WATER SUPPLY AND DEMAND SITUATION AMONG HOUSEHOLDS AND INSTITUTIONS IN NAKURU MUNICIPALITY, KENYA

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DECLARATION

I declare that this Thesis is my original work and has not been presented for a degree in any other University.

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This Thesis is dedicated to my dear wife Naomi and my daughter Lynne who were my greatest inspiration throughout the course of my research.

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ABSTRACT

The quantity and quality of water allocated and used by households and institutions is an important aspect of water supply which influences hygiene and the social wellbeing of humanity. Water contributes to economic growth and is regarded as a fundamental human right under a number of international treaties and conventions. This underscores the need for a proper allocation of water resources. In 1985, it was estimated that 25 % of the urban population in developing countries lacked access to safe water. In Nakuru Municipality, it is estimated that the current level of water supply is about 48%, which is below the national average of 60%. The circumstances behind this problem are not clear and needed further investigation.

The broad objective of this study was to investigate the water supply and demand situation within Nakuru Municipality. The study was done in three estates namely; Milimani, Shabab and Kaptembwo which represent different income levels. Water use in schools, health centers and hotels and restaurants within the Municipality was also assessed. The research employed social survey techniques. Both quantitative and qualitative data were collected from different sectors of the population within the study area. Primary data was collected using oral interviews, questionnaires, key informants, and observations. Stratified random sampling techniques were applied in collecting data from households, schools and health centers in the study area. Data analysis was done using the computer based Statistical Package for Social Sciences (SPSS). The study established that 88% of all households and institutions in the Municipality rely on water from the Municipal Council with 12% using vended or water from communal water kiosks and individual tube wells. Household size and education level were found to directly influence the amount of water needed by households. However, income ($t=0.966$; $p=0.335$) and occupation ($t=0.722$; $p=0.471$) levels did not have a significant effect on the amount of water used. The findings further showed that 75% of the residents in the Municipality use less than the average amount of water suggested by the World Health Organization (50 litres per day). The results also showed that 22% of the households used between 9 and 14 litres of water daily while 15% used between 14 and 27 litres. Only 25% of the respondents mostly from Milimani used more than 27 litres of water per day. The study concluded that the amount of water available for distribution falls short of demand and hence the need for new water sources.

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LIST OF ACRONYMS AND ABBREVIATIONS

GIS	Geographic Information Systems
GOK	Government of Kenya
CBOs	Community based organizations
HHs	Households
IDWSSD	International Drinking Water Supply and Sanitation Decade
MCN	Municipal Council of Nakuru
MDGs	Millennium Development Goals
KNBS	Kenya National Bureau of Statistics
MENR	Ministry of Environment and Mineral resources
MWI	Ministry of Water and Irrigation
MWR	Ministry of Water Resources
NAWASSCO	Nakuru Water and Sanitation Services Company
NEMP	Nakuru Environmental Management Project
NWRMS	National Water Resource Management Strategy
NWCPC	National Water Conservation and Pipeline Corporation
NWSS	National Water Services Strategy
OECD	Organization for Economic Co-operation and Development
RVWSB	Rift-valley Water Services Board
SPSS	Statistical Package for the Social Sciences
SSPPs	Small Scale Private Providers
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
WARMA	Water Resource Management Authority
WASREB	Water Services and Regulatory Board
WB	World Bank
WHO	World Health Organization.
WRI	World Resources Institute
WSBs	Water Service Boards
WSPs	Water Service Providers

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The blue planet that is our fragile and precious home has vast water resources but only a fraction of these resources are of fresh water (Sylvain, 2006). It is that small volume of freshwater that must meet the needs of billions of people, animals and plants. Water is a one of the environmental life support systems which is the basic requirement for all human related activities. It forms the backbone of growth and prosperity since industrial, farming and domestic activities require water. In the absence of water, humanity and other living things are threatened with extinction (Odongo and Mungai, 2002). The total amount of water supply globally remains almost constant and therefore if well managed is able to meet these various demands (Wright, 2005). Overall, the amount of fresh water on the planet is adequate to meet human needs even taking future population growth into account. This projection does not however take into consideration the distribution of water resources in relation to human population (Wright, 2005).

Domestic water supply is one of the fundamental requirements for sustenance of human life. Without water, life cannot be sustained beyond a few days and the lack of access to adequate water supplies leads to the spread of diseases (Odongo and Mungai, 2002). Children bear the greatest health burden associated with poor water and sanitation. Diarrheal diseases related to inadequate water supply, sanitation and hygiene account for 1.73 million deaths each year and contribute to over 54 million Disability Adjusted Life Years, a total equivalent to 3.7% of the global burden of disease (WHO, 2002).

The UN Mar del Plata Water Conference held in 1977 supported the targets set in the 1976 UN Vancouver Conference and recommended that the period from 1981 to 1990 should be declared the International Drinking Water Supply and Sanitation Decade (IDWSSD) (Clarke, 1991, McDonald and Kay (1988). The United Nations (1997) declared that all people, regardless of their social or economic status, have a right to clean drinking water and basic sanitation needed to prevent communicable diseases and provide for basic human dignity.

The World Health Organization, (2001) considers $1000m^3$ of water per person per year to be the minimum level below which most countries are likely to experience chronic shortages on a scale that will impede development and harm human health (WB, 2006). Some 45 countries, most of them in Africa and Middle East, were considered water stressed by UNEP, (2006). In other economically less developed countries in Sub-Saharan Africa and Latin America, the problem is accessibility and not the quantity of water (Tudor, 2003). In these countries, water management has often been an ad hoc response to particular pressing problems with only limited number of countries promoting water management at the national level.

The demand for water within the Nakuru Municipality by households and institutions currently stands at 75,000 cubic metres of water per day (NEMP, 2007). This leaves the town with a deficit of 25,000 cubic metres daily since the supply is estimated at 50,000 cubic metres per day (NAWASSCO, 2006). In line with the Water Act 2002, the Rift Valley Water Services Board (RVWSB) has the legal responsibility of ensuring efficient and economical provision of water in its area of jurisdiction. Rift Valley Water Services Board was established through Kenya Gazette Notice No. 1715 of 12th March 2004. It is estimated that the boreholes and some two surface water sources supply 35,000 cubic meters per day exclusive of losses to the Nakuru Municipality. Bulk transfer of water from River Thurasha is managed by the Rift Valley Water Services Board (RVWSB), from which Nakuru Water and Sewerage Services buys and supplies to Nakuru residents (NAWASSCO 2006).

The Water Act (2002) mandates the Water Services Board to contract a Water Service Provider. Within the Nakuru Municipality, Nakuru Water and Sewerage Services is the agent contracted as a Water Service Provider by the Rift Valley Water and Services Board. Among other responsibilities for this agent is the operation and maintenance of facilities as well as the billing and collection of revenue. Water Service Provider status is mandatory for those water boards providing water services to more than 20 households, supplying more than 15,000 - 25,000 litres per day of water for domestic purposes or supplying more than 100,000 litres of water per day for any use (NAWASSCO 2006).

1.2 The statement of the problem

Kenya is among those countries classified as water scarce. Nationally, 40% of the households in urban areas lack access to clean and safe drinking water. For example, In the Municipality of Nakuru, there is great imbalance between water supply and demand. It is estimated that the current level of water supply in the Municipality is 48%, which is below the national average of 60%. The statistics in Nakuru also show that there is a water deficit of 52%. This situation is not favorable given that the rate of urban growth within Nakuru Municipality is estimated to be 7% as a result of high birth rates and immigration from the surrounding regions. This population growth automatically translates to an increased demand for water which further strains the availability and/or accessibility of water to the residents and related institutions and obviously will also put pressure on the already over-burdened limited sources of water. In view of this, there is a potential of water related problems in future. The study therefore found it necessary to establish the demand and supply situation.

1.3 Objectives

1.3.1 Broad Objective

The broad objective of the study was to investigate the water supply and demand situation within the Nakuru Municipality.

1.3.2 Specific objectives

- To identify the sources of water supply for Nakuru Municipality residents
- b) To determine the quantity and quality of water supplied to the Nakuru Municipality.
- c) To estimate the average amount of water consumed by households and institutions within Nakuru Municipality.
- d) To identify factors affecting the supply and demand of water among the residents of Nakuru Municipality.

1.4 Research questions

The following questions guided the study

- What are the main sources of water for Nakuru Municipality?
- How much water is supplied to the Nakuru Municipality on a daily basis and can the water be considered safe and clean?
- What is the average amount of water used by households and institutions in Nakuru municipality?
- What factors affect water supply and demand among the residents of Nakuru Municipality?

1.5 Justification and Significance of the Study

According to UNEP, (2006), WRI, (2004), UNDP (2001) and the World Bank (1996), the top environmental priority for many cities in the developing world remains improving access to clean water and sanitation. The government's commitment to supplying water is clearly defined in many policy documents. For example, the Kenya National Development Plan for 2000-2005 indicates that water is a priority both in rural development and as an essential utility in urban areas. To achieve the ultimate goal of providing clean and safe water to all, scientists at the International Conference Center for Community Water Supply and Sanitation at the Hague, Netherlands (2000) recommended that community management of water resources is absolutely essential. The current government policy in Kenya requires that 84% of urban population and 74% of rural population be currently supplied with clean and safe drinking water (Republic of Kenya: MWI: 2005). Target number 7 part c of Millennium Development Goal 7 states that, the current population without clean and safe drinking water be halved by the year 2015. For the Nakuru Municipality to evaluate itself on the basis of these national and international projections, it is important for its demand and supply situation to be assessed. This is the focus of this social survey.

Kenya is classified as a water scarce country with a low water per capita (WASREB 2008). For example, Statistics from NAWASSCO indicate that there is a shortfall of about 33.3% of water against demand for municipal water supplies (NAWASSCO 2006). It is estimated that

Nakuru Municipality receives 50,000 cubic meters of water per day against a demand of 75,000 cubic metres for the more than 400,000 residents. In comparison, the national average coverage for urban and rural areas is 60% and 40% respectively (NAWASCO, 2006). Therefore Rift Valley Water Service Board's regional coverage, therefore, is below the national coverage. Lack of access to basic water and sanitation services impacts negatively on human health, mobility, productivity, poverty and on the environment (Republic of Kenya: 2002). Nakuru town continues to experience an upsurge in population and hence the demand for water is bound to increase in the future. A study of the water supply and demand situation within the Nakuru Municipality is therefore crucial.

Further, limited information exists on water allocation patterns among residential areas within Nakuru town. Also, during the past 30 years, the population of Nakuru town has increased with a factor of 7% (KNBS, 2006). This underlines the importance of this study to establish the current water supply and demand situation within the Nakuru Municipality. The research outcome generates useful information for sustainable water management and policy revision.

1.6 Scope of the study

The research design used in this study was a social survey research and focused on assessing the water supply and demand within the Nakuru Municipality. The respondent's perception of water quality was also assessed. The scope was based on three residential areas within the Municipality namely; Milimani, Shabab and Kaptembwo. Institutions within the Nakuru Municipality investigated included hospitals, schools, hotels and restaurants. The research was carried out between May 2010 and March 2011.

1.7 Definition of terms

Abundance: The amount of water in terms of amount and distribution.

Accessibility: This refers to the presence of a sustainable and affordable water source to the household in terms of quality, time and distance.

Availability: This refers to the continuous presence of water for use by the residents as need arises

Bore-hole: This is a hole that has been drilled or dug for purposes of providing water for drinking and or other domestic purposes.

Bungalow: A residential unit on its own compound whether single or multistoried. One or several families may occupy it.

Consumption of water: The fraction of withdrawn water that is actually used or otherwise made unavailable for other purposes as a result of direct human use.

Demand: This refers to the quantity of water required by an individual or household for consumption, hygiene and amenity use.

Flat: A self-contained multi - storied dwelling unit joined to others in a single structure.

Governance: The range of political, social, economic and administrative systems that are in place to develop and manage water resources and the delivery of water services at different levels of society.

Household: A group of people who live and eat together, whether or not they are related by blood, marriage or otherwise.

Marginal Propensity to Consume: This refers to the change in consumption due to a change in income or other factors that affect disposable income by households.

Per capita water: This refers to the amount of water per head in a country or other jurisdictional district under study.

Policy: A statement by a government or a public body providing guiding principles and goals in addressing public issues.

Slums: Legal or illegal but inadequate multifamily units usually built for rent by poor people.

Water: This is a compound of hydrogen and oxygen necessary for life on earth. It is the liquid used by humans for drinking, cooking, and washing at the household level and also for agriculture and industry.

Water scarcity: A situation that occurs when the annual supply of renewable fresh water drops below 1000 cubic metres per person.

Water Supply: The quantity of water being offered for sale at various prices to individuals, households and institutions, all other factors assumed constant.

Water quality: The degree to which water is clean enough to fulfill the requirements of various uses.

CHAPTER TWO

LITERATURE REVIEW

2.1 Importance of Water

Water is necessary for life on earth and has been said to be the universal raw material. Data on global water availability and use indicate that, overall, the amount of fresh water on the planet is adequate to meet human needs even taking population growth into account (Wright, 2005). The data does not, however, take into consideration the distribution of water resources in relation to human population. But it indicates that the problem lies with the allocation and availability, of fresh water (WHO, 2002).

Investigations have revealed that up to 31 countries, which represent nearly 8% of the world's population, face chronic water shortages (Population Reports, 1998). It has also been estimated that by the year 2025, the number of countries facing water shortages is expected to be nearing 48 affecting more than 2.8 billion people or 35% of the world's projected population (UNEP, 1997). Many nations are therefore handling water distribution and allocation as a priority in their policy formulation and implementation processes. Domestic water supply is one of the fundamental requirements for human life for without water, life cannot be sustained beyond a few days and the lack of access to adequate and safe water supplies leads to the spread of disease. Children bear the greatest health burden associated with poor water and sanitation (WHO, 2002).

The fact that easy access to water is a crucial precondition for habitability makes it logical that most poverty – prone countries are found in the arid and semi-arid tropics where water is scarce and rainfall efficiency is low because of the large water attraction capacity of the dry and warm atmosphere (William, & Januz, 1999). In the dry lands of the world, water scarcity has imposed significant negative implications on human well being. Safriel *et al* (2000) noted that dry land populations are always behind in socio-economic development because of water shortage. The prognosis is that this shortage is bound to rise rather than decline. Additionally, most of the world's fresh water is stored in icecaps and 90% of drinkable water in the world is

ground water which is increasingly threatened by depletion and contamination (UNEP, 1995). This leaves only 0.008% of fresh water available for use by man (UNEP, 2005). Many people however lack water not only due to the amount available but also because of uneven distribution (Pannet, 1989). It is inevitable that demands for fresh water will continue to rise. Increase in population and the concomitant need for food supplies, industrial development and recreation activities will increase expectations for availability of this scarce resource (World Bank, 1999). Water resources in many countries remain fragile, more due to the poor demand and supply management than to actual water scarcity (UNEP, 2002).

The need to improve the availability of water to the poor has not gone unnoticed by the world's governments. At the World Summit on Sustainable Development, governments agreed to halve the number of people without access to basic sanitation and who cannot access or afford safe drinking water by 2015 (Tudor, 2003). In 1996, the First World Water Forum in Marrakech requested the World Water Council to develop a World Water Vision for the year 2005. The exercise led to the preparation of Water Visions at global, regional, sub-regional and national levels and corresponding Frameworks of Action (Tudor, 2003). These visions were designed to generate massive public awareness of the risk of inaction. The ultimate goal was to generate the political commitment needed to turn the increased public awareness on the water issue into effective action for the benefit of all. Globally, many water supply agencies are struggling to cope with vandalism to existing networks and illegal connections (WMO, No. 974).

The inevitable outcome of current patterns of use and abuse of water supplies is water stress. Countries are defined as water stressed when they consume more than 20% annually of a renewable water supply. Currently, about 2 billion people are living in countries that have neither adequate water resources nor the funds to abandon intensive irrigation for more sustainable agricultural practices. About 1.2 billion people still have no access to safe drinking water, and 2.4 billion do not have adequate sanitation services (UNEP, 2002). Some 2 billon children die each year from water related diseases. In the poorest countries, one in five children die before the age of five mainly from water related infectious diseases arising from insufficient water availability (UNEP, 2002). If current trends persist, this number could spread to cover most of

the world's poor by the year 2050 (WMO, No. 974). Governance is an essential aspect of effective water resource management and often receives less attention than merits (World Bank 2006). The governance process determines decision making about type of water use, regulation of extraction from aquifers, regulation of discharges and allocation between competing uses, including the maintenance of basic environmental services. Experts claim that declining supplies of fresh water will be a source of increasing tension in the coming years.

Overall, Africa is urbanizing at a rate of about 5%, the fastest rate if the world (UN-HABITAT, 2000). Africa's urban population could jump to 500 million in the year 2020 increasing the already existing water stress in the cities. A 1990 survey of 29 sub-Saharan cities revealed that 8 were suffering from water scarcity and this number is likely to jump to 20 by the year 2025 (UN-HABITAT, 2000). In many African countries, utilities have not fully met the water and sanitation requirements of urban communities, particularly those in low income settlements (Republic of Kenya: WUP 2002). Studies indicate that in Africa, over 300 million people do not have access to safe drinking water, and an even greater number of over 500 million are without adequate sanitation (Tudor, 2003).

According to Kalyan Ray, co-coordinator of The Water for Africa Cities Program, the explosive growth of urban centers is rapidly depleting the once bountiful freshwater resources (Tudor, 2003). Community organizations, Non-Governmental Organizations and small scale private providers have made a substantial effort to bridge the gap (WHO, 2008). But due to rapid urban growth and increasing poverty, the number of un-metered households continues to rise. This urban water crisis has been receiving increasing attention in all international dialogues on water. The red flag was raised in Dublin and Rio de Janeiro in 1992 and subsequently gained momentum in other meetings in Nordwjik in 1994, in Beijing and Istanbul in 1996, in Cape Town in 1997, and in the World Water Forum in the Hague in 2000. At all these meetings, the water crisis in African cities has been of major concern (Tudor, 2003).

Tudor (2003) argues that water should not pose a constraint for Africa since it has abundant water resources with its large rivers, big lakes, vast wetlands and limited but widespread ground water resources. However in his work, he says the sustainability of this fresh water endowment is

threatened by certain natural phenomena and human factors. Among the natural threats are; the multiplicity of trans-boundary water basins, extreme and temporal variability of climate and rainfall and shrinking of some water bodies through desertification. The human threats include; inappropriate governance and institutional arrangements, pollution, deforestation, failure to invest adequately in resource assessment, protection and development as well as the unsustainable financing of investments in water supply and sanitation. The Africa Water Vision for 2025 was designed to avoid the disastrous consequences of these threats and to lead the continent to a future where the full potential of Africa's water resources can be readily used to stimulate and sustain growth in the region's economic development and social well being (UNEP, 2005).

The World Bank (2006) contends that in many parts of Africa, families devote inordinate amounts of time in collecting water. For example in the lowlands of Lesotho 30% of the families spend more than two and a half hours daily collecting water. This means that time that could be used in other economic activities is lost and puts a lot of physical strain especially on women and children. This also leads to a great loss of time that would otherwise be use in more productive economic activities like education, child care, farm cultivation or other activities that could improve health. The Bank concludes that Africa's social indicators will improve only if public policy and money are focused more on delivering systems that respond to the basic needs of a wider spectrum of beneficiaries especially the poor.

In response to consumer demand, a wide range of service providers have emerged offering door-to-door water delivery and water kiosk usually at unregulated rates. Many governments are moving away from direct delivery of services and are currently implementing decentralization programs with the objective of improving service delivery. Often these policies focus on urban or rural water supply and assume that by so doing they have catered for the needs of low income urban settlements.

Evidence from a number of case studies around the world suggests that the urban poor do pay for safe water but usually at a significant price to the welfare of their children (UNICEF, 2000). Payment for water becomes an addition to the many other services they have to pay. It does not

necessarily follow that because the urban poor pay proportionately more of their household expenditure for water than the rich, they will necessarily be better payers than the rich for service delivered by more formal systems such as a piped water scheme provided by a utility (UNICEF, 2000). Nor does it imply that improved water delivery and subsequent cost-recovery systems can be provided and operationalized on a large scale for the urban poor based on the evidence of payment by the poor for water supply through informal systems. According to UNICEF, the issue is not so much whether the urban poor can or do pay for water supply but rather under what conditions do they do so and how this can be used to scale for water supply to the urban poor.

