WILLINGNESS TO PAY FOR WATER IN SOUTH AFRICAN RURAL AREAS: A CASE STUDY OF NSIKAZI VILLAGES OF MPUMALANGA PROVINCE

by

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DECLARATION

I **Rirhandzu Cornelius Mahlale** declare that this dissertation hereby submitted by me for the MCom. degree at the University of Venda For Science and Technology is my own independent work conducted under the supervision of my promoter and has not been previously submitted at any other university or faculty. Copyright of this study lies jointly with the USAID who funded this work and the University of Venda For Science and Technology.

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RIRHANDZU CORNELIUS MAHLALE

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Views and opinions expressed in this study are made on the basis of the research undertaken by the researcher and the researcher retains responsibility for all errors and omissions.

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ABSTRACT

The scope and focus of this study was narrowed to the rural households in Mpumalanga Province – Nsikazi villages. Therefore the study was titled: The willingness to pay for water in South African Rural areas: A case study of Nsikazi Villages of Mpumalanga Province. The principal objectives of the study are as follows: determining the level of the relationship between the households' willingness to pay and the household's socio-economic and water sources characteristics; determining the amount of money that rural households are willing to pay for an improved water service, and the level of service that they would prefer to use, and lastly, determining the payment system that households prefer in their rural areas. This study was limited only to those households, staying in those villages in which the RDP water service was already put in place by the government. A Contingent valuation questionnaire was

used to collect data from households and the questionnaire comprised three parts, namely, water sources; household willingness to pay for three levels of water services, and questions about the socio-economic and demographic characteristics of the respondents. A Contingent valuation method was used in order to determine whether the households were willing to pay for the running costs of an improved water system.

Based on the willingness to pay estimates, households in Mpumalanga rural areas were willing to pay R6.1 million towards the cost of providing a yard tap water service. The revenue maximizing tariff per household in Mpumalanga Province for yard tap water was found to be R12.50 per household per month. An important finding of the analysis in this villages was that the overwhelming majority of households preferred a yard tap as they view it as a convenient water service option, and almost all the respondents expressed dissatisfaction with the street taps water supply system.

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INTRODUCTION

1.1 BACKGROUND

South Africa is a semi-arid country, where water is a key strategic resource in the development of all sectors of the economy. Efficient management of our limited water resources is therefore an essential element of that development. A large percentage of the population of South Africa has inadequate domestic water supplies and experiences critical water shortages. The inadequacy of the service is in terms of the volume of water delivered, inappropriateness of water distribution facilities, excessive walking distance, long queues at water points, poor maintenance and inadequate bulk water development. The disadvantaged groups are estimated to exceed 50% of the population. The Department of Water Affairs and Forestry's water supply and sanitation policy documents record that some 12 million people are without adequate water supply. Water supply systems in proclaimed towns are usually more sophisticated and capable of delivering high volumes of water per household.

The reasons for poor water supply situations are numerous, varied and include inappropriate choice of water supply technology, low levels of community involvement, (Wiseman R., 1987) ad hoc development, poor maintenance, insufficient supply of water, (Van Tonder et al, 1990), inadequate provision of water abstraction points (Van Schalkwyk, 1992). The prolonged drought has further aggravated the situation. Water losses in certain systems also drastically reduce the volume of available water to residents.

A review of the water supply situation in several hundred villages by the Water supply and Management (WSM), 1991,1993,1994) and the results of several socio-economic studies undertaken in the Northern Province (Van Tonder et al, 1990) would suggest that a large percentage of the water supply problems are related to inappropriate design. Designs are usually based on guidelines, which do not meet the aspirations of the communities.

Alcock, P.G (1987) reported that it is generally accepted that appropriate and adequate water supply facilities can only be developed and sustained by fully involving the community. According to Alcock this implies that it is essential to focus on the requirements of the domestic water user and not to use arbitrarily fixed design rules.

For most water utilities and donor agencies, the actual water supply situation in many third world rural areas is typically something of a mystery. From where do households obtain their water? How much water do different households use? What do they use the water for? How much do the households pay for water? If they pay something, what does the payment represent in terms of the proportion of the income a household receives? How much will they be willing to pay for improved water systems? Water utilities and donors do not always know the answers to such questions.

Many women in developing countries spend a significant portion of their day hauling water from various sources to their homes. One of the principal benefits of improved water delivery systems such as yard taps, hand pumps and stand-pipes, is that the time women spend carrying water is reduced. The time saved by not having to haul water from relatively distant sources may be put to many other productive uses, such as child care, wage employment, agricultural labour, or food preparation (Churchill et al., 1987).

1.2 Problem statement

The world's fresh water resources are under pressure to meet the growing demands of burgeoning populations and their various activities. The problem is repeatedly acknowledged at international forums such as the 1992 Rio Summit. The fact that South Africa receives less than the world's average annual rainfall suggests that it is a potential candidate for water stress. Most of South Africa is semi arid with an average mean annual rainfall across the country of about 500mm, compared with the world figure of 860mm. Rainfall is concentrated along the Eastern and Southern coastlines, with 65% of the country receiving less than 500mm annually. Erratic rainfall patterns, skewed distribution systems and the prevailing water rights system intensify the effect of this limited water resource on users.

Besides resource and supply problems, an estimated 30% of available water is wasted owing to poor management. New policy directives are emphasizing water demand management as a tool for safeguarding the limited water resources (Business Day, 11.7.95).

The lack of knowledge, however, rarely hinders investment-planning efforts in the water supply sector. Designs of new systems are generally made and projects constructed with little understanding of household water demand behavior. Engineers and planners tend to rely on very simplistic assumptions about what determines per capita water use and affordability.

Many water schemes often fail to achieve the goals set for the number households to be connected to the water system relative to the amount of water produced, and the proportion of costs recovered the gap between expectations and accomplishments is often great (World Bank, 1966b). South Africa is a water-scarce country, and as a result unit water consumption is expected to be less than in water-rich countries.

The growth in overall water use in South Africa is likely to emanate predominantly from two sources: domestic and industrial/commercial demand. The causal factors underlying this growth are threefold: population growth, improvement in access to water supply infrastructure (making up the backlog in infrastructure that arose during apartheid), and economic growth. There are three implications for the pricing policy. Firstly, improving access to domestic water supply is a political priority, hence pricing should not discourage access to water and the consumption of an amount. Secondly, it is particularly important that the additional water demanded be used wisely, beneficially and efficiently. Hence, thirdly pricing in the domestic and industrial/commercial sectors (in particular) should promote these goals (Department of city development (DCD), 1997).

1.3 Motivation for the study

Government policy is generally seen by many rural residents as not adequately supporting the economic development in their areas, including the provision of clean and safe water. In many villages, households may be prepared to pay a larger portion of the costs of piped water supply systems if the service is reliable.

It is stated by the act that the supply of water to the consumer or water user may be restricted or suspended if he or she does not pay the charges expected from him or her by the service provider, which is the water authority. The purpose of this particular study is to estimate the willingness of households to pay for water, so that the state water authority can make more informed decisions on how much to charge its customers.

The study is an attempt to encourage households to view water as a valuable resource commodity that ought to be used with care. The study aims at researching the demand-side responses to water allocation in Mpumalanga rural households. This study will also take into account the different physical, social and economic circumstances that exist in Mpumalanga rural households.

In areas where there is competition for water, charging a price for water will not in itself achieve the objectives of efficient use unless the price is appropriate. Too high a price will discourage water use that might otherwise have brought benefits to society and water will flow unused for direct human benefit. Too low a price will result in overuse in some areas and shortages in others, which will deny potential users access to water, which they could have used productively. Therefore a study like this aims at arriving at the precise water service option that households prefer to use.

1.4 Research objectives

The main objective of this study is to determine the willingness of rural residents to pay for water and the specific objectives are as follows:

- Determine the amount of money households are willing to pay for an improved water service.
- Determine the level of service that households prefer to use.
- Determine the payment system that households prefer in their rural areas.
- Determine the level of the relationship between the households' willingness to pay and the households' socio-economic and water sources characteristics.

1.5 Hypotheses

- If a prepaid system of payment can be introduced, then the demand of water by households will increase.
- Installation of yard taps will increase consumers' willingness to pay for water services in rural areas.
- A low tariff rate on water payment would lead to more households being willing to pay for water.

1.6 Outline of the study

The main aim of this study is to determine the willingness of rural households of Mpumalanga Province to pay for water. This document is divided into 8 chapters.

Chapter 1 Introduction: This chapter outlines the problem statement regarding water demand, the hypotheses, the objectives of the study and the motivation of the study.

Chapter 2 Brief outlook of the Water Supply and Water Service acts: The background to water policy and current institutional arrangements in South Africa are outlined in this chapter.

Chapter 3 Theoretical and Literature Review: Both the related theoretical and empirical literature reviews are discussed in this chapter.

Chapter 4 Research Methodology: This chapter outlines the socio-economic background of Mpumalanga Province. A detailed description of the method used in gathering and analyzing data is outlined in this chapter.

Chapter 5 Results and the findings of the study: The results and findings of the study are outlined in this chapter.

Chapter 6 Conclusions and Policy Implications: The final chapter contains summary of findings, policy recommendations and conclusions.

CHAPTER 2

WATER SUPPLY AND WATER SERVICE

2.1 Introduction

This chapter gives a brief review of the National Water Service acts of the Republic of South Africa. The Water Services Act of 1997 (Act 108 of 1998) and, The National Water Act (Act No.36 of 1998) are reviewed in this chapter

2.2 Brief overview of the Water Services Act of 1997 (Act 108 of 1998)

It is required by this act that every person has the right of access to a basic water supply and the basic sanitation[1] which is necessary to ensure sufficient water and an environment not harmful to health and well-being. The act states that water services institutions must take reasonable measures to realize these rights and every water service authority must, in its water services development plan, provide for measures to realize these rights (Water services act, 1997).

Some major objectives of this act are to provide for:

- Financial assistance to water services institutions.
- The setting of national standards and norms and standards for tariffs in respect of water services.

[1] Basic sanitation means prescribed minimum adequate collection, removal, disposal or purification of human excreta, domestic water- use and sewage from households, including formal households.

- The right of access to a basic water supply and the right to basic sanitation necessary to secure sufficient water and an environment not harmful to human health or well-being.
- The monitoring of water services and intervention by the minister or by the relevant province.

2.2.1 Conditions for provision of these water services

The act stipulates that water services must be provided in terms of conditions required by the water services provider[4] and these conditions must be accessible to the public and must be in accordance with conditions for the provision of water services contained in by-laws made by the water services authority having jurisdiction in the area in question. It also provides for the technical conditions of existing or proposed extensions of supply, the determination and structure of tariffs and the conditions of payment.

The procedures set out in the act for the limitation or discontinuation of water services must be fair and equitable. The act further requires that no person should be denied access to water services for non- payment where that person proves that he or she is unable to pay for basic water services. The act states that every person who uses water services provided by a water services provider does so subject to any applicable condition set by that water service provider (Water services act, 1997).

[4] A water service provider is any person or authority who provides water services to consumers or another water services institution, but does not include a water services intermediary.

2.2.2 Standards and tariffs

The act stipulates that the Minister[5] may, from time to time, prescribe compulsory national standards relating to the provision of water services and the standards relating to the quality of water taken from or discharged into any water services or water resource system. It is also required that national standards have to be prescribed by the Minister regarding the nature, operation, sustainability, operational efficiency and economic viability of water services.

The act requires that the standards and tariffs prescribed must differentiate between different users of water services and different geographic areas, taking onto account, among other factors, the socio-economic and physical attributes of each area (Water Services Act, 1997).

2.2.3 Water services Authority

It is stated by this act that every services authority has a duty to all consumers or potential consumers[6] in its area of jurisdiction to progressively ensure efficient, affordable, economical and sustainable access to water services. This duty is subject to the availability of resources and the need for an equitable allocation of resources to all consumers and potential consumers within the authority's area of jurisdiction. The act prescribes that the water service provider may limit water services when a consumer fails to meet his or her obligations to the water services provider,

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[5] Minister means the minister of Water Affairs and Forestry.
[6] Consumers are the end users who receive water services from any water service institution.

which includes failure to pay for water services (Water Services Act, 1997).

2.2.4 Water Boards

According to this Act, the Water Board is an organ of state established or regarded as having been established to perform, as its primary activity, a public function. The primary activity of the Water Board is to provide water services to other water services institutions within its service area (Water Services Act, 1997).

2.2.5 Water services committees

A water services committee can be established only if the water service authority-having jurisdiction in the area in question is unable to provide water services effectively in the proposed service area; the function of the water service committee is to provide water services to consumers within its service area (Water Services Act, 1997).

2.3 The National Water Act (Act No.36 of 1998)

The Act specifies that government, as the public trustee of the nation's water resources, must act as a public trust to ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner, for the benefit of all persons.

The act further recognizes that at all people have basic water needs for drinking and hygiene and those needs must be satisfied at all times. The act further states that water must be used to promote long -neglected social and economic development in the country.

