water bills on time?

1Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

108. Do you believe that water should be supplied free?
1Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

109. Do you believe that water can be supplied free?
1Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

110. Have you ever noticed any advertisement regarding water saving.

1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

PART 7 WILLINGNESS TO PAY FOR WATER IMPROVEMENTS:

[Note to Enumerator: please ask each household these questions]

Currently you are experiencing some problems with your water supply such as:

* water being "locked-off" at different times of the day, and having to store water, purchase water tanks and rely on water trucks to deliver water.
* low water pressure.
* discolouration in the water with sediments etc.
* those households without a tap in the house having the inconvenience of collecting water from standpipes, rivers, springs or rainwater and storing water drums etc.

111. Currently you are paying TT$----------per month, but experiencing constraints in your water supply. Using the PAYMENT CARD below as a guide only, what is the maximum amount of water are willing to pay per month for an improved service in terms of:

1) Better reliability: provide a water service with no disruptions in supply;

2) Better pressure:No drops in pressure;

3) Better water quality:clear, odourless, good taste;

4) A service upgrade (relevant to standpipe and yardtap users)

$0	$25	$50	$75	$100
$125	$150	$175	$200	$225
$250	$275	$300	$325	$350
$375	$400	$425	$450	$475

112. Can you afford this payment?
1Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

113. Would you like to make changes?
1Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

114. What is the final maximum amount you are willing to pay?

115. Rank 1,2,3 in the order of priority, which feature of the water service you are willing to pay the most for: 1=most, 3=least.

Reliability.....
Good Pressure.....
Quality.....

Water metering

INTRODUCTORY STATEMENT: Water metering is a way of measuring how much water a household uses and charging by how much water is consumed? The consumer benefits from metering in several ways:

* production costs are lowered so that more customers can be served.

* reduction in costs would lead to less service disruptions, low pressure and contaminated supplies;

* consumers would pay according to exact amount of water consumed and will therefore not be billed for an approximate amount of water consumed.

116. Did you know that water metering is a way of measuring how much water a household uses and charging by how much water is consumed?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

117. Have you lived in another country where water meters were used?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

118. If yes, were you satisfied with the water service?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

119. Are you aware that in some countries the water supply to the household is metered?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

120. Do you favour metering the supply of water in Trinidad?
1 Yes[] 2 No[] 3 Don't Know[] 4 Not Stated[]

[Note to Enumerator: respondents who have or wanted a metered service must answer this question]

121. What is your household's average net income (income you bring home) per month?

1	TT$0-599.....	9	$5000-5999
2	TT$600-899.....	10	$6000-6999
3	TT$900-1499.....	11	$7000-7999
4	TT$1500-2099.....	12	$8000-8999
5	TT$2100-2699.....	13	>or=$9000
6	TT$2700-3299.....		
7	TT$3300-3999.....		
8	TT$4000-4999.....		

122. Is your income

1 Regular..... 2 Irregular.....

Appendix 3.1
Statistical Indicators of Water Utilities in Asian Megacities,1993

INDICATOR	Bangkok	Delhi	Dhaka	Jakarta	Karachi	Seoul
Population (million)	6m	10m	5m	9m	10m	11m
Population with water	75%	69%	65%	44%	83%	100%
No.Hours of Water	24	7	6	19	4	24
Public Taps (1000)	0	14	1	2	21	0
Water Production Million Cubic Metres Per Day	3	2	2	1	2	5
Water Loss (UFW)	30%	40%	50%	52%	-	38%
Metered Customers	100%	53%	68%	100%	1%	100%
Domestic Water Use (lpcd)	240	225	120	157	124	198
Water Tariff Structure	Block	Various	Various	Block	Property Tax	Block
Domestic Cost of 30 cubic metres (US$)	$4.72	$0.49	$2.46	$7.60	-	$5.29
Staff/1000 Connection	5.5	8.9	21.3	8.7	11.7	1.9

Source:McIntosh,1994.

Appendix 3.2 Total Number of WASA's Registered Consumers

Year	No.of Registered Consumers
1982	190,346
1984	194,901
1990	250,000
1993	269,791

Source: WASA,1994.

