WILLINGNESS TO PAY FOR IMPROVED RURAL DOMESTIC WATER SERVICES: A CONTINGENT VALUATION STUDY OF SERICHO DIVISION, ISIOLO DISTRICT.

BY

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DECLARATION

This paper is my original work and has not been submitted for a degree course in any other University.

Signed _____ Date 12-09-05

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This Research paper has been submitted for examination with our approval as University supervisors.

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DR. JANE KABUBO-MARIARA

DEDICATION

This paper is dedicated to my late mum and dad.

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Finally let me make the usual disclaimer that much as I appreciate all other inputs, any mistakes solely remain mine.

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ABBREVIATIONS

ASAL-Arid and semi-arid land

CBO-Community based organization

CVM-Contingent valuation method

GoK- Government of Kenya

HPM-Hedonic pricing method

Kshs-Kenya shilling

MDGs- Millennium development goals

ML-Maximum likelihood

NGO- Non-governmental organization

OLS-Ordinary least squares

PRSP-Poverty reduction strategy paper

TCM- Travel cost method

UNEP- United Nations Environmental Program

WAB-Water appeals board

WHO-World Health Organization

WSS-Water supply and sanitation

WSTF-Water services trust fund

WTA- Willingness to accept compensation.

WTP- Willingness to pay

ABSTRACT

This paper employs the contingent valuation method (CVM) to assess the WTP for improved water services. A field survey was carried out in the study area to collect the necessary data. A stratified systematic random sampling was utilized. The CVM design employed a direct bid elicitation approach to capture WTP on a sample of 162 households. The study used both the OLS and probit methods in estimation.

The results show that there is an overwhelming WTP for improved water services despite the high-poverty level in the area. The willingness to pay was significantly influenced by household income, education levels and distance to water sources. Other socio-economic and demographic factors such as the household size, age, gender and marital status were less significant. Using the direct bid method, the study reveals that the individual average monthly WTP is Kshs 92.40. This is 19% of the individual's average monthly income. When this is aggregated across households in the study area it gives an economic value of Kshs 2.04 million a year.

The high valuation of water services improvement by households implies that water user charges should be imposed. Further, the government should prioritize poverty reduction to improve the income given the strong correlation between willingness to pay and household income.

CHAPTER ONE

INTRODUCTION

1.1 Background

Lack of access to safe water is at the heart of the poverty trap especially for women and children who suffer in terms of illness, drudgery in collection of water, and lost opportunities because of the time that water collection consumes. In rural Africa, according to the World Bank, 40 million hours are spent each year in collecting water for domestic use and half of Africa's population is without access to safe water (Black, 1998). Recent renewed focus on poverty alleviation has resulted in increased attention to the benefits of improved water accessibility. Poverty assessment research has consistently shown that improvement in water services is a critical element in designing and implementing effective strategies for poverty alleviation. What is less well recognized is that the performances of key sectors of the economy are also directly dependent on a reliable and adequate supply of good quality water (Kaliba *et al*, 2003).

The UN millennium declaration signed in September 2000 commits countries to reduce by half the proportion of people living on less than one dollar per day and those who suffer from hunger by 2015. In general, the Millennium Development Goals (MDGs) are intended to promote human development in order to improve living conditions and address global imbalances in poverty, hunger and disease. One of the goals is to ensure environmental sustainability, that is, to integrate the principals of sustainable development into country's policies and reverse the loss of environmental resources. Equally important is to half by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. The Government of Kenya is continuing to implement reforms in the water sector with the view to ensuring efficiency or effectiveness in water service delivery in line with the MDGs. To achieve this objective the government has set specific goals and targets for the country. One of the targets is to increase by 8 percent each year until 2004 access to safe drinking water and by 2010 create universal access to safe water (National Poverty Eradication Plan, 1999).

Water is crucial for human survival, economic development and the environment. Clean water is a "merit good" that confers relatively large social benefits to society which far outweighs the cost of its provision. The provision of this commodity at very low prices is on the understanding that water is one of the physiological needs and is found at the base of the Maslows Hierarchy of needs (Harambalos, 1985). Clean water adds to the quality of life through cost saving in medical and other bills. Consequently its characteristics differ from other public goods such as roads, education city lights etc, because of its necessity to life.

Clean fresh water and access to it are key factors that limit the potential for economic development because water is essential for human health and welfare as well as for agricultural and industrial production. Water scarcity primarily affects the major arid and semi-arid regions where most poverty is located-Africa, the Middle East and South Asia. Currently more than 1.5 billion people do not have access to running water and unless action is stepped up, this number could increase to 2.3 billion by 2005 (UNEP, 2003). Water resources contribute enormously to economic productivity and the social wellbeing of the population. The two rely greatly on adequate and good quality water supplies. With the country's growth in population and socio-economic pursuits including urbanization, industrialization, agricultural activity and others, the demand for water has increased rapidly. There has however not been a corresponding increase in the supply of water resulting in conflicts from competing uses.

According to Kenya's Poverty Reduction Strategy Paper, PRSP (2001), access to water for human consumption, agricultural and livestock use is a major problem in rural areas. The water supply situation in rural areas has deteriorated over the years to a point where demand cannot be sustained with current systems. Access to piped water has not increased since 1989 and those accessing water from other sources has increased from 14 to 29 percent of rural households over the same period. In Arid and Semi-arid Lands (ASAL), people have to trek long distances to access water for both domestic and livestock consumption. The women have to go even further in search of water for domestic use. ASAL areas lack piped water which brings direct benefits to women who

otherwise must make the choice between the effort and time involved in fetching and boiling water or facing the risk associated with consuming untreated and unboiled water.

Kenya experiences wide variation in climate. Most parts of the country receive two rainy seasons, March to May (long rains) and October to November (short rains). The spatial variability of rainfall is considerably varying from 250mm in the ASAL to 2,000 mm in the high mountain ecosystems. In the ASAL rainfall varies between +35 percent and –70 percent around the mean. About 66 percent of the country receives less than 500mm of rainfall annually. The rainfall is distributed inversely to the size of the catchments. That is, the Lake Basin with the smallest area has the largest rainfall, while the Ewasso Ngiro North Basin has the largest area but the least rainfall. Areas that receive low rainfall and runoff such as Ewasso Ngiro Basin are largely dependent on ground water as a reliable source. Particularly in the ASAL areas any contamination or over extraction of groundwater has very serious consequences for residents who are typically source of Kenya's poorest people. Droughts are pervasive and have become endemic in some parts of Kenya. The ASAL areas, the poorest regions of the country are the areas mostly affected by drought. Based on UNEP/GoK 2000 report, walking time for water increased from 6 hours to 21 hours per day per household in ASALs. Opportunity cost of this lost time was calculated using a rate of Kshs 30 per hour– the value of rural labor. The report further noted that 50 percent of the 0.5 million households in ASALs were affected by water shortage.