2.2 Water Supply and Water Demand

It is estimated that the world consumption of water stands at 4000 cubic kilometers per year, which is just 2% of the amount of water found in rivers, rocks and lakes (Punnet. 1989). Many people therefore lack water not due to the amount available but due to uneven geographical distribution around the earth (Punnet. 1989). In the year 2000 it was estimated that one-sixth of the world's human population (1.1 billion people) lacked access to any form of improved water supply within one kilometre of their homes (WHO and UNICEF, 2000). Lack of access to safe and adequate water supplies contributes to ongoing poverty both through the economic costs of poor health and in the high proportion of household expenditure on water supplies in many poor communities. This arises from the need to purchase water and/or the time and energy expended in its collection (WHO and UNICEF, 2000). Access to water services forms a key component in the United Nations Development Program Human Poverty Index for developing countries (UNDP, 1999). Thus WHO and UNICEF, (2000) observes that, the earth is facing a serious water crisis which is getting worse and will continue to do so unless corrective action is taken.

Saffiel *et al* (2000) states that, populations from water-scarce regions are always behind in socioeconomic development because of water shortage which is bound to rise rather than decline. According to Ndege (2007), estimates projected a decline in water availability in dry lands from 1300 per capita in 2000 to 1000 per capita in 2010. In contrast, water use in these areas is estimated to rise by an average of 25% per decade. These trends are likely to aggravate the water stress situation in these water scarce countries compounded by the fact that current

water availability is well below the sustainable water availability level of 2000 per capita (Safriel 2000). Zaag and Savanije (2006) outline seven characteristics of water that compound the market failures of its allocation. They state that water is vital, scarce, fugitive, bulky, indivisible, non-substitutable and non-homogenous thus presenting significant challenges in its market regulation.

Unlike today's relatively stagnant supply, demand has quickly evolved along with rapid urbanization, diversification of uses and users, raising environmental and health-related concerns, and issues to do with trans-boundary basins (Sylvain, 2006). According to statistics compiled by the World Resources Institute (1992), domestic water demand amounts to approximately 8% of global water withdrawals. Domestic water demand includes water for drinking, hygiene and cooking, public service and municipal use. In Europe this constitutes 13% of total abstraction while in Asia and Africa 6-7% is withdrawn for domestic use (Hunspeter, 1995).

Drinking water is the most valuable form of water use. Data shows that the average daily per capita of domestic water varies widely across the globe with 417 litres in North and Central America, 259 litres in Europe, 235 litres in South America, 86 litres in Asia and 47 litres in Africa as of 1995 (UNEP, 1995). The same statistics indicate that in Ethiopia and Kenya, each person uses on average of around 14 and 36 litres of water per day respectively. This figure is about 50 litres in India and Pakistan, 300 in Switzerland and 700 litres in the USA (UNEP, 1995). Africa therefore registered the lowest average daily per capita while Kenya has among the lowest daily per capita in the continent.

The United Nations International Drinking Water Supply and Sanitation Decade (1981-1990) was launched to improve the water supply situation in the developing world. The achievement during this decade indicate that although the provision of adequate drinking water increased from 44% to 69% over the decade, proper sanitation provision only rose from 46% to 54%. During this period, 700 million people were supplied with clean water but nearly 2 billion people remained in danger (Mark and Ximing, 2002). Although average national figures on water consumption may be available as earlier indicated, the actual supply and demand situation in

many Municipalities including Nakuru is not available. This research focused on filling this gap for the Nakuru Municipality.

The government has a clear understanding of the critical importance of institutional reforms for enhancing the development impact of water resources management and service provision at different levels. The figure below shows the institutional set-up as vested in the Water Act, 2002.

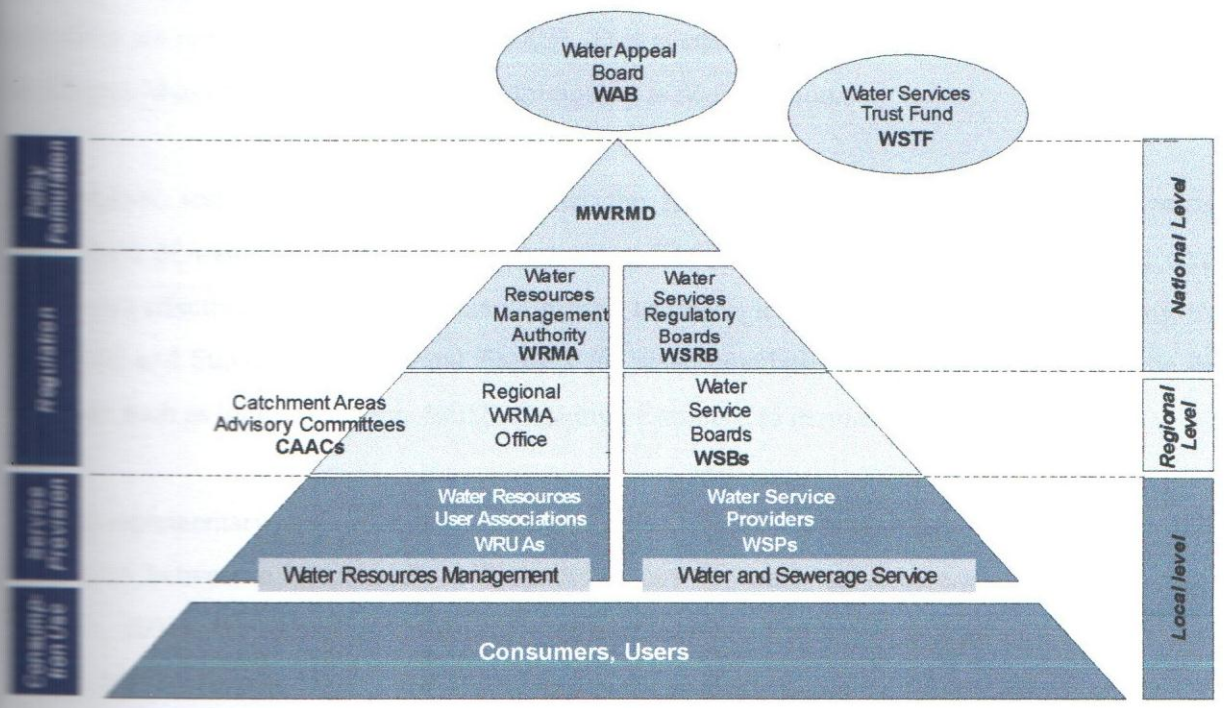

Figure 1: Institutional set-up under the Water Act 2002

Source: Rift Valley Water Services Board

2.3 Water Prices and Water Affordability

The role of the price of water is important in understanding water as an economic good (Ndege, 2007). This view of water was an integral principle in the Dublin Conference on Water and the Environment of 1992. Some water managers advocate for the consideration of all the physical aspects of water including its temporal and spatial distribution as well as the involvement of all stakeholders in water use decision making. They also advocate for taking into account the need for sustainability as well as giving due attention to the inter-sectoral use of

water. Average international water prices are projected to increase by 10% between 1995 and 2025 (Mark *et al*, 2002).

For connected households, water prices are projected to increase gradually from 2000 to 2020, reaching a level of 40% higher in developed countries and 80% in developing countries (Mark *et al*; 2002). Evidence suggests that in about half of the Organization for Economic Co-operation and Development countries, affordability of water charges for low-income households is either a significant issue now or might become one in the future, if appropriate policy measures are not put in place (OECD, 2003). This scenario is reflected in all less economically developed Municipalities and Nakuru Municipality is no exception.

Olmstead and Stavins (2007) considered the relationship between price and non-price regulations of water in some United States cities. The results indicated that price control was more cost-effective and revenue enhancing than technological control. However, according to Olmstead and Stavins, technological fixtures for water regulation ultimately lead to change in behavior such as longer showers, double flashing of toilets and increased sink flows.

A complementary way of looking at the politics of water affordability issues involves the distinction between a household's willingness to pay for water services and its ability to pay (OECD, 2003). Significant affordability problems exist and must be addressed, where prices exceed both willingness to pay and ability to pay for a sizable number of customers. If prices are lower than both willingness to pay and ability to pay, affordability is not an issue. The interesting cases are those where prices lie between willingness to pay and ability to pay. This may exist generally due to some recent history or to lack of financial planning for extreme events like hot weather that leads to high water consumption. Very different policy initiatives are called for in these situations (OECD, 2003).

In some OECD countries like Australia and Ireland, the existence of measures and structures such as policy measure and tariff structures directly applied to water bills have had a bearing on the perceived absence of the affordability problem (OECD, 2003). In Australia, what are known as "concessions" (some form of rebate) are now so much part of the economic culture that affordability was found to be generally perceived as a non-issue. In Ireland where all household

water charges were abolished in 1996 and consolidated into general taxation, household water affordability problem as such has ceased to exist by definition. The research endeavored to establish whether affordability influenced water demand within Nakuru Municipality.

2.4 Sources of water

Various water sources exist, for example, rainwater, ground water, spring water, surface water, rivers, lakes, ponds, fog and even glaciers (John, 2004). Water can be supplied from each source in many different ways but these can then be divided into piped or non-piped options. Households in many low-income regions face a variety of challenges in their effort to secure potable water (John, 2004). In large urban centres, water supply systems are often unreliable and fail to provide service to many in the city's poorest residents (Rivera, 1996).

Households in low-income areas differ from their high-income counterparts in that they spend a larger share of their income on water. They also may face a different set of circumstances regarding their supply of potable water. For example, it is common for households in low-income areas to have several possible sources of potable water. Mu, et al (1990), report that members of a small town in Kenya chooses among private pipe, communal wells and pumps, kiosks and water vendors for their potable water. One is tempted to imagine that the said small town might be or is similar to Nakuru since the water source scenario is just as described despite the fact that most rivers are seasonal and unreliable and the lake contains saline water. Some of the rivers that feed into the lake sink underground before reaching the municipality and are therefore not utilized by the Municipality or individuals for domestic use. These sources differ in their relative cost, convenience, reliability and quality (Rivera, 1996). The cost of each alternative is a combination of the time spent obtaining water, installation charges and prices. Households face the challenge of deciding which source(s) to use as well as how much water to obtain from each source and researchers face the challenge of understanding and modeling these decisions (World Bank, 1993).

There have been a number of attempts to model household decision-making regarding its choice of the source of drinking water and the households' valuation of improved access to reliable water supplies in low-income countries (Rivera, 1996). Various researchers have

conducted surveys that collect information on households' supply-sources choices and characteristics. For example, Madanat and Humplick (1993) examined the behavior of 900 households in Faisalabad, Pakistan and concluded that the more expensive the in-house pipe connection relative to the other sources, the less likely the household is to connect. In addition, the connection is strongly influenced by household expectations regarding the relative reliability and quality of alternative sources as well as their past experience with alternative supply sources. This research sought to find out whether being connected to the main Municipal water supply in Nakuru is influenced by these factors.

2.5 Water situation in Kenya

The general scarcity of water in Kenya was illustrated by UNEP in 2001 (Ndege, 2007). According to that report, the total water deficit stood at a massive 704,522 metres cubed per annum. The Kenya government recognizes the importance of water and continues to pursue development programs aimed at ensuring proper water resources management and service provision. For example, in 1974, the Kenya government committed itself to ensuring that potable water was made available at a reasonable distance to all households by the year 2000 (Republic of Kenya: 1999). In order to improve accessibility, the government has put forth effort to develop the National Water Master Plan, which is constituted within the National Development Plans. It is expected that this would be made possible through the establishment of water schemes, sinking boreholes, construction of catchments, dams and provision of conveyance infrastructure in the form of pipes and furrows (Republic of Kenya: 1999). For example in the Kenya National Development Plan for 2000-2005, water was placed as a priority both in rural development and as an essential utility in urban areas. However, despite all these well intended efforts, measures and structures are still inadequate to improve the situation and Kenya is still classified as a water scarce country.

Kenya as a water scarce country faces serious challenges with regard to current and future water supply (UN-HABITAT, 2000). Most existing water supply networks were constructed 20-40 years ago (Republic of Kenya: MWI: 2005). As a water-scarce country unit water consumption is expected to be less than in water-rich countries (WASREB, 2008). Although there may be enough water resources in the region sufficient to meet present requirements, the

distances required to pump water and the storage to meet drought, make the cost of obtaining new sources high (NAWASSCO, 2006). Nairobi's water crisis worsened in 2000 when a scorching drought forced the authorities to ration water and power supply (UN-HABITAT, 2000). As in most African cities, the problem is not so much that bulk treated water is in short supply, but that about 50% of the water is wasted and unaccounted for (UN-HABITAT, 2000).

In Kenya, water supply and demand has been tackled by a variety of studies. For example, Onjala (2001) focused on industrial water demand with the study using time series data drawn from 51 industries in Kenya. The study adopted a dynamic adjustment model that incorporated previous month's water consumption. Kabeya (2000) considered water supply and sanitation challenges and responses in Kisumu town. The findings depicted a negative trend encircling water and sanitation supply in both the formal and informal settlement areas as opposed to the prevalent view held by many that water and sanitation supply is a problem only in the informal settlement areas. Ndege (2007) indicated that incomes are positively correlated to water consumption and that water abstraction has negative effects on the ecology of the dry land.

The Kenya Government has put in place measures to ensure efficient distribution of water. These measures include the establishment of the National Water Resource Management Strategy (NWRMS), launched in Nairobi in 2007. The Water Services and Regulatory Board (WASREB), stipulates that good water coverage by any water provider should be over 90% and anything below 80% is unacceptable (WASREB, 2008). It also directs that any Unaccounted For Water (UFW) is acceptable at values below 20% and that hours of supply where population is greater than 100,000 should be 16-20 hours (WASREB, 2008).

A problem faced by the Kenya government is the management of water demand (Kabeya, 2000). Cairncross and Feachem (1993) suggest a number of strategies that may be used to manage water demand. These include the tariff structure, leakage reduction, water saving taps and fittings and consumer education. They further suggest that the tariff structure should be adequate to all those able and willing to pay, enforceable and that charges should be based on property value and characteristics. These characteristics would be reflected in the metering system that involves the unit rate charge. This helps in introducing a progressive tariff policy in

which water wastage is reduced and consumers from higher income households pay more for water. This helps to raise more revenue which may then be used to subsidize the cost of water for the poor. This research endeavors to establish whether the low income households do pay more for water than the high income households.

2.6 Water situation in Nakuru

The table below shows the water abstraction potential for Nakuru district compared to other districts within the Rift Valley Water Services Board jurisdictional area. The table shows that ground water is the most prevalent source of water supply for the Nakuru district followed by surface water. Surface water sources are most prominent in Keiyo while ground water sources predominate in Turkana district. Nakuru and Narok districts have equally exploited surface and ground water sources. The table also shows that Nakuru and Keiyo districts have the highest per capita abstraction for water supplies for human consumption. This research seeks to investigate the water per capita situation within the Nakuru Municipality.

Table 1: The Rift Valley Water Services Board's Water Potential

District	Water Sources by District							
	Surface Water sources	Ground Water	Ground Water & Surface Water	Not Specified	Other	Total	Volume Abstracted per Day (m3)	Per Capita Abstraction(l/p/d)
Baringo	39	35	4			4	5,898	5.0
Kanjo	90			1		91	15,099	57.0
Kuibinek	5	15		3		23	2,230	6.1
Nyandarua	77	13	1			91	26,733	44.6
Nakuru	**87**	**104**	**9**	**5**	**1**	**206**	**62,176**	**52..2**
Narok	18	17	3			38	4,437	9.8
Trans Mara	1	11		5		17	950	6.8
West Pokot	22	1				23	1,347	3.1
Total	339	196	17	14	1	567	118,870	33.7

Source: RVWSB.

According to the Nakuru Water and Sewerage Services Company (NAWASSCO), Nakuru relies on both boreholes and the water transfer scheme for half of its water supply (Table 1), which currently falls 25,000 cubic meters short of the daily demand of 75,000 cubic metres (NAWASSCO 2006). In the absence of a local reliable and established Municipal water supply, the urban poor must collect water from long distances or purchase it at considerable price from vendors. To address this problem, the Nakuru Municipal Council undertook an Agenda 21 local environmentalization planning process. In consultation with the local community and community-based organizations (CBOs), water demand and supply was identified as the key problem. In response to this problem, the Municipal authority established a number of public water kiosks especially in the low income estates like Kaptembwo.

Although the Municipal council of Nakuru has a private company to manage the water department, the firm is yet to come up with long term solutions to end the crisis. Apart from the boreholes, the Municipality also relies on surface water sources. In addition the Municipality gets water supply from the Kenya National Water and Pipeline Corporation (NAWASSCO, 2006). But despite these sources of water, most of the low income residential areas within Nakuru Municipality continue to be served by private water vendors (NAWASSCO, 2006). This indicates that there is a problem with water allocation within the Nakuru Municipality.

2.7 Theoretical and Conceptual Framework.

The study was based on the Market Theory according to Alfred Marshall. The theory describes the concepts of demand and supply which is an economic model of price determination in a market. It specifies that in a competitive market, the unit price for a particular good will vary until it settles at a point where the quantity demanded by consumers (at current price) will equal the quantity supplied by producers (at current price), resulting in an economic equilibrium of price and quantity. It illustrates the factors that influence the supply of a certain good to respond to the market within a given period of time.

The theory can also be used to describe the consumer behavior to certain goods given the prevailing market conditions. This includes factors that make consumers decide to buy the amount of goods they buy and why these decisions change from time to time. These factors include income level, house-hold size and composition and education level. The Demand theory states that the Marginal Propensity to Consume (MPC) may differ by income level, household composition and from one year to another.

The concept of demand and supply under the market theory considers all the factors that influence demand and supply. The supply of water to the residents will be affected by factors such as climate (since borehole water depends on replenishing of ground water through infiltration), level of funding, water supply infrastructure and prevailing policies. The fundamental case for flexible exchange rates is built upon the law of supply and demand. According to this theory, the price should regulate the quantities supplied and demanded and

vice versa so that the market clears and equilibrium is reached. A commodity or service in demand will be supplied at whatever price depending on the elasticity of demand.

The theory of supply and demand was used in this study and the Municipal Council was considered on the supply side while the residents and institutions were considered as the consumers (demand side). The study aimed at analyzing the current situation regarding water provision. Kibbe, (2007) suggests that if the price of a commodity is set too high, production may be high but demand low depending on the nature of the commodity. On the other hand, if the price is fixed too low, there will be shortage due to operational costs despite high demand. The conceptual framework shown in Figure 2 guided the study. The single arrows in the figure indicate the interaction between the various categories of variables while the double arrows represent the anticipated effects these variables have on water supply and demand situation within the Municipality.

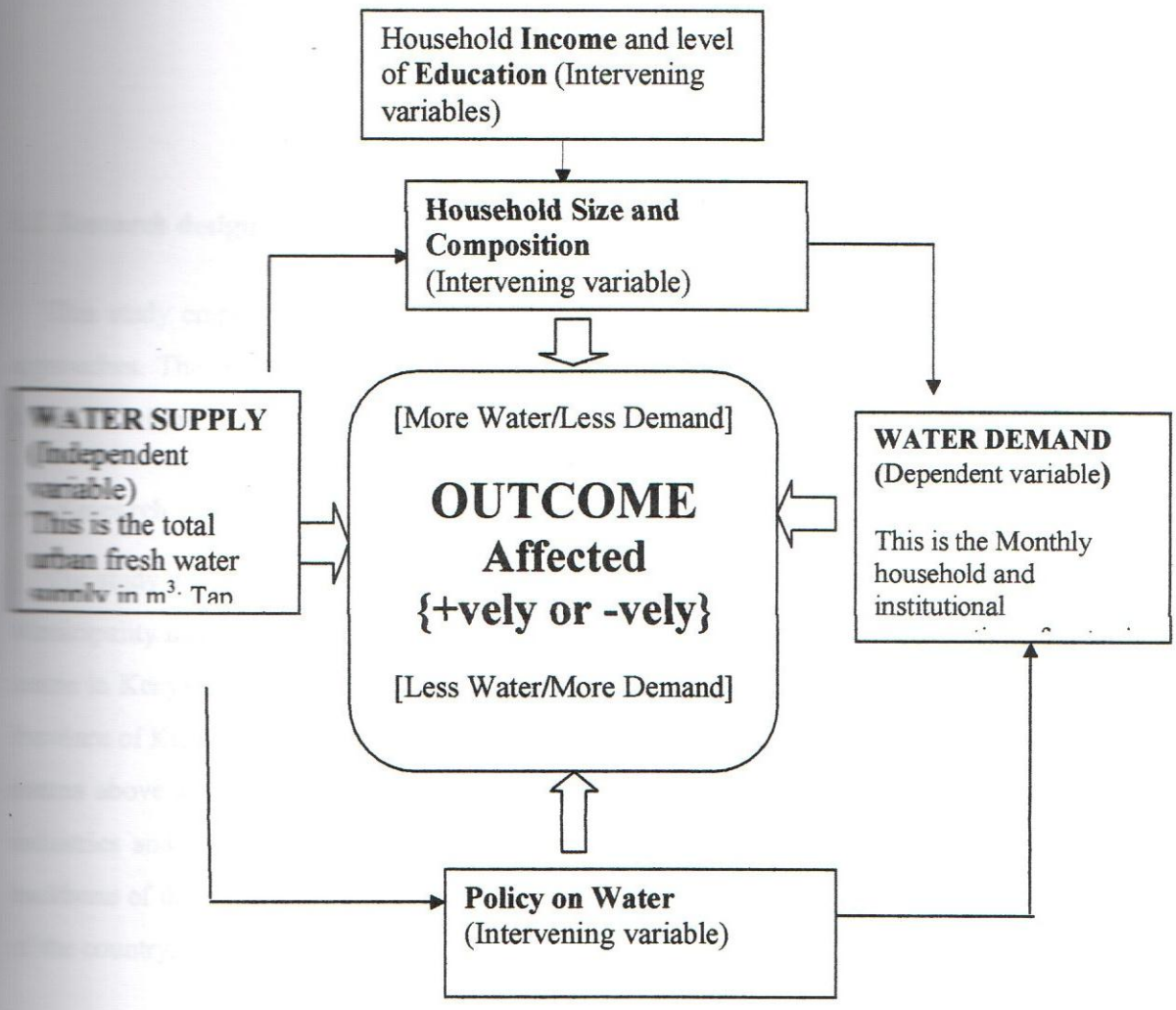

Figure 2: Conceptual Framework Model

Source: Alfred Marshall (Adapted)

CHAPTER THREE

METHODOLOGY

3.1 Research design

This study employed a social survey research design based on qualitative and quantitative approaches. The responses from the study objectives generated essential quantitative data on water use within the Nakuru Municipality.

