FACTORS INFLUENCING ACCESSIBILITY TO WATER FOR DOMESTIC USE IN KENYA; A CASE OF KIPKAREN DIVISION, NANDI COUNTY

BY

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DECLARATION

This research project is my original work and has not been presented to any other university.

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DEDICATION

This work is dedicated to my dear husband Christopher and our two lovely sons Lawrence and Fredrick, my parents Patrick and Mary, and my brothers Douglas, Tobias and Kevin.

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ABBREVIATIONS AND ACRONYMS

BWR Basic Water Requirement

CCS Combined Sewer Systems

GDP Gross Domestic Product

GOK Government of Kenya

GWDEs Ground Water Dependent Ecosystems

MDGs Millennium Development Goals

MOWI Ministry of Water and Irrigation

NGOs Non-Governmental Organization

SPSS Statistical Package for Social Science

UNDP United Nations Development Program

SSA Sub Saharan Africa

WHO World Health Organization

WRMA Water Resources Management Authority

ABSTRACT

Water is an important commodity to human survival. As a result, households in developing countries spend considerable amount of time fetching water. This study was carried out to assess factors influencing accessibility to water for domestic use in Kipkaren Division of Nandi north District. This survey tried to investigate how environmental, financial constraints, human and location influences accessibility to water for domestic use. The study employed a descriptive cross-sectional design on a statistically calculated sample of households and interviewees selected through cluster sampling technique. The target population was all households in Kipkaren division; the sample size was 322 females from households and 3 ministry of water officials. The total number of respondents was 325. Data instruments employed were questionnaires and interview schedules. Validity of research instruments was determined by experts from the department. Piloting was carried out to determine reliability of the instruments by use of split half technique where questionnaires were administered to residents of the neighboring Chepterwai division; the study used descriptive technique. The study provided valuable insights on factors influencing access to water for households in Kenya generally and Kipkaren division in particular. it was found out that environmental changes had a very strong influence on access to water, respondents cited that they experienced drought and water difficulties during non-rain months., "changing rainfall patterns affecting agriculture and reducing food security; worsening water security, it was also noted that most people depended on rivers as their main water source however most of the rivers are unprotected; human activities also affects accessibility to water, respondents cited deforestation as the main human activity that has greatly affected water supply this is majorly due to pollution, population pressures, deforestation and destruction of water catchment areas. Financial constraints influenced accessibility to water the findings revealed that majority of respondents indicated that the government was the major financiers of water projects in the study area and the individuals while donor funded projects were neglejable..The source of money to finance water projects still remains a big challenge. It was revealed that water sources were not far away from the respondents only that access in terms of roads and access roads was the major concern as it emerged from the interview schedule where the officials cited that most water sources emanate from private land hence hindering access or even development. It is hoped that the findings of this study will help the Ministry of Water and Sanitation and the county government to deploy appropriate resources and policy programs to be used to ensure access to adequate water for domestic use by Kenya's majority poor.

CHAPTER ONE

INTRODUCTION

1.1Background to the study

It is Approximated that half of the global population will be living in regions of high water stress by 2030 (World water development report 2009). The global population is expanding by 80 million people annually, increasing the demand for fresh water by 64 million m^3 a year (News service March 12 2009). Nations around the world have been over pumping their aquifers while most can be replenished, some are not, particularly in many of the most populous regions. For example the water table in Yemen is of the United Nations unanimously agreed on a set of 8 goals to reduce poverty by 2015 among which is reducing by half the proportion of households that do not have access to safe water (Galiani *et al*., 2005).

United States citizens are the most profligate water users in the world. It is estimated that by the year 2050 the population of California will have tripled to 60 million (Association of California Water Agencies Sept.2007). California drinking water is becoming increasingly polluted and the Californians are already feeling the consequences of water shortages resulting from falling supply in the face of rising demand. (Association of California Water Agencies Sept.2007). 2007 was the driest year on record and the Sierra Nevada Snow Pack, which supplies 90% of the water used in Los Angeles and stores 35% of the state's supply was at its lowest on record. Climate forecasters at Stanford University and the University of California Los Angeles predict that Snow Pack will shrunk by 35%.

In India Water pollution primarily from untreated domestic, agricultural and industrial waste is of growing concern, where it is estimated that 1600 lives are lost to waterborne diseases every single day (International Herald Tribunal 28 Sept.2008) the domestic sector is responsible for majority of India's water pollution. Over half of the 3.6 million cubic meter of sewerage produced by the city of New Delhi enters the water supply every day. Due to the recent expansion of agrochemicals use in India, the groundwater contains increasingly high levels of fertilizers and pesticides, several of which are considered extremely hazardous by the World Health Organization (International Herald Tribunal 28 Sept.2008) the industrial sector still commands only 3% of annual water withdrawals in India. It is estimated that industry generates 55000 million cubic meters of wastewater a day, including 68.5 million cubic meter dumped directly into rivers and streams (Imminent crisis in India).

In China according to a recent poll of 4 million people by the All-China Environmental Federation (ACEF), 95% of those surveyed believed that China was already experiencing water shortage crisis. China is indeed facing immense problems balancing supply with demand and its situation looks set to worsen in the coming years due to falling supplies of fresh water resources, widespread wastage of the resources and rising demand for drinking water (Water Quality and Health Council, 8 August 2005). The supply of water available is decreasing due to climatic change. The Qinghai Tibetan plateau is shrinking at rate of 17% a year which is already affecting the availability of water in the dry season (MSNBC Report 2006).