1.2 Water Policy in Kenya.

Since independence and in recognition of the significant role water plays in economic and social development, the Government has instituted various initiatives to improve access to water. Instrumental among these is the National Policy on Water Resources Management and Development published as *Sessional Paper No.1 of 1999*. The policy aims at achieving sustainable development and management of the water sector. The policy also places emphasis on enhancing the role of private sector participation and community management for sustainable services. The key objectives of the policy are:

(a) Preservation, conservation and protection of available water resources and allocation in a sustainable, rational and economic way.

(b) Supplying water of good quality in sufficient quantities to meet various needs and alleviate poverty while ensuring safe disposal of waste water and environment protection.

(c) Establishing an efficient and effective institutional framework to guide development in the sector.

(d) Sustainable service provision.

The National Poverty Eradication Plan (1999-2015) presents a framework on how the country plans to tackle poverty that afflicts a large percentage of our people. The Plan has set specific goals and targets for the water sector, namely; increase by 8% each year until 2004 access to safe drinking water by poor households, reduce time spent by women on water collection, and by 2010, create universal access to safe water. The Plan has noted that access to adequate and reliable supply of clean water and sanitation is key to public health, especially for low-income groups. This is an area of public action in which significant impacts on family welfare and quality of life can be made through the combination of appropriate technical services, community management, and poverty focused planning and social appraisal. The Ministry of Water and Irrigation (MWI) targets proposed for poverty reduction are to ensure all households access to safe potable water systems within 2 kilometers by the year 2010. This will be attained through the completion of some 400 ongoing water schemes, construction of 800 community based water supply projects, rehabilitation of 11,000 boreholes, 916 dams and 700 existing water supplies-all to operate at optimal capacity. The Plan has stressed the need to set mechanisms to include access by low income groups, and of poor women in particular before water supply improvement schemes are scheduled by either NGOs or Government.

Access to safe water supply and sanitation (WSS) facilities is central to a healthy and productive society. Less than 50 percent of Kenya's rural population and 75 percent of its urban population currently have access to safe water (Republic of Kenya, 1999). A household's inadequate access to water can have major adverse consequences on the length and hardship of poor woman's working day. In setting sector delivery targets for

safe water, the key social indicator for achievement will be the impact on women's workload. This target has been selected because water collection involves predominantly women's labor and it affects their priorities for family care.

1.2.1 Water Sector Reforms

The country's Poverty Reduction Strategy Paper (PRSP) and the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC) call for the implementation of structural reforms to make water and sewerage services autonomous, efficient and effective. To achieve this it is critical to mobilize investment for construction and rehabilitation and enhance partnerships with communities to expand services to the urban poor and rural communities.

Following the enactment of Water Act 2002, the Ministry of Water and Irrigation (MWI) has embarked on major reforms in the water sector aimed at improving the management of water resources and water services. The reform targets sustainability in resource management and service provision. It also addresses weaknesses in the sector by promoting integrated management of water resources and the development of water and sewerage services. Emphasis is given to greater involvement by communities to enhance sustainability. The Water Act 2002 introduces new features in the management of water resources and water and sewerage services. Essential features include separation of water resources management from water and sewerage services and decentralization of services to the regional level. The Water Services Trust Fund (WSTF) was also set up to support the financing of water services for the under served rural areas while the Water Appeals Board (WAB) handles disputes in the water sector.

1.3 Statement of the problem

The absence of clean water supply is a major problem for the majority of Kenyans especially the poor rural people who have no alternative but to use unsafe water from traditional wells, rivers and dams. Very often these sources are far from homesteads and sometimes are a cause of illness through water–borne diseases. Most rural women in Kenya are compelled to spend most of their time fetching water and the situation is worse in Isiolo district which is in the ASAL region. The fact that in rural areas most water

projects are funded by the government, people tend to believe that it is only the government who should provide for the initial cost, as well as operation and maintenance of water projects. The new reforms in the water sector provide a greater challenge to the communities because they will also be responsible for the operation and maintenance costs. Thus, it is important to study the feasibility of improvements in water services because most of the people are poor. An estimate of willingness to pay provides an indication of the demand for improved services and potential for sustainability of water supply schemes.

The residents of Sericho division are pastoralist communities who walk for long distances in search of water for human and livestock consumption. The division is situated in the marginalized part of the country and the government seems to have failed in the provision of this service. The area faces severe inadequate water services for domestic consumption. Most of the residents access water from sources that are short-lived. Women/girls child are over burdened by the role of fetching water. Also conflict arises over shared inadequate water resources and worsens during drought leading to loss of animals as well as human lives. Since the division is located in the dry part of Kenya, associated with low and sometimes failure of rains, the water table is low further contributing to the inadequacy of the water sources. In addition, the few water points are far from most households meaning the residents have to walk long distances in search of water, therefore, wasting a lot of time in the long run. For the few areas with piped water, the current system of water cannot cater for the whole population. The water is supplied from shallow wells with low capacity. More so, the wells dry up during the dry seasons when the water level falls. Therefore water rationing is a common phenomenon in those areas. Further, given the fact that most of those who fetch water are school children, this has largely contributed to the mass failure of the schools in the region in the National Examinations and large number of school dropouts. Overall, few studies have been carried out to address the water problem in Kenya. In particular no research has been done in Sericho division despite its poor water services. The World Bank (2001) conducted a similar study in Ukunda (Kenya) and this study adopts the same approach to analyse the demand for water in Sericho division. This study determines empirically the

WTP of the residents for an improvement in the domestic water services using the technique of contingent valuation method (CVM).

1.4 Objectives of the study

The general objective of the study is to estimate Sericho division residents' willingness to pay (WTP) for improved domestic water services.

More specifically, the study seeks

(i) To assess the water supply conditions in Sericho division.

(ii) To determine and analyse factors influencing the WTP for improved domestic water services in the division.

(iii) Based on objectives (i) and (ii) above, draw policy recommendations for ensuring safe and accessible water for the residents of Sericho division.

1.5 Justification and significance

The WHO (1964) has set the ball rolling by recognizing that the improvement of human health as the ultimate goal and that improved water and sanitation services play a central role towards attaining that goal. Most of the literature available in Kenya is on sanitation services (e.g. Da'ar 2002). Though previous studies have estimated WTP for water services (World Bank, 2001) none has been conducted in this particular study area. The study will make additional contribution to the data base and provide for future empirical work on the subject. Based on the severity of the water problem in Sericho division, the study is important in the sense that it provides information to the policy makers, particularly the government ministries, non-governmental organizations (NGOs) and local community based organizations (CBOs) which are interested in water sector. The findings of the study are vital in revealing peoples preferences with regard to WTP to improve the situation.

CHAPTER TWO

LITERATURE REVIEW

This chapter discusses theoretical and empirical literature on valuation of environmental resources. The first section discusses theoretical literature on the various valuation methods and their usefulness. This is followed by empirical literature on the contingent valuation method. The last part discusses an overview of the literature review.