3.2 Research site

The study was conducted in Nakuru which received its township status in 1904 and became a Municipality in 1952. It is located 160 km North West of Nairobi and is the fourth largest urban centre in Kenya after Nairobi, Mombasa and Kisumu. Nakuru town is located in the Rift Valley Province of Kenya. The study area was the Nakuru Municipality which lies at an altitude of 1859 metres above sea level. It lies at grid reference 0°19'- 0°24' S / 36°04'-36°07 E and has many industries and a high population growth rate. Agriculture, manufacturing and tourism are the backbone of the economy of Nakuru since it is a high rainfall potential area compared to the rest of the country.

During the past 30 years, the population of Nakuru Municipality increased with a factor of five. In 1969, the population was 47,151 (Kenya, 1970), increasing to 92,851 in 1979 (Kenya, 1981), 163, 982 in 1989 (Kenya, 1994), 239,000 in 1999 and 473,288 in 2009 (KNBS, 2010). Nakuru Municipality is densely populated (1076 persons per square km, KNBS, 2006) with a multi-racial population estimated at 282,433 people (KNBS, 2006). Out of these, 138,533 are females and 143,880 are males residing in 83,577 households (KNBS, 2006). The estates considered in this study were Milimani, Kaptembwo and Shabab. Administratively, Milimani lies within Afraha sub-location in the Central location, Kaptembwo is found in the larger Kaptembwo location while Shabab is in Koinange location. Figure 3 below represents the location of the study area in regional context, the various surface water bodies as well as the specific estates from where data was collected.

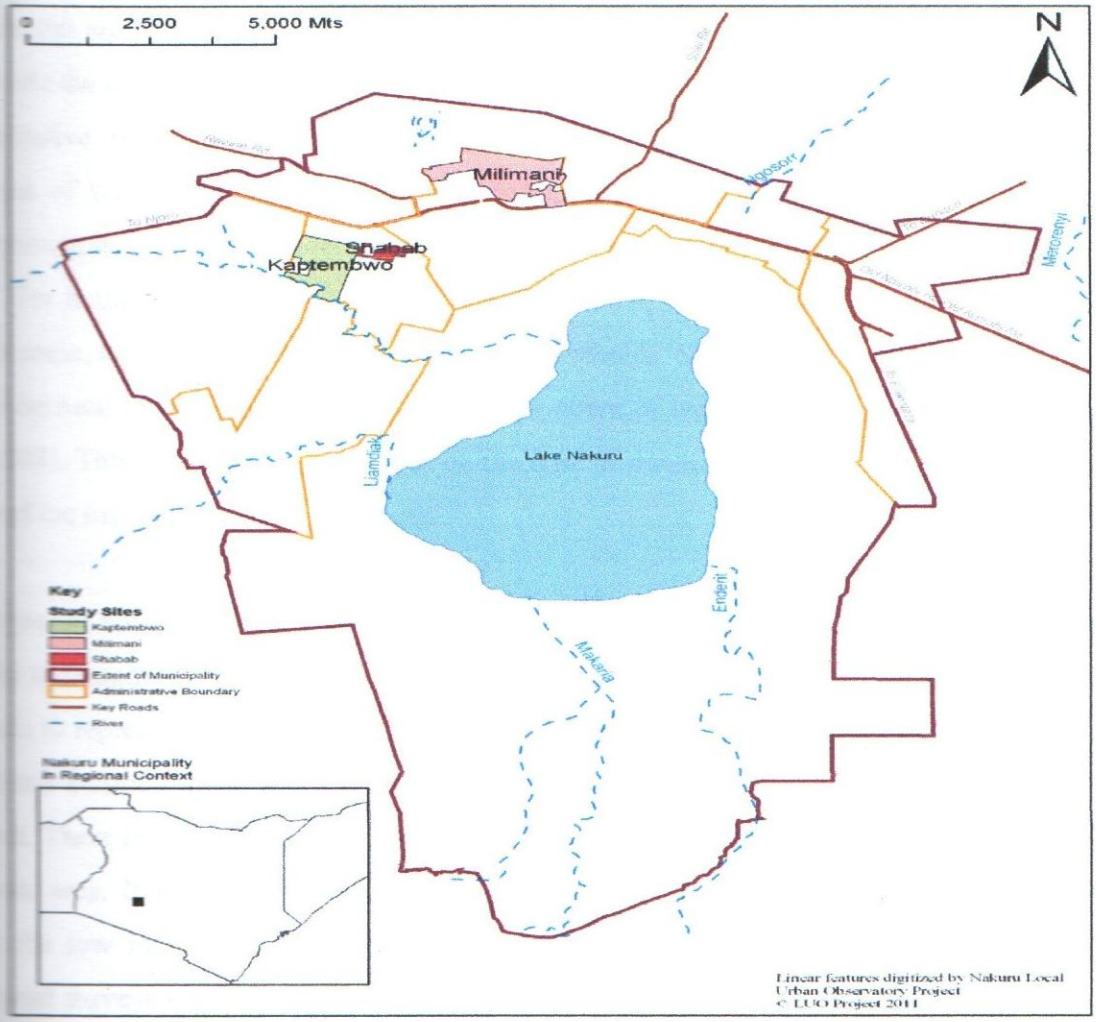

Figure 3: Location of Research sites in Nakuru Municipality

Source: Nakuru Local Urban Observatory Project

3.3 Sampling

The residential areas and institutions within the Nakuru Municipality were used as the sampling frames while the units of analysis were the households (HH) and the institutions. The study used both qualitative and quantitative approaches. Qualitative data was derived from water use experiences of water users (households and institutions) within the Municipality as well as through photography. The respondents provided essential quantitative data on the various aspects of water. For households, stratified random sampling was applied with the various strata being the low-income, middle- income and high-income households. Stratification was chosen because unlike in the rural set up, income level governs the pattern of water consumption in urban areas (Foley, 1988). This stratification was based on the type of dwelling unit which to a large extent represented the income level of the residents.

The types of houses in the various residential areas were used as an indicator of the level of income for the respondents. Milimani has a higher concentration of mansions and bungalows and was chosen to represent high income households. Shabab on the other hand is predominated by one to three bedroom permanent houses and was chosen to represent the middle income households. There is a high proliferation of bed-sitters and usually semi-permanent houses in the Kaptembwo area. It is here also where shanties and slums are found and this was chosen to represent the low income households. This approach was informed by researchers who did similar social surveys on water and energy within Municipalities (Kabeya, 2000, Ochodo, 2007 and Osuma, 2007).

To arrive at fifteen households for Milimani, a list of households obtained from the Rift Valley Provincial Planning Office was used to randomly choose fifteen households to be surveyed. The Shabab area was divided into three clusters with their housing blocks being categorized along access roads since this was the easiest way of reaching the households. Using this categorization, four blocks were chosen from each cluster. Households in these blocks were then listed and eighteen of them were randomly picked from each cluster. This gave a total of fifty four households chosen for Shabab. Since Kaptembwo is a densely populated area, the whole residential area was divided into fifteen clusters consisting of several rows of dwelling

units. Ten clusters were randomly chosen for listing of the available households. Again this clustering was done based on the accessibility to the houses. From the list obtained, one hundred and ninety two households were randomly picked for study. The representative sampled population size was 7.4% for Milimani, 7.5% for Shabab and 7.6% for Kaptembwo.

Figure 4 shows the number of respondents in the various categories. From the survey done within Nakuru Municipality, of all the respondents, 250 (79%) were households, 40 (11.3%) were schools, 27 (8.4%) hotels and restaurants with 3 (1.3%) being hospitals. All the institutions constituted 70 (21%) of all the respondents.

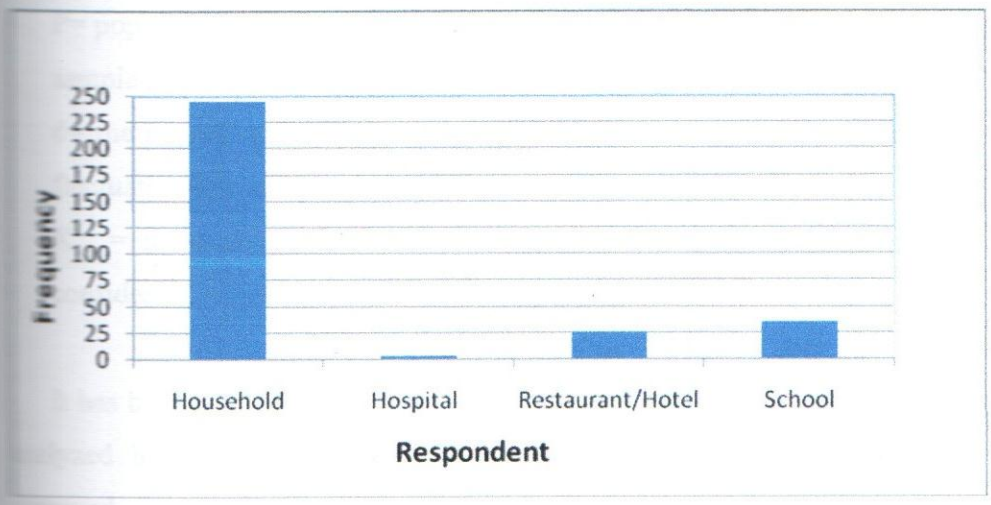

Figure 4: Number of Respondents Interviewed

Source: Field Survey, 2011

In surveying the institutions, lists of schools, hotels/restaurants, and hospitals were obtained from the Municipal Council office. Using random table numbers, the required representative number of institutions was picked for surveying. Random sampling was important to ensure representativeness of the institutions chosen and hence the reliability of the findings.

3.4 Sample size

In the sampling, Milimani was considered for high-income households, Shabab for middle-income households and Kaptembwo for low-income households. Household estimates for these areas were 11,048. The total number of households interviewed was 250. The calculated

representative sample sizes for the estates were 15 for Milimani, 43 for Shabab and 192 from Kaptembwo.

To determine the sample size, the Krejcie and Morgan (1970) formula for estimating sample size (S) was employed; this formula is given as:

$$S=\frac{X^2 NP(1-P)}{d^2(N-1)+x^2 P(1-P)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [1]$$

Where:

S= required sample

N= given population size

P= population proportion assumed to be 0.50 since this magnitude yields maximum possible sample size required.

d= the degree of accuracy as reflected by the amount of error that can be tolerated in the fluctuation of a sample proportion p.

X^2 = the table of chi square for the degree of freedom relative to the desired level of confidence, which is 3.841 for 0.95 confidence level.

It has been statistically shown that any sample size greater than 200 yields good results when analyzed by the SPSS (Krejie and Morgan, 1970). In this research 250 households were surveyed. To obtain the proportionate number to be surveyed in each residential area, the required sample size(s) were multiplied by the number of HHs in the respective residential area. Using the 1999 census statistics, the Kenya National Bureau of statistics estimated the population for Milimani to be 2,028 persons while those of Shabab and Kaptembwo were 5,703 and 25,413 respectively. The numbers of households were 676 for Milimani, 1,901 for Shabab and 8,471 for Kaptembwo, (CBS, 1999). The total number of households for the three estates was 11,048. Based on the total number of households and using the above formula, the required sample size was estimated as shown below:

$$S=\frac{3.841\times 11{,}048\times 0.5(1-0.5)}{0.05^2\times(11{,}048-1)+3.841\times 0.5(1-0.5)} \quad \ldots\ldots\ldots [2]$$

$$=371$$

The computed sample size for institutions is given by:

$$S=\frac{3.841\times 519\times 0.5(1-0.5)}{0.05^2\times(519-1)+3.841\times 0.5(1-0.5)} \quad \ldots\ldots\ldots\ldots [3]$$

$$=220$$

However, a total of 250 households and 70 institutions (total 320) were used. To obtain the proportionate sample of households in each of the three residential areas, the number of households in each residential area was multiplied by 0.022629 obtained from (250÷11,048). Hence the respective sample sizes for the various estates were 15 HHs for Milimani, 43 for Shabab and 192 for Kaptembwo. The total number of institutions (schools, hotels/restaurants, hospitals/health centres and prisons) in the municipality is 519 (CBS, 2006).The number of institutions surveyed was obtained by multiplying the total number for each category by 0.1349 (70/519).

Table 2: Sample size for respondents from institutions

Institution	Total No. in Municipality	Sample size
Schools	293	40
Hotels/ Restaurants	200	27
Hospitals	25	3
Prisons	1	0
Total	**519**	**70**

Source: CBS, 2006

3.5 Data collection Instruments

The following methods were used for both primary and secondary data collection and analysis. Secondary data was obtained from books, reports, the internet, scientific magazines and other publications while primary data was collected using the following tools:

Questionnaires (Appendices) were administered to sample units within the area of study. Both closed and opened types of questionnaires were used. The questionnaires were administered to different water consumers to ascertain supply levels. This was done within a period of three months with the help of three research assistants. The main target groups were primarily households and institutions. Primary data related to water supply and consumption was sourced from NAWASSCO. These included meter cards, account numbers, name and physical address of account holders, type of water outlet and the location of water outlet. The Council, RVWSB, and NAWASSCO provided a significant set of data required through personal interview schedules. Focus Group Discussions were organized especially when collecting data

from water supply and management agencies as well as from water vendors. A single representative group was organized each in Shabab and Kaptembwo. At NAWASSCO, a meeting was held with the relevant zone managers and meetings were held with bicycle water vendors in Shabab and Kaptembwo. Interview schedules for water service providers, institutions and water vendors were prepared and administered.

Interviews were especially used with water supply officers at NAWASSCO, water vendors, households, Institutions and other relevant entities were interviewed to get the existing situation of water supply. This method was also used to gauge the level of commitment to providing better access to safe water. Interviews help in attaining higher response rates than mail surveys (Babbie, 2001).

3.6 Data Processing

The data collected was first coded before analysis by allocating values to non-numerical or qualitative data to allow for computer analysis. Variables were assigned numbers 1,2,3,4 or 5 as the situation warranted. As stated by Peter (1994), data processing includes data editing, cleaning, coding, classification and tabulation. For example while yes was coded 1, no was coded 2. Information obtained through interviews and Focus group Discussions was scrutinized objectively and reported in line with the research objectives.

3.7 Data Analysis

This was done using the Statistical Package for Social Sciences (SPSS). For testing the research questions, and making of inferences, descriptive and inferential statistics were used. Descriptive tables, means, percentages and Chi-square tests were employed. The chi-square was carried out at $\alpha = 0.05$ level of freedom since most of the data obtained was categorical. The t-test analysis was used to determine if the mean scores of different groups were significantly different.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Characteristics of Households

The main household characteristics considered were age, gender, household size and composition, income level, occupation and education level. The household size and composition were considered in order to determine how they impacted on water consumption and/or demand. The number of individuals in a household and its gender parity were important parameters considered since they affect the amount of water demanded.

From figure 5, 58.4% of the respondents were aged between 23 and 40 years. Of these, 34.5% were females with the males accounting for 23.9%. This could be because data collection was mainly carried out during the day when most males were at work. Due to gender roles, it was mostly women who were found at home during the day. In total, all the women interviewed accounted for 63.4% while the males constituted 36.6%. This shows that gender is often an important factor in explaining water use, but "the direction of the influence depends on the specific cultural context". For example, according to the World Bank (1993), female respondents' willingness to pay for water exceeds that of men in Tanzania and vice versa in Haiti.

The data also indicates that there was a small ageing population in these estates. 3.7% of the respondents were aged above 60 years with 2.1% of these being females. Those aged between 12 and 22 years represented 24.3% of the respondents. The big difference in numbers between males and females in this age group could have been due to the presence of a large number of female house-helps especially in the medium and high income estates. This is because the residents of these estates can afford to hire house-helps unlike in the low income households.

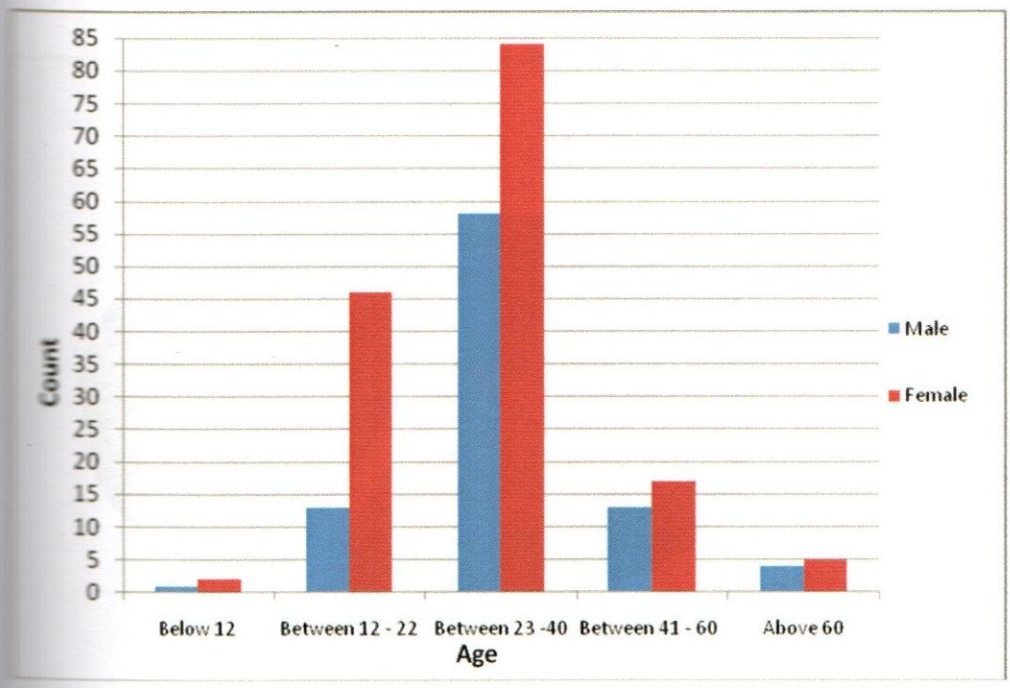

Figure 5: Age and Gender Categories at the study sites

Source: Field Survey, 2011

In the study, the building materials and size of houses were used as indicators of the income levels of its occupants. For example, no mansionnates or bungalow were found in Kaptembwo which is a low income estate indicating a low income of the residents. Data on the types of houses was important because it helped in assessing the relationship between income levels, types of houses and hence water demand. It was found that the most common type of houses across the three estates were flats with 33.2% of the respondents living in such houses. These types of houses were most common in the middle income estate (Shabab) and the low income estate (Kaptembwo). The mansionnates and bungalows (23.9%) were common in Milimani which is a high income estate. The 21.3% semi-permanent houses were all found in Kaptembwo and the bed-sitters which accounted for 21.6% were spread across the middle income and low income estates of Shabab and Kaptembwo. This is because those living in these estates are not financially able to own or rent better houses. Within the study area, 73.8% of the mansionnattes, 92.9% of the bungalows, 95.7% of the semi-permanent houses, 75.9% of the flats and 95.5% of the bed-sitters were rented facilities. Figure 6 below represents these different categories of houses.