Over the past 15 years the lakes in the Jangtie River Region decreased by 10.64% and the ministry of water resources reported a drop of 10% in the water level of the Yellow River, Huai River and Hai River Basins(Water Quality and Health Council, 8 August 2005). The problem is compounded by the extraordinary pace of desertification in the north of the country, where the desert is expanding at a rate of 950 miles a year. Wastage of water in the agricultural sector accounts for 69% of China's water use thus putting a further strain on resources(Water Quality and Health Council, 8 August 2005). 95% of Chinese farms use gravity flow irrigation systems, which have an efficiency rate of only 35-60% to grow water intensive crops like rice and wheat. It is estimated that 8.5% of the world's water is wasted this way (Erin Henry 2004). Consequently water is being extracted from the ground and surface sources faster than it can be replenished by precipitation. In the Hai River, the extraction rate is as high as 90% which is far above the 30% needed to conserve the resource (Erin Henry 2004).

It is estimated that by 2030 there will be 1.5 billion people in China and per capita water resources could fall to 1750 cubic meters barely above the 1700 cubic meters measurement that defines a water scarce nation (http://www.uswaternews.com). The quality of china's drinking water is also a cause for concern. According to the state environmental protection agency 70% China's rivers and lakes are polluted and 90% ground water is too polluted to drink.

Climate change is a phenomenon we can no longer deny as its effects have become increasingly evident worldwide. On the list of warmest years on record, almost every year since 1992 is included and NASA and NOAA data,

2012 was the hottest. As the earth's temperature continues to rise, we can expect a significant impact on our fresh water supplies with the potential for devastating effects on these resources. As temperatures increase, evaporation increases, sometimes resulting in droughts. As of 2013, the U.S. has been experiencing one of the most severe, multi-state, multi-year droughts in decades.

The relationship between climate change and water doesn't end there. The systems used to treat and move public water supplies require large amounts of energy, produced mainly by burning coal, natural gas, oil and other fossil fuels. So, when we use water we also use energy and contribute to climate change. In addition, bottled water is a small but real contributor to greenhouse gas emissions, because it takes fuel to make plastic bottles and ship them around the country (and even the world). This is unnecessary when you consider that bottled water is often just filtered tap water.

Kenya is limited by annual renewable fresh water supply of 647 cubic meter per capita and is classified as a water scarce country (Momanyi, quyen le 2005.) only 57% of the rural population has access to improved drinking water source and the time intensive pursuit of water collection prevents women from taking up income generating activities for girls prevents them from attending school (ministry of water and irrigation strategic plan 2009-2012). In 2007, findings from the national water service strategy indicated that the water sanitation is poor with only 57% of households using water from sources considered safe. Sustainable access to safe water is around 60% in the urban setting and drops to as low as 20% in the settlements of the urban poor , where half of the population lives(KIHBS 2005/2006/2007) Over 50% of

Kenya's households do not have access to safe drinking water and the proportion is higher for the poor. This is also replicated with huge disparities between geographical regions where north eastern and eastern regions getting less than 30% of safe water compared to western regions' 60% (Social policy in Kenya report) While most countries have committed to increasing access to safe water, there is little consensus on how to actually achieve this goal (Birdsall and Nellis, 2002). In general, international consensus exists that the private sector has a role in the provision of urban water and sanitation services (Njiru, 2004). Governments who want to privatize water systems are typically motivated by potential efficiency gains. They hope that these efficiency gains will be translated into expanded access and enhanced service quality and thereby improve health outcomes (Asingo, 2005). World Bank (2005) observes that poor access to water supply is often a result of poor policies and management practices; however, there is significant disagreement over the approach to addressing the problem. World Bank (2003) argues that a first and crucial step towards improving water situation and its management is to treat water as an economic good. The Economist argues that the problem "above all, is that it has been colossally underpriced and that to meet the target of halving the proportion of people without access to clean water money will play a part. Water is therefore viewed as an economic as well as social good. But greater reliance on pricing and markets are even more crucial" (The Economist July19-25, 2003).

Experiments of more than a decade have shown that privatization of water services was a poor policy prescription, involving spectacular failures (UNDP, 2006). Problems have been associated with the difficulty of

establishing competitive market structures (Estache et al., 2005; Kessides, 2004; Kirkpatrick et al., 2006), ineffectiveness of regulation in the presence of information asymmetries and incomplete contracts (Martimort, 2006), and negative welfare effects (Bayliss, 2003; Dagdeviren, 2006). The privatization of water supply and sewage disposal is currently a political issue in many countries around the world (Shiva, 2002; Swyngedouw, 2004). It is highly contested because water is an indispensable good: to exclude people from access to drinking water means to deprive them of the basis of their existence; and a lack of access to sanitation systems is a threat to living quality because it can be the cause of serious diseases. What is involved here is the struggle between the logic of water as a public good thatshould be accessible to everybody independently of his or her purchasing power, and the logic of water as a commodity that is produced and sold under capitalist market conditions. While, in general, water sector reforms for improving efficiency service quality and access are welcome, heavy reliance on tariff rationalization without paying much attention to investment and maintenance needs could be a serious problem (Dagdeviren, 2006).

While Kenya is water insecure and vulnerable, water is at the same time critical to the economy. Kenya is a largely agricultural economy, contributing 27 percent of GDP, employing an estimated 80 percent of the workforce, and providing 57 percent of exports (MoA 2009; MoWI 2009b). According to the Minister for Water, in August 2010 the area under irrigation was 120,000 ha, out of a potential area of 539,000 ha (Hansard 2010b).The City of Nairobi meets its demand from both surface water (Ruiru, Sasumua, and Ndaka'ini dams) and groundwater (Kikuyu Springs and thousands of

boreholes). Nairobi generates approximately 50 percent of Kenya's GDP (KIPPRA 2008). The city has at times been held hostage to restricted water supply. Because of this, many domestic, commercial, and industrial water users rely on their own boreholes as a coping strategy in the face of inadequate municipal supply. Abstraction across the metropolitan area is estimated to be 160 MLD, or 58 MCM/yr (WRMA 2010a). Similarly, the investment legacy has meant that water supplies to the major population centers of the coast have often been under stress. All the significant water sources that provide water to the port, industry, tourism, commerce, and residential population on the coast are groundwater (Lamu sand duneaquifer, Baricho aquifer, Mzima Springs, Marere Springs and Tiwi aquifer), which puts this vital component of Kenya's economy at the mercy of climate change.