2.1 Theoretical Literature Review

2.1.1 Economic Valuation of Environmental Resources

Measurements of benefits of environmental changes have long presented analytical problems for economists. Although it is likely that demand curves that are necessary for estimating benefits do exists for public goods, it is very difficult to estimate them without direct transactions in these goods. As a result, analysts have resorted to indirect market valuation methods to assess benefits from proposed environmental changes (Hanley *et al*, 1993). This includes hedonic pricing method (HPM), travel cost method (TCM) and the contingent valuation method (CVM).

The travel cost method (TCM) is based on the theory of consumer demand in which special attention is given to value of time. Its origin can be traced to Hotelling (1931), who suggested that the observed travel behavior can be used to derive a demand curve and to estimate a value of non-priced environmental good. This is possible if the increasing travel costs are treated as a surrogate for resource use prices. The TCM is typically applied to the estimation of recreational value of recreational site by analyzing the travel expenditures (petrol, etc) of visitors to that site. Although conceptually straight forward, the TCM may present some methodological and statistical problems particularly in the proper specification of the functional form of the travel cost equation. Also, conducting the site survey, collecting and processing the necessary data could be extremely expensive and time consuming. Because of these problems, it is difficult to conceive the validity of TCM as a technique for the valuation of the demand for water services as in this study.

The HPM identifies environmental service flows as elements of a vector of characteristics describing a marketed good, typically housing. HPM seeks to find a relationship between the quality of environment and the prices of marketed goods. Thus the HPM can be employed to identify how much of a property value differential is due to a particular environmental difference between the properties and deduce how much people are WTP for an improvement in the resource quality. Differences in property values arise from many sources, such as the amount and quality of accommodation available, accessibility to the central business area, congestion factor, traffic, access to recreation areas, air quality and noise levels (Hotelling, 1931). As in the case of TCM, the econometric problems of correctly specifying and estimating the HP function can be severe. The data, time and computer requirements for this technique are substantial. Moreover, data availability in developing countries makes it difficult to apply this method. Apart from these reasons, this method cannot be used in our study because of the lack of well defined property rights for the water resource management in rural Kenya. The indirect methods such as the TCM and HPM only capture use values and thereby omit any non-use values elements of the environmental goods under investigation. As such, these techniques may underestimate the total economic value of such goods.

2.1.2 The Contingent Valuation Method (CVM)

The contingent valuation method (CVM) uses survey questions to elicit from a sample of consumers their WTP and/or willingness to accept (WTA) compensation for a change in the level of environmental goods or services in a hypothetical market. The CVM is conducted using various methods such as telephone, mail or face-to-face interviews. According to Hoevenagel (1994), the CVM has wider applicability compared to other valuation methods and it measures both use and non-use-values. Seip and Strand (1990) observed that CVM is potentially subject to a number of problems. Since it does not analyse actual behavior, the most important question concerns its accuracy in simulating the conditions of the real world. Surveys are by nature hypothetical and also people (especially in the developing world) have little or no experience in making explicit decisions about the value of environmental goods. However, CVM like any other technique is subject to a number of biases which may affect the reliability of the results.

Free-riding and strategic behaviors are some of the problems which economists have focused upon in criticizing the CVM. This is because the neo-classical economic theory describes the rational individual as essentially selfish such that they may not want to reveal their true preferences or values. If individuals think that by giving false answers the service will be provided, they may tend to overstate their preferences especially if the service is a public good. On the other hand, a person may understate his preferences if he thinks he will end up being asked to pay for the service. Moreover, respondents may answer only to please the interviewer. There is also information bias as the respondents may not be clear about the nature of the service or the proposed scenario. This occurs when the respondent does not understand the question exactly in the same sense as the interviewer. This may create hypothetical bias, implying that the respondent sometimes may not take the survey seriously. The problem is said to be more pronounced in rural areas especially when it comes to choosing between goods with which people are not familiar. Since most respondents in the rural areas are 'educationally challenged', the interviewer has to make concerted effort to explain the nature of the service. With clear explanation of the purpose of the study and avoiding questions that instill fear will make the situation more comfortable for the respondents.

Theoretically, WTP and WTA are supposed to provide similar results, but empirically they give different estimates such that the estimates based on WTA tend to be greater than the estimates based on WTP (Turner, 1993). Randall *et al* (1983) has suggested that WTP is more preferable as it relates valuation of gains or losses to the *status quo*, and thus fits more easily with the potential pareto improvement criterion (also known as the Hicks-Kaldor Criterion). Potential pareto improvement refers to a situation where there is some gain by some people and others loose but the losers are compensated to ensure that there is no welfare loss. However, according to Pearce and Markandya (1990) the choice of the method will be determined by the choice decision in question. If the project in question has adverse effects on the residents in an area, WTA is the appropriate measure because the respondents would need to be compensated for their loss in welfare. On the other hand, if the project is socially beneficial and the residents are demanding to obtain

it, as the case of *improved water services* in our study, then the maximum amount each resident would pay to express his need for the project is appropriately described by WTP.

2.2 Empirical Literature Review

Valuation methods in section 2.1 have been widely applied in the valuation of environmental resources. Here we review some of the CVM studies in the developed and developing countries.

Da'ar (2002) employed the CVM to capture economic value measures from field survey on three aspects; environmental health in Wajir town, benefits and costs associated with environmental health, and socio-economic, demographic profiles of Wajir residents. A stratified systematic random sampling was utilized. The CVM design employed a direct bid elicitation to capture WTP on the same sample of households. The study used explanatory variables like cost of monthly solid waste disposal, income, family size, age, gender and marital status. The results indicate that there is overwhelming WTP for improved environmental sanitation even though these bids are low owing to the low income levels in the area. Factors such as family size, age and gender were less significant while education had mixed effects on the WTP for improved environmental sanitation. The average expected monthly WTP was higher than the current average monthly disposal cost implying that there was relative preference for the expected improvement.

Kaliba *et al* (2003) used the CVM to analyze the willingness to pay to improve community-based rural water utilities in the Dodoma and Singida regions of central Tanzania using Multinomial Logit functions. Surveys were conducted in a total of 30 villages in the two regions. The independent variables used were sex, age education, wealth, family size, respondent's ranking on participation in the project activities and individuals cash contribution among others. The Multinomial Logit functions indicated that the respondents were willing to pay more than the existing tariffs and that the estimated potential revenue was higher in Dodoma than in Singida.

World Bank (2001) used the Logit and Probit model to determine the key factors influencing the demand for improved water systems. They analysed water use in different areas including Ukunda (Kenya). The estimation process involves modeling the demographic impacts on access to improved water systems. This is done by use of both indirect (revealed preference) and direct (contingent valuation) methods to study how households made their choices about water sources. The two methods yielded the same results. The researchers' findings in the multivariate analysis of water use in Ukunda (Kenya) revealed that household income and cost of water were significant while perceived quality of water was insignificant. In addition, females were willing to pay more for improved water systems.