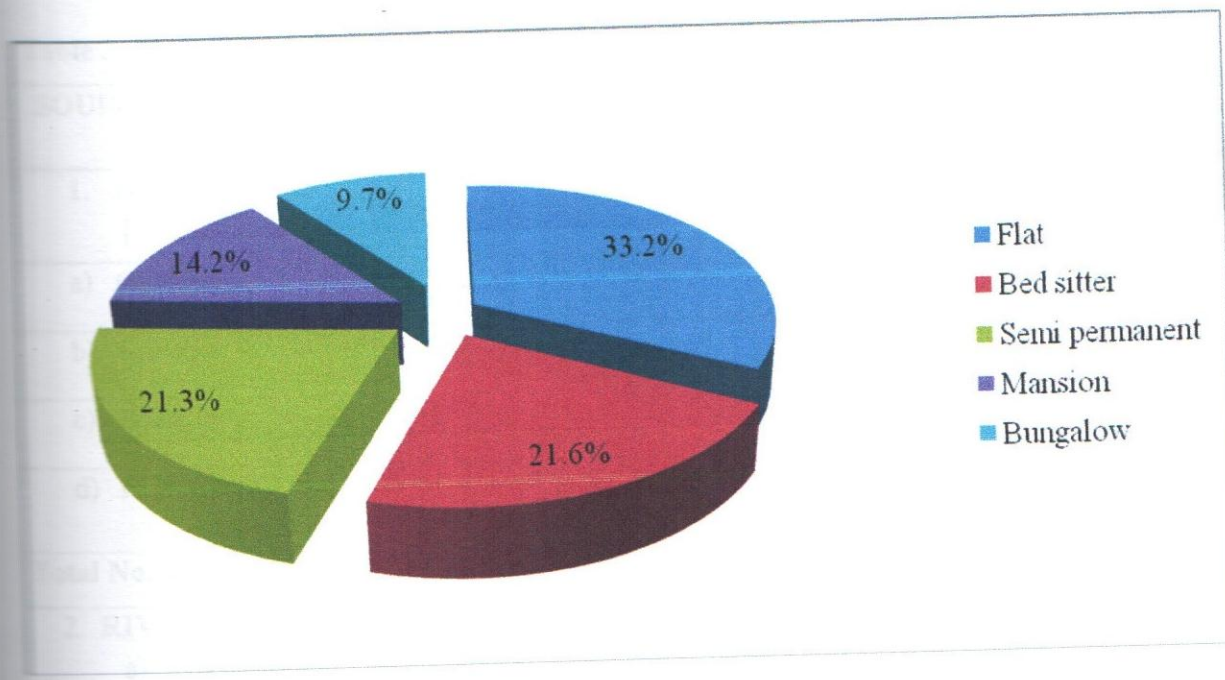

Figure 6: Categories of houses

Source: Field Survey, 2011

4.2 Water Sources for Nakuru Municipality

From an interview with NAWASSCO officers, it was found that the Nakuru Municipality receives water from two main sources namely boreholes and rivers. Table 3 shows the names of the rivers and bore holes and their pump abstraction levels. The study found that currently, there are a total of 20 active boreholes supplying water to the Nakuru Municipality. According to NAWASSCO officers, once abstracted the water is treated at a Municipal facility before distribution. The government stipulates that all such water sources need to be protected to ensure their cleanliness and safety. Where conventional treatment systems fail, the government requires that the water be boiled before consumption. From Table 4, the Nakuru Municipality supplies 50,800 liters of water on a daily basis to its residents. However, according to data collected from Nakuru Rural Water Services Company (NARUWASSCO) who are the custodians of the river Thurasha water project, they are currently only supplying 5,500 liters to NAWASSCO. This is because 1,500 liters is supplied to Kiamunyi estate and its environs (NARUWASSCO, 2009).

Table 3: Main Water Sources for NAWASSCO, Nakuru Municipality

SOURCE	NUMBER OF PUMPS	TOTAL ABSTRACTION [Litres/Day]
1. **BORE HOLES** [Location]		
a) Ol- Banita	4	8,500
b) Kabatini	8	16,500
c) Baharini	5	9,500
d) Nairobi road	3	6,500
Total No. of B/holes	**20**	**30,000**
2. **RIVERS**		
a) R. Thurasha		5,500
b) R. Malewa		4,300
Total		**50,000**

Source: NAWASSCO, 2011

The Nakuru Municipality residents indicated that they have a variety of water sources for their domestic use which include; the Municipal council through NAWASSCO, water vendors (62.5% of water vendors said that they got their water from private water works), communal water kiosks, Individual tube well (especially in schools and some parts of Milimani estate) and rain water.

According to Odongo and Mungai,(2002), the cost of developing new water sources to cater for increased demand, expanding existing sources and improving existing distribution networks is always higher after the most accessible water resources have already been tapped. At the same time, governments are becoming reluctant to pay the rising investment costs as long as utilities are unable to meet these costs from user charges (UNEP, 2002). To achieve the 60% metering requirement, the government and/or the water utility must be willing to progressively invest in developing new water sources. This can be achieved through seeking new abstraction sites or formulating policies to encourage roof water harvesting and storage either through local by-laws

or government housing policies. According to officials from NAWASSCO, there has been no new water abstraction sites developed or expanded for the Municipality over the last five years.

Households Perception on Water Quality

From Figure 7, 53.9% of the households considered the water they used to be clean and safe. However, 23% said they did not consider the water to be clean and safe while the further 23% said they were not sure. The data also showed that 93.5% of the respondents said they did not treat the water further but rather consume it as supplied by NAWASSCO since they considered it to be from certified sources.

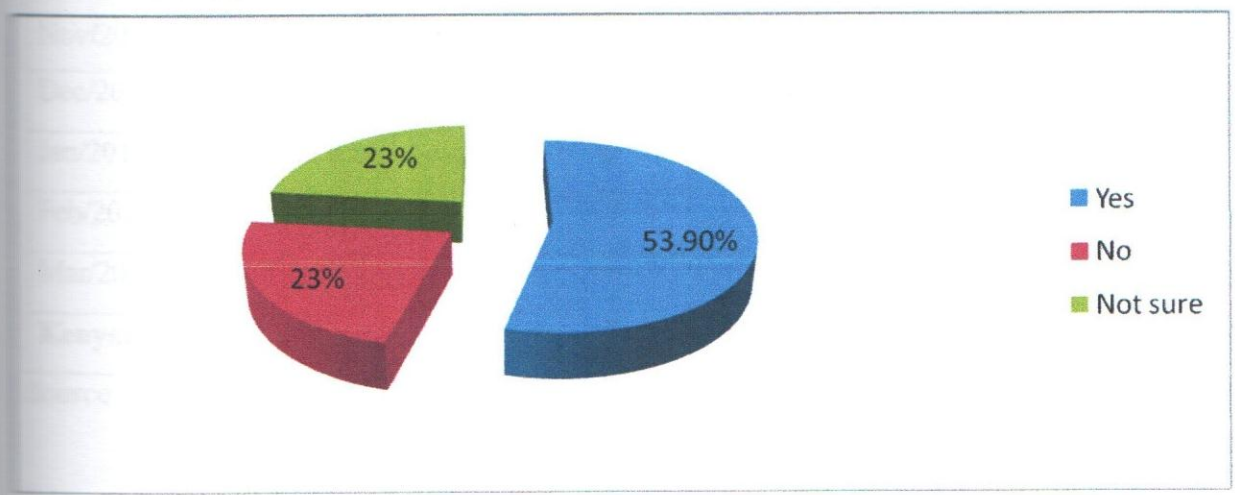

Figure 7: Household perception on water quality

Source: Field survey, 2011

This was collaborated by secondary data obtained from NAWASSCO water quality monitoring laboratory. Water samples are periodically tested both at the source and at chosen consumer sampling points. The most common parameters/substances tested include water temperature, turbidity color, PH, chloride, fluoride, heavy metals and conductivity. The values obtained are then assessed against Kenyan water quality standards as dictated by the Kenya Bureau of Standards. Some of their data bank during the period of my research is shown in Table 4 below. The table indicates that most of the substances tested during this period were

within the set Kenyan standards. However, most sample sites registered high fluoride levels which NAWASSCO officials said they do further treatment to achieve the set standards.

Table 4: Water Quality Analysis

Units		°C	NTU	pH scale	mg/l
	Sampling Points	Temp.	Turbidity	pH	Fluoride
May/2010	Baharini borehole	25	10	6.5	1.1
Jun/2010	Turasha River	18.8	12	7.8	0.6
Jul/2010	Kabatini borehole	27.6	-	6.3	0.4
Aug/2010	Malewa river	20.4		6.9	3.0
Sep/2010	Nairobi rd borehole	32.1	0	7.1	4.2
Oct/2010	Olebanita borehole	17.3	7	6.5	3.7
Nov/2010	Turasha River	20.3	8	7.0	5.0
Dec/2010	Baharini borehole	23	2	6.8	3.8
Jan/2011	Nairobi rd borehole	29	6	7.4	5.1
Feb/2011	Malewa river	19	12	6.3	1.4
Mar/2011	Baharini borehole	28	5	7.2	3.7
Kenyan Standards (maximum)		**27**	**15**	**6.5-8.5**	**1.5**

Source: NAWASSCO Observatory Laboratory, 2012

Table 5 shows that 88.1% of all respondents rely on municipal water supply while only 11.9% relied on private water works and vendors. It was noted that of all the respondents relying on municipal water supplies, 67.4% were households, 1.3% were hospitals, and 8.4% were hotels and restaurants while 11% were schools. An analysis by location for reliance on municipal piped water is shown in table 6 below. This table indicates that 93% of the respondents in Shabab, and 88% of those in Milimani rely on piped water from the municipal supplies. However, the number of those relying on municipal piped water from Kaptembwo is much less with only 48.7% saying they rely on municipal water. Those without piped water said that they got their water from bicycle vendors.

The problem of low metering level in these low income areas was attributed to insufficient funds to improve the infrastructure as well as low capacity. The municipal council is currently undertaking water kiosk installation programs in these low income areas to address the needs of the 30% without piped water. They are also addressing past neglect on water service infrastructure to increase accessibility. On the other hand, with the population growth within the municipality at 7% (KNBS, 2006), most of the increase is expected in the low income areas which aggravate the water problem already existing in these areas. This increase in population will lead to the growth of slums leading to the inevitable problem of environmental degradation.

Table 5: Respondents Using Municipal piped water

Respondent	Municipal piped water		Total %
	Yes %	No %	
Household	67.4	11.6	79
Hospital	1.3	0	1.3
Restaurant/ Hotel	8.4	0	8.4
School	11	0.3	11.3
Total	88.1	11.9	100

Source: Field Survey, 2011

The levels of reliance by the respondents on Municipal water supply were also assessed. The data showed that 93% in Shabab and 88% in Milimani relied on the Municipality as a water source since most of them had the networks in place. However 51.3% of the respondents from Kaptembwo said they did not rely on this water source. This was because of the absence of networks and the heavy operation of vendors in this estate. Table 6 contains this information.

Table 6: Municipal water use by location

Residential area	Municipal piped water		Total (%)
	Yes (%)	No (%)	
Kaptembwo	48.7	51.3	100
Milimani	88	12	100
Shabab	93	7	100

Source: Field Survey, 2011

The Chi-Square analysis of the Nakuru municipal council as a water source in Table 7 below indicates that the Council (NAWASSCO) was a significant source of water for the Nakuru Municipality residents. The outcome shows that the council (NAWASSCO) unlike rainfall, tube wells and private waterworks whose tests were insignificant is a major water source for the Nakuru Municipality households and institutions. NAWASSCO obtains 75% of its supply from ground water as Table 4 shows raising the issues of the need for fresh water to be managed and not to be left to market forces.

Table 7: Chi-Square Test for the Municipal council as a water source

Test	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.584(a)	3	.035
Likelihood Ratio	13.106	3	.004
Linear-by-Linear Association	7.757	1	.005
N of Valid Cases	310		

Field Survey, 2011

The period that water vendors had carried out business was assessed and it was found that 55.8% had carried out business for up to five years and 14% had been in that business for over 10 years as shown in Table 8 below. This signifies that a greater number of those interviewed

were not new to the water vending business. The presence of water vendors for such a long time also indicates that water has been a problem within the municipality for a long time.

Table 8: Average duration of water selling by vendors

Duration	Frequency	Percent
1-5 years	48	55.8
6-10 years	26	30.2
over 10 years	12	14.0
Total	86	100.0

Source: Field Survey, 2011

Water vending is a big business and therefore a source of water for residents within the Municipality. Trucks, handcarts and bicycles are the most common means used by the vendors to transport water. Figure 8 shows that 37.5% of the small scale vendors relied on Municipal water supplies while 62.5% said they got their water from private water works. This implies that some of the water sold to the Nakuru Municipality residents may be less than sanitary water which can have far reaching health consequences on the consumers.

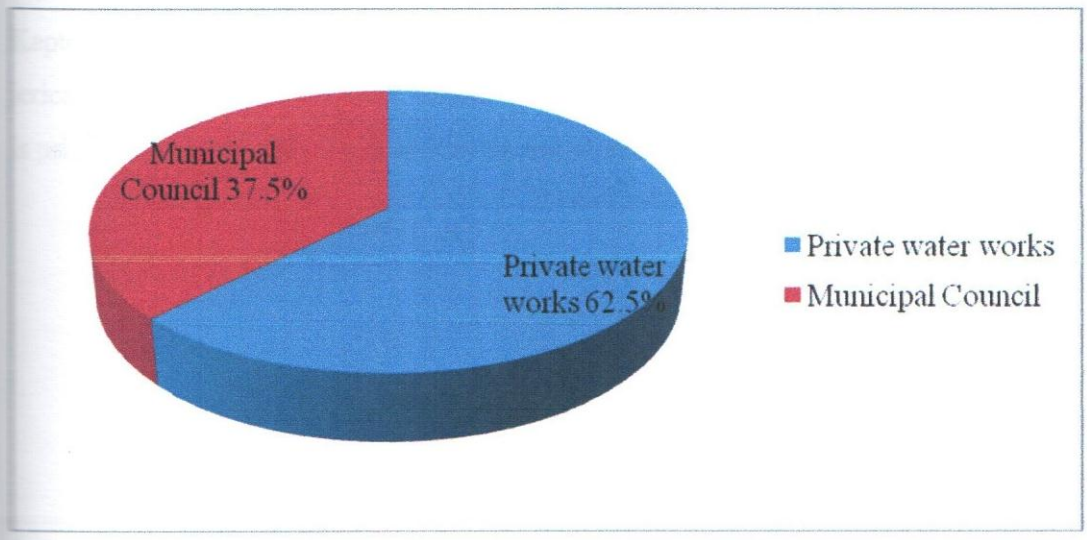

Figure 8: Sources of water for vendors

Source: Field Survey, 2011

Sixty six point three percent of the vendors said that they sold on average 200 to 400 liters of water daily. This is the equivalent of 5 to 20 jerri-cans per day. From Table 9, 33.7% of them said that they sold more than 500 litres of water daily. It was however difficult to establish these claims since the vendors were not directly billed by the water service provider.

Table 9: Average Water sold by Vendors per Day in Shabab and Kaptembwo

Amount sold (litres)	Frequency	Valid Percent
100-200	20	23.3
200-400	37	43.0
Over 500	29	33.7
Total	86	100.0

Source: Field Survey, 2011

Plate 1 below shows one of the main water selling and distribution points within Kaptembwo estate. There were no small scale vendors observed at the Milimani estate indicating that reliance on vendors was minimal in this estate. The only vendors found here were large scale vendors who sold bulk water using vehicle tankers. There were three (3) vending stations identified in the Kaptembwo while only 1 was identified in the Shabab estate. The vendors pool together water jericans in several stations from where the residents purchase. One of these water selling points is privately owned while three are run by the Municipal council through NAWASSCO.

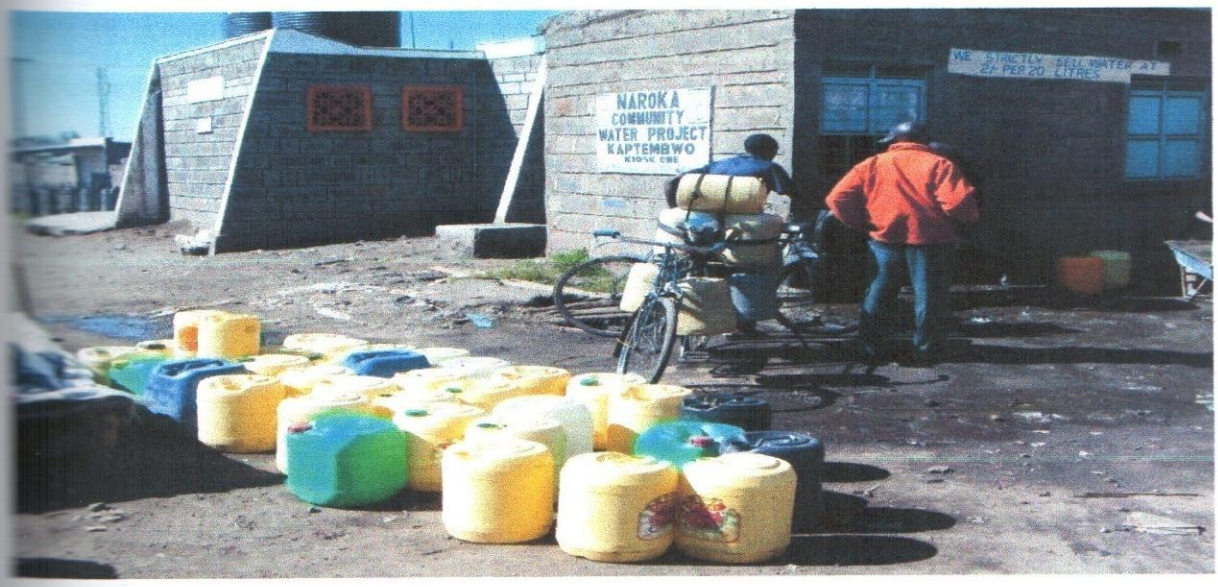

Plate 1: Naroka Community Water Project in Kaptembwo, Nakuru

Source: Field Survey, 2011

There were a number of bulky water vending vessels like the one in Plate 2 (Appendix 2) within the Nakuru Municipality. They sell most of their water to institutions and the high income Milimani estate. This was so because those in Milimani have sufficient storage and can afford the bulky water which is usually cheaper than bicycle vended water. They usually buy this water when the Municipal supplies are inadequate or during periods or low pressure. Other Plates showing the different water vending mechanisms are found in Appendix 2.

4.3 Daily Per capita Water for Households and Institutions in Nakuru Municipality

Table 10 gives a case summary of the findings on daily per capita water for Nakuru Municipality households and institutions. Most of the respondents use less than 120 litres of water per day with only 25% using more than 27 litres of water per day. The 5% of institution that indicated using between 101 litres and 120 litres of water daily were mostly public schools whose supply networks were mostly dry and depended on vended water. Other institutions constituting 75% said they were not sure of how much water they were using. This was because a part of the Municipal metered water supply, they also depended on vended water. Some also claimed that the bills they received were not a true reflection of their monthly water consumption.

Table 10: Amount of water used per day in litres

Households and Institutions	Amount of water used per day in litres							Total
	below 40	41-60	61-80	81-100	101-120	over 120	not sure	
Households	6.6%	21.9%	14.9%	17.4%	14.5%	24.8%	0%	100%
Institutions	0%	0%	0%	0%	0%	25%	75%	100%

Source: Field Survey, 2011

Gleick (1996) suggests that in developing countries, a minimum of 3 litres per capita per day is required for adults in most situations for drinking. However, households with least access to water supplies are more likely to be engaged in at least moderate activity and often in above-average temperatures. White *et al.* (1972) provides estimates of water quantity needs at different temperatures and activity levels. They suggested that 2.6 litres of water per day is lost through respiratory loss, insensible perspiration, urination and defecation. In addition, a significant quantity of water is lost through sensible perspiration if hard work is performed. They note that under extreme conditions of hard work at high temperatures in the sun the per capita water could rise to as much as 25 litres per day. However, households with least access to water supplies are more likely to be engaged in at least moderate activity and often in above-average temperatures thus requiring a relatively higher water per capita (White *et al.,* 1972).

Norms for quantities of water to be supplied have been varied for certain specific conditions. For instance the sphere project sets out 15 liters of water used per capita per day per person as being a key indicator in meeting minimum standards for disaster relief (Sphere, 1998). Well, (1998) suggested that a minimum criterion for water supply should be 20 liters per capita per day. A similar figure has been suggested by Carter *et al.*, (1997). Gleick (1996) suggested that the international community adopt a figure of 50 liters per capita per day per person as a basic water requirement for domestic water supply. However, the amount of daily water per capita varies with the individual, as it depends on the condition of the subject, the amount of physical exercise and on other environmental factors (Wright, 1993).