Accordingly, the Water Act Cap 372 underwent various amendments which resulted to the Water Act 2002 which became operational on the 18th March 2003. The Act has therefore seen local authorities form municipal water companies, which operate on strict commercial lines, for example Kisumu, Nairobi, Nyeri, Eldoret and Mombasa among others, have all privatized their water and sanitation services and formed companies to manage them and number of local authorities are in the process of establishing their water companies.

The study assesses how environmental changes, financial constraints and human changes affects the accessibility to water services in six Locations in Kipkaren Division of Nandi North District; Kipkaren Salient, Laboret, Chepkemel, Ndalat, Kapkatet and Kabiemit Locations.

1.2 Statement of the problem

It is Approximated that half of the global population will be living in regions of high water stress by 2030 (World water development report 2009). The global population is expanding by 80 million people annually, increasing the demand for fresh water by 64 million m^3 a year (News service March 12 2009).Kenya is limited by annual renewable fresh water supply of 647 cubic meter per capita and is classified as a water scarce country (Momanyi, quyen le 2005.) only 57% of the rural population has access to improved drinking water source and the time intensive pursuit of water collection prevents women from taking up income generating activities for girls prevents them from attending school (ministry of water and irrigation strategic plan 2009-2012). In 2007, findings from the national water service strategy indicated that the water sanitation is poor with only 57% of households using water from sources considered safe.

Kipkaren division has a total population of 69,041 people and a total of 13,332 households (2009 population census) water coverage is approximated at only 13%, which is far below the national coverage in rural areas in Kenya. There are only 87 protected wells, 2 boreholes and no protected springs in the whole division. Most people get their water from rivers and springs. The average distance to the nearest water point is approximately 500 meters with women and girls having the sole responsibility of fetching water for domestic use. The division is predominantly agricultural dependent. There are 348 simple pit latrines, 44 VIP latrines toilets and no septic tanks. Population growth is estimated at 3.1%. It is against this background that this study aims

at establishing how environmental changes, financial constraints, human activities and water source location influences accessibility to water for domestic use in Kipkaren Division of Nandi North District.

1.3 Purpose of the study

The purpose of this proposed study is to assess the factors influencing accessibility to water for domestic use in Kipkaren division in Nandi County.

1.4 Objectives of the study

1) To assess how environmental changes influence accessibility to water for domestic use in Kipkaren division in Nandi County
2) To assess how financial constraints influence access to water for domestic use in Kipkaren division in Nandi County
3) To determine how human activities influence access to water for domestic use in Kipkaren division in Nandi County.
4) To determine how location of water sources influence accessibility to water for domestic use in Kipkaren division in Nandi County.

1.5 Research questions

The proposed study will be guided by the following questions:

1. How do environmental changes influence accessibility to water for domestic use in Kipkaren division in Nandi County?
2. To what extent do financial constraints influence accessibility to water for domestic use in Kipkaren division in Nandi County?
3. How do human activities influence accessibility to water for domestic use in Kipkaren division in Nandi County?

4. How does location of water sources influence accessibility to safe and clean water for domestic use in Kipkaren division, Nandi County?

1.6 Assumptions of the study

The proposed study will base on the following assumptions: The respondents will be willing to avail the information as stipulated in the questionnaires and provide honest responses that reflect the real effects of accessibility to safe and clean water in Kipkaren division. There will be no drastic changes in the sources of water for households in Kipkaren division.

1.7 Delimitation of the study

The study will investigate factors influencing accessibility to water for domestic use in Kipkaren division.

1.8 Limitations of the study

The study will focus on the assessment of factors influencing accessibility to water for domestic use in Kipkaren division only therefore limiting the study findings to a specified geographical location. In addition, the study is limited by time as the final report must be provided within a specified time frame which may be restrictive in enabling the researcher to gather additional relevant information. This will be counteracted by the development of a research plan to effectively and optimally manage time allocated to conduct the study. Lastly, there was also the issue regarding information dissemination whereby, the target population may be reluctant to provide the relevant data regarding personal information about their

households. This will be counteracted by the option of anonymity with regard to the structured questionnaires to be administered to respondents.

1.9 Significance of the study

The study will be relevant to the Kenyan Ministries of Health and Water which will find the study useful in planning and developing strategies to improve on accessibility to clean and safe water. The study will also enable the Kenyan government to re-evaluate its funds allocations to promote accessibility to clean and safe water in the country, to include improvement of water sources in many rural areas. The community will also be able to determine and understand the benefits of better management of local sources of household water**.**

1.10 Definition of significant terms

Water for domestic use refers to water for both human, animals and agricultural use.

Accessibility to water refers to the ease with which one can get and make use of water in a given area and time.

Environmental changes are the various determinants which have varied with time affecting accessibility to safe and clean water.

Financial constraints these include monetary impending issues hindering people from access to clean and safe water.

Human activities these includes are those actions done either knowingly are unknowingly by people which in one way or another affects access to water.

Location of water sources where water is gotten from is it from private or public source and how to reach there.

1.11 Organization of the study

Chapter one entails; background of the study, purpose of the study, objectives of the study, research questions, assumptions, scope, limitation, chapter two entails; introduction, effects of climatic changes on accessibility to safe and clean water which includes; global warming greenhouse emissions and gases. Human activities like; population increase, pollution by; fertilizers, animal wastes, septic tank effluent, atmospheric dispositions, lead in drinking water. Deforestation, destruction of wetlands and a table on the wards in Kipkaren division. Effects of financial constraints on access to water which include; scarce financial resources, price of water, distance and cost resource allocation, effects of water source location on access to water, and finally the conceptual framework. Chapter three includes; introduction, research design, study area, target population, sampling design and sampling size, breakdown of sample size, data collection instruments; questionnaire interview, observation, data collection procedure; validity and reliability of data, data analysis and ethical consideration.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter deals with the review of what various writers have documented about access to water in general and what has been studied about access to water for Kenyan households in particular. Emphasis is put on the Kenyan experience with a view to identifying the gaps that exist and which justifies this particular study. The topics to be covered are: influence of human changes, effects of environmental changes, influence of social changes, effects of economic changes on access to clean and safe water, Theoretical framework and Conceptual framework.