The act requires that a national resource strategy should be established. The strategy must set out, inter alia, the strategies, objectives, plans, guidelines and procedures of the minister, and institutional arrangements relating to the protection, use development, conservation, management and control of water resources. The ultimate aim of the water resource management is therefore to achieve the sustainable use of water, and not total protection.

According to the act sustainability means that three things must be in balance at the same time:

- Social development and equal access to water.
- Economic growth (water must support economic and social development).
- Ecological integrity (water resources must be protected so that they will continue to provide water in the future).

The act also provides the broad policy framework for measures to finance the provision of water resource management services and the development of water resources, as well as financial and economic measures to support the implementation of strategies aimed at water resource protection, conservation and beneficial use of water.

2.3.1 Level of water services and their costs

According to the RDP[7] the water supply system that has been installed in the rural areas is the communal street tap which is within 200 metres from where a household is staying and it is capable of delivering 25 litres of potable of water per person (capita) per day with a reliability of 98% and a flow rate of 10 litres/minute. The decision regarding the provision of this water service option has largely been based on the need to "fast track" the access to clean water, at the lowest cost as possible. The low incomes in rural areas have meant that rural residents could only afford to pay for a water service that is not expensive.

[7] Reconstruction and development program, which was adopted by the new South African government after the democratic elections.

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

This chapter endeavors to outline briefly the documented success experienced by other countries in the use of The contingent valuation method, The travel cost method and The hedonic pricing method. So both theoretical and empirical literature reviews are outlined in this chapter.

3.2 Theoretical Literature Review

3.2.1 The Contingent Valuation approach

Contingent Valuation approach came to be used first in the early 1960's when the economist, R.K. Davies (1963), unaware of Ciriacy-Wantrup's suggestion of "direct interview method" used it to measure the value associated with a natural resource. R.K Davies used questionnaires to estimate the benefits of outdoor recreation in a Maine backwoods area, in the USA. It has been used commonly to estimate the values for goods without market data.

Contingent valuation is a survey-based technique for eliciting people's preferences for non-marketed goods, such as environmental amenities, in a form which allows one to estimate how survey respondents trade-off private consumption for non-marketed goods in monetary terms or what respondents will be willing to pay for specified improvements to them. The essence of this method is aimed at eliciting people's willingness to pay (WTP) for public goods circumventing the absence of a market (Randall et al, 1983).

It is the most commonly used approach in placing a monetary value on non- marketed environmental resources. Recent applications have valued improving water quality. In developing countries contingent valuation has been principally used to value the provision of basic public services such as water delivery and waste removal. The success of the contingent valuation method is due to the techniques flexibility in constructing markets for non-marketed goods, and the fact that elicitation of stated preferences is the only approach to valuing non-marketed goods, which is not limited to inferring value from past actions (Mitchell and Carson, 1989).

The contingent valuation method (CVM) is the method that requires individuals to express their preferences for some environmental resources or change in resource status, by answering questions about hypothetical choices. Respondents to a contingent valuation questionnaire will be asked a variety of questions about how much they would be willing to pay (WTP) to ensure welfare gain from a change in provision of a non-market environmental commodity; or how much they would be willing to accept (WTA) in compensation to endure a welfare loss from a reduced level of provision of that item. The basic question for the implementation of the CVM is whether WTP or WTA is the most appropriate indicator of the value of a given situation.

Based on the Kaldor Hicks compensation test, WTP would seem to be an appropriate measure for gainers from some resource allocation decision, and WTA the proper measure for losers from the same reallocation. Individuals are asked neither about their attitudes nor their opinions, which may be poor predictors of their actual behavior. Rather, they are asked about their contingent valuation ("if this happened, what would you be willing to pay?") Questions asked in CVM are hypothetical instead of attitudinal.

Interviews between respondents and enumerators are conducted face-to-face in the contingent valuation method, wherein a respondent is presented with a questionnaire consisting of three parts: (i) A detailed description of the goods being valued and the hypothetical circumstance under which it is made available to the respondent. A detailed market is constructed by the researcher, which is communicated to the respondents in the form of a scenario that is read during the interviews by the interviewer. Questions describe the goods to be valued, baseline provision, structure under which the goods are provided, range of available substitutes and the method of payment. (ii) Questions which elicit respondents' willingness -to-accept are modeled to facilitate the valuation process without themselves biasing the respondents' willingness WTP amounts, (iii) The socio-demographic characteristics of the respondents (age, education, income, sex) and their preferences relevant to the goods being valued and their use of the goods, are elicited.

The major type of biases are as follows: (i) Strategic bias, which depends on how respondents perceive the consequences of the hypothetical experiment; they may behave strategically and not reveal their true preferences (ii) Information bias, which arises from providing too little information about the choice offered or from an interviewer who is misleading. (iii) Instrument bias, which arises if the respondent is hostile to the means by which payment would be collected. The method chosen for payment may result in different WTP responses. (iv) Hypothetical bias is the potential error induced by confronting the individual with an imaginary situation, (v) Sampling, interviewer or non-respondent bias.

Researchers previously have pointed out that it is often not easy to identify gainers and losers conclusively since the contingent valuation judgment is influenced by the value's own perspective or the respondent's perspective.

Various procedures have been developed in recent years that enhance the credibility of a survey and make it more likely to produce reliable results. These touch all aspects, including sampling, instrument development, formulation of the valuation scenario, questionnaire structure and data analysis.

This is how President of American Petroleum Institute and other critics have characterized contingent valuation (DiBona, 1992). The essence of their argument is summarized in titles such as "ask a silly question" and "pick a number" (Annon 1991). It does not require any unusual perspicacity to see that this approach is unlikely to produce reliable results. For precisely this reason, it is not what good contingent evaluation researchers do, and it is not what was recommended by The NOAA panel on contingent valuation (Arrow et, al., 1993).

Serious surveys of the general public avoid convenience sampling, such as stopping people in the street; they employ statistically based probability sampling. They also avoid self-administered surveys, such as mail surveys or questionnaires handed out in a mall, because of lack of control over the interview process. For a major study, the NAOO panel recommended personal interviews for their superior reliability. Furthermore interviews should occur in a setting that permits respondents to reflect and give a considered opinion, such as in their homes. Unless the study deals with consumer products, shopping malls are a poor choice. Indeed, the only contingent valuation study in which people were stopped for a minute was one performed for Exxon (Desvousges et al., 1992).

The crux is how one elicits value. The two key developments have been to confront subjects with specific and realistic situations rather than with an abstraction, and to use a closed-ended question, which frames the valuation as voting in a referendum.

A common temptation is to characterize the object of valuation in rather general terms: "What would you pay for environmental safety?" "What would you pay for wilderness?" The problem is that these are abstractions.

People's preferences are not measured in the abstract but in terms of specific items. "Paying for wilderness" is meaningless; what is meaningful is paying higher taxes or prices to finance particular actions by somebody to protect a particular wilderness in some particular manner. Therefore one wants to confront respondents with something concrete. Moreover, one should try to avoid using counterfactuals. "What would you pay not to have had the *Exxon Valdez* oil spill?" is utterly hypothetical because one cannot undo the past. By contrast, "What would you pay for this new program that will limit damage from any future oil spills in Price William Sound?" offers something that is tangible.

The goal in formulating a contingent valuation survey is to formulate it around a specific commodity that captures what one seeks to value, yet is plausible and meaningful. The scenario for providing the commodity may be real; if not, the key is to make it seem real to respondents. They are actually not making a payment during the interview, but they are expressing their intentions to pay. The vaguer and less specific the commodity and payment mechanism, the more likely the respondents are to treat the valuation as symbolic. To make the payment plausible, one needs to specify the details and tie them to provision of the commodity so that this cannot occur without payment. There should be a clear sense of commitment; for example, if the program is approved, firms will raise prices, or the government taxes, so there is no avoiding payment once a decision is made.

Until in the mid-80's, most contingent valuation methods used open-ended questions, like "What is the most you would be willing to pay for...?" Since then, most major contingent valuation studies have used closed-ended questions like "If it cost $x, would you be willing to pay this amount?" or "If it cost $x, would you vote for this?" Different people are confronted with different dollar amounts. Plotting the proportion of "yes" responses against the dollar amounts traces out the cumulative distribution function of willingness to pay.

Moreover, there is abundant evidence that respondents find open-ended willingness-to-pay questions much more difficult to answer than the closed–ended ones. For market and no market goods alike, people can generally tell you whether they would pay some particular amount, but they find it much harder to know what is the most that they would possibly pay. Indeed, the experience with open-ended willingness-to-pay questions for market goods is that people are more likely to tell you what the goods, cost than what they are worth to them. In addition to being less realistic and harder to answer, the open-ended format creates incentives, which are different from those in the closed-ended format.

The simplest way to approach the valuation problem, is to consider a contingent valuation survey as essentially a self-contained referendum in which respondents vote to tax themselves for a particular purpose.

Portney (1994) describes other ways of making contingent valuation questionnaires more reliable: providing adequate and accurate information; making the survey balanced and impartial; reminding respondents of the availability of substitutes, and of their budget constraints; facilitating "don't know" responses, and allowing the respondents to reconsider at the end of the interview. Several steps can be taken to eliminate any perception of interviewer pressure. At the outset the interviewer can assure respondents that there are no "right" answers. Before asking a voting question, to legitimate a negative response, the interviewer could say something like: "We have found that some people vote for the program and others vote against it. Both have good reasons for saying "no". For example, the interviewer might note that some people prefer to spend their money on other social or environmental problems instead; they find the cost to be more than they can afford or than the program is worth, or they cannot support the program because it would benefit only one area (Carson et al., 1992).

Other valuation studies conducted in other developing countries, confirm that it is possible to conduct a valuation study among poor, often illiterate communities and still obtain reasonable and consistent results. This conclusion also holds even when many of the respondents are not fully integrated into the monetary economy in the form of formal employment (Mitchell and Carson ,1989).

The contingent valuation technique represents a departure from traditional applied benefit- cost analysis in that individuals are faced with a current choice based on a current source of information provided in the survey. As contingent valuation does not require a linkage with an existing market, respondents may be faced with an economic choice directly related to the provision of the environmental goods of interest. The designer of CV survey has a substantial degree of control over the information provided to survey respondents. There are, of course, limitations to the amounts and types of information which can be meaningfully conveyed in the survey. Some of these limitations simply follow from the amount of time available in the survey; others follow from the inability of some respondents to process complex information quickly, and still others relate to the prior information possessed by respondents. A CV survey provides one means by which a respondent can obtain information about goods, and a choice offered in the survey provides an incentive to process that information (Hanemann, 1992).

There is also a criticism associated with contingent valuation technique. This criticism argues that contingent valuation does not measure the quantities it purportedly wants to measure. The three major points usually raised by critics are that (1) CV estimates are overly sensitive to the order in which goods are valued. (2) CV estimates are insensitive to the scope of the goods being valued; and (3) that CV overestimates 'true' economic value. The term "embedding" (Kahneman and Knetsch, 1992) has often been used to refer the first two phenomena. These two phenomena, however, are quite distinct from an economic perspective (Carson and Mitchell, 1995).

For contingent valuation to work, it is essential that three conditions hold: (1) non-marketed goods must be well defined, (2) the scenario must provide a plausible means of provision, and (3) there must be a plausible mechanism for making the trade-off between the consumption of private goods and non-marketed goods of interest. If a CV survey violates one or more of these conditions, the survey results become more difficult to interpret. This also applies to marketed goods, as it is difficult to obtain consumer surplus estimates for goods which are poorly defined in terms of their inherent characteristics or terms of trade. Poorly defined goods are difficult to value under any circumstances whether the goods are traded in private markets or not. The notion that the terms of trade and the characteristics of the goods being traded matter to individuals is fundamental to the development of economic theory. Non-marketed goods are no exception to this maxim (Hanneman, 1991).

3.2.2 Travel cost method

The travel cost method evaluates the recreational use of value for a specific recreational site by demand for that site (measured as site visits) relative to its price (measured as the costs of a visit). The travel cost method model can be defined by a 'trip-generation function' (tgf) such as

$V=f(c, x)$

Where:

V=visits to a site

C=visit costs

X=other socio-economic variables which significantly explain v.

The literature can be divided into two basic variants of this model. According to the particular definition of the dependant variable *v.* the individual travel cost method, (ITCM) simply defines the dependant variable as the number of site visits made by each visitor over a specific period, say one year. The zonal travel cost method (ZTCM), on the other hand, portions the entire area from which visitors originate into a set of visitor zones and then defines the dependant variable as a visitor rate, (i.e. the number of visits made from a particular zone in a period divided by the population of that zone) (Clawson, 1959 and Clawson and Knetsch, 1966).