Appendix 4.1

List of Names of Local and International Professionals Interviewed

Executive Director of WASA	Emile Warner
Head of Institutional Strengthening Unit	Emile Charles
Deputy Head of Commercial Department of WASA	Godfrey Ventour
WASA Board Member	S.Teemal
Former Deputy Chairperson of WASA Board	Imtiaz Hosein
Water Resource Agency	Marilyn Critchlow
Advisor to Minister of Public Utilities	Elton Wyke
Chairman of Public Utilities Commission	Edward Beckles
Commissioner of Valuations Division	K.P Subran
Former Commissioner of Valuations Division	Gladstone Staples
Director of Town and Country Planning	Victoria Charles
Eco-Engineering Consultants Limited	George K.Sammy
Planning Associates	Timothy Mooledhar
Urban Division, World Bank	Michael Cohen
Water and Sanitation Division, World Bank	Harvey Garn
" " " " " "	Thelma Triche
" " " " " "	Peter Koneig

Appendix 7.1 Ownership of Consumer Durables
(% Who own At Least One)

	Quintiles					
	Poorest	II	III	IV	Richest	Total
Cars	15.3	23.6	33.7	54.0	71.2	39.6
Motorbikes	1.7	0.2	1.1	1.5	2.9	1.5
Freezers	62.3	77.2	90.0	92.3	94.2	83.4
Stereos	25.2	43.4	49.1	59.8	59.5	47.4
TVs	72.6	84.5	93.9	94.8	95.8	88.4
Stoves	94.0	96.7	97.7	98.3	98.6	97.0
Polishers	1.0	3.6	5.4	9.3	12.0	6.2
Radios	46.3	53.6	64.6	70.5	74.7	62.0
Airconditioners	0.0	1.5	3.2	7.0	11.9	4.7
Sewing Machines	28.8	38.5	50.6	56.1	58.0	46.5
Vacuum Cleaners	3.2	4.4	12.2	23.0	38.7	16.3
Washing Machines	15.2	27.6	44.0	58.8	71.2	43.4
Hot Water	0.7	2.0	5.2	14.8	30.7	10.7
Clothes Dryer	0.5	1.8	3.5	8.3	20.1	6.9
Lawn Mower	0.4	3.3	5.1	9.2	20.8	7.8
Bicycles	11.5	16.7	20.4	27.0	29.7	21.1
Other	23.5	16.6	15.5	10.5	9.0	15.0
Sample Size	1243	1235	1253	1241	1248	6220

Source: Survey of Living Conditions, 1992.

Appendix 7.2 Water Characteristics by Income, County and Sector

	Piped water in dwelling	Piped water in yard	Public Standpipe	Other
QUINTILE				
Poorest 20 %	33.7	15.1	31.3	19.9
II	51.1	15.8	18.9	14.2
III	61.6	11.3	13.0	14.1
IV	75.5	10.2	6.5	7.8
Richest 20 %	80.3	7.0	5.1	7.6
COUNTY				
Port-of-Spain	67.6	18.6	13.8	0.0
San Fernando	83.5	5.5	11.0	0.0
St. George	68.3	8.8	15.5	7.4
Caroni	44.5	22.5	10.8	22.3
Nariva	50.9	14.9	26.9	7.4
St. Andrew	40.9	14.7	10.2	34.2
Victoria	64.0	10.0	15.4	10.6
St. Patrick	55.4	5.8	19.2	19.7
Tobago	64.7	17.5	9.8	8.1
SECTOR				
Urban	68.9	9.6	15.1	6.4
Rural	54.1	13.6	14.7	17.6
OVERALL	60.5	11.9	14.9	12.7

Source: Survey of Living Conditions, 1992.