Table 11 shows that 26.6% of Kaptembwo residents use between 61 and 80 litres of water per day. This translates to between 13.5 litres and 17.8 litres per capita water per day. Those using below 40 litres (i.e. 8.9 litres daily per capita water) were 10.4%. Only a small percentage (11.8%) had over 26.7 litres daily per capita water (over 120 litres daily) in this estate. The highest percentage recorded in Shabab was 36.7% which represented those who used over 120 litres of water daily. This is equivalent to 26.7 litres percapita water daily which is a much higher mount per head than in Kaptembwo. In the Milimani estate, 68.3% of the respondents used more than 120 litres of water daily translating to more than 26.7 litres daily per capita. These statistics show that a greater percentage of the respondents in Milimani had higher daily water per capita followed by Shabab and lastly Kaptembwo. This was attributed to the presence of a better supply network especially in Milimani and Shabab. Those in Milimani also rely heavily on tanker truck water which is sold in bulk and hence cheaper than bicycle vended water most common in Kaptembwo and parts of Shabab.

Table 11: Amount of water used per day in the different Estates

Estate	Amount of water used per day in litres							Total
	below 40	41-60	61-80	81-100	101-120	over 120	not sure	
Kaptembwo	10.4%	14.6%	26.6%	19.4%	13.5%	11.8%	0.7%	100%
Shabab	2.2%	5%	10.6%	11.8%	22.6%	36.7%	11.1%	100%
Milimani	0%	0%	0%	0%	2.4%	68.3%	29.3%	100%

Source: Field Survey, 2011

Figure 9 gives a summary of all respondents' responses as to whether they considered the water they received to be enough. 72.5% of them said the water was not adequate while 27.5% of them said the water they received was adequate. But most of those who said had enough water were institutions especially schools which had private boreholes. As found out, this was necessary in order to ensure a more reliable supply was available to these institutions. 53.2% of

those who said the water they received was not enough were from Kaptembwo while only 2.4% were from Milimani with the rest (19.4%) coming from Shabab. Access to sufficient, clean and safe water directly impacts on sanitation and health (WHO, 2008). This scenario has contributed to the cleaner environment in the high income households and a higher prevalence of diarrheal and other water related diseases in Kaptembwo.

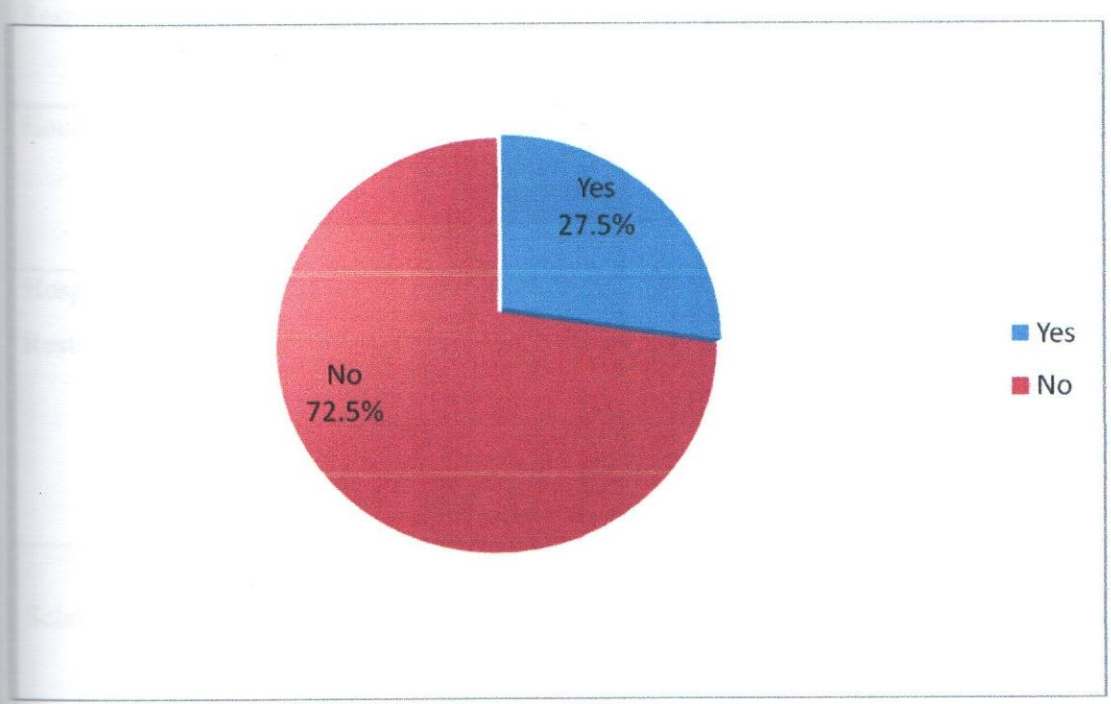

Figure 9: Water Adequacy

Source: Field Survey, 2011

Table 12 shows the respective percentages for their responses. 78% of the households said they did not have enough water citing scarcity as the major reason for this inadequacy. All the hospitals interviewed said they had enough water while only 28% of the hotels and restaurants said they had enough water. The scenario was however slightly different in schools where more than half indicated that they had enough water. This was attributed to the fact that a number of the schools had private sources from their private tube wells. The remaining 42.9% of the schools lacked enough water and had to offset their deficit by relying on bulky water vendors. Those respondents not receiving enough water gave a number of reasons for the inadequacy with the most frequent reason for households being scarcity or rationing at 74.0%. Scarcity and

rationing accounted for 72.2% for hotels and restaurant and 74.4% for school as the reasons for not having enough water. 1.5% of the households cited lack of funds as a cause of inadequate water supply while this figure was 5.6% for hotels and restaurants.

Table 12: Responses on Water adequacy

Respondent	valid	Frequency	Percent	Valid Percent
Household	yes	54	22.0	22.0
	No	191	78.0	78.0
	Total	245	100.0	100.0
Hospital	yes	4	100.0	100.0
Restaurant/Hotel	yes	8	30.7	28.0
	No	18	69.2	72.0
	Total	25	96.2	100.0
School	yes	20	57.1	57.1
	No	15	42.9	42.9
	Total	35	100.0	100.0

Source: Field Survey, 2011

It was found out that hospitals used on average 2,477 units of water monthly for a number of reasons. Firstly, many procedures require the use of large amounts of water including the sterilization of apparatus and equipment for hospital staff and patients. Secondly, the staff and patients are in the institutions for 24 hours each day. Also, hospital cleaning takes place a number of times in a day as a measure to control the possible spread of diseases while more water is used for amenity purposes especially for the lawn. This is because a beautiful environment is considered as an occupational therapy for the sick.

4.4 Socio-economic Factors Influencing Water Demand among Nakuru Municipality Households

The socioeconomic factors considered in this study were age, household size and composition, education level, income level and occupation. Education level of households has a direct bearing on the type of jobs they have, the amount of money they earn and hence where they are likely to stay within the Municipality. Occupation influences the household's income and hence the amount of funds available to spend on water. Financial hardships may be an incentive for water consumers to cut back on essential water use, probably resulting in damage to personal and public health. Table 13 shows the impact of these socio-economic factors on demand for water within the Nakuru Municipality.

Table 13: Socio-Economic factors influencing Water Demand

Socio-economic factor	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	2.145	0.802		2.675	0.008	0.566	3.725
Age	0.092	0.136	0.040	0.674	0.501	0.176	0.359
Household size	0.648	0.094	0.411	6.892	0.000	0.463	0.834
Male's education level	-0.082	0.156	-0.033	-0.523	0.601	-0.389	0.226
Male's income level	0.068	0.070	0.062	0.966	0.335	-0.070	0.206
Father's occupation	0.052	0.071	0.043	0.722	0.471	-0.089	0.192

Source: Field Survey, 2011

Household average size incorporates not only individuals related by blood but also those who are related by marriage and distance relations. Household size is an important consideration in household water use as it impacts on hygiene and human health. As shown in the Table,

household size with a t-value of 6.9 (p= 0.001) has a significant impact on water demand implying that the larger the family size the more the amount of water consumed or demanded. Shonnar (2007) observed a similar relationship between household size and the demand for water. The amount of water demanded or consumed in a household may also increase when the number of young, elderly and invalids is higher (WHO, 2008). This has been attributed to the fact that more water will be required to maintain a high level of hygiene for these vulnerable groups. Additionally, these dependents require a higher frequency of cooking, bathing and laundry and hence more water will be used. Table 13 shows a negative t-value for education level. This is so because water is a basic commodity and hence its demand is not dependent on one's education level. This reasoning would also be used to explain why there were no significant relationships between occupation and water and income level.

On average, the modal class for household size was found to be 3 to 4 members and this accounted for 35.2% of the total households while those with 5 to 6 members constituted 32.6%. These averages are close to the national figure for household size of 5.1 (Ministry of Planning and National Development, 2007) and are shown in Table 14 below. About twenty one (21.1%) of the respondents indicated there were more than seven occupants per household. This was attributed to big families and staying relatives especially in the Kaptembwo estate and the presence of more than one house help and/or garden boys in the Milimani estate. It was found out that the higher the number of occupants in a household, the more the water they consumed and vice versa.

Table 14: Average household size

Household size	No. of HH (Respondents)	Percentage (%)
1-2	34	13.6
3-4	103	41.2
5-6	93	37.2
7-8	10	4.0
9-10	10	4.0
above 10	0	0
Total	250	100.0

Source: Field Survey, 2011

Household Education level

The household education attainment was also studied and was described as either being illiterate, having adult education, or having acquired primary level, secondary level or tertiary level. This was done in order to make inferences on possible water use benefits of higher education. Increased educational attainment would suggest that the household recognizes the value of water and thus invest on water saving technologies. Table 15, indicates that 8.7% of the respondents were illiterate with a higher percentage of these being adult males and females. However, the lowest illiteracy level was registered by the male youth (1.0%). Most adult male respondents (40.8%) had secondary education and at least 94.5% of them have a minimum of primary education. From the table, it can be noted that most of the males interviewed had secondary education representing 40.8%.

On the contrary, 42.9% of adult female respondents were found to have primary education but the number of adult female respondents with tertiary education level was only 12.3%. Tables 15 below also indicate that there were more females who attended adult education (6.5%) as compared to the percentage for males (1.6%). This index for males was higher than for females who had 34.5% with secondary education. 42.9% of the females had gone up to primary level with 3.9% being illiterate.

Table 15: Education Levels for Nakuru Municipality Respondents

Education Level	Father		Mother		Son(s)		Daughter(s)		Relatives	
	Count	%	Count	%	Count	%	Count	%	Count	%
Illiterate	12	3.9	12	3.9	3	1.0	7	2.3	27	8.7
Adult educ	5	1.6	20	6.5					46	14.8
Primary	94	30.4	133	42.9	62	20.0	150	48.4	135	43.5
Secondary	126	40.8	107	34.5	159	51.3	108	34.8	77	24.8
Tertiary	72	23.3	38	12.3%	86	27.7%	45	14.5	25	8.1

Source: Field Survey, 2011

Table 16 shows that a greater percentage of the respondents had attained secondary education. In Milimani, 57.1% had post-secondary education where the highest literacy level was recorded in Milimani estate. Most communities put more emphasis on educating the boy child and hence the reason for a higher literacy level among the males across the different estates. Milimani is a high income residential area and its residents have the ability to finance secondary and post secondary education. This explains why most of those with tertiary education came from this residential area. Milimani estate registered the highest literacy level as well as the highest per capita water.

Thompson et al (2001) notes that in East Africa, average water consumed by households with higher education levels was found to be marginally higher than those households with less education. Higher levels of education were an indicator of higher income which gives the residents in high income estates a higher propensity to consume water. Education level for both the males and females from the various households was assessed against their areas of residence as shown in the cross tabulations in Tables 16 and 17.

Table 16: Male's education level

Male education level	Residential Area						Total	
	Kaptembwo		Milimani		Shabab			
	Count	%	Count	%	Count	%	Count	%
Illiterate	3	1.6	0	0	9	8.7	12	3.9
Adult education	0	0	0	0	4	3.1	5	1.6
Primary	60	32.4	3	21.4	21	20.4	84	27.6
Secondary	86	46.5	4	28.6	40	38.8	131	43.1
Tertiary	36	19.5	8	57.1	29	28.2	72	23.7
Total	185	100	14	100	103	100	304	100

Source: Field Survey, 2011

From Table 17, 43.5% of the females in Kaptembwo had attained primary education while 38.7% had tertiary education. Only one of the females in Milimani had adult education with all the others having a minimum of primary education. No females in Milimani were illiterate just like in the case of males. In Shabab, 41.7% of the females had gone up to primary level while 18.4 had a tertiary education level. The percentage of those who have primary education was proportionally higher in Milimani than Shabab.

These statistics indicate that there is a weak relationship between the place of residence and the level of education for the parents in the households. A greater percentage of females and males in Milimani had secondary and tertiary education compared to Shabab and Kaptembwo estates. The only 12 illiterate females were recorded in Kaptembwo and Shabab estates as reflected in Table 17. This was similar for males where 12 of them were illiterate but only from Kaptembwo and Shabab. The levels of adult education were highest in females and again mostly concentrated in Kaptembwo and a few in Shabab. These findings agree with those of Thompson, (2001) since it was found out that the amount of water consumed in Milimani is marginally higher than that in Shabab and Kaptembwo estates. Despite the disparity in education levels in the three estates, the amount of water demanded did not reflect this. This is because water is a basic commodity whose requirement does not depend on education level.

In most developing countries, women and girls are responsible for collecting water for cooking, cleaning, health and hygiene (Tudor, 2003). There is need therefore to have gender sensitive education for both men and women since women are the caregivers and managers of the household (UNEP, 20002). According to Tudor (2003), limited investment in education especially on women may have a tremendous effect on family health. The Focus group discussions done in this study established that where literacy levels were such as at Milimani high cases of water related diseases were low and vice versa.

Table 17: Female's education level

Female's education level	Residential Area						Total	
	Kaptembwo		Milimani		Shabab			
	Count	%	Count	%	Count	%	Count	%
Illiterate	4	2.1	0	0	8	7.7	12	3.8
Adult education	13	7	1	5.3	6	5.8	20	6.5
Primary	101	54.3	9	47.4	43	41.7	133	42.9
Secondary	52	30	7	36.4	27	26.2	107	34.5
Tertiary	16	8.6	2	1.1	19	18.4	38	12.3
Total	186	100	19	100	103	100	310	100

Source: Field Survey, 2011

Occupation Levels of the Residents and Their Willingness to pay for Water Services

This study endeavored to assess if there was any relationship between occupation level and water demand. Figure 10 shows the occupation levels for males within Nakuru Municipality. 37.7% of the males were self employed with 29.0% being casual laborers, 22.6% having white collar jobs and 9.7% being jobless. Of the residents 1% were school going children. 89.3% of the residents were secularly employed and expressed their willingness to pay for whatever amount of water they needed for their use. Therefore, their occupations did not significantly affect the amount of water demanded. Kabeya (2000) on a study in Kisumu Municipality concluded that the amount of water demanded by residents within the Municipality was not a reflection of the type of occupation of the individual households.

The economic performance of a community can be assessed by the occupation of the residents. Cairncross and Feachem (1993) and Well (1998) suggest that where water is purchased, the price may be a limiting factor on the quantity of water used. However, Cairncross and Kinnear (1992) show that the price of water purchased from vendors in Khartoum, Sudan, did not lead to a significant reduction in the quantity of water procured. Cairncross and Kinnear (1992) further suggest that in poorer communities, where an increasing proportion of household income must be spent on acquiring water, the only major item of expenditure available for sacrifice was the food budget and therefore it was probable that high costs of water were

contributing to under-nutrition. Residents who were connected to water networks, and who had not had a problem in water supply, showed more willingness to pay. Osama (2007) reports similar results in his work on affordability and willingness to pay in Palestine.

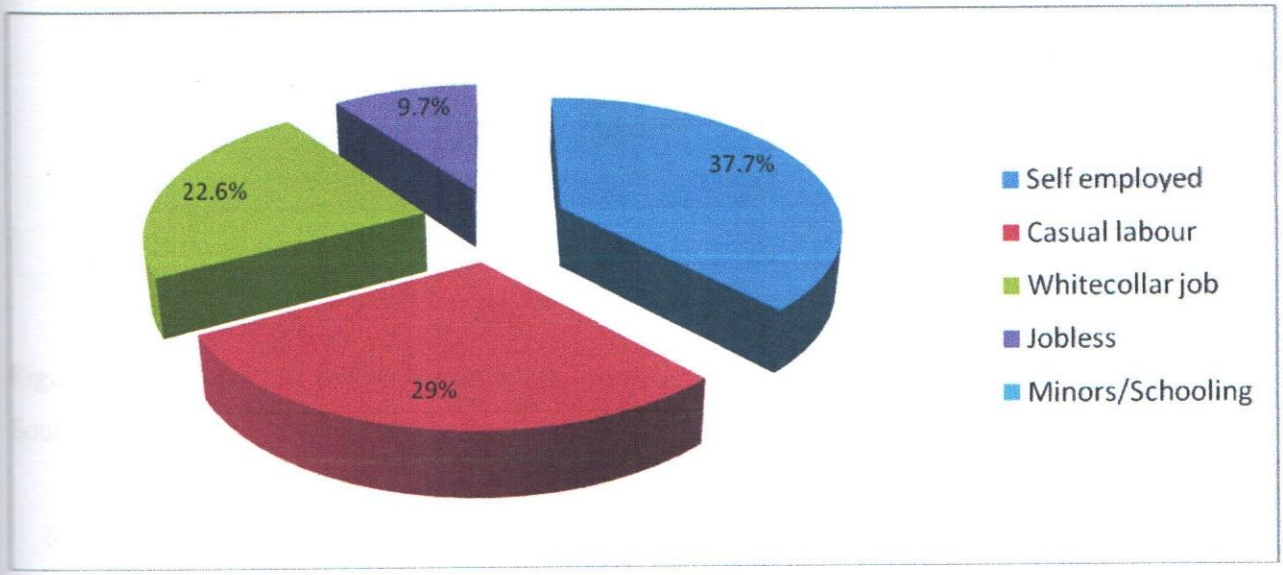

Figure 10: Occupation Levels for Males

Source: Field Survey, 2011

Figure 11 shows the occupation levels for females within the area of research. As can be seen, 47.1% of the women were self employed compared to 37.7% of men. Those women who were self employed were found to be running food kiosks, charcoal shops and grocery shops among other small private enterprises. However, 19% of the women interviewed worked as casual laborers while men were 29%. The occupation of females as in the case of males did not seem to significantly affect the amount of water demanded. This may be because conventionally it is men who mostly pay for bills even in cases where their wives are working while the inordinate burden to fetch and the management of household water is mostly viewed as a female issue (Tudor, 2003). The 10% of minors/school going were those females who responded to our questionnaires but were either minors or were school going.

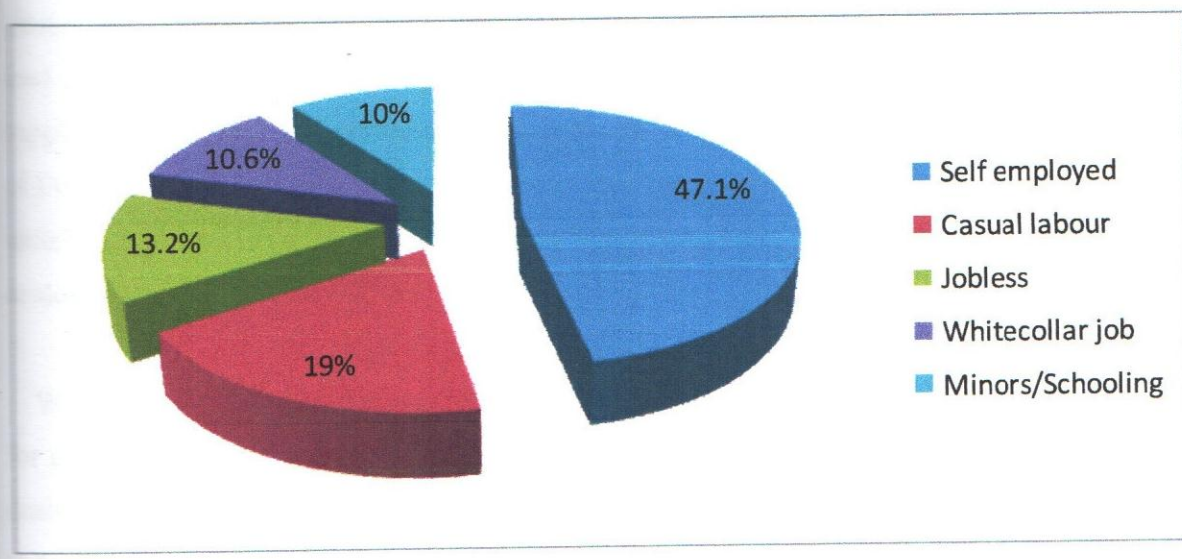

Figure 11: Occupation Levels for Females

Source: Field Survey, 2011

Sixty percent of the water vendors sold water to the low income estates at between Ksh. 15.00 and Ksh. 20.00 for a 20 liter jerrican. However, the metered high and middle income households paid up to Ksh. 500.00 for 11 units which are equivalent to 11,000 liters. This translates to Ksh. 0.05 per liter or Ksh. 0.9 per 20 liter jerrican. This is less than what respondents were paying in the low income households. Howard (2002) reports that there is limited evidence of a significant association between cost of water and quantities of water collected. However, according to OECD (2003) for many countries, the poor are expected to devote a larger than average proportion of their income to water charges. For example, in Soroti, in Uganda quantities of water were actually greater from sources where payment was required (Howard, 2002). According to Howard (2002), this willingness to pay is likely to have been a function of access.