The travel cost method is a survey technique. A questionnaire is prepared and administered to a sample of visitors at the site where the research is to be conducted in order to ascertain their place of residence; necessary demographic and attitudinal information; purposefulness; length associated costs, etc. From the data obtained, costs of visits can be calculated and related with other relevant factors, so that a demand relationship can be established. This demand function can then be used to estimate the recreational value of the whole site, while in more advanced studies attempts can be made to develop demand equations for differing attributes of recreational sites and values assessed for these individual attributes.

The demand function estimated by the travel cost method is an uncompensated ordinary demand curve incorporating income effects, and the welfare measure obtained from it will be that of a Marshallian consumer surplus.

The travel cost technique was used to value three recreational facilities in Nigeria: The Agodi Gardens, Ibadan; the University of Ibadan Zoological Garden, Ibadan, and The Luna Amusement Park, Lagos. The travel cost method outlined by Clawson and Knetsch and put in its current perspective by several researchers, was adopted for the study. The first two-stage technique, the general equation for predicting household visits to recreation centres was specified as:

V_{ij} = f (TC_{ij}, Dij, Dik, Si, A_j, Pij, Wij) ……..(1)

Where:

V_{im}= the number of recreation trips taken by the household i to recreation centre j during the year prior to the year of interview,

TC_{ij}= average recreation expenditure (transportation costs, entry fees, and miscellaneous expenses) incurred by household i per trip to centre j,

D_{ij}=two way distance from household i's residence to center j,

D_{ik}=two-way distance from household residence to the alternative centre k

S_i = socio-economic status of the head of household i, defined by age, education in years, occupation, place of residence, and income bracket.

A_j=attraction index of centre j, defined as the percentage of recreational activities offered by all centres, to reflect imperfect substitutability among centers.

Pf_{ij}= preference for centre j by household i, defined as a percentage of trips taken to the centre relative to all recreational trips,

W_{ij}= the maximum amount of money household i would be willing to spend per annum on the type of recreation offered by j.

One of the limitations of The travel cost method is the assumption of equal tastes and preferences among centre users. Including socio-economic variables in the model should be partially correct from this limitation since sociological studies have established a positive relationship between these variables and the tastes and actions of individuals. The effect of time, both in travel and on site time, on the demand for recreation centres and the benefits derived from such centers have been analysed in detail by several researchers. In general, failure to include on- site time costs would have opposite effects.

To account for travel time costs, a rectangular hyperbola function between time and money costs was used as a basis for replacing the expenditure term in the general equation for predicting household visits to recreational centres. This was done by relating a recreational trip or visit to a new variable defined as MT, where M is monetary cost and T time cost, so that the new general equation for predicting household visits to recreation centers now becomes

$V_{ij} = f\ (MT_{ij}, Dij, D_{ik}, Si, Aj, PFij, Wij)\ldots(2)$

Thus for a visit associated with one hour and N1 costs, the value of the new expenditure term can be taken as (1x1) or 1. This method permits an estimation of visit rate for any additional money cost simply by changing M, without T, and then calculating the new visit rate.

3.2.3 Hedonic pricing method

Griliches (1971) and Rosen (1974) developed this technique. This technique comprises of a method estimating the implicit prices of characteristics, which differentiate closely, of related products. Hedonic pricing of unmarked environmental services is based on the following principle. There are no precise market prices, which exist, which can reveal preferences or willingness to pay for the resource, as the environmental resource, which wishes to be valued, has not defined the market. The resource can be defined in terms of a service it yields or an "attribute" it embodies. These attributes can embody other assets or goods which are marketed and do have observable prices. Statistical techniques (in particular multiple regression analysis) may enable us to identify the contribution which the attribute in question makes to the price of traded goods. One could then identify an implicit or shadow price for the attribute and regard this as an estimate of the value of the environmental resource.

Environmental quality affects the price people are willing to pay for certain goods or services. For example, ocean front hotels charge different rates depending on the view; e.g., rooms with ocean views cost more than the same sized room with a garden view.

Hedonic models have been used to examine the contribution of different attributes to prices for housing and to wage levels, including the quality of the environment. Property values depend on the physical attributes of the dwelling (such as the number of rooms, amenities such as plumbing, etc.); on the convenience of its access to employment, shopping, and education, and on a number of less tangible factors such as environmental quality.

This approach is interesting because many environmental dimensions are likely to be embodied in property values. A home in a neighborhood with low air pollution, for example, should sell for more than a similar home in the neighbourhood with ambient air pollution. Hedonic models allow this effect to be measured, holding other factors such as size and amenities constant.

The hedonic pricing approach is in fact similar to the household production approach since both require the weak complementary assumption. Hedonic pricing differs in that it operates through private good price changes rather than private goods quantity changes.

Given that different locations of property will have different levels of environmental attributes and that these attributes affect the stream of benefits from the property, then the variation in the attributes will result in the differences in property values (since property values are related to the stream of benefits). The hedonic price approach looks for any systematic differences in property values. Consequently, the implicit prices found for environmental attributes must be related to the consumers' tastes and preferences in order to find the attributes demand function (since the implicit price of the attributes reflect the forces of supply and demand).

To find the demand function relating to the quantity of the environmental attribute to individuals WTP, it is necessary to first define the market commodity (e.g. air quality). A functional relationship is then specified between the market price and all relevant attributes of the market commodity. This is called The hedonic pricing function. The hedonic pricing function is then estimated using multiple regression techniques from data on property values and associated attributes of the property. We are thus able to find the hedonic price function coefficient on the attribute of interest (air quality) and this coefficient is known as the marginal implicit price of the attribute. It indicates the additional amount of money that must be paid by the individual to buy identical market goods but with a higher level of the environmental attribute (Freeman, 1979).

The hedonic price method (HPM) attempts to impute a price for environmental goods by examining the effects, which its presence has on the relevant market-priced goods. The notion of land characteristics being reflected in land values can be tracked back to Ricardo. However, it was Ridker (1967) who conducted the first recognizable HPM study, noting that if the land markets were to work perfectly, the price of the plot of land would equal the sum of the presently discounted stream of benefits and costs derivable from it (i.e. environmental values are reflected in associated market prices (Ridker, 1967); and, equally importantly, that since air pollution is specific to locations and the supply of locations is fixed, there is less likelihood that negative effects of pollution can be significantly shifted onto other markets (i.e. these markets can be identified as capturing these environmental values).

Rosen (1974) shows that the hedonic pricing method can be applied to any market which can be fully estimated. The vast majority of hedonic pricing method studies have looked at the property market as a reflection of surrounding environmental characteristics such as air quality, water quality and noise. By checking for structural (e.g., size), location (e.g., access to work place) and other characteristics of a house, we can isolate the effects which environmental characteristics have upon house prices and thereby ascertain the implicit price of a specific public attribute such as air quality.

The hedonic pricing method is dependent upon a number of assumptions:

-Willingness to pay is an appropriate measure of benefits.
-Individuals can perceive environmental quality changes: these changes affect the future net benefit stream of a

property, and therefore people are willing to pay for environmental quality changes.

-The entire study area can be treated as one competitive market with freedom of access across the market and perfect information regarding house prices and environmental characteristics.

3.3 Empirical Literature Review

In recent years these techniques have been applied in many countries. They have been used to value water quality improvements, the benefits of reduced air pollution, and the option or existence values of wilderness areas or ecologically important species. The application of these techniques (and evidence of their accuracy) was limited in developing countries until 1987, but a few available studies suggest that they can be successfully applied (Whittington et al., 1990a,b, 1991,1992; Briscoe et al., 1990; Boadu, 1992; Singh et al., 1993; Altaf et al., 1993). With the rising awareness of the of cost environmental degradation and misuse in less developed countries, coupled with pressure from donor agencies about the inclusion of an environmental impact assessment in project designs, these two techniques are now being used extensively in both developed and developing countries to evaluate the benefits of water and tourism projects.

Below are some case studies involving the use of these techniques in developing countries and this will assist in designing our own model of study.

3.3.1 Contingent Valuation Method

Most of the empirical literature on the use of the contingent valuation and the hedonic pricing method was mainly done to estimate the value of the benefit consumers gained in the consumption of environmental goods. The major objective was to determine the factors which influence the maximum amount the typical consumer is willing to pay for an improvement in the quality of the goods in question. In USA 290 households were interviewed using the contingent valuation method (CVM) in an attempt to compare the contingent valuation method with the hedonic pricing approach in valuing different air quality levels in Los Angeles (Brookshire, et al (1982).

A contingent valuation survey was conducted to determine whether a household would vote in favour of having water and sewer lines installed in its neighbourhood if everyone in the community had to pay a specified assessment fee (whether or not they connected), and then if water and sewer lines were installed, whether households would choose to connect to them if a specified monthly tariff were charged.

The majority of the households answered “yes” to those valuation questions. After the first couple of days of administering the contingent valuation questionnaire, they discovered that everyone was saying “yes” to everything, regardless of the assessment fee or monthly tariff offered to them.

Of the 164 answers that were recorded as "no", 52 respondents (32%) answered "yes", but they said they couldn't afford the system. Another 18% agreed, but they said the costs were too high for them. However a further 30% of the respondents said they needed to know others' opinions about the program before they could decide. According to the enumerators this was simply a polite way of saying that they did not need the system (Whittington et al, 1992).

A contingent valuation study was conducted which was solely done to estimate the benefits that foreign visitors to the Fes Medinas would receive. During the summer of 1997 World Bank financing carried out the survey to estimate the benefits that foreign visitors to the Fe's Medina would receive. The survey distinguished between visitors the willingness to pay for improvements to the site itself from that of other visitors to Morocco.

A multi-stage sample of 600 adult visitors was designed to represent visitors (including both tourists and those visiting for business or other purposes) to Morocco during June-July, 1997. Of the total of 600 interviews, 400 were undertaken in Fes. Of the remaining interviews, 120 were carried out in Casablanca and 80 in Tangier, on the basis of their respective visitor flows.

The first section of the survey consisted of 16 questions requesting information about the respondent's visit to Morocco and to Fes. In the second section, the situation at Fes was presented to respondents using a short narrative supplemented by show cards featuring colored photographs of the Medina. This presentation provided respondents with a standardized set of information about the character and condition of the Fe's Medina today. It concluded by saying that without a major rehabilitation effort the Medina would continue to decline. The third section of the instrument presented a plan to rehabilitate the Fes Medina, which was described as having been developed by "the Moroccan government in collaboration with experts from international agencies." Respondents were told that the plan would accomplish three things:

- It would improve the Medina's appearance: buildings, streets, sewers, public spaces, and monuments would be repaired and cleaned up;
- It would preserve the Medina's traditional character and cultural heritage for future generations; and
- It would ensure that the Medina would continue to be a productive and vibrant living city (Carson, R.T et al, 1997).

In recent years, there has been increasing use of contingent valuation (CV) methods to value environmental goods and services, in both developed and developing countries. Recent examples carried out in the context of World Bank operations include:

Three types of impacts were measured: impact on the villagers, impact on the environment, and impact on tourism and existence value. Opportunity cost analysis, recreational demand analysis and productivity analysis were the methods used to measure the value of different stakeholders of the Mantadia Park in Madagascar.

Opportunity cost analysis. It was established that approximately 3,400 people in sets of villages would be adversely affected by the park and that adequate compensation of approximately $100 per household would be appropriate. Such compensation could be made in the form of education, health facilities, and income earning enterprises in the buffer zone of the park or other development activities.

A Recreational demand analysis estimated the value of the park under two different scenarios based on tourists willingness to pay if they were able to see the same number of birds and lemurs. The estimate aggregated over all tourists, amounted to $253 000 annually. Although the estimated tourism benefits were only one part of the total value of the new national park, the results show that tourism can be a significant source of benefits when parks are created in a tropical country, even one with a modest level of international visitors. Governments may wish to use tourism taxes, user fees, and similar revenues to capture some of this willingness to pay in order to finance conservation activities.

Productivity analysis showed a $547,176 net present value of total expected crop loss due to flooding without the park being designated as a protected area, as opposed to a $475,620 net present value of damage if the park was a protected area.

The findings of the Mantadia park study indicate that reliance on the willingness to pay is fundamental to the economic approach to valuation, but tends to highlight the value ascribed to richer foreign visitors because their ability to pay is a key element. In particular, social elements like distributional equity would need to be considered to protect the basic rights of local residents (Randall A. Kramer et al).

Between 1987-1991 (Whittington al, 1990a,b, 1991,Briscoe, et al, 1990) and The World Bank research team investigated the determinants of household demands for improved water sources including relevant socio-economic and demographic characteristics of the households as well as extensions of existing and new water supplies, such as price distance, quality and reliability, in Latin America (Brazil and Haiti), Africa (Nigeria: Anambra state, and Zimbabwe), and South Asia (Pakistan and India). Various sites were investigated in various regions of each country. Sites in Brazil included a well-off, water abundant area in the Southeastern State of Parona and a poor dry area in the Northeastern State of Ceara. In Pakistan, three areas in Punjab were selected; one had easily accessible, high quality ground water; another had easily accessible brackish water; a third was an arid zone where ground water was relatively deep and inaccessible. In India (Kerala), one area had abundant good quality ground water and another area suffered from water scarcity.