2.2 Concept of environmental changes on access to water for domestic use.

According to the Africa Partnership Forum, "Although Africa is the continent least responsible for climate change, it is particularly vulnerable to the effects," and the long-term impacts include, "changing rainfall patterns affecting agriculture and reducing food security; worsening water security; decreasing fish resources in large lakes due to rising temperature; shifting vector-borne diseases; rising sea level affecting low-lying coastal areas with large populations; and rising water stress".

More specifically, (Human Development Report 2006) predicts warming paired with 10% less rainfall in interior regions of Africa, which will be amplified by water loss due to water loss increase from rising temperature. This warming will be greatest over the semi-arid regions of the Sahara, along

the Sahel, and interior areas of southern Africa.(Intergovernmental Panel on Climate Change 2007) reports that climate change in Africa has manifested itself in more intense and longer droughts in the subtropics and tropics, while arid or semi-arid areas in northern, western, eastern, and parts of southern Africa are becoming drier and more susceptible to variability of precipitation.

(Human Development Report 2006) goes on to explain that because of Africa's dependence on rain-fed agriculture, widespread poverty, and weak capacity, the water issues caused by climate change impact the continent much more violently compared to developed nations that have the resources and economic diversity to deal with such global changes. This heightened potential for drought and falling crop yields will most likely lead to increased poverty, lower incomes, less secure livelihoods, and an increased threat of chronic hunger for the poorest people in sub-Saharan Africa. Overall this means that water stress caused by changing amounts of precipitation is particularly damaging to Africa and thus climate change is one of the major obstacles the continent must face when trying to secure reliable and clean sources of water

The relationship between water, energy, agriculture and climate is a significant one. More and more, that relationship is falling out of balance jeopardizing food, water and energy security (Nasac 2007). Climate change is a phenomenon we can no longer deny as its effects have become increasingly evident worldwide. On the list of warmest years on record, almost every year since 1992 is included and, according to NASA and NOAA data, 2012 was the hottest.

As the earth's temperature continues to rise, we can expect a significant impact on our fresh water supplies with the potential for devastating effects on these resources. As temperatures increase, evaporation increases, sometimes resulting in droughts. As of 2013, the U.S. has been experiencing one of the most severe, multi-state, multi-year droughts in decades (Parry, M.L et al 2007*).* In addition, rising temperatures are melting glacial ice at an unprecedented rate. Glaciers are an important source of freshwater worldwide, and some, like those at Glacier National Park, are in danger of disappearing within the 21st century. Once these glaciers have melted away, they can't be restored. Areas that previously depended on glaciers for freshwater will then have to seek other sources.

It is all the more critical that increased water use by humans does not only reduce the amount of water available for industrial and agricultural development but has a profound effect on aquatic ecosystems and their dependent species. Environmental balances are disturbed and cannot play their regulating role anymore

More than 50 percent of the world's freshwater come from mountain runoff and snowmelt. Complicating this potential outcome is the prediction that in a warmer environment, more precipitation will occur as rain rather than snow. Although more rain than snow may seem like a plus, it could mean more frequent water shortages. When snow and ice collect on mountaintops, water is released slowly into reservoirs as it melts throughout the spring and summer. When rain falls, reservoirs fill quickly to capacity in the winter, which can also result in excess water runoff that can't be stored. Because rain

flows faster than melting snow, higher levels of soil moisture and groundwater recharge are less likely to occur. Areas that rely on snowmelt as their primary freshwater source could increasingly experience water shortages, like having low water supplies by summer's end.

The systems used to treat and move public water supplies require large amounts of energy, produced mainly by burning coal, natural gas, oil and other fossil fuels. So, when we use water we also use energy and contribute to climate change. In addition, bottled water is a small but real contributor to greenhouse gas emissions, because it takes fuel to make plastic bottles and ship them around the country (and even the world). This is unnecessary when you consider that bottled water is often just filtered tap (WaterMeinshausen, M., et al nov.2011).

There's a lot we can do to reduce emissions, prevent climate change and protect our threatened freshwater sources (WaterMeinshausen, m, et al nov.2011). Using less energy is a great place to start. This can be done by turning off lights, better insulating our homes to conserve heat and air conditioning, driving more fuel efficient cars and driving less. Cars and light trucks (like vans and SUVs) are responsible for about 20 percent of U.S. energy-related carbon emissions. In addition, eating lower on the food chain, even going meatless just one day a week can have a significant impact on environmental resources because industrial meat production has significant greenhouse gas emissions associated with it (WaterMeinshausen, M, et al nov.2011).

Conserving water, food and other resources is an important step towards reducing overall energy use, because most everything that is made, transported and thrown away requires the use of fuel and water. By carpooling, using public transportation, driving less, and reducing our consumption of food and consumer goods, each individual can make an impact on curbing greenhouse gases (Water Meinshausen, M, *et al* Nov.2011).

2.3.1. Human and accessibility to water for domestic use

Nearly half of the global population will be living in regions of high water stress by 2030(World water development report 2009). The global population is expanding by 80million people annually, increasing the demand for fresh water by 64 million m3 a year (News service march 12 2009). Global population numbered 6.1 billion in 2000 and is currently growing by a net increment of some 77 million people per year. By 2025, the United Nations Division, in its 2000 Revision of the world's population prospects, estimates that the total world populations will be of the order of 7.8 billion. The impact of this growth will be focused mainly in less developed countries, where currently some 1.2 billion people, the majority of whom are women and children, are living in extreme poverty.