This was similar with the findings of this research where 92.6% of households, 100% of hospitals, 88% of hotels and restaurants and 68.6% of schools said they would be willing to pay for whatever amount of water they needed if it was available (Table 17). In Morocco, Mephail (1993) found out that the poor pay up to 50% more than those living in high income areas (UNICEF 2000). In peri-urban areas Mauritania, it was found that the poor pay as much as 14 to 20 percent of their household budget for water and in peri-urban Malawi, the poor pay up to 12 times more than the affluent (UNICEF, 2000). This means that residents in the low income

states use a greater percentage of their disposable income in paying for water. This is likely to lead to a budget constraint which compromises the family's ability to acquire adequate food supplies. This in turn will contribute to poor health, a weak workforce and hence low standards of living. To curb this, OECD (2003) suggests that the waiving or reducing the charges on "early units" in a given billing period as an income support measure can help the poor. This would be analogous to an increase in income for them.

Willingness to pay is an expression of the demand for a service, and it is a strong prerequisite for sustainable cost recovery because it is the materialization of users' satisfaction and of their desire to contribute to its functioning (Cardone and Fonseca, 2003). This willingness to pay for water services was used as a proxy of income. Direct techniques for the estimation of willingness to pay would be based on the observation of what people actually did in order to ensure water provision (including how much money they had to pay for it). Since most respondents were not exact on how much they were spending on water monthly, the indirect ways drew conclusions from users' responses to hypothetical questions about their willingness to pay for water services (Hope and Garod, 2004).

The responses in Figure 12 shows that 89% of all types of respondents were willing to pay for whatever amount of water they needed, while 11% said that they were not able. This is an indication that water inadequacy is not a function of income and/or education level.

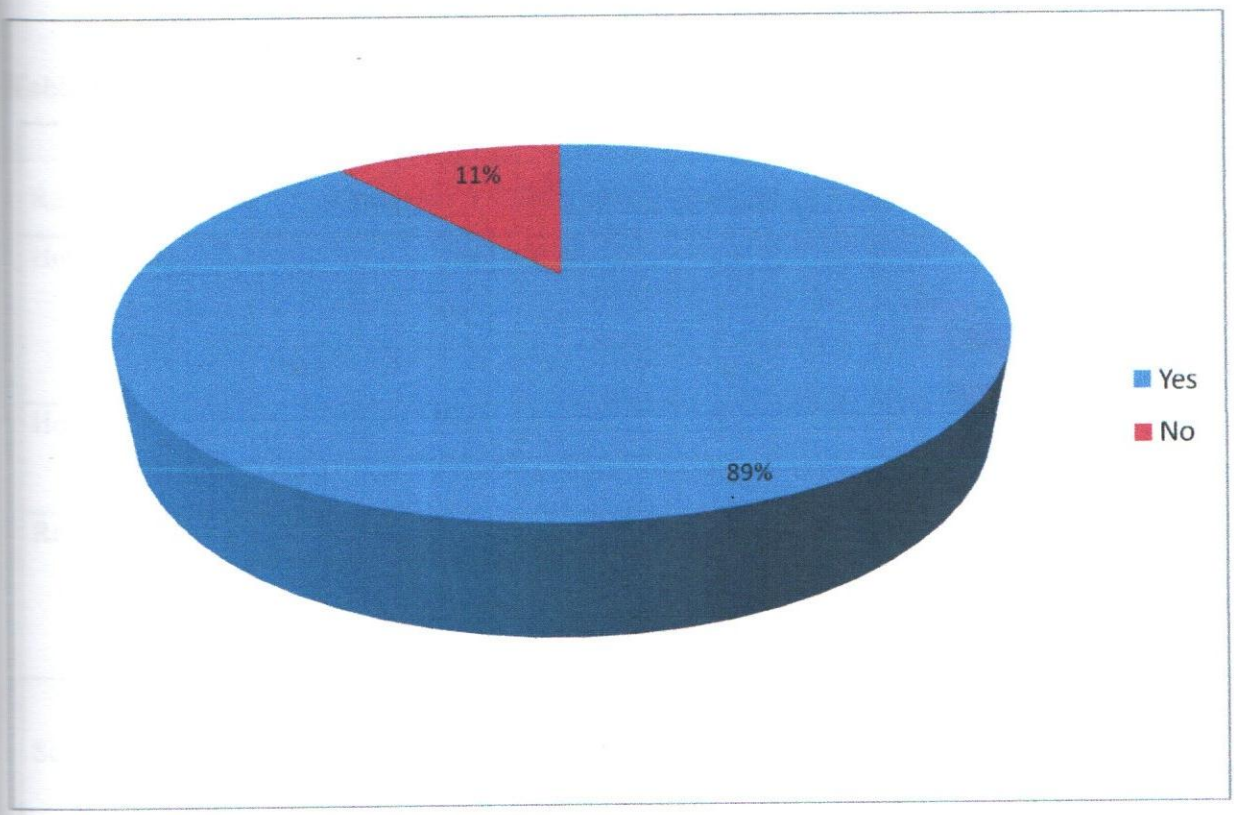

Figure 12: Willingness to pay for water services by respondents

Source: Field Survey, 2011

Table 18 shows the responses from the different respondent types. It shows that most of the respondents were willing and able to pay for whatever amount of water they needed if it was available. Only 35 schools (50%) responded to this question due to the fact that some schools had private water sources. This accounted for the 31.4% who answered no to this question.

Table 18: Ability of Respondents to pay if more water was available

Respondent	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Household	Yes	224	91.4	92.6	92.6
	No	21	8.6	7.4	100.0
	Total	245	100.0		
Hospital	Yes	4	100	100.0	100.0
	Total	4	100.0		
Restaurant/Hotel	Yes	22	84.6	88.0	88.0
	No	4	15.4	12.0	100.0
	Total	26	100.0		
School	Yes	24	68.6	68.6	68.6
	No	11	31.4	31.4	100.0
	Total	35	100.0	100.0	

Source: Field Survey, 2011

A comparative survey was carried out to assess how much the respondents were spending for other services such as electricity. This was used as a proxy to determine the respondent's actual ability to pay for services. In Appendix 5, Table A2 shows that 22% of the households paid more than Ksh. 900.00 for electricity. Approximately 60.4% of the households paid between Ksh. 300.00 and over Ksh. 900.00 for electricity on a monthly basis. A comparative analysis between the latest water bill (Table A1) and the latest electricity bill (Appendix 5) reveals that the amount of money paid for electricity are above that for water. Table A1 shows that, 115 households (46%) pay less than Ksh. 200.00 for water on a monthly basis. According to Table 19 below, 52.6% in Kaptembwo paid below Ksh. 200.00 with 29.5% of those in Shabab paying between Ksh. 401.00-600.00 monthly. In Milimani, 53.8% paid over Ksh. 1000.000 per month for water. Only 19% of all the household respondents paid above Ksh. 1000.00 for water. Some 22% of all households were not sure how much they were spending on water. This was because they stayed in areas where rent was a consolidated figure for housing, water and electricity. The previous

month's (latest) water bill was used as an indicator of the relative amount of water consumed by the households. The purpose of the latest electricity bill as a proxy of income was to show that if the respondents are able to pay their bills that are even higher that those of water they can pay for more water if it is available.

Table 19: Household's previous month's water bill

Residential Area		Water bill in the previous month							Total
		below 200	201-400	401-600	601-800	801-1000	above 1000	Not Sure	
Kaptembwo	Count	72	4	12	12	4	9	24	137
	%	52.6	2.9	8.8	8.8	2.9	6.6	17.5	100.0
Milimani	Count		1	4	-	-	7	1	13
	%		7.7	30.8	-	-	53.8	7.7	100.0
Shabab	Count	2	1	13	2	1	3	22	44
	%	4.5	2.3	29.5	4.5	2.3	6.8	50.0	100.0
Total Count		74	6	29	14	5	19	47	194
	%	38.1	3.1	14.9	7.3	2.6	9.8	24.2	100.0

Source: Field Survey, 2011

As shown in Appendix 5 (Table A1), the amount paid by institutions for water varied widely ranging from Ksh. 4,500.00 to Ksh. 101,000.00. Table 20 given below shows the relative amount of money paid by the institutions for water as of the month prior to the data collection. The amount of money used was then converted into water units (a unit of water is equivalent to $1m^3$ of water) by applying the tariffs systems for NAWASSCO where the first 6 units are charged a constant figure Ksh. 250. 00. Each extra unit is charged Ksh. 25 up to 99 units. An extra 100

units above this is then charged Ksh. 33.00. Using this conversion system, on average hospitals used 2,477 units of water, hotels and restaurants used 235 units while schools used 196 units.

Table 20: Last Water Bill Paid by Institutions

Respondent	Water bill in the previous month	N	Minimum	Maximum	Mean (Ksh.)	Std. Deviation
Hospital		4	36500	101516	81009.00	29942.368
	Valid N (listwise)	4	-	-	-	-
Restaurant/Hotel		24	5000	18700	10331.25	4041.223
	Valid N (listwise)	24	-	-	-	-
School		35	4500	36000	18633.43	9047.040
	Valid N (listwise)	35	-	-	-	-

Source: Field Survey, 2011

Hospitals paid the highest amounts for water on average that is Ksh. 81,009.00 due to their nature of work with a twenty four hour service to patients in addition to cleaning and other medical procedures requiring the use of a lot of water. Hotels as well have a twenty four hour service provision as opposed to schools most of which were public day schools. There were also more faucets in hospitals and hotels which contributed to the higher consumption of water as opposed to the few, often regulated outlets that are found in schools. According to table 20, restaurants and hotels had a standard deviation of 4041.223 indicating that there was a greater similarity in the amount paid for water in these institutions than in schools and hospitals. This deviation was accounted for by the fact that some of the schools and hospitals had private water sources like boreholes and hence did not pay for all the water they used to NAWASSCO.

Distance of Water Source from Homesteads

When asked, most of the water vendors said their pricing was determined by availability of water as well as by the distance of the water source from the intended market. Table 21 indicates that 16.1% of the respondents got their water from within less than half a kilometer from there residential area. Only 5.5% of all interviewees had their water sources further than half a kilometre. Those staying furthest from the water source were found to pay more for water. Similar responses were also registered in a survey carried out in Korogocho Nairobi by the Consumer Information Network (Odongo & Mungai 2002).

In this study, 75% of the respondents said they were not comfortable with the water prices. All these respondents were however found to be those living furthest from water sources hence the high rates were mainly attributed to distance. It was found out that 79% of the vendors within Nakuru Municipality sold water at between Ksh.5.00 and Ksh.15.00 per 20 litre jerrican. The average price for a twenty liter jerican of water was found to be Ksh.10.00. Distance was also found to impact on the amount of water used with those nearer to the primary water source using more water. Cairncross (1987) provides an example from Mozambique that demonstrated that water consumption in a village with a standpipe within 15 minutes was 12.30 litres per capita per day compared 3.24 litres per capita per day in a village where it took over five hours to collect a bucket of water.

Bulky water dealers using tankers sold water at the rate Ksh. 2,000.00 for 1000 liters of water which translates to Ksh.250.00 for one cubic meter of water. However, these whole sale vendors were only common in the Milimani area and only a few traded in Shabab. This was due to affordability and storage issues in the Milimani area. This rate is cheaper than that of the small scale vendors who sell water predominantly in the low and medium income estates of Kaptembwo and Shabab. At the rate of Ksh.10.00 per 20 litre jerican of water, (the average small scale vending price), residents in these estates pay Ksh.500.00 for a cubic meter of water. This means that in the absence of municipal water supply, residents in low income estates who can not buy water in bulk end up paying double what those in high income estates pay. This finding is supported by a report by the government of Kenya on improving water supply and sanitation service delivery to low income urban communities in Africa which argues that, often times the

urban poor may even pay up to 10 times more per unit of water (often 20 liters) than high income households (Republic of Kenya: WUP: 2002).

Table 21 shows that 83.9% of the households had water within their compound. Cumulatively, 94.5% of the respondents got water from a distance of less than a kilometre while 5.4% got water from between half a kilometre to over a kilometre. According to the World Health Organization guidelines, when the distance of a drinking water source is more than one kilometer or is found at 30 minutes total collection time, consumption cannot be assured, hygiene is not possible and there is a very high level of health concern (WHO, 2003). Based on distance travelled, the Nakuru situation is therefore conducive for the residents to access drinking water.

Table 21: Distance of water source from home

Distance	Frequency	Percent	Valid Percent	Cumulative Percent
within compound	260	83.9	83.9	83.9
less than 0.5km	33	10.6	10.6	94.5
0.5-1km	8	2.6	2.6	97.1
over 1km	9	2.9	2.9	100.0
Total	310	100.0	100.0	

Source Field Survey, 2011

As indicated in Table 22, distance influenced how much water was sold. This is shown by the fact that 10.5% of the vendors who got their water further than 2 kilometres sold it at Ksh. 15.00 or more. Studies reviewed provide evidence that greater quantity actually provides a measures of accessibility, with the assumption that increased accessibility equates to increased volumes of water used (Esrey *et al.*, 1991; Cairncross 1987). Cairncross (1987) suggests that there is a direct positive response of water volumes used by households to accessibility.

Table 22: The price of a 20 liter jerrican and distance of source from market

Price of 20 litre jerrican	Distance of source from market				Total No. of vendors
	1 km	1-2 km	2-3 km	over 3 km	
5.00	31	3	0	0	34
15.00	17	11	5	1	34
20.00	6	8	2	1	17
30.00	1	0	0	0	1
Total	55	22	7	2	86

Source: Field Survey, 2011

Once the time taken to collect water exceeds 5 minutes or 100m from the house, the quantities of water collected decrease significantly. There is little change in quantity of water collected within these boundaries (Cairncross and Feachem, 1993). Beyond distance of one kilometre or more than 30 minutes, total collection time, quantities of water will be expected to further decrease. In urban areas, where water supplies may be close but total collection times are very high, greater volumes may be collected that will support hygiene. Findings from a study from Jinja, Uganda suggest that once water is delivered through at least a single tap on-plot, the quantity of water increases significantly and further increases are found only when water is piped into the home and is available through multiple taps. When water is outside the home, average consumption drops still further to roughly one-third the average consumption at a compound tap and one-tenth that of households with water piped into the home (Well, 1998).

4.5 Uses of Water by Respondents

The study found that drinking, cooking, bathing, personal hygiene, laundry, watering lawn and animals and amenity influence how water is used. Appendix 5 summarizes the major uses of domestic water by the Nakuru Municipality residents. It shows that 97.5% of the households use water for domestic consumption while 75% of the hospitals use water for the same purpose. However, 61.5% of the hotels indicated that they used water for cooking, bathing, laundry and

the lawn. On the other hand, 51.4% of schools use water for watering animals in addition to consumption, hygiene and amenity uses. The amenity uses for households included car washing, laundry, lawn watering and washing. The main productive uses of water listed by some households were animal watering and small scale irrigation.

In its Guidelines for Drinking-Water Quality, WHO defines domestic water as being 'water used for all *usual* domestic purposes including consumption, bathing and food preparation' (WHO, 1993; 2002). This implies that the requirements with regard to the adequacy of water apply across all the uses and not solely in relation to drinking water. Sub-dividing uses of domestic water is useful in understanding minimum quantities of domestic water required and to inform management options. White *et al.* (1972) suggested that three types of use could be defined in relation to normal domestic supply. These are; Consumption (drinking and cooking), hygiene (including basic needs for personal and domestic cleanliness) and amenity use (for instance car washing, lawn watering). Thompson *et al.* (2001), adds that a fourth category can be included of 'productive use' which was of particular relevance to poor households in developing countries. Productive use of water includes uses such as brewing, animal watering, construction and small-scale horticulture.

4.6 Factors Affecting the Supply of Water to Nakuru Municipality Residents

A number of factors were found to impact on water supply to the residents of Nakuru Municipality. One of this was the absence of proper infrastructure (NAWASSCO, 2010). Through an interview, NAWASSCO officials said that the current piping networks were laid down in 1910. All terminal extensions have been added to reach new populations from these below capacity networks. They said that the type and size of these networks are too small to cater for the high population densities that were not considered when they were first laid down. Also, the institutional capacity (human resource) is another factor affecting the efficiency of water supply to the Nakuru residents. Through interview it was established that NAWASSCO has 250 employees who are often deployed to other council departments. This reduces the efficiency of field services including monitoring for leaks and other problems. The number and skills of the workers is therefore a limiting factor. A third factor affecting water supply according to

NAWASSCO officials is budgetary allocation geared towards the expansion of water distribution. This, they reckon is not adequate to meet the demands of the increasing population.

In addition, NARUWASSCO sells water to NAWASSCO at the rate of Ksh. 33.00 per cubic metre as from May 2010. NARUWASSCO depends on river Thurasha to supply the Municipality with water. The potential of river Thurasha to continue supplying water to Nakuru rural and Nakuru Municipality is threatened by increased human settlement at its catchment around the Kipipiri area. This has led to siltation at the lower course of the river reducing its discharge capacity and the problem is further compounded by vandalism and illegal connections along the Gilgil-Nakuru networks leading to great water loss. Another factor affecting the effectiveness of the water supplier to meet customer demand is illegal connections. NAWASSCO officials agreed that they lose a lot of water to illegal connections which may go unnoticed leading to great loses. Vandalism is another impediment to effective water supply which contributes to high maintenance charges in repairs and replacement of stolen or damaged equipment.

The survey included an investigation as to what the water consumers felt concerning vandalism and illegal connections as factors impeding effective water supply. It was found out that 64.2% of the respondents said this was a big problem. While 17.4% said they were not sure, 18.4% reckoned that this was not a major problem. The water service providers indicated that it was difficult for them to determine whether the Un accounted For Water (UAF) was due to vandalism, illegal connections or due to undetected leakages. These perceptions are shown in the Figure 13 below.

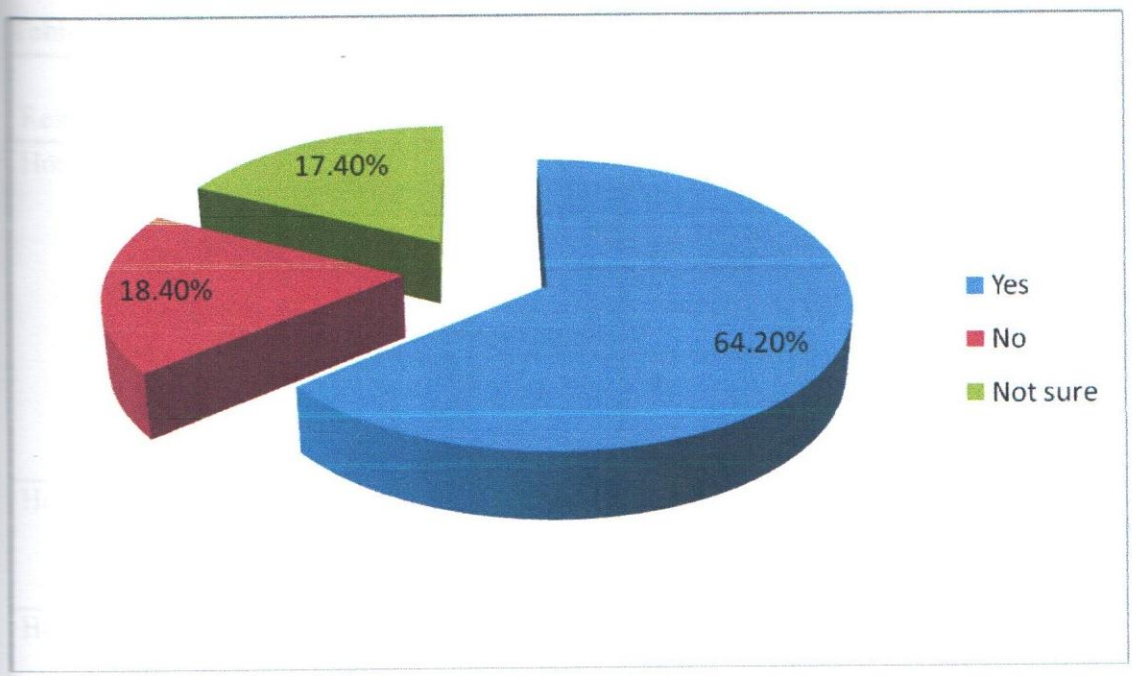

Figure 13: Perceptions concerning illegal connections and vandals

Field Survey, 2011

Efficiency of the Water Service Providers

Under the Water Act of 2002, the Water Services Boards (WSBs) are required to ensure that services are provided within their areas of coverage without leaving gaps (Republic of Kenya: MWI: 2005). According to the strategy, service provision is not to be restricted to those who can afford the service. The poor are to be considered in the provision of water services. This is further reinforced in the National Development Plan 2002 -2008. The respondents were asked whether they considered what the service providers were doing their best. Table 23 shows their responses. 47.3% of the households said they disagreed while 16.9% strongly disagreed. This gave a total of 64.2% households who disagreed. Conversely, 65.4% of hotels and restaurants agreed that the water service providers were doing their best as did 75% of hospital respondents. The percentage of households who said the water providers were not doing their best was higher than the others because more households depended on vended water.