Using data from a large representative sample of annual households in one region of Philippines, North and Griffin, (1993), estimated determinants of the actual value of dwellings using the bib-rent approach to the hedonic price model. They formulated a random model in which the bib-rent parameters are estimated by predicting the type of household likely to occupy a particular house. The rental bid is divided into a systematic [b (h)] and a random component, and the probability that a household of type t will occupy a dwelling with characteristic h is given as follows,

$$P\ (t/h) = P\ [(b_t + (h) + {}_{t)} > (b_t{}^{1}\ (h) + {}_t{}^{1})] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.2$$

Where $_t$ is household type, t^1 and h represents characteristics of the dwelling, b_t is the bid of representative household t and is a random disturbance. This model was estimated as a logit under the assumption that the errors are identically and independently distributed. Variables used to describe characteristics of the dwelling include water source, number of bedrooms, quality of construction materials and location. The number of bedroom measures size of residence, with size expected to be positively related to imputed rent. The results from the estimation were consistent with other studies and reveal that the housing market in the rural area does place a value on water source.

Carson, Hanneman and Mitchell (1986) tested the accuracy of voting intentions in water quality bond elections in California in 1985. Closed-ended CV questions were placed in the field California poll a month before the vote, using different figures for the household costs. Adjusted for "I don't know" responses, the predicted proportion of "yes" votes at the actual cost was 70-75 percent. The ballot vote in favour was 73 percent.

Boado (1992) uses an interactive bidding approach to examine the relationship between socio-economic household characteristics and these households willingness to pay for water. Using data collected from selected villages in Ghana, the following multiple linear regression was estimated by OLS for each village:

$WTP_i=b_0+b_1X_{1i}+b_2X_{2i}+b_3X_{3i}+b_{4i}+b_5X_{5i}+b_6X_{6i}+b_7X_{7i}+b_8X_{8i}$ $+u$....2.3

Where WTP_i is the willingness to pay bid, X_{1i} is household income from all sources; X_{2i} is household size (number of persons of all ages); X_{3i} is education level of the household head (number of years of schooling); X_{4i} is the age of the household head (years), X_{5i} is the distance of the household from the existing water source (kilometers); X_{6i} is drought (number of drought months), X_{7i} is illness within thirty days of the survey (dummy), and u is an error term assumed to distributed as $(o,^2)$. The expected signs are, $b_1, b_2, b_3, b_5, b_6, b_7$, and $b_8>0, b_4<0, b_2<0$, for private connections and $b_2>0$, for public standpipes.

The results show that household income is the principal factor influencing the WTP for water. There was a statistically significant positive relationship between household history of water related illness and their WTP for water. The effects of most of the other socio-economic factors in the study did not follow any consistent pattern and broad generalization was not possible.

People's willingness to pay for improved communal water services was evaluated in three different studies: Limon and Guanacaste (Costa Rica) and Muang Xai Thaui (Laos) were investigated by Anguilar and Sterner, (1995). In Limon a survey was carried out in 1993, covering some 300 households out of 1556 in 5 villages to investigate the influences that different socio-economic variable have on water and the willingness to pay for improved water services. Data were collected on age, head of household, family size, education level, income, quality of source, health information and other items, such as length of time respondent have been living in their homes and variables measuring whose responsibility they thought water management should be. The data collected were used to estimate the following function,

$$\ln TotWTP = X_i + e \qquad (2.4)$$

Where X_i is a vector of various variables outlined above (generally in a log form).

The results from the study indicated that, on average, inhabitants were willing to pay over 40% more than the current fees in order to receive improved services. The distinctions between various groups of consumers with respect to age, sex, education, income, information, experience and attitudes, seem to be accordance with what was expected, although most of the variables are not statistically significant at the conventional level of significance. The willingness to pay varied strongly in a fairly interesting way regarding age and sex. Women were, on average, willing to pay more than men, and younger people more than older ones. The factor, however, is not the same for men as for women.

94 of 118 customers were interviewed in Guanacaste. They were promised a clean and safe water supply. Data were collected in all variables and an equation estimated. The willingness to pay results were the same as in the Limon area. Age and income had the expected effect on willingness to pay. Committee constitution and family size were found to have a convex relationship.

Over 300 interviews were carried out in seven small villages. Coverage ranged from 18-53% of the population. Using the same analysis to the previous study, it was found that males had a higher willingness to pay.

Willingness to pay was found to be above the current water tariffs (40% higher in Limon, 84% in Guanar and 70% in Muang) and sufficient to finance new improved supply systems in the three studies.

The contingent valuation method was used by Kamara (1996) to estimate and analyse communal livestock farmers in the Southeast district of Botswana. A semi-structured questionnaire was used to obtain data from communal farmers with no more than 50 cattle.

Open access grazing in the communal areas was compared by respondents to the alternative system of grazing controlled by the community grazing association. Those who were in favour of the new system were asked to indicate their maximum willingness to pay to meet the expenditure of the association. A multiple regression equation was estimated to see how the various variables influenced the farmers' willingness to pay. Information on the following variables: age, sex, income and education levels, number of cattle and their expenditures on livestock management, was elicited. According to the results education was a significant variable influencing the WTP.

In **Croatia,** CV was used to estimate tourists' willingness to pay for the restoration of forested landscapes in coastal areas that had been destroyed during the war, as part of the economic analysis for the coastal forest reconstruction and protection project (World Bank, 1996b). Two parallel surveys were carried out, one among tourists in Croatia itself and one among foreign tourists at similar destinations in Italy. Both showed a willingness to pay for forested landscapes amounting to about US$3/person/day.

In **Morocco**, CVM was used to estimate tourists' willingness to pay for conservation and rehabilitation of the historic Medina at Fes, a UNESO world heritage site that is rapidly deteriorating. The survey distinguished between visitors willingness to pay for improvements to the site itself (those who derived use value from visiting the site) from that of other visitors to Morocco (who only derive existence value and option value). Visitors to the site itself were found to be willing to pay as much as US$70 each in the form of increased tourist taxes or admission fees for improvements aimed at preserving and improving conditions in the Medina, while non-visitors were willing to pay about US$30 each (NOAA, 1993).

3.3.2 Travel cost method

Empirical estimation of the value of travels and on –site time.

If travel time has a positive utility (i.e. individuals enjoy the travel as part of their recreational experience), then using some general travel cost-time figure to price this will over-estimate the consumer surplus of a visit. Bojo (1985), does not include a travel time cost (of zero) on the grounds that 80% of survey respondents expressed a positive utility for travel time to the site under analysis. This approach assumes that ignoring residual travel time costs only leads to a minor underestimation of the true consumer surplus. If travel time has a negative utility (i.e. individuals actually dislike travelling to recreational sites) then the use of a generalized time cost may now underestimate total travel costs and consequently the consumer surplus of a visit.

One approach to the pricing of travel time is to examine its relationship with individuals' wage rates. The seminal work in this area is that of Cesario (1976) and Cesario and Knestch (1970; 1976). This approach examined commuters' choice of transport to and from work (and relevant costs) to estimate an implicit value of travel time.

Caesar (1976) concluded that the value of time with respect to non-work travel is between one quarter and one half of (individual's) wage rate, and subsequently used a value of one-third of the wage rate to price the travel time. An alternative approach is that of Nelson (1977), who calculated a marginal implicit price of proximity to the central business district with housing data for Washington, DC, which, when related to wage rates, falls within the Cesario range. However, as he recognized at the time, Cesario's analysis only considers commuter time and there is no necessary reason why the marginal utility obtained should be applicable to recreation travel time.

Common (1973) and McConnell and Strand (1981) used an alliterative process whereby successive time values are substituted into the 'trip-generation function' *tgf*, the final choice being determined where the explanatory power (R^2) of the model is maximized. Desvouges *et al.* (1983) applied the value of time results of Cesario (1976), McConnell and Strand (1981), and full wage rate assumption, to the following simple model of individual visitation patterns at 23 water recreation sites in the USA:

$$Ln(V_{iJ})=a_0+a_1\ MC_j+a_2TC_j+a_3Y \quad \text{.....................................} 2.5$$

Where:

V_j= visits to site j

MC_j=mileage cost per visit to site j

Tc_j=time cost per visit to site j

Y=household income.

If the Cesario (1976) estimation that the opportunity cost of travel time was approximately one-third of the wage rate is correct then, a_2/a_1 is expected to equal 1/3.

Testing equation at 10% significance level (Desvouges et al., 1983) rejected the McConell and Strand (1981) approach, while both Cesario (1976) and full wage assumption performed equally well, both being rejected in 7 of the 23 cases. On the basis of these Smith and Devouges (1986) concluded that for practical purposes, there is no clear-cut alternative to their use of full wage rate as a measure of the opportunity cost. Even though it may overstate the opportunity cost none of the simple adaptations are superior.

A further approach to the valuation time, theoretically applicable to both in-travel and on-site time, is that of Bocksteal et al. (1984), who examined labour supply functions, mapping the various relationships between earned income and leisure time which occur during the working week; normal work time; overtime working; second jobs, and recreation time. Unfortunately, because of the rigidities of normal working practice, individuals are usually unable to reallocate hours according to their personal preferences and this line of research has not received any significant empirical application.

3.4 Water Demand Model

In the water demand estimation model, quantity of water consumed is the dependent variable, and the factors which are thought to influence water use, include socio-economic parameters, access to water, water availability and inhibitors, while these are used as independent variables. The water demand model is thus based on the theory that water demand is a function of various factors which define consumer behaviour and that variations in household domestic water demand can be accounted for by differences in:

-Population density	-Household size	-Family structure
-Housing type	-Electricity use	-Income
-Business activity	-Education	-Expenditure pattern
-Motor vehicle and other fixed asset ownership	-Water user type	
-Sanitation facility	-Water tariff	-Water quality
-Agricultural activity	-Water supply system type	

The results of several studies and a review of available information have shown that there is a strong relationship between the volume of water required for domestic purposes and the standard of living of the consumer (Horn Glasson, 1989; Department of water affairs, 1988 and Jackson, 1989).

3.4.1 Average daily water demand

Domestic water demand users require water for several different household purposes but its usage is for personal hygiene, sanitation and gardening use. The volume of water required varies in accordance with the value orientation of the user. As values change and the level of standard of living of the community rises, so water demand increases. Communities, which have relatively low level standard of living, would require less than the 25 l/c/d required for communities having a higher standard of living.

In order to estimate water demand it is therefore necessary to determine the value orientation of the community. The value orientation of individual households, which comprise a community, varies widely because of the diverse nature of human beings. It is therefore difficult to define conclusively the value orientation of the community. A number of indicators are therefore provided which may guide the planner, designer and developer to determine the approximate value orientation and standard of living of a community.

The estimated water demand would reduce significantly should it be known that the domestic water user has to, or will have to pay for water used. In such instances, wastage and the indiscriminate usage of water is lessened. The volume of water used for personal hygiene and gardening is considerably reduced. The degree to which water use is limited is related to the type of tariff and level of subsidy applied. The greatest impact on water demand occurs where residents pay the full rate and payment is based on the volume of water used. Residents are also charged increased rates, based on a sliding scale, for exceptionally high water usage. A lesser impact is experienced where water users, who draw water from hand pumps or street taps, are charged a flat rate regardless of the volume of water used (Lottering, 1994).

The tendency is for per capita water use to increase substantially as living standards improve. Data provided by Van Duuren (1974) confirms this observation. The major differences in water use in communities having different socio-economic status are mainly in terms of dish washing, personal hygiene, sanitation and gardening activities. It is thus hypothesized that the desire to use water is related to disposable income, value orientation, enthusiasm for gardening, ability and willingness to pay for water used and an awareness of water scarcity. Factors and indicators, which describe the consumer and his immediate living environment, are crucial to the estimation of the level of water demand of the particular domestic water consumer.

3.4.2 Income

Income is an important indicator as it reflects the capacity of the domestic water user to improve his dwelling: to having, ultimately, access to kitchen and bathroom facilities, developed gardens and to acquire material items and appliances which all result in increased water demand. From a survey performed in Kwandebele, the results showed an expected general increase in water use with increased income level (Ekert, 1986).

3.4.3 Housing type

The predominant housing type, which occurs in the villages, is considered a suitable and effective indicator of the prosperity and value orientation of the community. Credit facilities are usually not available to most households in view of the current land tenure arrangement and other economic factors. Improvements to dwellings are therefore a reflection of the economic status of the community and are readily determined by making a cursory visit to the village or town (WSM, 1994).

The household water demand model in which the quantity (in litres) of water consumed per capita per day (LCD) can be hypothesized to be a function of the following dependent variables:

The dependent variable is the amount of water carried home per day by household members, divided by the total number of individuals in the household. On the basis of the consumer demand theory, we would expect households with a higher collection rate for their chosen water source to use less water per capita because the real resource costs of water of water use at home would be higher.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

According to the October 1995 Household survey, the population of the Mpumalanga Province was estimated to be approximately three million people, of which 31% lived in urban areas and more than 69% in rural areas. Three – quarters of all Africans lived in the rural areas compared to only 18% of their white counterparts. Among the adult population, 20 years and older, African females had the lowest level education in Mpumalanga, followed by African males. 28 percent of African females had never been to school, whilst the figure for their male counterparts stood at 22 percent. By contrast, all white females and males had some education (SSA, 1998).