The bulk of the population growth will accrue in the regions of the world least able to absorb large increments of people, increasing migration threatening sustainable development and the quality of life. Fresh water is distributed unevenly, with nearly 500 million people suffering water stress or serious water shortage (population and development strategies series 2003).

2.6 billion People lack adequate sanitation (2002, UNICEF/WHO JMP 2004) 1.8 million people die every year from diarrhea diseases. 3.900 children die every day from water borne diseases (WHO 2004). Daily per capita use of water in residential areas: 350litres in North America and Japan, 200litres in Europe, 10-20litres in sub-Saharan Africa. Over 260 river basins are shared by two or more countries mostly without adequate legal or institutional arrangements.

Access to clean, safe water is a recognized as a fundamental human right by the World Health Organization. Nobel Prize winning biochemist, Albert Szent-Gyorgyi (Hungary) advised, "There is no life without water." Contaminated water accounts for 2 million worldwide deaths annually. Declining supplies of quality water sources increase poverty through declining employment and income opportunities for the poor. The combination of rural poverty, population pressures and dwindling water supplies is a powerful force driving rural to urban migration, as well as cross border movements. Rapid urban growth often leads to people establishing slums where there are serious problems with, for example, water supply, sanitation and industrial waste. The rapid pace of urbanization further hinders the development of adequate infrastructure and regulatory mechanisms to cope with water pollution and the by-products of population and economic growth (Hunter, 2001). At the same time, increased consumption patterns in urban areas may divert water from rural areas. Thus, mobility and spatial distribution of populations are significant determinants of sustainability and in particular of water consumption patterns (Global Science Panel, 2002)

Although food security has been significantly increased in the past thirty years, water withdrawals for irrigation represent 66 % of the total withdrawals and up to 90 % in arid regions, the other 34 % being used by domestic households (10 %), industry (20 %), or evaporated from reservoirs (4 %). (*Shiklomanov, 1999*)As the per capita use increases due to changes in lifestyle and as population increases as well, the proportion of water for human use is increasing. This coupled with spatial and temporal variations in water availability, means that the water to produce food for human consumption, industrial processes and all the other uses is becoming scarce.

Already there is more waste water generated and dispersed today than at any other time in the history of our planet: more than one out of six people lack access to safe drinking water, namely 1.1 billion people, and more than two out of six lack adequate sanitation, namely 2.6 billion people (Estimation for 2002, by the WHO/UNICEF JMP, 2004). 3900 children die every day from water borne diseases (WHO 2004). One must know that these figures represent only people with very poor conditions. In reality, these figures should be much higher.

As a way of assessing how changes in land use in the basin during the past 50 years have affected nitrate concentrations in ground water discharging to springs, nitrogen inputs from various nonpoint sources were estimated. Methods for compiling and estimating nitrogen inputs for each of five selected counties (Suwannee, Lafayette, Gilchrist, Columbia, and Alachua) in the study area are discussed below. For each county, estimated N input loads were computed for fertilizers, atmospheric deposition, animal wastes (dairy and

beef cows, layer and broiler chickens, and swine), effluent from septic tank systems, and atmospheric deposition.

Estimates of N from fertilizers applied to cropland were computed by using two sources of information: (1) fertilizer sales records compiled annually by the Florida Department of Agriculture and Consumer Services (DACS), and (2) recommended rates of fertilizer application for various crop types by the Florida Institute of Food and Agricultural Sciences (Jones and others, 1974; Kidder and others, 1998). To obtain estimates of N inputs from fertilizer sales information, the amount of N was estimated for various materials sold as fertilizers. These dominant materials [with percentage by weight of N in parentheses (Farm Chemicals Handbook, 1998)] included anhydrous ammonia (82), ammonium nitrate (34), ammonium sulfate (21), Cyanamid (21), potassium nitrate (16), nitrogen solutions (33), and urea (46). The relative amounts of these materials varied annually; however, the largest inputs of N were from the fertilizer materials anhydrous ammonia, ammonium nitrate, and nitrogen solutions. The amount of each material sold was multiplied by the percentage of N and summed to obtain the annual estimates of N from fertilizers sold in each county. Fertilizer sales data tended to overestimate the amount of N applied because not all fertilizer sold in a particular county was used in that county. There was no reliable way to track the amount of fertilizer sold in a particular county that was transported in or out of a county or that which was stockpiled in any given year. Therefore, estimated inputs of N from fertilizer sales information may represent maximum values of N inputs. Another estimate of N inputs from fertilizers

was obtained from recommended application rates for various crop types and published information on crop acreage in each county. N inputs from fertilizer applications for years 1954, 1959, 1964, and 1969 were calculated by multiplying the total amount of fertilizer applied per unit area by the area on which fertilizer was applied (from Florida Agricultural Census data) by the average percentage of N by weight for fertilizers sold in each county. The average percentage of N by weight was calculated from historical sales data for each county for these 4 years. The percent N in each fertilizer mixture was weighted by amount sold for quantities greater than 22,700 kilograms (kg) or 25 tons. This represented approximately 94 percent of the total weight of mixed fertilizers sold annually. The remaining 6 percent was assumed to have the same percentage of N as the known amount.

Starting in 1974, data for major crop acreage were compiled for each county. The number of acres of harvested crops was multiplied by the recommended rates of fertilizer application for each crop type (Kidder and others, 1998) and summed to obtain the total N for each county for a given year. Since the sum of the harvested cropland acreage was less than the reported total acres on which fertilizers were applied (DACS Census data), the total N loading from fertilizers was adjusted by multiplying the N-loading amounts for the harvested cropland acreage by the ratio of total acres of fertilizer applied to the sum of the harvested cropland acreage.