Table 23: Rating of Water Service Providers by Various Users

Respondent	Responses		Frequency	Percent	Valid Percent	Cumulative Percent
Household	Valid	strongly disagree	41	16.7	16.9	16.9
		Disagree	115	46.9	47.3	64.2
		Agree	78	31.8	32.1	96.3
		strongly agree	9	3.7	3.7	100.0
		Total	243	99.2	100.0	
	Missing	99	2	0.8		
	Total		245	100.0		
Hospital	Valid	Disagree	1	25.0	25.0	25.0
		Agree	3	75.0	75.0	100.0
		Total	4	100.0	100.0	
Hotel& Rest	Valid	Disagree	9	34.6	34.6	34.6
		Agree	17	65.4	65.4	100.0
		Total	26	100.0	100.0	
School	Valid	Disagree	9	25.7	25.7	25.7
		Agree	25	71.4	71.4	97.1
		strongly agree	1	2.9	2.9	100.0
		Total	35	100.0	100.0	

Source: Field Survey, 2011

Table 24 below shows the various reasons given by respondents as to why they thought the water company was not able to meet water demand. 74% of the households stated that scarcity or rationing were the major drawbacks whereas 72.2% of the hotels and restaurants and 73.3% of the schools gave the similar response. The Table shows that 1.5% of households and 5.6% of hotels and restaurants said that lack of funds affected how much water they used. This is an indication that lack of sufficient amounts of water with most respondents was not because they were unable to pay for it. However, the water utility reckoned that water rationing was inevitable due to the increase in population within the municipality. The officials also said that during some parts of the year, abstraction levels from the boreholes are low due to climatic factors leading to rationing. They said this was especially in the months of December to February and June to

August since they are generally drought months. Tudor, 2003 also agrees that climate may have an effect on Municipal water supply.

Table 24: Reason for inadequacy of water within Nakuru Municipality

Respondent	Reason		Frequency	Percent	Valid Percent	Cumulative Percent
Household	Valid	scarcity or rationing	145	59.2	74.0	74.0
		lack of funds	20	8.2	10.2	84.2
		low pressure	10	4.1	5.1	89.3
		Scarcity & Lack of funds	3	1.2	1.5	90.8
		Scarcity & Low pressure	17	6.9	8.7	99.5
		blockage	1	.4	.5	100.0
		Total	196	80.0	100.0	
	Missing	99	49	20.0		
	Total		245	100.0		
Hospital Restaurant/Hotel	Missing	99	4	100.0		
	Valid	scarcity or rationing	13	50.0	72.2	72.2
		lack of funds	1	3.8	5.6	77.8
		low pressure	3	11.5	16.7	94.4
		Scarcity & Low pressure	1	3.8	5.6	100.0
		Total	18	69.2	100.0	
	Missing	99	4	15.4		
		Total	8	30.8		
	Total		26	100.0		
School	Valid	scarcity or rationing	11	31.4	73.3	73.3
		low pressure	4	11.4	26.7	100.0
		Total	15	42.9	100.0	
	Missing	99	20	57.1		
	Total		35	100.0		

Source: Field Survey, 2011

Rainfall data was obtained from the Kenya Industrial Training Iinstitute Meteorological weather station to ascertain the rainfall patterns over the said months. Data for a period of 15 years was used to work out the average rainfall recorded over these months. It was found out that

the lowest rainfall averages were in the months of July to September. The average amount of rainfall for these months over the 15 years was 34.7ml. January and February were also dry months averaging 17.6ml of rainfall. These low rainfall months coincided with the months when water rationing cases by NAWASSCO were reported to be most frequent. This was an indicator that the annual distribution of rainfall influenced water supply to the residents by NAWASSCO.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The main water sources for the Nakuru Municipality were found to be twenty boreholes and two rivers mainly distributed across the Northern side of the Municipality. The rivers are however trans-boundary water transfers from catchment areas outside the Municipality. It was also found out that fewer water vendors relied upon Municipal water supplies while the majority got their water from private water works. The results of this study established that 88.1% of all the respondents rely on water from the Municipal council as dispensed by NAWASSCO.

The study also established that despite evident water deficiency, there has been no clear effort by the Municipality water suppliers to develop new or expand old water abstraction sites. It also found that three quarters of all the households use less water than that recommended by the international community of 40 to 50 litres of water per head per day. A majority of the institutions said they were not sure how much water they used daily. This was attributed to the fact that in addition to vended water some institutions had private water sources. The quality of water supplied to the Nakuru Municipality was found to be in comparatively good quality except for high levels of Fluoride in many samples.

The survey also found out that consumers in the low income settlements paid more for vended water than their counterparts in the high income areas. It was also found out that the existing Institutions of water management and distribution do not guarantee universal access to water due to lack of capacity.

Among the various socio-economic factors affecting water demand, household size was found to be the most significant. Education level, income level and occupation had no significant effect on the amount of water demanded. This is because water is a basic commodity whose demand is not bound by these factors.

It was also established that willingness to pay for the service was not related to income. Most respondents were ready to pay for whatever amount they needed if such amount were available. Among the factors affecting water supply within the Nakuru Municipality were found to be poor infrastructure, illegal connections, vandalism, high maintenance charges and lack of adequate institutional and human capacity.

5.2 Recommendations

Since the amount of water supplied by the Municipality fall short of demand, this study recommends that NAWASSCO explores additional water sources to increase water quantity. These may include:

- ✓ Sinking more boreholes/wells.
- ✓ Encouraging residents to harvest and store roof water during the rainy season.
- ✓ Commercializing private wells where owners can sell water to NAWASSCO.
- ✓ Exploring the possibility of the Goethermal Development Co-operation supplying water to the Municipality from their Menengai site.

The amount of household water consumption was found to be less than internationally recommended averages. The Municipal council/NAWASSCO should:

- ➢ Prioritize the allocation of water to low income communities. The local trust fund or constituency development fund could be invoked to improve on water services since any form of development is premised on water availability.
- ➢ Reduce water prices for the urban- poor to ensure that they have adequate and affordable water.
- ➢ Build community based institutions for policing of water misuse which awards those who give confidential reports leading to water recovery or the apprehension of illegal water users.
- ➢ Adopt water demand management measures that can help reduce wastage. Such measure may include leakage detection, reduction of illegal connections and in-house retrofitting. They can also manage demand by applying water pricing measures such as tariff structure and water metering to each household.

- Invest in Education and information. This is an important management tool which can be used through raising public awareness and entrenching the same in in-school education.
- Improve the billing system. This can also help them to address illegal connections if all consumers are captured. This will enhance revenue collection which can be ploughed back to improve water services.
- Improve water treatment especially on chemical substances such as Fluoride which was found in many samples.

The factors affecting water supply to the Municipality are; network types & sizes, human capacity and budgetary allocation. This study recommends that NAWASSCO should:

- Improve its infrastructure/networks
- Employ enough staff to address consumers' needs.
- Put in place mechanisms to both monitor leakages and illegal connections.
- The Municipal Council should increase its budgetary allocation for water.

CHAPTER SIX

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APPENDIX 1

QUESTIONNAIRE FOR HOUSEHOLDS

Dear respondent,

I am an MSc. Student at Egerton University and currently carrying out field research in the Nakuru Municipality. The focus of my research is household water supply and demand within the Municipality and aims to improve the water supply situation within the Municipality. My research centres on three key estates namely; Milimani, Shabab and Kaptembwo.

Kindly respond to the following questions as accurately as possible to make this research a success and your responses will be held in confidence. Your cooperation will be highly appreciated.

Yours Sincerely

Sammy Mathendu

(Researcher)

Please circle the choice corresponding to your reply or otherwise fill in the spaces provided.

1. PERSON INFORMATION

1. Name of respondent .....

2. Telephone number (optional).....

3. Sex

   1. Female 2. Male

4. Age bracket

   1. Below 12 2. 12-22 3. 23-40 4. 41-60 5.Above 60

5. (a) Size of households

   1) 1 – 2 2) 3 – 4 3) 5 – 6 4) 7 – 8 5) 9 – 10 6). Others (state) .....

   b) Number of adults.....

   c) Number of children.....

   d) Number of Males.....

   e) Number of Females.....

6 a) Residential area/location. (Estate)

1) Kaptembwo 2) Milimani 3) Shabab 4. Others (state).....

b) House No.....

SOCIO-ECONOMIC STATUS

7. Type of house

a. Mansion b. Bungalow c. Semi-permanent d. Flat e. Bed sitter

8. In what Land Tenure system do you life?

1. Own house and land with title deed 2.Rented house 3. Squatting on private land

4. Squatting on public land 5. Own house without title deed 6.Others (specify)..

9. Number of households employed.....

10. Length of stay in the estate

1) Below 1yr 2) 1-4 yrs 3) 5 – 8 yrs 4). Others(specify) .....

11 Please give us some general information about your household. Use the numbers 1 to 5 below to fill your scores in the table

Individual	Level of education (a)	Occupation (b)	Income level (c) Kshs
Father / Husband			
Mother/Wife			
Son(s)			
Daughters(s)			
Others e.g. Relatives, house-help etc.			

a) 1 – Illitrate
2- Adult educ
3. – Primary
4. – Secondary
5. College / University

b) 1-White collar job
2 – Casual labor
3 – Self employed
4 – Jobless
5. Minor / Schooling

c) 1. 1000 – 5000
2. 6000 – 10000
3. 11000 – 15000
4. 16000 – 20000
5. 21000 – 25000
6. Above 25000

12. (a) Where do you get your water?

1. Municipal council piped water 2. Water vendors 3. Rain water

4. Communal borehole 5.Personal tube well/borehole

6. Public faucet/municipal water kiosk 8. Others (Specify).....

(b) How far is the water source from your home?

1) Within compound 2) Less than 0.5km 3) 0.5 – 1km 4) Over 1km

(c) Is your water metred?

1. Yes 2. No

(d). How often does the council read your water meter?

1) Monthly 2) After two months 3) Erratic

(e). How often do you receive your bills?

1) Monthly 2) After two Months 3) Erratic 4) Never receives

(f). Do you think the bills you receive are accurate?

1. Yes 2. No

13. (a) Is the water you get for your household enough?

1. Yes 2. No.

(b) If no what is the reason?

[1] Scarcity / Rationing

[2] Lack of funds – Cannot afford

[3] Low pressure

[4] Others (specify).....

(c) For how long on average is Water available to you on a daily basis?

[1] 1-4hrs [2] 5-8hrs [3] 9-12hrs [4]) 13 – 16hrs

[5] 17-20hrs [6] 21-23hrs [7] 24hrs

(d) Which months of the year do you have enough water?

[1] Dec-Feb [2] Mar-May [3] Jun-Aug [4] Sept – Nov [5] None

f) Which months don't you have enough water?

[1] Dec-Feb [2] Mar-May [3] Jun-Aug [4] Sept – Nov [5] None

(e) Are your toilets connected to the sewer line or do you use a latrine/pit?

[1] Connected to Sewer [2] Latrine / pit?

(f) If not connected, what is the reason for this?.....

1. Lack of piped water 2. No sewer line 3. Cannot afford 4. Others (specify) .....

14. How much water do you use on a daily basis in litres?

[1] Below 40 [2] 41 – 60 [3] 61 – 80 [4] 81 – 100

[5] 101 – 120 [6] 120-300 [7] Others (Specify).....

15. (a) How much did you pay for water last month in cash or bill?

1) Below 200 2) 201-400 3) 401-600 4) 601-800 5) 801-1000 6. 1001 – 1200

7. Others (specify).....

(b) What is the highest and lowest price you have ever paid for water and in which Months/year?

b) Amount in Kshs.	c) Month when paid
1. Highest	
2. Lowest	
3. Cannot remember	

15. How much water do you think would be enough for your household/institution per day in litres?..... litres.

16. (a) How much do you pay for electricity per month?

[1] Less than 100 [2] 101 – 300 [3] 301-600 [4] 601-900 [5] 901-1200 [6] Others (Specify).....

(b) How much do you pay for water from vendors for a 20 litre Jeri can in Kshs?

1. Ksh. 10 2. Ksh. 15 3. Ksh. 20

4. Ksh. 25 5. Ksh. 30 7. Ksh. 40 8.Others (specify) .....

17. Do you consider the water you use to be clean and safe?

[1] Yes [2] No

18. (a) Have you ever had complaints about water quality or quantity?

1. Yes 2. No

b) What problem was it?

1. Rationing 2. Blockage 3. Scarcity 4. Disconnection 5. Contamination 6. Low pressure 7. Others (specify) .....

c) What action(s) did the water providers take?

1. None 2. Reconnected 3. Increased pressure 4. Others (specify) .....

19. (a) Do you know of any current water project(s) in your area?

1. Yes 2. No

b) If yes please which one/s?.....

20. How do you use the water you get?

a) Cooking, bathing and laundry

b) Cooking, bathing, laundry and the lawn

c) Cooking, bathing, laundry and the lawn

d) Other (specify).....

POLICY ISSUES

For the following questions, circle the correct answer and explain where appropriate

21. I would be able to pay for the total amount of water my household needs if the water were available.

1. Yes 2. No

22. The water service providers are doing their best in providing water to Nakuru Municipality residents

1. Strongly disagree 2. Disagree 3. Agree 4. Strongly agree

23. Illegal connections and vandalism are a major cause of water shortage in our area.

1. Yes 2. No 2. Not sure

24. Who provided the piping material for your water supply?

(a) Self (2) Municipal council (3) NAWASCO

(4)Others (Specify).....

25. (a) Have you ever attended a local meeting on water matters?
(1) Yes (2) No
(b) If yes, when and where? Date..... Place.....

26. (a) Do your know of any guidelines on water services?
(1) Yes (12) No.
(b) If yes state some of these.....

Thank you for your co-operation

APPENDIX 2

QUESTIONNAIRE FOR WATER VENDORS

Dear respondent,

I am an MSc. Student at Egerton University and currently carrying out field research in the Nakuru Municipality. The focus of my research is household water supply and demand within the Municipality and aims to improve the water supply situation within the Municipality. My research centres on three key estates namely; Milimani, Shabab and Kaptembwo.

Kindly respond to the following questions as accurately as possible to make this research a success and your responses will be held in confidence. Your cooperation will be highly appreciated.

Yours Sincerely

Sammy Mathendu

(Researcher)

Please circle the choice corresponding to your reply or otherwise fill in the spaces provided.

1. **Name of water Vendor (Optional).....**
2. **Telephone Number:.....**
3. **Residential area:.....**
4. For how long have you been selling water?

   [1] 105 yrs [2] 6-10yrs [3] Over 10 yrs
5. Where do you get water from?

   [1] Municipal Council [2] Private water works [3] Nearby River

   [4] Private bore hole [5] Other (Specify)
6. Approximately how many litres of water do you sell in a day?

   1) 50 – 100 litres
   2) 100 – 200 litres
   3) 200 – 400 litres
   4) Over 500 litres

7. How far in metres is the source of water from your selling station?

1. Less than 1 km
2. 1 km
3. 1-2km
4. 2-3km
5. Over 3km

8. How much do you pay for a 20-liter jeri-can at the source? Kshs.....

9. How much do you sell 20-liter jeri-can in Kshs? Please fill in the table below.

Amount in Kshs.	***Month when charged***

10. a) Does the Municipal Council control your selling price?

1. Yes 2. No

b) If yes, please state how controls are applied.

.....

11. What considerations do you make when pricing water?

1. Distance 2. Estate 3. Season 4. Other (Specify)

12. What is the highest or the lowest you have ever charged for a 20-litre jeri can?

Amount in Kshs.	***Month when charged***

13. a) Are you aware of any health or environmental standards you should keep as a water vendor?

1. Yes 3. No

b) If yes please list some of these standards

14. a) Are you self-employed or you are working for someone?

[1] Self Employed

[2] Working for Someone

b) Do you keep records of your sales?

1. Yes 2. No.

c) If yes, what is your average monthly income in Kshs?

1. 1-2000 2.2001-4001 3. 4001-6000 4. 6001-8000. 5. Others(specify).....

15. How often is water available in the week?

[1] Once a week **[2]** Twice a week **[3]** Thrice a week **[4]**4 to 5 days a week

[5] Daily **[6]** Erratic

16. (a) Have you received any training on water vending?

1. Yes 2. No.

If yes, state;

b) Where the training was .....

c) Who were the trainers... .....

d) How long was the training? .....days/weeks

17. What was the training on?

1. Finances 2. Water quality 3. Water transport 4. Water laws/by-laws

5. Others (Specify).....

18. How do you ensure that the water you sell is clean?

a) Treat before distribution

b) Ask the seller

c) Buys from certified points

d) Others (specify).....

19. What problems do you face in your business? Please list them.

a) Financial

b) Harassment fro Municipal officials

c) Distance from where we get the water

d) Lack of customers

e) Others (specify) .....

APPENDIX 3

PERSONAL INTERVIEW: QUESTIONS FOR WATER SERVICE PROVIDERS

Dear respondent,

I am an MSc. Student at Egerton University and currently carrying out field research in the Nakuru Municipality. The focus of my research is household water supply and demand within the Municipality and aims to improve the water supply situation within the Municipality. My research centres on three key estates namely; Milimani, Shabab and Kaptembwo.

Kindly respond to the following questions as accurately as possible to make this research a success and your responses will be held in confidence. Your cooperation will be highly appreciated.

Yours Sincerely

Sammy Mathendu

(Researcher)

Please circle the choice corresponding to your reply or otherwise fill in the spaces provided.

1. a) Name of Respondent .....

   b) Name of Organization/Company.....

2. For how long has your organization been in operation?

   (1) 1-5 yrs (2) 6 – 10 yrs (3) 11-15yrs (4) Over 20yrs

3. What are the main sources of water for your Company and how much water do you receive from each?

	Water Source	**Amount Received**	**No./Name of sources**
1.	Bore holes		
2.	River(s)		
3.	Dam(s)		
4.	Lake		
5.	Others - Specify		

4. a) How much water do you receive per month in litres?..... litres

b) How much water do you supply to clients within the municipality per month in litres or %?..... litres/%.

c) What percentage of the urban population is metered?

(1) 1 – 20 (2) 21 – 40 (3) 41 – 60 (4) 61 – 80 (5) Over 80

d) How much more water would you require to meet the current demand?..... litres.

5. How much water is supplied to Milimani, Shabab and Kaptembwo (monthly)?

- Milimani ..... litres
- Shabab .....litres
- Kaptembwo .....litres

6. What guides you in allocating water to your consumers?

7. Do you supervise the operation of water vendors?

a) Yes

b) No.

If yes, how do you do so?.....

.....

.....

.....

8. How often do you issue Gazette notices to water vendor on tariffs and other regulations?

[1] Monthly [2] Bi-annual [3] Quarterly [4] Annually [5] After a few years

[6] Never done

9. What are some potential water sources for the Municipality that have not been tapped?

10. How many households/ institutions/ consumers have been connected over the last;

a) 1 year?..... households/ institutions/ consumers

b) 2 years?..... households / institutions/ consumers

c) 5 years?..... households / institutions/ consumers

11. From your projections, what proportion of the population within Nakuru Municipality is likely to have access to clean and safe drinking water by 2015?..... %

12. What policies govern the supply of water services to households and institutions within the Municipality?

-
-
-
-
-

13. Does the MCN have by-laws dealing with water?

a) Yes b) No.

If yes state some of these by-laws.....

.....

.....

.....

.....

14. a) What policies do you have to protect your water consumers?

-
-
-

b) Are there any incentives given to those taking care of the water catchment area?

1. Yes

2. No

If yes, kindly state some of these incentives.

-
-
-

15. Where do you get your funding from?

a) Government b) The MCN c) Revenue from sales d) Others (specify)....