According to the survey, 33% of the labour force was unemployed, which is higher than the national rate of 29%. The unemployment rate in the rural areas was 35%, which was lower than the national figure, of 38%. 24 percent of males were unemployed as opposed to 48% of females. 31% of the Africans earned between R12 661 and R23 940 per annum.

Only 31% Africans as opposed to 99% of whites, had access to electricity. African households in the rural areas who had access to electricity amounted to 38 percent as opposed to 65 percent in the urban areas. 47 percent of households in the rural areas used candles for lighting, and only 15 percent used paraffin.

It was found that 33 percent of African households in the rural areas in Mpumalanga had taps inside their dwellings, and 26 percent had a tap on site. Those who obtained water from a river, streams, dams or well amounted to 10 percent, and approximately 14 percent obtained water from boreholes. Only 17 percent of households in Mpumalanga had flush toilets in their dwellings with a further 12 percent making use of flush toilets on site. Fifty percent of households used pit latrines on site compared to 40 percent for the country as a whole (CSS, 1996).

This chapter outlines the methodology used to investigate the overall situation of the household's willingness to pay for water in the Mpumalanga rural areas. The collection of data, sources of information, choice of study areas, sample design and interviewing procedures and methods of data analysis are discussed in this chapter.

4.2 METHODOLOGY

The following methodology was used in order to fulfill the study objectives:

This study is the result of two years of intensive work and wide consultation with the village leaders and other responsible village authorities. Data were collected in Mpumalanga Province. In order to determine the rural household's willingness to pay for improved water services in the Mpumalanga Province in South Africa this study uses contingent valuation method. The study was designed to be able to estimate the demand for improved water services in the rural areas of South Africa, and particularly in Mpumalanga Province.

4.2.1 Data used

Primary data were gathered through a questionnaire completed by households in different villages in Mpumalanga Province. Specimens of the questionnaire are supplied in Appendix A. The questionnaire was administered to collect information in three categories of variables (Water sources, uses and problems; household willingness to pay; and socio-economic and demographic characteristics of the household). The information gathered through this survey was used to analyse the willingness to pay and to estimate the value placed by rural residents on water services.

4.3 Data Collection

4.3.1 Choice of study area

The study was narrowed down to the rural areas of Mpumalanga province. The rural villages identified for inclusion in this study fall within the North Nsikazi water supply scheme. These areas were chosen for the willingness to pay analysis since they were privileged to have had RDP water pipes installed in their areas by the government. With the aid of maps sites were identified where the government in the province had already implemented RDP water services.

The list of (RDP) Reconstruction and Development Programme water projects was obtained from provincial departments of water affairs and forestry. Statistics South Africa helped with the list of regions and Transitional Local Councils.

4.3.2 Sample Design and Household survey

A simple random sampling of the households was used to select respondents. Individual households completed a single questionnaire during personal interviews conducted by enumerators during the months of July to September, 2000. The questionnaire used was in English, but interviews were conducted in the local language, which was understood by every respondent in those particular villages.

The questionnaire consisted of three sections: The first section dealt with household water sources and usage.

The second section consisted of the bidding games designed to determine how much households would be willing to pay for improved levels of water service: (a) public stand pipes within 200m from their homes; (b) yard taps, and (c) house connections with full reticulation.

A sequence of low and high starting bids was used for the different levels of water services. High and low starting point values were used. Starting point values were assigned randomly across our sample of households. However if a respondent received a high value for the willingness to pay questions for a public stand pipe, he or she also received a high value for the willingness to pay question for yard tap and house reticulation. The order of questions remained the same across the boards i.e. respondents were asked about their willingness to pay for a street tap and then for a yard tap and then for house reticulation.

The third section of the questionnaire elicited information about the socio-economic and demographic characteristics of respondents.

The study was further limited to estimating the use value of water for domestic activities, i.e. drinking, cooking, personal hygiene, sanitation and backyard gardening. The study survey was conducted among 121 household interviews in North Nsikazi villages.

The required number of households was obtained by using a systematic sampling technique in the sampled villages. In each of the villages sampled, the relevant village headmen and chiefs first granted their permission before interviews were conducted. The household head was interviewed whenever available or, failing this, any senior household member was interviewed. In order to ensure that any formal sector employees were left out some interviews were done after hours. This was to ensure that no formal sector employees were systematically missed in the survey.

4.4 Analytical model

The contingent valuation method (CVM) was used to analyse how households make their choices about water sources. The method used questions to the respondents as to the amount they would be willing to pay given different service level options like yard taps, public standpipes and house reticulation.

Questions were: (i) do people agree with the idea of paying for water service; (ii) choice of service level, option of service level and how much people are willing to pay for the service level of their choice (iii) what influences the choice of that service level.

Willingness-to-pay bids are used for several purposes:

(i) To determine the number of households that will opt for a particular service level given the tariffs. The percentage of households opting for a particular service and the tariffs that they are willing to pay will be used to determine the revenues to be generated if the service level was to be implemented.

(ii) To determine the level of relationship between the household's willingness to pay and the households' socio-economic and water sources characteristics.

4.5 Description of variables used in the analysis

In an attempt to explain household behaviour with regard to willingness to pay for hypothetical choices or an expressed preference for a water service option, household responses were related to a set of independent variables representing water source and use, as well as household characteristics. The list of independent variables and their hypothesized relationship with WTP for a water service option are presented below.

4.6 Rationale for independent variables

Household income. Water service is regarded as normal goods therefore the larger the households' income the greater the willingness to pay for an improved water service. A positive relationship between income and willingness to pay is expected.

Expenditure on water. A positive relationship between expenditure on water and WTP is expected since households who are already paying for a less desirable water service would be willing to pay for an improved service.

Household size/ Number of rooms. A Considerable amount of household time is expected to be used to collect water to satisfy household needs if the household is a large one, as measured by the number of household members or number of rooms in the house or compound. Therefore the convenience of having water available through an improved water service will have a great appeal for large households. A positive relationship is expected between household size and WTP.

Distance/ Time to available water source. The theory suggests that households would pay more for an improved water supply service when the costs in terms of time (for travel and queuing) and distance in obtaining water from an existing source could be reduced. A positive relationship between WTP and distance from existing source source/time it takes to get water from existing source ,is expected.

Reliability/ availability. The reliability of the water source is very crucial to a household's WTP. A water system that supplies water sporadically (i.e. a system that is functional for only a few hours or for a few days in a week) causes a great deal of inconvenience and dissatisfaction to users. On the other hand, increased reliability means people do not have to worry constantly about obtaining water and can therefore devote their time to other important concerns. WTP is expected to be positively related to reliability of water source.

Quality of water currently used. Households that consider water currently being used to be deficient (or unsafe) will prefer an improved water system that will be safe for household use. It is expected that a household will be willing to pay more for an improved water source when the perceived quality for an existing or alternative water source is poor.

Gender. This variable represents the sex of the respondent. Because women and children, particularly in Africa, usually bear the responsibility for collecting water, women-headed households would attach more importance to improved water services than would households headed by men, and women would therefore be willing to pay more for improvement in water service. A positive relationship is therefore expected between willingness to pay and households headed by women.

Marital status. The presence of a female in a married relationship increases the likelihood that households with married couples would be more willing to pay for an improved water service.

Age. Age of the household head. The expectation is that willingness to pay for an improvement in water service will decrease when people are older. Older people may be used to the traditional "free" source of water supply (streams, rivers, springs) and may be less willing to pay for a new source which entails user fees. A negative relationship between the age of the household head and WTP is hypothesized.

Education. Formal education is crucial for an understanding of the importance of clean water, disease prevention and other healthy living practices. Therefore if improved water services were not available, one would expect households with higher levels of formal education to be more willing to pay to obtain water than would households with lower education levels. Furthermore, because better-educated households have higher opportunity costs for time spent collecting water from a source far from or outside the house, they might well be willing to pay more for improved services than would other households. A positve relationship is therefore expected between attainment of secondary education and WTP.

4.7 Method of analysis

Ordinary least squares regression and correlation analysis are used to determine the relationship between willingness to pay and the socio-economic and water source variables identified above. The dependent variable in our analysis is not the maximum amount the household would be willing to pay. Rather the midpoints of the intervals constructed in the bidding game were used. The use of the midpoints of the intervals as dependent variables in an ordinary least squares has been applied in studies similar to this in Pakistani Punjab (Altaf et al: 1992) and in Tanzania (Whittington et al: 1989) and have yielded results that are consistent with other models and parameters and are easier to interpret.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

According to the October 1995 Household survey, the population of the Mpumalanga Province was estimated to be approximately three million people, of which 31% lived in urban areas and more than 69% in rural areas. Three – quarters of all Africans lived in the rural areas compared to only 18% of their white counterparts. Among the adult population, 20 years and older, African females had the lowest level education in Mpumalanga, followed by African males. 28 percent of African females had never been to school, whilst the figure for their male counterparts stood at 22 percent. By contrast, all white females and males had some education (SSA, 1998).

According to the survey, 33% of the labour force was unemployed, which is higher than the national rate of 29%. The unemployment rate in the rural areas was 35%, which was lower than the national figure, of 38%. 24 percent of males were unemployed as opposed to 48% of females. 31% of the Africans earned between R12 661 and R23 940 per annum.

Only 31% Africans as opposed to 99% of whites, had access to electricity. African households in the rural areas who had access to electricity amounted to 38 percent as opposed to 65 percent in the urban areas. 47 percent of households in the rural areas used candles for lighting, and only 15 percent used paraffin.

It was found that 33 percent of African households in the rural areas in Mpumalanga had taps inside their dwellings, and 26 percent had a tap on site. Those who obtained water from a river, streams, dams or well amounted to 10 percent, and approximately 14 percent obtained water from boreholes. Only 17 percent of households in Mpumalanga had flush toilets in their dwellings with a further 12 percent making use of flush toilets on site. Fifty percent of households used pit latrines on site compared to 40 percent for the country as a whole (CSS, 1996).

This chapter outlines the methodology used to investigate the overall situation of the household's willingness to pay for water in the Mpumalanga rural areas. The collection of data, sources of information, choice of study areas, sample design and interviewing procedures and methods of data analysis are discussed in this chapter.

4.2 METHODOLOGY

The following methodology was used in order to fulfill the study objectives:

This study is the result of two years of intensive work and wide consultation with the village leaders and other responsible village authorities. Data were collected in Mpumalanga Province. In order to determine the rural household's willingness to pay for improved water services in the Mpumalanga Province in South Africa this study uses contingent valuation method. The study was designed to be able to estimate the demand for improved water services in the rural areas of South Africa, and particularly in Mpumalanga Province.

4.2.1 Data used

Primary data were gathered through a questionnaire completed by households in different villages in Mpumalanga Province. Specimens of the questionnaire are supplied in Appendix A. The questionnaire was administered to collect information in three categories of variables (Water sources, uses and problems; household willingness to pay; and socio-economic and demographic characteristics of the household). The information gathered through this survey was used to analyse the willingness to pay and to estimate the value placed by rural residents on water services.

4.3 Data Collection

4.3.1 Choice of study area

The study was narrowed down to the rural areas of Mpumalanga province. The rural villages identified for inclusion in this study fall within the North Nsikazi water supply scheme. These areas were chosen for the willingness to pay analysis since they were privileged to have had RDP water pipes installed in their areas by the government. With the aid of maps sites were identified where the government in the province had already implemented RDP water services.

The list of (RDP) Reconstruction and Development Programme water projects was obtained from provincial departments of water affairs and forestry. Statistics South Africa helped with the list of regions and Transitional Local Councils.

4.3.2 Sample Design and Household survey

A simple random sampling of the households was used to select respondents. Individual households completed a single questionnaire during personal interviews conducted by enumerators during the months of July to September, 2000. The questionnaire used was in English, but interviews were conducted in the local language, which was understood by every respondent in those particular villages.

The questionnaire consisted of three sections: The first section dealt with household water sources and usage.

The second section consisted of the bidding games designed to determine how much households would be willing to pay for improved levels of water service: (a) public stand pipes within 200m from their homes; (b) yard taps, and (c) house connections with full reticulation.

A sequence of low and high starting bids was used for the different levels of water services. High and low starting point values were used. Starting point values were assigned randomly across our sample of households. However if a respondent received a high value for the willingness to pay questions for a public stand pipe, he or she also received a high value for the willingness to pay question for yard tap and house reticulation. The order of questions remained the same across the boards i.e. respondents were asked about their willingness to pay for a street tap and then for a yard tap and then for house reticulation.

The third section of the questionnaire elicited information about the socio-economic and demographic characteristics of respondents.