Aguilar *et al* (1995) employed CVM to investigate peoples' WTP for improved water services in three different study areas i.e. Limon and Guanacatse (both found in Costa Rica) and Muang Xaithani, Laos. In Limon a survey was carried out covering 300 households out of 1556 in five villages. The main objective of the study was to investigate the influence that different socioeconomic variables have on WTP for improved water services by the households. They used the log-linear function to estimate the total willingness to pay for improved water services. The results were consistent with the priori expectations, although most of the variables were not significant at conventional levels of significance. The findings indicated that women were on average, willing to pay more than men do. The young people were also found to be willing to pay more than older people were. In Guanacaste, the same data was collected as in Limon. The results were somehow similar to the results obtained in Limon especially with the case of WTP. Income and age had positive effects on WTP as had been expected. Family size variable was found to have a negative relationship with WTP by the household. In Muang Xaithami (Laos), the results were not different from those obtained from the two other study areas, except that it was found that males have a higher WTP for improved water services than women, a finding which was contrary to the priori expectations. Family size, income and other factors exert positive influences on the WTP by the households. Overall, the results from the three studies indicate that WTP was significantly above the current water tariffs.

Bah (1997) used both the CVM (checklist format) and Hedonic Pricing approaches to estimate and analyze WTP for an improved water supply services in Free town, Sierra Leone. He employed data from selected strata in Gumma valley water consumer wards. The effects of most of variables in the study followed a consistent pattern and thus enhanced the possibility of generalization. The regression results from the CVM study indicate that gender, education level, income, number of years in residence, expenditure on water and respondents attitudes towards water management have a significant influence on WTP for an improved water service. The HPM results indicate that the size of the household and the expenditure on water are significant in determining the rental value of a house in Freetown.

Jordan and Elnagheeb (1992) used CVM to estimate people's WTP for improvement in drinking water in Georgia, USA. They regressed two equations that were estimated using Ordinary Least Squares (OLS) and Maximum Likelihood (ML). The results were compatible with other empirical findings such that WTP was found to increase with income. Women and younger respondents were found to be willing to pay more than their counterparts. In addition, WTP was found to increase with the level of education, thus confirming the importance of education in creating and raising people's awareness about environmental problems. Moreover, on average private well owners were willing to pay more than an individual served by a public water system.

The World Bank (1993), investigated the determinants of household demand for improved water sources in Latin America (Brazil and Haiti), Africa (Nigeria's Anambra state and Zimbabwe) and South Asia (Pakistan and India). The study area in Brazil included a relatively well-off water-abundant area in the South Eastern state of Perona and a poor dry area in the North Eastern state of Ceara. In Pakistan, three areas in Punjab were selected; one had easily accessible high quality ground water, another had easily accessible but brackish water; the third was in an arid zone where ground water was relatively deep and inaccessible. In India (Kerala), one area had abundant good quality ground water, the other had abundant but saline ground water and still the third area suffered from water scarcity. The researchers employed both indirect (*revealed*

preference) and direct methods to study how households made their choices about water sources. The indirect method used discrete choice econometric technique (Tobit and Probit models) to derive households' decisions and to estimate the welfare change of the actual choices that households made, given alternative sources. On the other hand, the direct approach asked people who did have an improved water source whether they would use a new source if it were provided under specific conditions, and how much they would be willing to pay for access to different kinds of improved systems, such as public tap or private house connections. For the direct approach, the WTP bids were regressed on the number of socio-economic and demographic factors. Using the indirect approach, the findings were consistent with those obtained using direct approach. Their results indicate that income and education had the expected signs while gender, family size and composition of household had mixed effects. The households will pay more for an improved supply if it is reliable and when costs in time and money of obtaining water from existing sources are higher. The researchers concluded that the household response to a new improved water system is not due to any one set of determinants, but their joint effect as modeled in the multivariate analysis.

In another study, Griffin *et al* (1995) has used the CVM to assess the WTP for an improvement in the quality of water services in several rural villages in India. Respondents were allowed to consider hypothetical changes in water supply characteristics and to respond to questions about the effect on cost of connections, monthly service and improved quality of service. The results of this application suggest that the local water authority can lead the way to a better water service by making some critical policy changes, encouraging private water connections by incorporating the cost of connection into the monthly tariff; charging a higher monthly tariff and using the resulting increased revenues to invest in and maintain a higher quality water service.

Whittington *et al* (1991) undertook WTP for water in Onitsha, Nigeria, using the CVM approach. The study used open-ended elicitation method to gather the people's WTP. The study found out that not only were people willing to pay for piped water service but also that they were already paying high amounts to water vendors. This meant that that people

place great importance to water services. The average household annual income in Onitsha was N 7,000(US$ 1,600) but 25% of the households had an annual income of N 2,400(US$ 500). These incomes were relatively high in Nigeria at the time. The high WTP amounts for the household were attributed to the fact that their incomes were high and that they were being charged unfairly by the water boards. This says that the higher the income the higher will be the WTP for a welfare gain.

2.3 Overview of the Literature:

Based on the various studies that have been carried out in both developed and developing countries, the CVM has come out strongly as a powerful tool for measuring the economic benefits of the provision of non-marketed goods such as *improved water services.* The literature reveals that the decision of the potential users of piped water connection system depends on a combination of factors such as socio-economic, demographic, quality and reliability of the system. However, Griffin *et al* (1995) cautions that when doing water valuation studies in developing countries one must be very careful in applying models from developed countries because of differences in nature of the areas, culture, behavior and management styles. CVM is widely applied as a valuation method since it has more potential application to a wide range of environmental goods than any other technique. The CVM approach is thus employed in this study to elicit the value a typical rural household places on an improved water service with the intention of drawing up concrete policy recommendations regarding rural water services in Kenya.

CHAPTER THREE

METHODOLOGY

The study employs the CVM approach to solicit the respondents' willingness to pay for improved domestic water services. This chapter discusses the methodology used in the study. We start by specifying the models employed which includes both direct and indirect methods. The last part discusses the study area followed by data type and source.

3.1 Model Specification:

3.1.1 Direct approach

This approach uses OLS method as used by Aguilar *et al* (1995), and Jordan and Elnagheeb (1992) in their studies. The respondents are asked open-ended questions about their WTP. The WTP bids are regressed on a number of socio-economic and demographic factors. We specify the following econometric model;

$WTP_i = f(Inc, Edu, Fs, Tim, Dis, Gen, Age, Hoh, Ms)$

Where, WTP_i is the dependent variable which stands for willingness to pay for improved water services. This variable is expressed in monetary terms as the monthly payment consumers of improved water services are willing to pay, which is a function of independent variables which include:

Inc = monthly income of the household (Kshs).

Edu = level of education attained by the respondent (years).

Hhsize = household size in numbers.

Tim = time spent in collecting water (minutes).

Dis = distance to nearest water source (kilometers).

Age = age of the respondent (years).

Gen = sex of the respondent (1= male, 0 = female)

Hoh = status of the household respondent (1= household head, 0 = otherwise)

Ms = marital status (1 = married, 0 = otherwise).