16. Are the funds you receive sufficient for your current needs?

1. Yes 2. No.

17. a) How much water are you not able to account for?..... % or litres

b) Do you have any leak monitoring systems?

1. Yes 2. No

c) If yes what are your inspection/monitoring frequencies?

1. Monthly 2. Once in 6 months 3. Annually 4. Daily 5. Twice in a week

6. Others (specify) .....

18. What is the frequency of your rehabilitation and maintenance programs for the networks?

a) Annually b) 2-3yrs c) 4-5yrs d) 6-10yrs e) Randomly

19. How are you linked to RVWSB and the MCN?

20. What challenges do you face as service providers?

21. What type of piping material do you use?

22. How many licensed water kiosks are currently in operation?

23. For how long are public distribution systems open?

24. How long are payment stations open in a week?

25. What systems do you have to notify customers on supply interruptions?

26. When is a disconnection unjustified?

27. a) How many workers to you have across departments?

b) Is your staff adequate?

APPENDIX 4

QUESTIONNAIRE FOR INSTITUTIONS

Dear respondent,

I am an MSc. Student at Egerton University and currently carrying out field research in the Nakuru Municipality. The focus of my research is household water supply and demand within the Municipality and aims to improve the water supply situation within the Municipality. My research centres on three key estates namely; Milimani, Shabab and Kaptembwo.

Kindly respond to the following questions as accurately as possible to make this research a success and your responses will be held in confidence. Your cooperation will be highly appreciated.

Yours Sincerely

Sammy Mathendu

Please circle the choice corresponding to your reply or otherwise fill in the spaces provided.

1. PERSON INFORMATION

1. a) Name and position of respondent .....
   b) Name and type of institution.....

2. Telephone number (optional).....

3. (a) Number of employees/students/patients

   1) 1– 30 2) 31 – 60 3) 61 – 90 4) 91 – 120 5) 120 – 150 6)Others (specify) ...

   b) Number of Males.....

   c) Number of Females.....

4 (a) Is your water metred?

   1. Yes 2. No

   (b) Whose property is the metre?

   1. Self 2. Water service providers

   (c) Metre Number .....

   (d).How often does the council read your water meter?

   1) Monthly 2) After two months 3) Erratic

(e) In what Land Tenure system are you?

1. Own land with title deed
2. Rented facility
3. Squatting on private land
4. Squatting on public land
5. Own facility without title deed
6. Others (specify).....

5. (a) Where do you get your water?

1. Municipal council piped water 2. Water vendors 3. Rain water
4. Communal borehole 5.Personal tube well/borehole
6. Public faucet/municipal water kiosk 8. Others (Specify).....

(b) How far is the water source from your Institution?

1) Within compound 2) Less than 0.5km 3) 0.5 – 1km 4) Over 1km

6. (a) Is the water you get for your Institution enough?

1. Yes 2. No.

(b) If no what is the reason?

[1] Scarcity / Rationing

[2] Lack of funds – Cannot afford

[3] Low pressure

[4] Others (specify).....

(c) For how long on average is Water available to you on a daily basis?

[1] 1-4hrs [2] 5-8hrs [3] 9-12hrs [4]) 13 – 16hrs

[5] 17-20hrs [6] 21-23hrs [7] 24hrs

(d) Which months do you have enough water?

[1] Dec-Feb [2] Mar-May [3] Jun-Aug [4] Sept – Nov [5] None

(e) Are your toilets connected to the sewer line or do you use a latrine/pit?

[1] Connected to Sewer [2] Latrine / pit?

(f) If not connected, what is the reason for this?.....

1. Lack of piped water 2. No sewer line 3. Cannot afford 4. Others (specify) .....

7. How much water do you use on a daily basis in litres?

[1] Below 400 [2] 401 – 600 [3] 601 – 800 [4] 801 – 1000

[5] 1001 – 1200 [6] 1201-3000 [7] Others (Specify).....

8. (a) How much did you pay for water last month/bill?

1) Below 200 2) 201-400 3) 401-600 4) 601-800 5) 801-1000 6. 1001 – 1200

7. Others (specify).....

(b) What is the highest and lowest price you have ever paid for water and in which Months/year?

b) Amount in Kshs.	c) Month when paid
1. Highest	
2. Lowest	
3. Cannot remember	

9. How much water do you think would be enough for your household/institution per day in litres? ..... litres.

10. (a) One average how much do you pay for electricity per month? Ksh. .....

(b) How much do you pay for water from vendors for a 20 litre Jeri can/tank in Kshs?

1. 10 2. 15 3. 20 4. 25 5. 30 7. 40 8. Others (specify).....

11. Do you consider the water you use to be clean and safe?

[1] Yes [2] No

12. (a) Have you ever had complaints about water quality or quantity?

1. Yes 2. No

b) What problem was it?

1. Rationing 2. Blockage 3. Scarcity 4. Disconnection 5. Contamination 6. Low pressure 7. Others (specify) .....

c) What action(s) did the water providers take?

1. None 2. Reconnected 3. Increased pressure 4. Others (specify) .....

13. (a) Do you know of any water project(s) in your area currently?

1. Yes 2. No

b) If yes please which one/s?.....

14. How often do you receive your bills?

1) Monthly 2) After two Months 3) Erratic 4) Never receives

15. Do you think the bills are accurate?

1. Yes 2. No

16. How do you use the water you get?

a) Cooking, bathing and laundry

b) Cooking, bathing, laundry and the lawn

c) Cooking, bathing, laundry and the lawn

d) Other (specify).....

POLICY ISSUES

For the following questions, circle the correct answer and explain where appropriate

17. We would be able to pay the total amount of water my household needs if the water were available

1. Yes 2. No

18. The water service providers are doing their best in providing water to Nakuru Municipality residents

1. Strongly disagree 2. Disagree 3. Agree 4. Strongly agree

19. Illegal connections and vandalism are a major cause of water shortage in our area.

1. Yes 2. No 2. Not sure

20. (a) Have you ever attended a local meeting on water matters?
(1) Yes (2) No

(b) If yes, when and where? Date..... Place.....

21. (a) Do your know of any guidelines on water services?
(1) Yes (12) No.

(b) If yes state some of these.....
Thank you for your co-operation

APPENDIX 5

Analysis Tables

Table [A1]: Latest Water Bill for All Respondents

Water bill in the previous month (in Ksh)		respondent				Total
		Household	Hospital	Restaurant /Hotel	School	
below 200	Count	115				115
	Row %	100.0				100.0
201-400	Count	10				10
	Row %	100.0				100.0
401-600	Count	17				17
	Row %	100				100.0
601-800	Count	17				17
	Row %	100.0				100.0
801-1000	Count	10				10
	Row %	100.0				100.0
above 1000	Count	21				21
	Row %	100.0				100.0
Not Sure	Count	55				55
	Row %	100.0				100.0
4500	Count				1	1
	Row %				100.0	100.0
5000	Count			1	1	2
	Row %			50.0	50.0	100.0
5500	Count			1		1
	Row %			100.0		100.0
6000	Count				2	2
	Row %				100.0	100.0
6500	Count				1	1

Continued		Row %				100.0	100.0
	6800	Count			1		1
		Row %			100.0		100.0
	7000	Count			1		1
		Row %			100.0		100.0
	7200	Count			1		1
		Row %			100.0		100.0
	7500	Count			1		1
		Row %			100.0		100.0
	8000	Count			3		3
		Row %			100.0		100.0
	8500	Count			2		2
		Row %			100.0		100.0
	8700	Count			1		1
		Row %			100.0		100.0
	8870	Count				1	1
		Row %				100.0	100.0
	9000	Count				1	1
		Row %				100.0	100.0
	9100	Count			1		1
		Row %			100.0		100.0
	9500	Count			1		1
		Row %			100.0		100.0
	9700	Count				1	1
		Row %				100.0	100.0
	9750	Count			1		1
		Row %			100.0		100.0
	10500	Count			1		1
		Row %			100.0		100.0
	11150	Count			1		1

Continued		Row %			100.0	100.0
	12000	Count			2	2
		Row %			100.0	100.0
	12600	Count			1	1
		Row %			100.0	100.0
	13000	Count		1	1	2
		Row %		50.0	50.0	100.0
	13500	Count			1	1
		Row %			100.0	100.0
	14000	Count	1		1	2
		Row %	50		50.0	100.0
	14500	Count	1		1	2
		Row %	50		50.0	100.0
	15000	Count			1	1
		Row %			100.0	100.0
	16000	Count			3	3
		Row %			100.0	100.0
	17000	Count		1		1
		Row %		100.0		100.0
	18000	Count		1	1	2
		Row %		50.0	50.0	100.0
	18550	Count		1		1
		Row %		100.0		100.0
	18700	Count		1		1
		Row %		100.0		100.0
	19500	Count			1	1
		Row %			100.0	100.0
	20000	Count			1	1
		Row %			100.0	100.0
	21000	Count			1	1

	22000	Row %				100.0	100.0
Continued		Count				1	1
		Row %				100.0	100.0
	23000	Count				4	4
		Row %				100.0	100.0
	24500	Count		1		1	2
		Row %		50		50.0	100.0
	27000	Count				1	1
		Row %				100.0	100.0
	28000	Count				2	2
		Row %				100.0	100.0
	29000	Count				2	2
		Row %				100.0	100.0
	36000	Count				3	3
		Row %				100.0	100.0
	101516	Count		1			1
		Row %		100.0			100.0
Total	Count		245	4	24	35	308
	Row %		79.5	1.3	7.8	11.4	100.0

Table [A2]: Latest Electricity Bill

			respondent				Total
			Household	Hospital	Restaurant/Hotel	School	
	less than 100	Count	2	0	0	0	2
		% within respondent	.8%	.0%	.0%	.0%	.6%
	101-300	Count	20	0	0	0	20
		% within respondent	8.2%	.0%	.0%	.0%	6.5%
	301-600	Count	44	0	0	0	44
		% within respondent	18.0%	.0%	.0%	.0%	14.2%
	601-900	Count	50	0	0	0	50
		% within respondent	20.4%	.0%	.0%	.0%	16.1%
	above 900	Count	54	0	0	0	54
		% within respondent	22.0%	.0%	.0%	.0%	17.4%
	inclusive of rent	Count	37	0	0	0	37
		% within respondent	15.1%	.0%	.0%	.0%	11.9%
	Not sure	Count	38	0	0	0	38
		% within respondent	15.5%	.0%	.0%	.0%	12.3%
	4000	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%

Continued	6000	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	6500	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	8000	Count	0	0	1	2	3
		% within respondent	.0%	.0%	3.8%	5.7%	1.0%
	8420	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	8570	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	9000	Count	0	0	1	0	1
		% within respondent	.0%	.0%	3.8%	.0%	.3%
	10000	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	11000	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	12000	Count	0	0	2	1	3
		% within respondent	.0%	.0%	7.7%	2.9%	1.0%
	12300	Count	0	0	1	0	1
		% within respondent	.0%	.0%	3.8%	.0%	.3%

Continued	13000	Count	0	0	2	0	2
		% within respondent	.0%	.0%	7.7%	.0%	.6%
	15000	Count	0	0	3	0	3
		% within respondent	.0%	.0%	11.5%	.0%	1.0%
	17000	Count	0	0	1	2	3
		% within respondent	.0%	.0%	3.8%	5.7%	1.0%
	17800	Count	0	0	1	0	1
		% within respondent	.0%	.0%	3.8%	.0%	.3%
	18000	Count	0	0	1	1	2
		% within respondent	.0%	.0%	3.8%	2.9%	.6%
	19000	Count	0	0	1	1	2
		% within respondent	.0%	.0%	3.8%	2.9%	.6%
	20000	Count	0	0	1	2	3
		% within respondent	.0%	.0%	3.8%	5.7%	1.0%
	21000	Count	0	0	0	3	3
		% within respondent	.0%	.0%	.0%	8.6%	1.0%
	21700	Count	0	0	1	0	1
		% within respondent	.0%	.0%	3.8%	.0%	.3%
	22000	Count	0	0	0	2	2
		% within respondent	.0%	.0%	.0%	5.7%	.6%

Continued	22500	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	23000	Count	0	0	2	0	2
		% within respondent	.0%	.0%	7.7%	.0%	.6%
	25000	Count	0	0	1	0	1
		% within respondent	.0%	.0%	3.8%	.0%	.3%
	26000	Count	0	0	1	1	2
		% within respondent	.0%	.0%	3.8%	2.9%	.6%
	27000	Count	0	0	2	0	2
		% within respondent	.0%	.0%	7.7%	.0%	.6%
	27700	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	28000	Count	0	0	1	0	1
		% within respondent	.0%	.0%	3.8%	.0%	.3%
	30000	Count	0	0	0	2	2
		% within respondent	.0%	.0%	.0%	5.7%	.6%
	32000	Count	0	0	0	1	1
		% within respondent	.0%	.0%	.0%	2.9%	.3%
	34000	Count	0	0	0	1	1
		% within responden	.0%	.0%	.0%	2.9%	.3%

		t					
Continued	35000	Count	0	0	1	2	3
		% within responden t	.0%	.0%	3.8%	5.7%	1.0%
	36000	Count	0	0	1	0	1
		% within responden t	.0%	.0%	3.8%	.0%	.3%
	37000	Count	0	0	0	2	2
		% within responden t	.0%	.0%	.0%	5.7%	.6%
	39000	Count	0	0	0	2	2
		% within responden t	.0%	.0%	.0%	5.7%	.6%
	43000	Count	0	1	0	0	1
		% within responden t	.0%	25.0 %	.0%	.0%	.3%
	54000	Count	0	1	0	0	1
		% within responden t	.0%	25.0 %	.0%	.0%	.3%
	55000	Count	0	0	0	1	1
		% within responden t	.0%	.0%	.0%	2.9%	.3%
	75000	Count	0	0	1	0	1
		% within	.0%	.0%	3.8%	.0%	.3%

		respondent					
	76000	Count	0	1	0	0	1
		% within respondent	.0%	25.0%	.0%	.0%	.3%
	98000	Count	0	1	0	0	1
		% within respondent	.0%	25.0%	.0%	.0%	.3%
Total		Count	245	4	26	35	310
		% within respondent	100.0%	100.0%	100.0%	100.0%	100.0%

Table [A3]: Water use patterns for Nakuru Municipality

respondent			Frequency	%	Valid %	Cumulative %
Household	Valid	cooking, bathing and laundry	234	95.5	97.5	97.5
		cooking, bathing, laundry and the lawn	3	1.2	1.3	98.8
		cooking, bathing, laundry and watering animals	8	3.3	1.3	100.0
		Total	245	100.0	100.0	
Hospital	Valid	cooking, bathing and laundry	3	75.0	75.0	75.0
		cooking, bathing, laundry and watering animals	1	25.0	25.0	100.0
		Total	4	100.0	100.0	
Restaurant/Hotel	Valid	cooking, bathing and laundry	2	7.7	7.7	7.7
		cooking, bathing, laundry and the lawn	16	61.5	□□□□	69.2
		cooking, bathing, laundry and watering animals	5	19.2	19.2	88.5
		cooking, laundry and cleaning	3	11.5	11.5	100.0
		Total	26	100.0	100.0	
School	Valid	cooking, bathing and laundry	2	5.7	5.7	5.7
		cooking, bathing, laundry and the lawn	18	51.4	51.4	57.1
		cooking, bathing, laundry and watering animals	9	25.7	25.7	82.9
		Washing classes	6	17.1	17.1	100.0
		Total	35	100.0	100.0	

Source: Field Survey, 2011

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APPENDIX 6

Water Vending Mechanisms and Stations within the Research Estates

Plate 2: Large scale water vending vessel taken within the Central Business District

Source: Field Survey, 2011

Plate 3: A water distribution point in Shabab Estate,Nakuru

Source: Field Survey, 2011

Plate 4: A Handcart – one of the major means of transporting water

Source: Field Survey, 2011

Plate 5: A Loaded bicycle, ready for delivery in Kaptembwo

Source: Field Survey, 2011

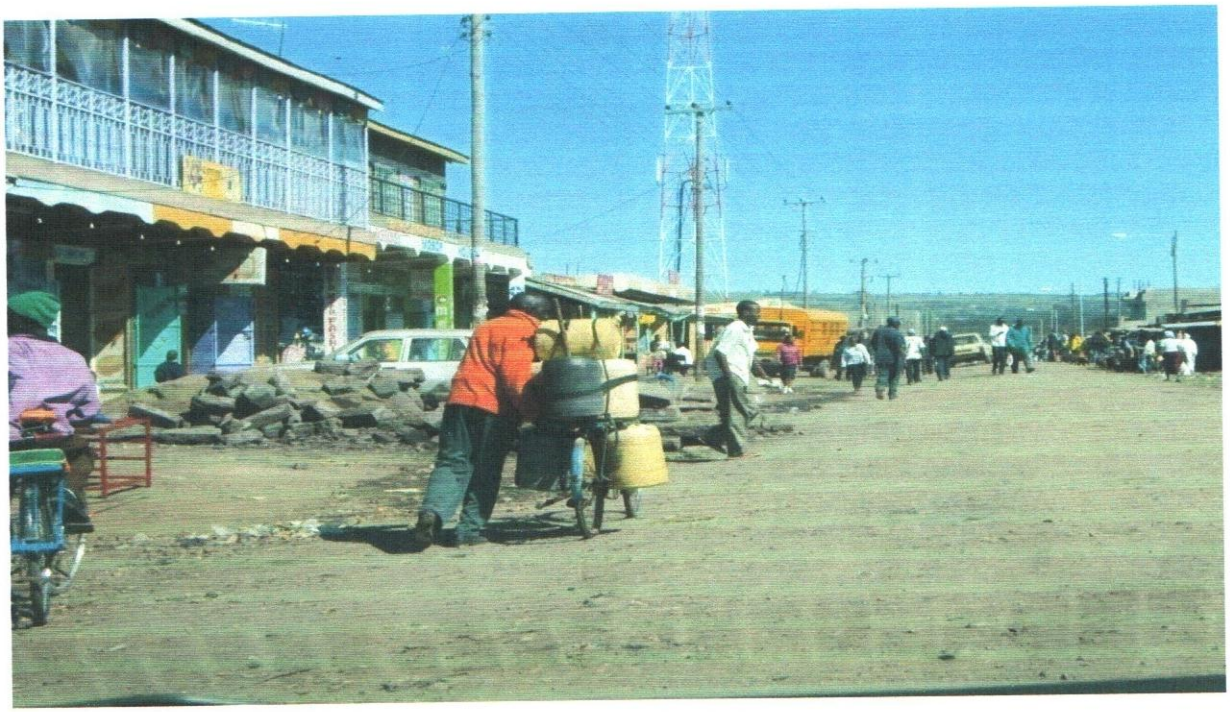

Plate 6: A bicycle vendor in Kaptembwo estate

Source: Field Survey, 2011

Plate 7: An Unlicensed water distribution point at Check point, Kaptembwo

Source: Field Survey, 2011

APPENDIX 7

Institutions Surveyed

Hospitals:

1. War Memorial Hospital
2. Valley Hospital
3. Evans Sunrise Hospital

Schools:

1. Menengai High
2. Lions primary
3. Lake Lowrenzo Academy
4. Moi Primary
5. Kaptembwo Primary
6. Nakuru West Secondary
7. Mama Ngina primary
8. St. Xaviers primary
9. Nakuru Girls High
10. Uhuru Secondary
11. St. Xaviers primary
12. Carol Academy
13. Melvin Jones Academy
14. Upper Hill
15. Nakuru Day
16. Nakuru Elite
17. St. Luke.s
18. Christ the King
19. Shah Llaji Academy
20. Muslim Primary
21. Koinange Primary
22. Challen Academy
23. Muthaiti secondary
24. Kivumbini Primary
25. Langalanga High
26. Prisons Primary
27. Moi Secondary
28. Kisulisuli Primary
29. Kenyatta Secondary
30. Menengai Primary
31. Jamuhuri Primary
32. Nakuru west primary
33. Loreto secondary
34. Nakuru boys high
35. Harambee Khalsa
36. St. Joseph's primary
37. St. Xaviers secondary
38. Shinners Girls
39. Root's Academy
40. Elite Secondary

Hotels and Restaurants:

1. Cathay Hotel
2. Avenue suites
3. Nuru palace
4. Jumuia
5. Eclipse
6. Genevieve
7. Chester
8. Pivot hotel
9. Kunste
10. Midlands
11. Bontana
12. Bamboo Chinese restaurant
13. Stem
14. Gituamba
15. Taidys
16. Tipsy Restaurant
17. Shik Park View
18. Komotho
19. Mt. Sinai
20. Rift Valley Sports club
21. Nakuru Athletics Club
22. Water buck
23. Tas Restaurant
24. Garden Villa
25. Carnation Hotel
26. Salama Lodge