The study was further limited to estimating the use value of water for domestic activities, i.e. drinking, cooking, personal hygiene, sanitation and backyard gardening. The study survey was conducted among 121 household interviews in North Nsikazi villages.

The required number of households was obtained by using a systematic sampling technique in the sampled villages. In each of the villages sampled, the relevant village headmen and chiefs first granted their permission before interviews were conducted. The household head was interviewed whenever available or, failing this, any senior household member was interviewed. In order to ensure that any formal sector employees were left out some interviews were done after hours. This was to ensure that no formal sector employees were systematically missed in the survey.

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Gender. This variable represents the sex of the respondent. Because women and children, particularly in Africa, usually bear the responsibility for collecting water, women-headed households would attach more importance to improved water services than would households headed by men, and women would therefore be willing to pay more for improvement in water service. A positive relationship is therefore expected between willingness to pay and households headed by women.

Marital status. The presence of a female in a married relationship increases the likelihood that households with married couples would be more willing to pay for an improved water service.

Age. Age of the household head. The expectation is that willingness to pay for an improvement in water service will decrease when people are older. Older people may be used to the traditional "free" source of water supply (streams, rivers, springs) and may be less willing to pay for a new source which entails user fees. A negative relationship between the age of the household head and WTP is hypothesized.

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4.7 Method of analysis

Ordinary least squares regression and correlation analysis are used to determine the relationship between willingness to pay and the socio-economic and water source variables identified above. The dependent variable in our analysis is not the maximum amount the household would be willing to pay. Rather the midpoints of the intervals constructed in the bidding game were used. The use of the midpoints of the intervals as dependent variables in an ordinary least squares has been applied in studies similar to this in Pakistani Punjab (Altaf et al: 1992) and in Tanzania (Whittington et al: 1989) and have yielded results that are consistent with other models and parameters and are easier to interpret.

CHAPTER 5

RESULTS AND FINDINGS

Both the results and the findings of the study are presented in detail in this chapter.

5.1 Water Services and Attitude towards Paying for Improved Water Service

A major characteristic of the RDP is a water supply system which is to supply households with water from street taps at the rate of 20-30 litres / day within a distance of 200 meters from where they stay or from their homes. The North Nsikazi water supply scheme which suppliers water to the villages in the greater Nsikazi area in White River was identified in order to fulfill this aim.

As illustrated in the table below (Table 5.1) the majority of respondents, who constitute 86% of the sample in Mpumalanga Province (Nsikazi), expressed disagreement with the idea of paying for a water service. Most of the respondents who disagreed with the idea for paying for water service, said that they were not satisfied with the level of service they were receiving from street taps. The street taps were installed earlier in their area by the government and it is not surprising that households are unwilling to pay for a water service that does not satisfy their water needs. However, the respondents were given the option to choose between different levels of water service systems which were: a yard tap, the improvement being that one receives water on the house compound; a street tap, located 200 meters from where the household members reside and provides a 24 hour supply water to the household.

Table 5.1 Attitude towards paying for water

	Number of households	Household percentage (HHS%)
Are you satisfied with the level of service from street tap? Yes No	 1 120	 1 99
Do you agree with the idea of paying for water? Yes No	 17 104	 14 86
Reasons for disagreement with paying for water (i) Not satisfied with the level of service (ii) Water is a natural resource and should not be paid for. (iii) It is the responsibility of the government to provide free water	 109 11 1	 90 9 1
Which is the preferred level of service? (I) Yard tap (II) House reticulation	 121 0	 100 0
Preferred method of payment (% of households). (i) Pre-paid (ii) Flat monthly rate (iii) Monthly billing system	 38 35 48	 32 29 39
Mean WTP for (i) Yard tap	 16.30	
Supply system problems (i) Cannot get water every day (ii) Cannot get water all day (reliability) (iii) Cannot get water at all (availability)	 4 26 91	 3 22 75

The majority of the survey respondents in Mpumalanga Province showed their preference for a yard tap and households showed that their main reason for opting for yard taps is that the street taps are unreliable and they cannot get water every day and all day and they do not prefer street taps as the majority of households believe that street taps is an inconvenient water service system. As presented in Table 5.1, 75% of the respondents, or 91 out of 121 respondents, said that they could not get water every day, as they would expect.

The majority of households, which constitutes 39% of the total households, expressed their preference for a monthly billing system as they view it as a convenient way of paying for their water; 32% preferred pre-paid method of payment, and the other 29% preferred a flat monthly rate.

5.2 Analysis of willingness to pay (WTP) Nsikazi villages

The analysis of willingness to pay in these villages is limited to the yard connection as the number of households choosing street tap and house reticulation does not provide a meaningful analysis of the willingness to pay for water service option.

5.2.1 Willingness to pay for yard tap

All the households surveyed in the villages in the greater Nsikazi area would choose a yard connection as their best level of water provision, if given the choice (see Table 5.1), meaning that all 121 households in Nsikazi or 100% believe that yard tap is their best water service option when compared to the street tap water service option. The mean willingness to pay for yards taps is R16, 30 per household per month.

The questionnaire used in this study was primarily designed to allow the researcher to estimate the households' willingness to pay for water (See Appendix A). The willingness to pay questions first asked for a four- step YES/NO interaction, with individual households' valuations for different types of improved water service options. After the interactive questions, the maximum a household could pay per month was asked as a direct question.

In this section, the results of the responses to willingness to pay questions for improved water services are presented. These responses indicate the maximum monthly tariff that a household is willing to pay for a particular water service option described.

The water service options presented to respondents were:

(i) Improved water system that provides street taps which are within a 200 meter radius of every household (i.e.) the basic RDP communal street tap.

(ii) Improved water system that provides a yard tap for every household.

(iii) Improved water system that provides for full house reticulation.

From the responses in the YES/NO bidding game, it is possible to classify households into a number of bid classes based on how much the respondent indicates the household is willing to pay per month for a given improved water service option. The information obtained is used to address a number of issues pertaining to household water-related behaviour.

Firstly the frequency distribution of the willingness to pay bids can be used to address the question of how many households would opt for (or connect to) a particular improved water service if different prices were charged for water. Thus for a given price of water, the percentage of households in the sample that stated that they would like to have a particular improved water service can be calculated.

Secondly, the frequency distribution of willingness to pay bids can be used to estimate the total willingness to pay for a given water service option. Total willingness to pay is the total economic benefit of improved water service provision.

Thirdly, the frequency distribution of the willingness to pay bids can also be used to estimate roughly revenue from the provision of an improved water service at a specified price. This is done by first predicting the total number of households in the rural community that would be willing to pay for a water service at a specified (bid) price and then multiplying this by the bid price.

5.3 Total willingness to pay

The total willingness to pay of a community for a given improved water service is calculated by multiplying the frequency distribution of the sample by the total rural population to get the estimated population in each WTP class interval. Then the mid-point of each class interval issued as the mean to estimate the total WTP. If WTP bids are accurate measures of the households' preferences, the total WTP serves as an estimate of the total benefit of an improved water service.

Table 5.2 Total willingness to pay for a yard tap

WTP Bids interval	Frequency %	Number of households (Feq. X 344 485)	WTP Mean Bid	Total WTP for yard tap
0-5	3%	10334.55	2.5	25836.375
5.1-10	29%	99900.65	7.5	749254.875
10.1-15	20%	68897	12.5	861212.5
15.1-20	27%	93010.95	17.5	1627691.625
20.1-25	4%	13779.4	22.5	310036.5
25.1-30	17%	58562.45	27.5	4272116948.1
Total	100%	344485.05		427592 3979

AV WTP=R16, 30
(Total household units in rural area=344 485)

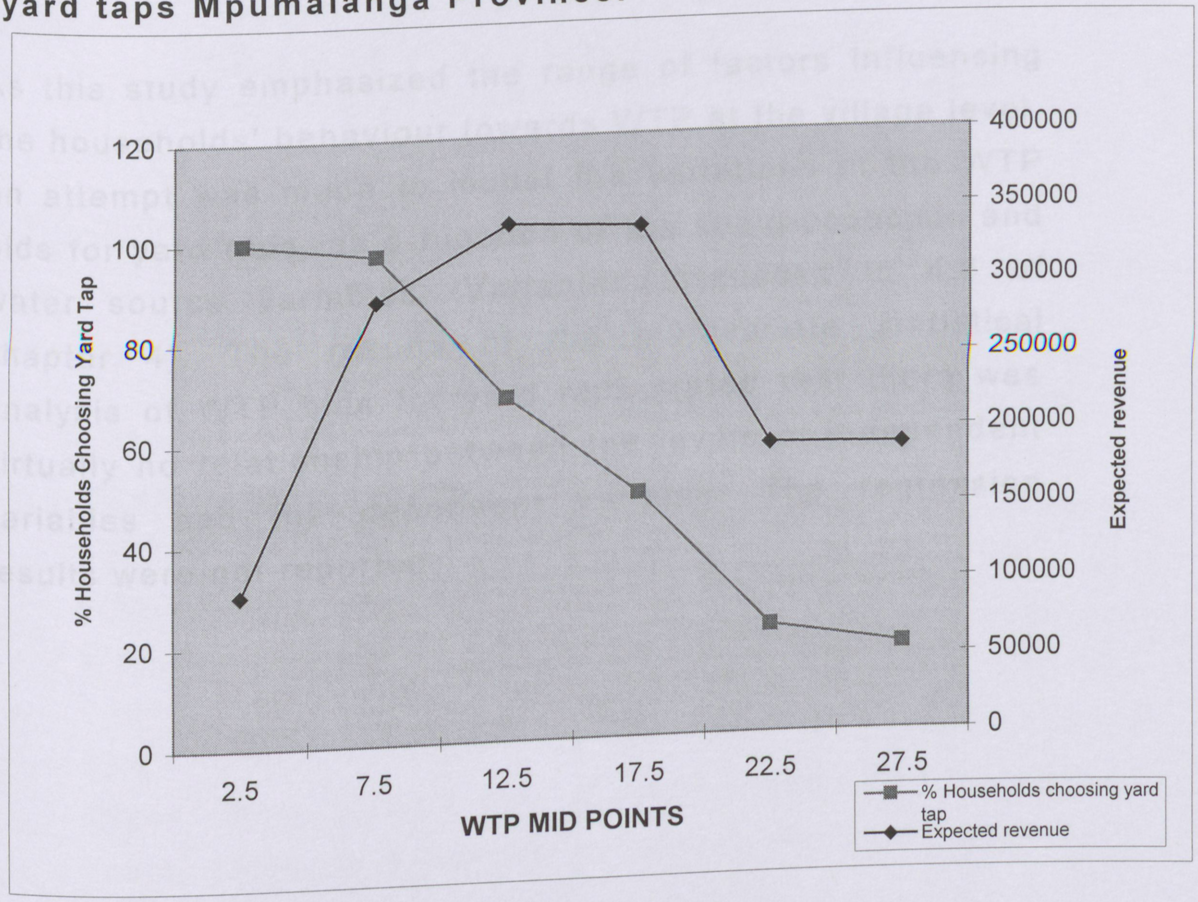
Table 5.2 presents the total willingness to pay for an improved water service via yard taps in Mpumalanga Province. The table further indicates that the total willingness to pay for a yard tap water service for the more than 344 thousand rural households in Mpumalanga Province amount to about R4.2 million per month.

5.4 Proportion of the households opting for yard connection and expected revenues

Table 5.3 Proportion of the households opting for yard connection and expected revenues.

WTP interval	No. of HH	% of HH	H.H opting for yard taps	% Of H.H opting for yard taps	WTP midpoints	Total WTP	No. Of H.H opting for yard tap	Expected revenue
0-5	4	3	1208	100	2.5	3020	40 249	10 0623
5.1-10	35	29	11 672	97	7.5	87 540	39 041	29 2808
10.1-15	24	20	8050	68	12.5	10 0625	27 369	34 2113
15.1-20	33	27	10 867	48	17.5	19 0173	19 319	33 8083
20.1-25	5	4	1610	21	22.5	36 225	8452	19 0170
25.1-30	20	17	6842	17	27.5	18 8155	6842	18 8155
Total	121	100	40 249			60 5738		14 51952

Figure 5.1 Connection rate and expected revenues-yard taps Mpumalanga Province.



The only level of service that these households have is the street tap water service system. According to the descriptive analysis in this study it is clear that there is a high rate of unwillingness to pay for the street tap service and a high willingness to pay for the yard tap. It is also evident that there is a small response regarding the willingness to pay for house connection, as it could be easy for people to extend water pipes into houses once the yard taps are in place. The majority of households could not distinguish clearly between a yard connection and a house connection.

5.5 Multivariate Analysis of Willingness to pay

As this study emphasized the range of factors influencing the households' behaviour towards WTP at the village level, an attempt was made to model the variations in the WTP bids for yard taps, as a function of the socio-economic and water source variables (Variables discussed in 4.6 of chapter 4). The results of the multivariate statistical analysis of WTP bids for yard taps stated that there was virtually no relationship between the levels of independent variables and the dependent variable. The regression results were not reported.