Appendix 9.1 Water Tariff Structure of Selected Cities

Country, year, state or city	Lump-sum connection charge	Fixed monthly fee	Consumption charge	Standpipe charge	Commercial charges relative to residential charge
Brazil, 1974					
Belo Horizonte	n.a.	Flat rate	n.a.	—	Higher
Minas Gerais	n.a.	Minimum charge	Two blocks (rising);	—	Higher
Bujumbura, Burundi, 1966	By pipe diameter and length of pipe	Meter rental fee (for five years)	Two blocks (rising); rising with dwelling area and declining with family size	—	Higher
Cameroon, 1975	Flat charge	Minimum charge; flat fee where unmetered	Three blocks (first rising, then falling)	Rate charged	Equal
Colombia					
Bogotá, 1979	Rising with property value and cost of installation	Minimum charge rising with property value	Five blocks (rising); rising with property value	Free	120–130 percent of residential tariffs
Cali, 1978	Rising with property value and cost of installation	Minimum charge rising with property value	Five blocks (rising)	Free	Consumption charge equal to residential monthly fee, approximately equal to mean residential fee
Libreville, Gabon, 1973	n.a.	n.a.	Five blocks (first rising, then falling)	—	—
Accra/Tenna, Ghana, 1974	n.a.	Minimum charge	Flat rate	—	Higher
India					
Ahmadabad, 1973	n.a.	General property tax	n.a.	Free	—
Bombay, 1978	Charge rising with meter size	Minimum charge and meter rental fee rising with meter size; tax on property value for unmetered users; special low rate for slums	Flat rate; higher rate for properties with large lawns or swimming pools	Free	Higher
Indonesia					
Jakarta, 1973	Charge rising with pipe diameter	Meter fee increasing with diameter of pipe	Two blocks (rising)	Rate equal to highest residential rate	Higher
Malang, 1974	Flat charge	Minimum charge	Flat rate	—	Higher rising; block rates
Kingston, Jamaica, 1975	—	Rate varying with meter size; low-value properties are exempt	Six blocks (rising)	—	Highest residential tariff
Kenya					
Mombasa, 1975	Flat charge	Meter rental rising with diameter; flat rate for nonmetered users	Two blocks (rising)	—	Lower
Nairobi, 1973	Connection fee and returnable deposit	Minimum charge and meter rent	Flat rate	Private operators charge unit rate five times official rate for house connections	Equal
Malaysia					
Kuala Lumpur, 1973	n.a.	Minimum charge	Flat rate	—	Higher
Penang, 1973	—	Minimum charge	Two blocks (rising)	—	Higher
Mexico City, Mexico, 1973	n.a.	For nonmetered users flat charge rising with pipe diameter	Six blocks (rising)	—	Equal
Kathmandu, Nepal, 1970s	Flat charge	For nonmetered users flat charge rising with pipe diameter	Two blocks (rising)	—	Equal
Tunis, Tunisia, 1973	—	n.a.	Flat rate	—	Lower
Seoul, Rep. of Korea, 1972	—	Flat minimum charge	Five blocks (rising)	Higher than low-use residential fees	Higher
Lahore, Pakistan, 1973	Flat charge	Minimum charge rising with pipe diameter; meter rental charge	Flat rate	—	Higher minimum charge
Bangkok, Thailand, 1975	Charge varying with pipe diameter	n.a.	Six blocks (rising)	Free	Equal

Source: Bahl and Linn, 1992 —Not Available n.a Not applicable

Appendix 10.1 Charges Under the Squatter Regularization Programme for the Average Lot in Ackbarali Trace, Trinidad

CHARGES UNDER THE SQUATTER REGULARIZATION PROGRAMME FOR AN AVERAGE LOT IN ACKBARALI TRACE

Types of Charges	Charges	Repayment Period	Monthly Charge
PROGRAMME CHARGES			
Administrative	$ 0		
Land	$ 1,000	1 year	$ 83.33
Infrastructure	$10,800	30 years	$ 30.00
Conveyancing fee	$ 100	1 year	$ 8.33
Legal fees	$ 10	1 year	$ 0.83
Lease	$ 1	30 years	$ 0.08
NON-PROGRAMME COSTS			
Electricity	$150/2months	Duration of lease	$ 75.00
Water	$250/quarter	Duration of lease	$ 83.33
Sewerage	$ 75/quarter	Duration of lease	$ 25.00
Telephone	$ 5/ month	Duration of lease	$ 5.00
Land and building tax	$130/ year	Duration of lease	$ 15.00
Home improvements/ maintenance	$498/ year	Duration of lease	$ 41.50

Source:Frojmovic.1994.

SUMMARY OF AVERAGE MONTHLY PROGRAMME-RELATED CHARGES

1 year to acquire lease	$ 92.49
30 year repayment option including income-based subsidy	$271.91

Appendix 10.2 Estimated Meter Installation Cost In Trinidad (TT$)

Purchase Standard Meter	$200
Remote meters on 50% of installations	$20
Meter Box	$200
Supplies	$20
Sub-total	$440
15% Value added tax	$66
Total supply costs	$500
Installation costs	$400
Total Cost Per Unit	$900

Adapted from Delcan 1992.