The equation to be estimated is

$$WTP_i = \beta_0 + \beta_1 Inc + \beta_2 Edu + \beta_3 Hhsize + \beta_4 Tim + \beta_5 Dis + \beta_6 Age + \beta_7 Gen + \beta_8 Hoh + \beta_9 Ms + \omega_i \quad \ldots\ldots 1$$

Where ω_i is the random error term.

3.1.2 Indirect approach

The most widely used approach to eliciting information about the respondents WTP is the so called dichotomous-choice format. The payment question asks the respondent if he would be willing to pay to obtain the good. There are only two possible responses, "yes" or "no". Here we use the probit model. The probability of giving a positive WTP (Pi) is the dependent variable and thus predicts the likelihood of the WTP given a set of household characteristics or attributes. The model is used in the study to estimate the Yes-or-No WTP bids. The respondents are asked to answer "Yes" (WTP>0) or "No" (WTP=0) and P=1 if the respondent has a positive WTP and P=0 otherwise. This is specified as

$$P_i = F(\alpha_0 + \beta_i V_i) + \varepsilon_i \quad \ldots\ldots 2.$$

Where P_i = probability of obtaining a positive WTP.

F is the cumulative probability distribution function assuming normal distribution.

Vi is the vector of independent variables.

α_0 is the intercept and β_i respective variable coefficients.

The model to be estimated is specified as

$$P_i = \alpha_0 + \alpha_1 Inc + \alpha_2 Edu + \alpha_3 Hhsize + \alpha_4 Tim + \alpha_5 Dis + \alpha_6 Age + \alpha_7 Gen + \alpha_8 Hoh + \alpha_9 Ms + \varepsilon_i \quad \ldots\ldots 3.$$

Table 3.1: Signs and Rationale

Variable	Ho Sign	Explanation
Gen (male =1, female = 0)	-	Women are more likely to demand improved water services because they are primarily responsible for water fetching.
Age in years	-	Older people are more likely to be less supportive of improved water utility services.
Education in years	+	Education increases the desire for improved water utility services.
Household size in numbers	+	Large families have to spend a lot of time in search of water-- therefore they are more likely to demand improved water related services.
Income variable	+	Richer individuals are likely to demand improved services as resources are not a major constraint.
Distance	+	Individuals who walk long distances to water points are likely to pay more for improved water services.
Time spent	+	An individual who spends more time to access water services is likely to be willing to commit more resources for improvement
Respondent's status (1=household head, 0 = otherwise)	+	The household head is likely to be willing to commit more resources for improvement because of the responsibility.
Marital status (1= married, 0= otherwise)	+	Married individuals are likely to pay more because they are important decision makers in the family.

3.2 Study site and data

3.2.1 The study area

Sericho division is in Isiolo district of Eastern Province. It is one of the six administrative divisions of the district. The division which covers an area of 4,381 Km^2 has a population of 8,998, comprising of 4,465 males and 4,533 females and a population density of 2.0 persons per square Km. The total number of households is 1,843 (District Statistics Office: Isiolo, 2005). There are four locations in the division namely, Modogashe, Sericho, Iresaboru and Eldera. Most of the division is flat, low lying plain. There are two perennial rivers in the division; namely Ewasso Nyiro, which originate from Mt.Kenya and Togi, which originates from the Nyambene hills. The division is hot and dry for most of the year. It is classified as an arid area with average rainfall ranging between 150-250mm. The rainfall is erratic and unreliable, hence the scanty vegetation and barren nature of the zone. High temperatures are recorded in the division throughout the year, with a mean annual temperature of 27^0C. Most parts of the division record about nine

hours of sunshine, and the rate of evaporation is high. The main stay of the economy in the region is livestock rearing and trade. The estimated livestock population in Sericho division is 46,000 cattle, 56,000 sheep, 44,000 goats, 3,800 camel, 4,000 poultry, and 4,400 donkeys. Estimated income per capita from livestock products in the division is 429 Kshs and is one of the lowest in the district (Source: Isiolo District Situation Analysis–SITAN, 2004). Few people have formal employment with the government and local authority. Trade is mainly in foodstuffs sold in the shops and 'miraa' sold in the streets mostly by women.

3.2.2 Data type and source

Data used in this research is primary collected from households in the study area. The study used stratified random sampling where the residents of the study area were grouped into four strata according to residential zones (locations). There are four locations in the division and samples drawn in proportion to the population. The questionnaire survey initially targeted about 180 households. However, the actual survey covered only a sample of 162 households due to constraints in terms of time, money and non-return of questionnaires. The questionnaire was designed and administered to the respondents. It consists of three sections; (i) household characteristics (ii) water use problems and practices (iii) WTP questions (appendix 1).

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

This chapter discusses data analysis and presentation. It starts with descriptive statistics of the data. It further gives the empirical results of both the OLS and probit models.

4.1 Descriptive Analysis

As a first step of data analysis, the observations recorded in the survey questionnaires were translated into numerical data for quantitative analysis. The result of descriptive statistics is shown in table 4.1.

Table 4.1: Statistical summary of the variables

Variable	Mean	Median	Min	Max	Std dev.	Range
Probit	0.815	1	0	1	0.390	1
WTP	92.407	50	0	600	109.282	600
Income	2964.198	2000	700	16000	2714.571	15300
Education	3.154	2	0	16	3.820	16
Household size	6.136	5	1	16	3.237	15
Time	37.123	30	10	130	20.863	120
Distance	2.067	2	0.1	7	1.320	6.9
Age	33.759	30	18	70	11.910	52
Gender	0.623	1	0	1	0.486	1
Household status	0.803	1	0	1	0.400	1
Marital status	0.722	1	0	1	0.449	1

Source: Field data

From table 4.1 above, the average household size is 6 persons. Most of the interviewed households had a family size of between 1-5 persons representing 50.62 percent of the sample (table 5.1). The minimum household income reported was Kshs 700 while the maximum was Kshs 16,000. The mean household income is Kshs 2964 and considering the average household size of 6 persons, this translates approximately into Kshs 494 per individual per month. This further translates into Kshs 16.50 per day for an individual. which is far below the national poverty line. The standard deviation of income is large showing how spread income is around the mean. The mean monthly WTP is Kshs 92.40 or Kshs 1108 annually. This is high given the low incomes in the area. However, it has a

large standard deviation indicating that the degree of dispersion around the mean WTP is large.

Education is an important social indicator of development. The mean education level (in years) is 3 years, the least educated person has no formal education and the highest educated person has university education (16 years). Among the interviewed individuals 48.15 percent had no formal education, 43.83 percent had primary education, 3.7 percent had secondary education and 4.32 percent had tertiary education (table 5.2). The eldest reported person among the interviewed was 70 years of age, the youngest was 18 and average age was 34 years. Most respondents were in the age bracket of 18-30, representing 57.4 percent of the interviewed individuals (table 5.3).