CHAPTER 6

SUMMARY OF FINDINGS, POLICY RECOMMENDATIONS AND CONCLUSIONS.

6.1 Summary of findings

From the results of this study, the following points are noted and conclusions are drawn:

- The study concentrated on the rural households of Mpumalanga Province Nsikazi villages. The overwhelming majority of the households interviewed expressed dissatisfaction with the water services received from street taps. It was clear that 100 percent of the interviewed households would choose a yard taps service option and small number of households expressed their preference for street taps. The most common problems households encountered were availability and reliability of water form the street taps.

- Most of the households interviewed seemed to disagree with the idea of paying for water.

- A monthly billing method of payment seemed to be the most preferred method of payment, with 39% of the households interviewed expressing preference for this method and the least preferred method was the prepaid method payment, with only 29% of the households opting for it.

- The mean of the willingness to pay bids for yard tap connection in Nsikazi was found to be R16.30 per household per month.

- The maximum revenue of R3.42 million was found to occur at tariff rate of R12.50 per household per month, but only 68% of the households would be able pay for such a service.

6.2 Policy implications

The results from this study suggest that contingent valuation surveys provide valuable information on households' willingness to pay for improved services. Such information can be helpful in several ways:

(1) In determining the appropriate level of service. Our analyses have revealed an overwhelming preference for a yard tap water service by households in Nsikazi rural communities. The finding lends support to recent government pronouncement on policy changes that allows for a choice of water service levels in the provision of water in rural areas.

(2) In providing information on the number of households that would choose to connect to an improved water service if different methods of payment are offered. Our analysis has enabled us to compute willingness to pay (mean WTP bids) and the total willingness to pay for the yard tap service option. In addition tariff rates at which a water service provider could maximize revenues have been obtained from our analysis.

(3) The number of households that can afford to connect to an improved service level at the different tariff rates has also been estimated. Such information makes it possible to make informed

decisions on the pricing of water services, at least in the rural areas of the province that the study covered.

(4) The reliability of a water service was found to be the biggest problem that households are facing. This implies that in designing water scheme a significant attention must be paid to the issue of reliability, if the water service provider is to win the confidence of consumers and by implicating their willingness to pay for the service.

6.3 Recommendations

Based on the findings of this study, it is suggested that further research be undertaken which would lead to an improved understanding of the dynamics of population development in this field. The research will have to aim at collecting data more intensively as the needs of communities vary in accordance with level of living, value orientation, aspirations, gardening activities and other socio-economic factors. A community profile should be compiled of the needs, expectations, perceptions and lifestyles of the inhabitants, and in addition, aspects such as the existing infrastructure and the cultural values of the community and traditions, should also be taken into account.

The results of this research would allow more accurate quantification of the value orientation of communities, The rate of improvement of communities, factors that define the movement of people and refinement of population growth in terms of fertility and mortality. A more accurate estimate of the population growth rate and value orientation is vital for the planning, design and development of not only water supply, but all other services as well.

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APPENDIX A

Questionnaire for the Willingness to pay for water in South African Rural areas: A case study of Nsikazi rural Areas of Mpamalanga Province

University of Venda for Science and Technology.

Department of Economics.

Name of Enumerator……………………………

Starting time…………………………… End time…………

Date:……………………

Village name:……………………………………

Village Chief/Headman:……………………………

Language of Interview……………………………

Questionnaire Number……………………………

THE DEMAND FOR WATER IN SOUTH AFRICA'S RURAL AREAS

I am……………………………and I am part of the research team from the University of Venda that is conducting a study of the water situation in the………………………………………………… Province/district. Your village has been selected as one of the villages for our study. We have received permission from to conduct the study and you have been selected as one of the household we would like to interview. The interview would just take a few minutes and your answers will be completely confidential.

IMPROVED WATER SYSTEM.

1. Is the water system working today?
   a) Yes

b) No

If no go to question 5.

2. If yes, is the system reliable? (i.e. does it provide water round the clock?)

a) Yes

b) No

If yes, go to question 4.

3. If no, what is the main problem?

a) Can not get water everyday

b) Can not get water all day

c) Can not get water at all

d) Other (specify)-----------------------------

4. How much, on average, do you spend on water per month?

R --------------

5. For how long has the system not been working?

a) Number of hours-----------------

b) Number of days-----------------

c) Number of weeks---------------

d) Number of months---------------

e) Number of years-----------------

6. What is (are) the other source(s) of water for your household?

a) Rivers

b) Bore holes / hand pump

c) Springs / fountains

d) Wells

e) Bore hole / Electricity

f) Other (specify)--

7. How far is this source from your household (metres) -------

8. How long does it take you to get to the source one way (minutes/hours)----

a) Number of minutes----------

b) Number of hours…………………..

9. How many times do you go there per day?------------

10. How many litres per day does your household use?-----------

11. How often do you do your laundry?

a) Once per week

b) Twice per week

c) Daily

d) Other (please specify)………………………………

12. If you do your laundry at home, how many litres do you use?

Number of litres……………………..

13. If you do your laundry at the river/stream/public standpipe/bore hole, how far is this source from your home?

a) Metres……………………………………

b) Kilometres…………………………………

14. How do you get there?

a) Walk
b) Drive
c) Other (please specify)……………………………………………………

15. How long does it take you to get there (one way)?
a) Minutes
b) Hours

16. How long does it take you to do the laundry?
a) Number of minutes
b) Number of hours

17. Who is responsible for water collection in your household?
a) Women
b) Girls
c) Boys
d) Men
e) Others (specify)-----------------------

18. What is the most serious problem with this source of water?
a) Quantity
b) Quality (odour, taste, particles, etc)
c) Reliability
d) Availability

19 Has any member of your household suffered from deficient water quality?
a) Yes
b) No
If no, go to question 21.

20. If yes, Which one of the following?

a) Diarrhoea

b) Cholera

c) Typhoid

d) Bilharzia

e) Other (please specify).............

21. Do water vendors ever sell water in this village?

a) Yes

b) No

c) Do not know

If no, go to question 28.

22. If yes, what type of container do they usually sell the water in?

a) 20l container

b) 25l container

c) 30l container

d) 50l container

e) Other type of container (please specify)

23. How much do they usually charge for this container?

a) Amount of money-----------

b) Do not know

24. Does your household ever purchase any water from water vendors?

a) Yes

b) No

If no go to question 28 .

25. If yes how many litres?

a) Per week, ---------------------

b) Per day, ----------------------------

26. If no, why?

a) Too expensive

b) Supplement with water from other sources

c) Other, please specify

27. How will you judge the quality of water sold by the vendors? ,is it:

a) Good?

b) Bad?

c) Do not know.

RAIN WATER COLLECTION.

28. Do you ever collect rainwater?

a) Yes

b) No

If no, go to question 34.

29. If yes, how do you collect it?

a) Rainwater collection tank

b) Drums

c) Buckets

d) Other, (specify)------------------------------------

30. What do you use rainwater for?

a) Drinking purposes

b) Laundry

c) Washing
d) Irrigation
e) Cooking
f) Other, (specify)---

31. If your neighbour runs out of water, do you provide them with rainwater?

a) Yes
b) No

If no, go to question 36.

32 If yes, do you charge something for the rainwater?

a) Yes
b) No

If no, go to question 36.

33. If yes, how much?

a) Per 20L container
b) Per 25L container
c) 30l container
d) 50l container
e) Other, (specify)---

34. If you do not have a rainwater collection facility, do you ever purchase rainwater from your neighbours?

a) Yes
b) No

If no, go to question 36.

35. If yes, how much do they normally charge you?

a) per 20l container R----------

b) per 25l container R----------

c) per 30l container R----------

d) per 50l container R----------

e) Other (please specify)-------------------

36. How will you judge the quality of rainwater?

a) Good

b) Bad

c) Do not know

Willingness to Pay.

According to the Water Act no. 36 Of 1998, the South African government is committed to providing every citizen with water to meet basic human needs. The water in question is intended to provide for the essential needs of individuals and includes water for drinking, for food preparation and for personal hygiene. Given the fact that South Africa is generally a dry country, the Act also makes provisions for water use charges. To this end, the government expects every citizen to pay for the water they use. This payment is intended to encourage conservation of this scarce resource and meeting the costs of supply and maintenance of the water system. People who are not willing to pay for water will be denied access to water and only those willing to pay will have access to water.

We understand that an RDP water project has been installed in your village. This improved system is supposed to provide you with a guaranteed reliable water supply round the clock. In order to ensure a more responsible use of water, meet the cost of providing this improved system, as well as maintenance of the improved system, every household in this village is required to pay for the water used. As you know, those who are not willing to pay are excluded from using this system.

37. Do you agree with the idea of paying for water?

a) Yes

b) No

If yes, go to question 39.

38. If no, what is your main reason?

a) People must not pay for water since it is a natural resource.

b) It is the government's responsibility to provide people with free water.

c) Other, (specify)--

39. Are you satisfied with the current rate charged for water?

a) Yes

b) No

If yes, go to question 41.

40. If no, what is your main reason?

a) I do not have enough money to pay

b) It is the government's responsibility to provide free water.

c) The rate is expensive relative to the service provided

d) Don't see any reason why I should pay for water.

e) Other, (specify) --

41. Are you satisfied with the level of service (i.e. street taps) that you have?

a) Yes

b) No

If yes, go to question 43.

42. If no, which level of service would you prefer?

a) Yard taps.

b) House connections (full reticulation)

c) Other (specify)--

43. Suppose that the Government decided to provide an improved system that provides public standpipes, which are within 200m radius from every household. Suppose further that it was calculated that in order to provide this improved water supply service, every household would have to pay R 3.00 per month for water. Any household not willing to pay would not have access to water. Would you be willing to pay R 3.00 of your household's monthly income (that is R 36.00/year) for water?

a) Yes………………. Go to question 44

b) No…………………. Go to question 47

c) I do not know………… Go to question 47

44. Would you be willing to pay R 15.00 per month (or R 60.00/year) for water?

a) Yes………………. Go to question 47

b) No……….. Go to question 45

c) I do not know……… Go to question 47

45. Would you be willing to pay R 12.00/month (or R 144.00/year) for water?

a) Yes…………………… Go to question 47

b) No…………………… Go to question 46

c) I do not know……….. Go to question 47

46. Would you be willing to pay R 7.00/month (or R 84.00/year) for water?

a) Yes…………………… Go to question 47

b) No…………………… Go to question 47

c) I do not know……….. Go to question 47

47. Take your time to think about this question. What is the highest amount you would be willing to pay per month for water from public standpipes?

a) Amount of money R……………………..

b) I do not know.

(Enumerator to quickly work out how much this figure would translate to an annual water bill. Ask the respondent, you have just told me that the maximum amount you are willing to pay for water is R /month which works out to R /annum. Are you willing to pay R /month, which is R /annum?

a) Yes……………………

b) No……………………

48. If you are willing to pay, what is your preferred method of payment?

a) Service charges

b) Pre-paid meter system

c) Flat monthly rate
d) Monthly billing system
e) Other (please specify)..

49. In order to be able to pay R for water, which expenses of your monthly household budget would you reduce?
a) Food
b) *Entertainment*
c) Clothes
d) Transportation
e) School fees
f) Energy requirements
g) Other, (specify)..

50. Do you really think you can reduce the above expenditure (expenditure on) so as to be able to pay the maximum that you indicated above (Rand)?
a) Yes
b) No
c) Not sure

51. What is the maximum amount you think your household is able to pay per month without problems? R.........................

You may revise your willingness to pay amount at any point. Please tell me now if you wish to do so.

52 Suppose that the Government decided to provide an improved system that provides public standpipes, which are within 200m

radius from every household. Suppose further that it was calculated that in order to provide this improved water supply service, every household would have to pay R 20.00 per month for water. Any household not willing to pay would not have access to water. Would you be willing to pay R 20.00 of your household's monthly income (that is R 240.00/year) for water?

a) Yes……………… Go to question 56

b) No……………… Go to question 53

c) I do not know………………… Go to question 56

53. Would you be willing to pay R 6.00 per month (or R 72.00/year) for water?

a) Yes……………… Go to question 54

b) No………. Go to question 56

c) I do not know……… Go to question 56

54. Would you be willing to pay R 11.00/month (or R 132.00/year) for water?

a) Yes……………… Go to question 55

b) No………………… Go to question 56

c) I do not know……… Go to question 56

55. Would you be willing to pay R 15.00/month (or R 180.00/year) for water?

a) Yes……………… Go to question 56

b) No……………… Go to question 56

c) I do not know……… Go to question 56

56. Take your time to think about this question. What is the highest amount you would be willing to pay per month for water from public standpipes?

a) Amount of money R…………………..

b) I do not know.