Estimates of N inputs from animal manure were calculated for 1955-95 from the numbers of beef cattle, dairy cattle, swine, broiler chickens, and egg-

laying chickens in each county (U.S. Department of Commerce, 5-year intervals from 1946-97), and from estimates of the nutrient content of manure for each of these animals, as described below. Estimates of losses due to volatilization and other processes resulting from various waste management practices are discussed in a later section. Nutrient contributions, in kilograms per day (kg/day) of nitrogen, from animal wastes were as follows, based on 454 kg (1,000 pounds) of animal: dairy cows, 0.18; beef cows, broiler chickens, 0.50; egg-laying chickens, 0.38; and swine, 0.24. Average weights, in kg, of animals used in the calculations were: broiler chickens, 0.9; egg-laying chickens, 1.4; beef cows, 364; dairy cows, 635; and swine, 61 (American Society of Agricultural Engineers, 1996). Nitrogen loading to ground water from poultry manure and poultry litter (combination of manure and bedding materials) during 1954-97 was estimated by using information on the annual estimates of the number of broilers (also called fryers or frying chickens) from Florida agricultural census data (DACS, 1954-97) and from estimates of the amount of annual manure production and its average total N content. An annual N-loading estimate of 0.022 kg per broiler is based on a manure production rate of 1.1 kg with an average total N content of 2 percent (Sloan and others, 1992; Vest and Merka, 1994).

Annual N inputs from domestic septic tank systems were estimated by multiplying the average mass loading of N, 4.09 kg N per capita per year (Otis and others, 1993), by the number of people that are contributing wastes to septic tank systems in each of the five counties (U.S. Bureau of the Census, 1990). The percentage of the population contributing wastes to septic tanks or

cesspools in each county was calculated from sewage disposal data from the 1990 Census of Housing: Alachua (27), Columbia (72), Gilchrist (88), Lafayette (83), and Suwannee (76). Sewage disposal data were available only from the 1990 Census of Housing (U.S. Bureau of the Census, 1993). To estimate N inputs from septic tanks prior to 1990, it was assumed that the percentage of the population on septic systems remained constant back to 1955. The average mass N loading assumes a water use of 170 liters per capita per day (Otis and others, 1993). Nitrogen loading from other human waste sources, such as commercial septic tank effluent and recreational vehicle wastewater, were assumed to be negligible in this study.

Clearing land for agriculture and urban growth often leads to water pollution. When soil is stripped of its protective vegetation it becomes prone to soil erosion. This leads to an increase in the murkiness of the water which can cause the following: it can block the gills of fish; bottom dwelling plants cannot photosynthesize as the sun's rays cannot reach them; and there is an increase in disease as bacteria and viruses use the soil particles as a method of transportation. *Damming of rivers* Damming of rivers can have an impact on water in the following ways: Water flowing out of dams: has reduced suspended material as a large amount settles to the bottom of dams; is depleted of nutrients; and is often more saline with detrimental effects on downstream agriculture and fisheries. Enhanced eutrophication may result due to the water spending a longer time in the dam. There is also increased evaporation in dams, especially those with a large surface area, such as the Vaal Dam.

Wetlands are nature's way of cleaning water as well as damming water (they hold back water in summer and release it in winter). Destruction of wetlands: Destroys the habitat of many birds and fish; Removes the natural filters capable of storing and degrading many pollutants, such as phosphorus and heavy metals; Destroys natural dams and causes flooding further downstream

Table 1: Wards of Kipkaren Division

No.		Name of ward	Population (2009 National Census)	Area (Sq. Km)	Description
1	775	Kipkaren	19,147	93.90	Laboret, Kipkaren Salient and Chepkemel Locations of Nandi North District.
2	778	Ndalat	18,651	75.10	Kabiemit, Kapkatet, and Ndalat locations of Nandi North District l

Source: Independent Electoral and Boundaries Commission (IEBC)

2.4 effects of financial constraints on access to water for domestic use

African leaders have declared their commitment to achieving universal access to clean water, through their development blueprint, the New Partnership for Africa's Development (NEPAD), and through their support for the Millennium Development Goals (MDGs), which were adopted by world leaders in 2000.A communal village water tap in Ethiopia: In poor and remote rural areas, community water management may be more feasible than either public utilities or commercial companies.

The seventh MDG is to cut in half, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. In sub-Saharan Africa, that proportion was reduced from 52 per cent to 44 per cent between 1990 and 2004. But the target, 26 per cent, still remains very distant. Some countries, such as Senegal, Gabon, Uganda and South Africa, are significantly increasing the number of new water connections and expanding delivery in urban areas, through both public and private investment. Senegal, reported the UN in a June 2007 assessment of progress towards the MDGs, "is on track to achieving the water and sanitation goals through a national investment programme financed with donor money."

Africa faces a number of constraints in achieving expanded access to clean water. These include an insufficient number of skilled personnel and effective institutions. In some countries, water scarcity or pollution also pose particular challenges. The most common hindrance is the limited resources available to most countries. "Inadequate financing is the single most important factor affecting the continent's fresh water delivery abilities," Peter Akari,

chief water policy officer of the African Water Facility at the African Development Bank (ADB), told *Africa Renewal***.**

The source of money to finance water projects still remains a big challenge. Donors are likely to provide only a portion of the estimated $5 bn needed annually to achieve the MDG target. TheUN Development Programme (UNDP) estimates that total budgetary spending in the water and sanitation sectors in sub-Saharan Africa is currently around $800 mn a year. This amount could likely be increased to $2.5 bn through "cost recovery" measures by service providers (charging users for water) and financial mobilization by local communities. Governments should also be able to increase their own budgetary allocations somewhat. In addition, a number of countries, at the urging of the World Bank and the International Monetary Fund (IMF), have sought to enlist private investment in expanding water facilities. "There is not one single solution to ensuring everyone gains access to water," says the UK charity Water Aid. "So it is impossible to say in general terms whether it is a good idea for private, public or community organizations to be involved in the delivery and management of services. Each circumstance should be looked at individually and a suitable pro-poor, affordable and sustainable solution found to fit each community. "The UNDP(*Human Development Report 2006)* agrees n seeking to expand access to clean water, the report comments: "Decisions about the appropriate public-private mix have to be taken case by case on [the basis of] local values and conditions."