Out of the 162 interviewed persons, 101 were male representing 62.3 percent while 61 were female representing 37.7 percent. Being household head was also considered important in decision-making. Both genders featured as household heads. However, in the study area males were in most cases the household heads. Among the interviewed individuals 80.3 percent were household heads comprising both males and females. The other 19.7 percent were related to the household heads as spouses, sons, daughters and other relations. Out of the interviewed individuals 72.2 percent were married while 27.8 percent were not married. Average distance to water sources is 2.07 kilometers and average time for water collection is 37 minutes.

From the sample, 132 respondents were willing to pay (WTP) while 30 were not willing to pay (NWTP). In addition to the descriptive in table 4.1, we also analyzed the characteristics for those sub-samples. The results are presesented in table 5.9. The mean income of those WTP (Kshs 3247) is greater than the mean of those NWTP (Kshs 1716). Average education level of the two samples is also different with number of years in school for those WTP being 3.8 years while those NWTP being 0.3 years. There is also a difference in the average distance to water sources between the two sub-samples. The differences in income, education and distance for the two groups differ and probably this

explains the differences in their WTP bids. We test whether these differences explain the WTP using multivariate regression analysis in the next section.

About 18.5% of respondents indicated that they were satisfied with the *status quo* (thus not WTP) and 81.5% proposed for improvement (they were WTP). The occupation of most of the interviewed individuals was livestock rearing which represented about 78.4% of the respondents, formal employment was 6.17% and business was 15.43% (table 5.4). On water access the results show that 46.3% of the interviewed sourced water from the seasonal rivers, 17.29% from dams, 16.04% from traditional wells, 11.11% from communal stand pipes and 9.26% from vendors (table 5.5). Further, only 8.64% of the respondents indicated that they have suffered from water borne diseases (table 5.6). On the question of desired payment system 74.07% preferred cash monthly payment, 17.9% preferred cash/20 litres while 8.03% suggested cash annual rate (table 5.7).

4.2 Empirical Results

In estimation, the study applies both the direct and indirect approach that uses the OLS and probit models respectively. This section on empirical results discusses the results of both probit and OLS models. In both models the study used a sample size of 162 households.

4.2.1 Determinants of WTP for improved water services.

To achieve the objectives of our study, we first investigate the factors that determine whether or not a household is WTP for improved water services. In his case the dependent variable takes a value of 1 if a household is willing to pay for improved water services and 0 otherwise. From the sample 81.5% gave a positive WTP response (P=1) while 18.5 % gave a negative response (P=0). We hypothesized that WTP is a function of a number of explanatory variables namely income, education, household size, distance, age, gender and marital status. The probit estimation results are presented in table 4.2.

Table 4.2: Probit results for willingness to pay

Probit	Coefficient	Marginal effects	Robust Std. Err.	z	P>|z|
Income	0.0004	1.11e-06	2.43e-06	2.68*	0.007
Education	0.4822	0.001329	0.002603	2.66*	0.008
Household size	-0.0042	-0.000011	0.000185	-0.07	0.947
Distance	1.4226	0.003920	0.008446	4.53*	0.000
Age	-0.0082	-0.000023	0.000061	-0.51	0.611
Gender	0.4566	0.001614	0.003068	1.10	0.273
Marital status	0.2692	0.000918	0.002373	0.81	0.421
Constant	-2.6802		0.884289	-3.03*	0.002
n=162 Wald chi2 (7) = 31.86 Prob> chi2 = 0.0000 Pseudo R2 = 0.5734 Log pseudo-likelihood=-33.115895					

Note: * The coefficient is significant at 1% level

The marginal effects results show that positive and statistically significant variables are income, education and distance. This implies that an increase in income by Kshs 1000 is expected to increase the likelihood that a household is WTP by about 0.0011. An increase in education level of an individual by one year increases the probability that a household is WTP for improved water services by 0.1329%. This is consistent with empirical results of other studies (e.g. Daar 2002 and Kaliba *et al*). An increase in distance to water source by one kilometer will increase the probability by 0.39%.

The variable household size is insignificant and has a negative sign against our expectations. This means that households with large members are less likely to choose to pay for improved water services. This result is contrary to our expectations because usually large families need more frequent water collection trips to cater for demand of large family. Age variable has the correct expected sign but is insignificant. Older people were thus more likely to choose to maintain the *status quo* since they are less likely to be directly involved in water collection activities.

In this region, males were more willing to pay for improvement than female respondents, which is surprising since women are primarily responsible for water fetching activities. This might be explained by the fact that in most cases men are the household heads and thus make decisions for the household. More so, time spent by women and children in search of water has a compounding effect on all members of the household. However, this variable is highly insignificant. Marital status variable has a positive effect on the probability of WTP for improved water services. This means that those respondents who are married are more likely to choose to pay for an improved water services than their unmarried counterparts.

4.2.2 Determinants of amounts households are willing to pay

In this sub-section, we estimate and discuss the determinants of the amounts households are WTP for improved water services. We employ OLS regression methods to derive the parameter estimates for the WTP model. The results are presented in table 4.3.

Table 4.3: OLS results for willingness to pay

WTP	Coefficient.	Robust Std. Err	t	P>|t|
Income	0.029	0.002	11.91*	0.000
Education	3.952	1.639	2.41**	0.017
Household size	0 .764	1.606	0.48	0.635
Distance	8.849	3.430	2.58**	0.011
Age	0.164	0 .480	0.34	0.732
Gender	21.402	11.034	1.97***	0.054
Marital status	-14.130	12.715	-1.11	0.268
Constant	-38.805	17.098	-2.27**	0.025
n=162				
F (7, 154) = 38.10				
Prob > F = 0.0000				
R-squared = 0.6901				
Adj R-squared = 0.6760				
Root MSE = 62.2				

Note: * The coefficient is significant at 1% level.
** The coefficient is significant at 5% level
*** The coefficient is significant at 10% level

Most of the regressors have expected signs save for age, gender and marital status. From the result it can be seen that an increase in the household's income by 1 Kshs, holding other variables constant will increase the willingness to pay for improved water services by 3 cents. The coefficient is positive and highly significant at 1% level, implying that household income is an important determinant of WTP. The coefficient of education has correct expected sign and highly significant at 5% level. This is consistent with empirical results of other studies (e.g. Whittington *et al* 1991, Jordan and Elnagheeb 1992 and Kaliba *et al*). Increasing the education level by one year will increase the willingness to pay by Kshs 3.95 *ceteris paribus.* The importance of education can be attributed to the fact that educated individuals fully understand the benefits of improved water services. Distance as a variable is positively related to WTP and is significant at 5% level. Increasing distance to water source by one kilometer will increase the WTP by Kshs 8.85.

The coefficient of gender is significant at 10% level but has a wrong sign. From the results males pay on average Kshs 21.40 more than females. In this region, males are more willing to pay for improvement than female respondents, which is surprising since women are primarily responsible for water fetching activities. This might be explained by the fact that in most cases men are the household heads and thus make decisions for the household. More so, time spent by women and children in search of water has a compounding effect on all members of the household. The other variables like household size, age and marital status are insignificant.