(Enumerator to quickly work out how much this figure would translate to an annual water bill. Ask the respondent, you have just told me that the maximum amount you are willing to pay for water is R /month which works out to R /annum. Are you willing to pay R /month, which is R /annum?)

a) Yes………………..

b) No…………………

57. If you are willing to pay, what is your preferred method of payment?

a) Service charges

b) Pre-paid system

c) Flat monthly

d) Monthly billing system

e) Other (please specify)………………………………………

58 In order to be able to pay R for water, which expenses of your monthly household budget would you reduce?

a) Food

b) Entertainment

c) Clothes

d) Transportation

e) School fees

f) Energy requirements

g) Other, (specify)…………………………………………………….

59 Do you really think you can reduce the above expenditure (expenditure on) so as to be able to pay the maximum that you indicated above (Rand)?

a) Yes

b) No

c) Not sure

60 What is the maximum amount you think your household is able to pay per month without problems? R……………………………

61. Suppose that the Government decided to provide an improved system that provides yard taps in every household. Suppose further that it was calculated that in order to provide this improved water supply service, every household would have to pay R 12.00/month for water. Households not willing to pay would not have access to water. Would you be willing to pay R 12.00 of your household's monthly income (that is R 144.00/year) for water?

a) Yes………………. Go to question 116

b) No………………… Go to question 119

c) I do not know………….. Go to question 119

62. Would you be willing to pay R 26.00/month (or R 312/year) for water?

a) a) Yes………………. Go to question 119

b) b) No………. Go to question 117

c) I do not know……… Go to question 119

63. Would you be willing to pay R 21.00/month (or R 252.00/year) for water?

a) Yes………………… Go to question 118

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b) No…………………. Go to question 119

c) I do not know……….. Go to question 119

64. Would you be willing to pay R 17.00/month (or R 204.00/year) for water?

a) Yes………………… Go to question 119

b) No………………….. Go to question 119

c) I do not know………. Go to question 119

64. Take your time to think about this question. What is the highest amount you would be willing to pay per month for water from public standpipes?

c) Amount of money R…………………..

d) I do not know.

(Enumerator to quickly work out how much this figure would *translate to an annual* water bill. Ask the respondent, you have just told me that the maximum amount you are willing to pay for water is R per month which works out to R / annum. Are you willing to pay R /month, which is R per annum?

a) Yes……………….

b) No………………..

65. If you are willing to pay, what is your preferred method of payment?

a) Service charges

b) Pre-paid meter system

c) Flat monthly rate

d) Monthly billing system

e) Other (please specify)………………………………………

66. In order to be able to pay R for water, which expenses of your monthly household budget would you reduce?
   a) Food
   b) Entertainment
   c) Clothes
   d) Transportation
   e) School fees
   f) Energy requirements
   g) Other, (specify)

67. Do you really think you can reduce the above expenditure (expenditure on) so as to be able to pay the maximum that you indicated above (Rand)?
   a) Yes
   b) No
   c) Not sure

68. What is the maximum amount you think your household is able to pay per month without problems? R……………………

You may revise your willingness to pay amount at any point. Please tell me now if you wish to do so.

70. Suppose that the Government decided to provide an improved system that provides yard taps in every household. Suppose further that it was calculated that in order to provide this improved water supply service, every household would have to pay R 30.00/month for water. Households not willing to pay would not have access to water. Would you be willing to pay R 30.00 of your household's monthly income (that is R 360.00/year) for water?

a) Yes………………. Go to question 128

b) No………………… Go to question 125

c) I do not know………….. Go to question 128

71. Would you be willing to pay R 13.00/month (or R 156.00/year) for water?

a) Yes……………….. Go to question 126

b) No……….. Go to question 128

c) I do not know……… Go to question 128

72. Would you be willing to pay R 24.00/month (or R 288.00/year) for water?

a) Yes………………… Go to question 128

b) No……………….. Go to question 127

c) I do not know………. Go to question 128

73. Would you be willing to pay R 20.00/month (or R 240.00/year) for water?

a) Yes………………… Go to question 128

b) No………………….. Go to question 128

c) I do not know……… Go to question 128

74. Take your time to think about this question. What is the highest amount you would be willing to pay per month for water from public standpipes?

a) Amount of money R……………………

b) I do not know.

(Enumerator to quickly work out how much this figure would translate to an annual water bill. Ask the respondent, you have just told me that the maximum amount you are willing to pay for water is R per month which works out to R / annum. Are you willing to pay R /month, which is R per annum?

a) Yes…………………

b) No…………………

75. If you are willing to pay, what is your preferred method of payment?

a) Service charges

b) Pre-paid meter system

c) Flat monthly rate

d) Monthly billing system

e) Other (please specify)…………………………………………………

76. In order to be able to pay R for water, which expenses of your monthly household budget would you reduce?

a) Food

b) Entertainment

c) Clothes

d) Transportation

e) School fees

f) Energy requirements

g) Other, (specify)

77. Do you really think you can reduce the above expenditure (expenditure on) so as to be able to pay the maximum that you indicated above (Rand)?

a) Yes

b) No

c) Not sure

78. What is the maximum amount you think your household is able to pay per month without problems? R……………………

You may revise your willingness to pay amount at any point. Please tell me now if you wish to do so.

79. Suppose that the Government decided to provide an improved system that provides house connections (full reticulation) to every household. Suppose further that it was calculated that in order to provide this improved water supply service, every household would have to pay R 23.00/month for water. Any household not willing to pay would not have access to water. Would you be willing to pay R 20.00 of your household's monthly income (that is R 276.00/year) for water?

a) Yes……………….. Go to question 134

b) No……………….. Go to question 137

c) I do not know…………… Go to question 137

80. Would you be willing to pay R 43.00/month (or R 516.00/year) for water?

a) Yes………………. Go to question 137

b) No……….. Go to question 135

c) I do not know……….. Go to question 137

81. Would you be willing to pay R 31.00/month (or R 372.00/year) for water?

a) Yes………………… Go to question 136

b) No……………….. Go to question 137

c) I do not know……….. Go to question 137

82. Would you be willing to pay R 38.00/month (or R 456.00/year) for water?

a) Yes………………… Go to question 137

b) No…………………. Go to question 137

c) I do not know………. Go to question 137

83. Take your time to think about this question. What is the highest amount you

would be willing to pay per month for water from public standpipes?

a) Amount of money R……………………

b) I do not know.

(Enumerator to quickly work out how much this figure would translate to an annual water bill. Ask the respondent, you have just told me that the maximum amount you are willing to pay for water is R .00/month which works out to R / annum. Are you willing to pay R per month, which is R per annum?

a) Yes……………….

b) No………………..

84. If you are willing to pay, what is your preferred method of payment?

a) Service charges

b) Pre-paid system

c) Flat monthly rate

d) Monthly billing system

e) Other (please specify)

85. In order to be able to pay R for water, which expenses of your monthly household budget would you reduce?

a) Food

b) Entertainment

c) Clothes
d) Transportation
e) School fees
f) Energy requirements
g) Other (please specify)

86. Do you really think you can reduce the above expenditure (expenditure on) so as to be able to pay the maximum that you indicated above (Rand)?
a) Yes
b) No
c) Not sure

87. What is the maximum amount you think your household is able to pay per month without problems? R……………………

You may revise your willingness to pay amount at any point. Please tell me now if you wish to do so.

88. Suppose that the Government decided to provide an improved system that provides house connections (full reticulation) to every household. Suppose further that it was calculated that in order to provide this improved water supply service, every household would have to pay R 50.00/month for water. Any household not willing to pay would not have access to water. Would you be willing to pay R 50.00 of your household's monthly income (that is R 600.00/year) for water?
a) Yes………………… Go to question 146
b) No………………… Go to question 143
c) I do not know…………… Go to question 146

89. Would you be willing to pay R 34.00/month (or R 408.00/year) for water?

a) Yes……………. Go to question 144

b) No………. Go to question 146

c) I do not know……… Go to question 146

90. Would you be willing to pay R 43.00/month (or R 516.00/year) for water?

a) Yes………………. Go to question 146

b) No………………. Go to question 145

c) I do not know……….. Go to question 146

91. Would you be willing to pay R 38.00/month (or R 456.00/year) for water?

a) Yes………………. Go to question 146

b) No………………. Go to question 146

c) I do not know……… Go to question 146

92. Take your time to think about this question. What is the highest amount you would be willing to pay per month for water from public standpipes?

a) Amount of money R…………………..

b) I do not know.

(Enumerator to quickly work out how much this figure would translate to an annual water bill. Ask the respondent, you have just told me that the maximum amount you are willing to pay for water is R .00/month which works out to R / annum. Are you willing to pay R per month, which is R per annum?

a) Yes……………….

b) No……………….

93. If you are willing to pay, what is your preferred method of payment?

a) Service charges
b) Pre-paid system
c) Flat monthly rate
d) Monthly billing system
e) Other (please specify)

94. In order to be able to pay R for water, which expenses of your monthly household budget would you reduce?

a) Food
b) Entertainment
c) Clothes
d) Transportation
e) School fees
f) Energy requirements
g) Other (please specify)

95. Do you really think you can reduce the above expenditure (expenditure on) so as to be able to pay the maximum that you indicated above (Rand)?

a) Yes
b) No
c) Not sure

96. What is the maximum amount you think your household is able to pay per month without problems? R…………………

You may revise your willingness to pay amount at any point. Please tell me now if you wish to do so.

Socio-Demographic Characteristics:

97. Gender
    a) Male
    b) Female

98. Age………………

99. Marital status
    a) Married
    b) Single
    c) Divorced
    d) Widowed
    e) Other (please specify)……………………………………

100. Educational level of household head
    a) Primary
    b) Secondary
    c) Tertiary
    d) Never been to school

101. If married, educational level of spouse
    a) Primary
    b) Secondary
    c) Tertiary
    d) Never been to school

101. Household size………………………………………

102. Composition of household
    a) No of adults (above 18 years)…………………………………

b) No of children..............................

103. Occupation

a) Formally employed

b) Self employed

c) Unemployed

d) Other (please specify)...

104. Total household income/year (Household head)

a) R 0.00 – R 20 000

b) R 20 001 – R 35 000

c) R 35 001 - R 45 000

d) R 45 001 – R 60 000

e) R 60 001 – R 80 000

f) R 80 001 – R 100 000

g) R 100 001 – R 150 000

h) R 150 001 – R 200 000

i) R 200 001 and over

105. Total income of spouse

a) R 0.00 – R 20 000

b) R 20 001 – R 35 000

c) R 35 001 - R 45 000

d) R 45 001 – R 60 000

e) R 60 001 – R 80 000

f) R 80 001 – R 100 000

g) R 100 001 – R 150 000

h) R 150 001 – R 200 000

i) R 200 001 and over

106. Total household income

a) R 0.00 – R 20 000
b) R 20 001 – R 35 000
c) R 35 001 - R 45 000
d) R 45 001 – R 60 000
e) R 60 001 – R 80 000
f) R 80 001 – R 100 000
g) R 100 001 – R 150 000
h) R 150 001 – R 200 000
i) R 200 001 and over

107. Is your household connected to electricity
a) Yes
b) No
If no, go to question

108. If yes, how much do you spend per month on electricity?……………

109. What are the other sources of your energy requirements
a) Firewood
b) Paraffin
c) Gas
d) Coal
e) Other (please specify)…………………………

110. How much do you spend per month on the energy requirements?...

111. How much do you spend per month on the following?
a) Food
b) Transport

c) Leisure
d) Other (please specify)

112. What is the roof of your house made of?
a) Grass thatch
b) Tiles
c) Corrugated iron sheeting
d) Other (please specify)

113. What is the floor type of the house?
a) Cement
b) Mud
c) Floor tiles
d) Other (please specify)

114. What are the walls constructed of ?
a) Mud bricks and mud plaster
b) Mud bricks and cement plaster
c) Cement bricks and cement plaster
d) Clay bricks
e) Face bricks
f) Other (please specify)

115. Number of rooms or huts in the household…………………

116. What type of sanitation facility do you have in this household?
a) Pit latrine
b) Water borne sewage
c) Other (please specify)

117. What household assets do you possess?

a) Motor car

b) Garage

c) Telephone/Mobile phone

d) Television

e) Radio

f) Livestock

g) Other (please specify)

The percentage of households which would choose to have yard tap water service at a specified (bid) price per month are presented in table 5.3 above. Plots of the relationship between the percentage of households choosing a yard tap service at different prices is shown in figure 5.1 Below. The relationship between the percentages of sample households that would choose to have a yard tap at different prices was obtained by multiplying the percentage by the total number of households in that province, viz. 344 485. The number of households that would choose to have yard taps at a specified (bid) price is then used to estimate the revenue a water service provider can expect to earn.

As highlighted in figure 5.1 below, the households' willingness to pay increases as the price or the water tariff decreases. The revenue yield from the provision of the yard tap will be maximized at the tariff rate of R12.50 per household per month and the total revenue received will be R3.42 million per month. However, based on a tariff rate of R12.50, only 68% of the rural households will be able to pay for or afford the yard tap water service system.