African governments have the responsibility to reach the over 300 million people who are currently deprived of improved drinking water ,argues Henry Ndede, a water coordinator for the UN Environment Programme

(UNEP) in Nairobi, Kenya Governments, he told *Africa Renewal*, "must put in place the right water policies to embrace the participation of the private sector in water provision. With the absence of policies, it becomes difficult."

He cites the example of Kenya, where a water policy developed in 1999 has led to improvements in the quality of water from the country's public system, raised revenue collection and brought more boreholes to rural communities. A 2002 water act decentralized the management of water resources and delivery. Local public companies were formed to manage water in municipalities. They largely achieved their goal of increasing the number of customers served with improved water by 50 per cent and reducing water wastage by over 40 per cent, without raising tariffs.

Some publicly owned water utilities in Africa "are efficiently run using local management structures," notes Stephen Donkor, a senior adviser on water issues for the UN Economic Commission for Africa (ECA), headquartered in Addis Ababa, Ethiopia. Their achievements, he says, counter the negative image held by some that African public utilities are inherently inefficient and can only be improved by the introduction of private owners or contractors. What these successful public utilities "do right should be shared with their sister institutions," in other countries, Mr. Donkor told *Africa Renewal*.

Yet even in Kenya, equitable access remains a challenge. "In the urban areas, the infrastructure caters for the planned, but not the unplanned, settlements," reports the Washington-based consumer advocacy group Public

Citizen. “For those in planned settlements, there is access to piped water. [But the] reliable flow of water varies from area to area.”

2.5 location and accessibility to water for domestic use

In developing countries like Kenya, only around 40 percent of the rural populations have access to good quality water. Almost 50 percent i.e. 12.6 million in rural and 3.3 million in urban areas of the 40 million Kenya’s population lack access to safe drinking water and sanitation. The government of Kenya in 1980 set a goal of providing safe and potable water at a source less than one kilometer from homes in high potential or water rich and less than five kilometers away in low potential or water deficient areas by the year 2000. Though the target has not been met, provision of safe drinking water still remains a priority item in the government’s development agenda (Onyango and Angienda, 2010). Kenya is below the international water scarcity threshold (1 000 m3 per person per year) with only 935 m3 available per person per year (FAO 2007), and population growth is forecast to reduce this figure to 359 m3 by 2020 (UN-Water 2006). Kenya’s water resources are unevenly distributed. Many of its arid regions receive only 250 mm or less of rain per year. Highly stressed water systems include Lakes Victoria, Nakuru, and Naivasha, as well as the Nzoia, Nyando, Turkwel, Kerio, Athi, Voi, Tana, and Ewaso Nyiro rivers. In addition, salinity levels in many water bodies, such as Lake Turkana, are too high for human use of the water. In arid regions, when they occur, rains come mainly in violent storms causing erosion and leaching nutrients from the soil.

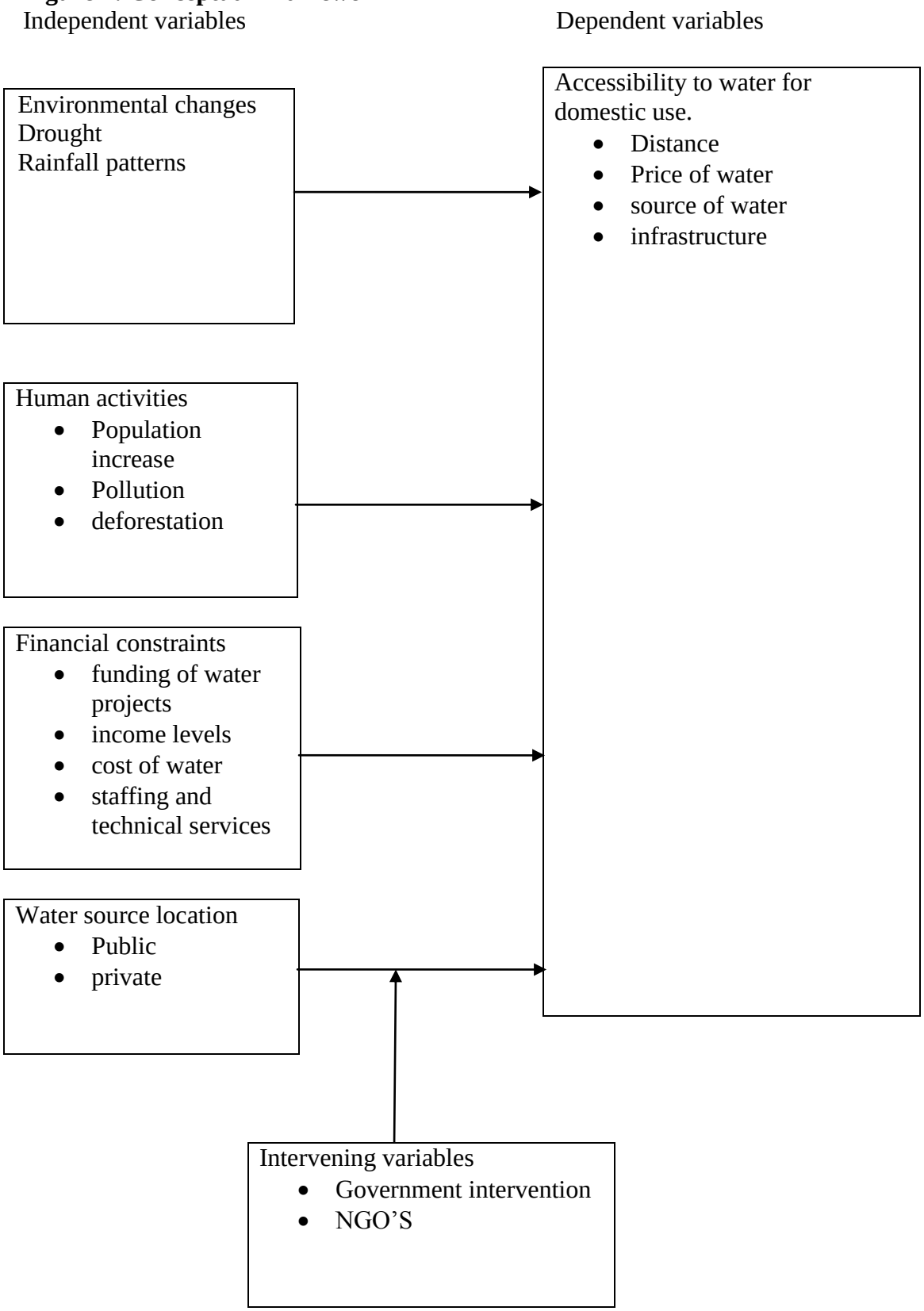
Women have the main responsibility for managing their household’s needs for water, sanitation, and health. In a number of regions, women and girls spend