Overall, the existence of the correct signs for most explanatory variables is consistent with empirical findings of other studies (Kaliba *et al* 2003 and Aguilar *et al* 1995) reviewed in chapter 2. According to the model 67.6% of the variations in WTP for improved water services are explained by the explanatory variables included in the model. Since the computed F-value is greater than the critical value (adjusted for degrees of freedom), then we conclude that the model has overall significance.

In addition to the regression results in table 4.3, we also analyzed the OLS regression results for the sample of those WTP. The result is presented in table 6.0. The table shows

that within the sub-sample of households willing to pay, the significant variables are income and gender. When income goes up by Kshs 1 WTP increases by 3 cents. The variable is significant at 1% level. Also males pay on average Kshs 25 more than females. The variable is significant at 5% level.

Based on the results of table 4.3, the estimated mean willingness to pay is Kshs 92.40 per month, which translates into Kshs 1108 per year per household. The number of households in the division is about 1,843. Although the sample size is small, we can infer from the results that potential revenue that could be generated from the residents of Sericho division is approximately Kshs 2,042,044 per year. This is quite substantial by Kenyan standards, meaning that there is potential for generating much more in the way of user charges. However, due to the low incomes in the area care will be needed to implement policies aimed at increasing revenue generation for water improvement purposes. High tariff or user fees may exacerbate inequality of access to water services because poorer households will undoubtedly be more price-sensitive than richer households.

To check against spurious regression, it is important that the data is subjected to some diagnostic statistical tests. Correlation analysis was done for examining any close association between independent variables, which leads to multicollenearity. The results show that multicollinearity was present but not serious (table 5.8). The highest positively correlated variables from the correlation matrix were distance and time (0.6798), household size and age (0.5791) and education level and household income (0.5421). The highest negatively correlated variables were age and income (-0.1320). The rule of thumb requires that correlation coefficients be less than the cut-off mark of $\pm$ 0.5. However, variance inflation factor (VIF) indicates that multicollenearity is not serious as such and hence will not affect the results. The variable time was dropped from the regression analysis since it is highly correlated with distance which is a better indicator. The variable household status was also dropped after observing that it was not varying. From the Cook-Weisberg test for heteroscedasticity, the χ^2 value was 21.24 at prob>χ^2 indicating that the error terms was not having constant variance. To correct standard errors for heteroscedasticity, the robust form of the OLS estimations was used

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATIONS

This chapter presents the conclusion of the study and suggests some policy implications.

5.1 Conclusions

The absence of clean water supply is a crucial problem for the majority of Kenyans, especially the poor rural people. The situation is worse in the ASAL region and particularly in Sericho division which faces inadequate water services. The new reforms in the water sector which advocates for community participation in the management of water services provide a greater challenge to communities. In light of the severity of the problem, this paper evaluates factors influencing household's willingness to pay (WTP) for improved domestic water services.

This paper investigates the factors influencing the willingness to pay for improved domestic water services in Sericho division. The study is based on primary data collected from a sample of 162 households. Descriptive and econometric procedures have been employed to achieve the objectives of the study. Probit techniques are used to analyse the determinants of WTP while OLS method are used to estimate the amount the households are WTP. Descriptive statistics shows that mean monthly income is Kshs 2964 while average education level is 3 years of primary school. The empirical results from OLS and probit estimations show that such socio-economic factors as household income, education and distance to water source are important determinants of household's WTP for improved water services. The average monthly WTP of the residents is Kshs 92.40. When aggregated across the households in Sericho division this gives total WTP as Kshs 170,293 per month and Kshs 2.04 million per year.

5.2 Policy Recommendations

Results for the WTP analysis for water services improvement imply that respondents were eager to improve the availability and efficiency of water services since a great deal of time and effort is expended in water-collection activities. The mean WTP is high implying that there is potential of raising revenues for water projects through water user charges. However, due to the low incomes in the area care must be taken to ensure that

those charges do not create undue hardships for the community or unduly inhibit access by the more disadvantaged families/individuals in the community (i.e. the poor or elderly). In addition, the results show that average income is low meaning subsidization may be a possible solution to obtaining improved water services. The total WTP indicates that there is potential for developing sustainable water supply programs since the residents are willing to pay for the operation and maintenance of water projects through user charges.

Given that water is a public good and considering the WTP preferences for improvement, the government should encourage residents to adopt demand-responsive approach to water services enhancement. This is where supply is dependent on demand (peoples preferences e.g. using WTP) as in this study. This is basically a market model in which different stakeholders (communities) determine their own preferences such that management and control can be shifted from supply authorities to the community. This will be consistent with the Water Act 2002 that focuses on local communities' participation in water projects as a way of furthering sustainable development.

Reducing poverty is both a moral imperative and a prerequisite for environmental sustainability. From both the OLS and probit results, income is highly significant and the WTP for water services forms a substantial percentage of income despite the high level of poverty in the region. Therefore, the government and other stakeholders should prioritize poverty reduction so that the residents can participate fully in improved water services given the strong correlation between willingness to pay and household income.

5.3 Limitations of the study and areas of further research

The study used contingent valuation method to value improved water services and obtain valid information for this purpose. However, the reliability of the method and validity of the responses depended much on the explicit presentation of the contingent market to the interviewees. Much as the study made explicit the hypothetical market, the results are still considered as approximations. It would have been better to incorporate other methods like travel cost methods and hedonic pricing method.

The study has concentrated on the economic aspect of improved water services. It would have been much interesting to capture or include other aspects in order to suggest more broad based solutions to the water problem. In addition, this study focuses on water for domestic use and ignores other uses of water especially livestock consumption. Considering that the main economic activity in the study area is livestock rearing, there is need for further research that addresses the different uses of water especially livestock consumption.

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APPENDICES

APPENDIX 1.

QUESTIONNAIRE FOR SERICHO DIVISION RESIDENTS:

Area/Location _____ **Respondents Name**_____

Date **Questionnaire Number:** **Interviewers Name:**

_____June/2005 _____ _____

INTRODUCTION

Hello,

*I am **Abdinasir Ali**, a student from the University of Nairobi, Department of Economics and I am carrying out a research on improvement of domestic water services in Sericho division. As you are aware the division is faced with severe inadequate water services. This research is a partial fulfillment for the award of MA Economics.*

You have been chosen through random sampling as one of the persons to participate in a survey regarding water problem, resultant risks and possible improvement in the situation. All data and information collected will be kept strictly confidential. So please answer the questions as truthfully as possible.

A: HOUSEHOLD CHARACTERISTICS

1. [AGE] How old are you (years)? .....

2. [GEN] Sex: [1] = Male [0] = Female

3. [HOH] (a) Are you the household head? [1] = Yes [0] = No

(b) If "NO", state your relation to the Household head?

[ ] Spouse [ ] Son [ ] Daughter [ ] Others (specify).....

4. [FS] how many members constitute your household?.....

Household Characteristics

	Gender	Age	Marital Status	Education (years)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
KEY	1: male 0: Female		1: Married or living together under local custom 2: Never married 3:divorced/widowed 4: Not applicable (child< 16 years)	

5. [OCC] what is your occupation?
Employment..... Business.....Farming/livestock rearing..... others (specify).....

6. [INC] Which of the following brackets best explains your household's total monthly income:

0-1,000	1,001-3,000	3,001-5,000	5,001-7000	7,001-9,000	9001-10,000	Above 10,000

[EXP] Household monthly Expenditure

Food .....
School fees .....
Housing .....
Clothing .....
Others, (specify) .....
Total _____

7. [EDU] what is your education level?

[ ] No formal education
[ ] Primary level
[ ] Secondary level
[ ] College level {Put actual number of years.....years}
[ ] Others (Specify).....

B: WATER PROBLEMS AND PRACTICES:

8. [WAS] Where do you get water for household use?

[ ] Traditional well
[ ] Borehole
[ ] Seasonal river
[ ] Communal stand pipe
[ ] Dam or pan
[ ] Rain water
[ ] Vendors
[ ] Other (Specify).....

9. Do you normally pay for the service? [ ] Yes [ ] No

(a) If "Yes how do you pay for water service? [ ] cash [ ] Kind

If cash, how much do you pay per month? .....Kshs

If kind, Specify.....No of goats/sheep ..... (Others)

(b) If "No", how much would you pay if you were obtaining water from commercial sources? .....Kshs

10. [DIS] what is the approximate distance to your current water source?.....Kms

11. [TIM] How long does it usually take to walk there..... (One way in Minutes)
How long do you usually take to wait in the queue there?.....(minutes)
Total time .....

12. [WAP] In your opinion, what is the most pressing problem with water situation in this area? Please rank them 1-4.with 1 = most important problem and 4 = least important problem;

a) Quality (taste, dirt, odour etc).....
b) Reliability .....
c) Availability .....
d) Cost .....
e) Others (specify) .....

13. [WRD] Has any of your household members suffered from water borne diseases such as cholera, or diarrhoea in the past one year?

[1] = Yes [0] = No

If "yes", which one was most serious?.....

C: WILLINGNESS TO PAY

14. [INF] Are you aware of Water Sector Reforms that is going on in the country?

[ ] Yes [ ] No

15. [PB] Assume that the government offers you an improved water service in the form of piped water connections, which means good quality water near your house and reliable source throughout the year, would you be willing to pay any amount in terms of service charge per month for the improvement?

[1] = Yes [0] = No.

If "Yes"

[WTP] What is the maximum amount you would be willing to pay per month for the *Improved domestic water service?*

.....Kshs per month
.....goats/sheep per month
.....others (specify)

[RNS] If you are not interested in the new system, what are the main reasons?

a. Satisfied with the current water system.....
b.I will not have enough money to pay for the system.....
c.Others (specify).....
d. Not applicable.....

16. What benefits do you expect from having a reliable water supply?.....
.....
.....

17. What kind of payment system would you desire?

Cash monthly flat rate.....
Cash annual flat rate.....
Cash per/20 litres.....
Others (specify).....

D: RESPONDENTS SUGGESTIONS

18. Would you like to suggest any other way to ensure safe drinking water for all?
.....
.....
.....

Thank you for your cooperation.

APPENDIX 2.

Table 5.1: Household size of the respondents.

Household Size	Frequency	Percent	Cumulative (%)
1-5	82	50.62	82 (50.62)
6-10	64	39.51	146 (90.13)
11-15	15	9.26	161(99.39)
16-20	1	0.61	162 (100.00)
Total	162	100.0	

Source: Field data

Table 5.2: Education levels of the respondents

Education Level	Frequency	Percent	Cumulative (%)
No formal education (0 years)	78	48.15	78 (48.15)
Primary education (1-8 years)	71	43.83	149 (91.98)
Secondary education (9-12 years)	6	3.70	155 (95.68)
Tertiary college/university education (13 and above).	7	4.32	162 (100.00)
Total	162	100.0	

Source: Field data

Table 5.3: Age brackets of the respondents

Age of respondents	Frequency	Percent	Cumulative (%)
18-30	93	57.40	93 (57.4)
31-40	34	21.00	127 (78.4)
41-50	15	9.25	142 (87.65)
51-60	17	10.50	159 (98.15)
61-70	3	1.85	162 (100.00)
Total	162		

Source: Field data

APPENDIX 3.

Table 5.4: Occupation of respondents

Occupation	Frequency	Percent
Employment	10	6.17
Business	25	15.43
Farming/livestock rearing	127	78.40
Total	162	100

Table 5.5: Sources of water

Source of water	Frequency	Percent
Traditional well	26	16.04
Seasonal river	75	46.30
Communal stand pipe	18	11.11
Dam/pan	28	17.29
Vendors	15	9.26
Total	162	100

Table 5.6: Incidence of water borne diseases

Did you suffer from any water borne disease?	Frequency	Percent
Yes	14	8.64
No	148	91.36
Total	162	100

Table 5.7: Payment systems

Payment system	Frequency	Percent
Cash monthly rate	120	74.07
Cash annual rate	13	8.03
Cash per /20 litres	29	17.90
Total	162	100

Table 5.8: Correlation Coefficient Matrix

	income	education	household Size	time	distance	age	gender	marital status
income	1.0000							
education	0.5421	1.0000						
householdsize	-0.1036	-0.0439	1.0000					
time	-0.0079	-0.0408	0.2267	1.0000				
distance	0.0701	0.0897	0.2770	0.6798	1.0000			
age	-0.1320	-0.1229	0.5791	0.1980	0.2093	1.0000		
gender	0.0975	0.1151	-0.0423	0.0181	0.0039	-0.0168	1.0000	
marital stat	0.1512	0.2423	-0.0764	-0.0096	-0.0332	0.0222	0.3714	1.0000

Table: 5.9 Descriptive statistics of the two sub-samples

	Willing to pay (WTP)		Not Willing to pay (NWTP)	
Variable	Mean	Std dev	Mean	Std dev
wtp	113.409	110.804	0	0
Income	3247.727	2874.087	1716.667	1272.815
Education	3.803	3.926	0.3	1.022
Household size	6.189	3.311	5.9	2.928
Time	37.644	20.687	34.833	21.833
Distance	2.324	1.320	0.937	0.423
Age	33.455	12.006	35.1	11.580
Gender	0.636	0.483	0.567	0.504
Marital status	0.75	0.435	0.6	0.498

Table: 6.0: OLS results for sub-sample of those WTP

WTP	Coef.	Robust Std. Err.	t	P>|t|
Income	.031	.002	13.63*	0.000
Education	1.589	1.672	0.95	0.344
Household size	1.571	1.637	0.96	0.339
Distance	.108	3.409	0.03	0.975
Age	.224	0.558	0.40	0.688
Gender	25.051	12.360	2.03**	0.045
Marital status	-25.094	14.414	-1.74	0.084
constant	-8.212	18.897	-0.43	0.665

Note: * The coefficient is significant at 1% level.
** The coefficient is significant at 5% level