many hours a day fetching water. In the Samburu District of central Kenya, for example, some women walk more than nine kilo meters daily to find water (Aguirre 2007). With the increased frequency of droughts, women's trekking distances for water are increasing. The time spent obtaining water is time that could otherwise be devoted to schooling, child-care, or to income-generating activities. In addition, women are confronted with personal security risks while away from home and they endure immense physical burdens, since 20litres of water can weight about 20 kg (UNDP 2008). Increasing the provision of clean, accessible water to communities can significantly decrease child mortality and fatal diseases and make it possible for children and women to go to school. Access to clean water is therefore crucial in attaining most of the MDG targets.

2.6 Conceptual framework

The conceptual framework figure shows the operationalization of the independent variables (the factors determining accessibility to clean and safe water) into the dependent variable (clean and safe water for domestic use). It also shows how the dependent variable (clean and safe water) relies on the independent variables.

Figure 1: Conceptual Framework



CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter captures the research design and methods that will be used in the study in order to attain the required objectives. It gives the description of the area of study, research design, and target population, sampling techniques, research instruments, validity and reliability of research variables, data collection and analysis procedures.

3.1 Research design

The study will adopt descriptive research design. Descriptive research design attempts to clarify why and how there is a relationship between two or more aspects of a situation or phenomenon. Descriptive research design is a useful research method, particularly for gathering and analyzing data at a specific point in time with the intention of describing the causative correlation among existing conditions, identifying standards against which existing conditions can be compared and determine the relationships that exist between specific events (Manion and Cohen, 1994).

3.3 Target population

The target population will be all households in Kipkaren division; 3211 households (2009 census). The sample size will be 322 females from households and 3 ministry of water officials. The total number of respondents will be 335.

3.4.1 Sample size

The sample size will be 325 respondents which includes of 322 females from households and three ministry of health officials.

3.4. 2 Sampling procedure

The sample will be selected using cluster random sampling technique where the entire study area will be clustered into two ward clusters that is; Kipkaren and Ndalat ward clusters. Gay (2003) recommends that when the target population is small (less than 1000 members), a minimum sample of 30% is adequate for educational research and 10% for a population of over 1000. In this study therefore will use 10% sample. Using proportionate sampling, the study will involve a sample size of 270 and 52 respondents from Kipkaren and Ndalat respectively from these two ward clusters. Will also do a purposive sampling of; 3 ministry of water officials.

Table 2: Breakdown of sample size

Ward	**Target Population**	**Procedure**	**Sample size**
Kipkaren	2,699	2,699x10%	270
Ndalat	512	512x10%	52
TOTAL	**3,211**		**322**

Source: Author, 2013

3.5 Data collection procedure

The study will involve both qualitative and quantitative data. Primary data will be collected directly from the respondents using questionnaires and interviews, also getting technical relevant data using purposive interviews on ministry of water and health departments. Secondary data will be collected from existing records and documents relevant to the study objectives such as health records, government survey reports, libraries and internet.

3.6 Data collection instruments

Household Survey will be administered to all the respondents. They are preferred because they can be used to gather data quickly from a large sample population. They are also deemed appropriate as many respondents can be reached (Borg and Gall, 1983; Monette et al, 1989). They are economical in terms of time, effort and cost. Questionnaires are characterized by low rate of return of the dully filled in questionnaires when mailed (Kerlinger, 1986). On the other, hand they can only be used when respondents are educated and cooperating and there is also the possibility of ambiguous replies to or omissions of replies to certain questions, interpretation of omissions can be difficult. For this reasons the questionnaires will be self-administered and collected immediately.

The questionnaire will include items on socioeconomic characteristics, work and work-related conditions, health, hygiene practices, water collection, storage and treatment practices, social networks, as well as a time use survey for the female head in charge of fetching water.

a. Interview

Face to face interviews will be conducted on purposively sampled ministry of health and water staff. This will provide rich data, offer the opportunity to establish rapport with interviewees, and help to explore and understand complex issues (Borg and Gall, 1983; Monette et al, 1989).

b. Observation

Observation helps to comprehend issues through direct observation (either as participant or non-participant) and then, if it is possible asking questions to seek clarification on certain issues. The data obtained are rich and uncontaminated by self- report biases (Kerlinger, 1986).

3.7.1 Validity

Validity refers to the correctness and soundness of results of conclusions reached in the study (Kothari, 2009). The content selected and included in the research tools must be relevant to the variables being investigated for it to pass the validity test. Content validity of the instruments will be determined by giving the questionnaire to my supervisors, colleagues in class and scholars in the school of Distance and Continuing Education, University of Nairobi to carefully and critically examine and assess the relevance of the items to objectives of the study.

3.7.2 Reliability

Reliability refers to the degree of consistency of an instrument or whether it can be relied upon to produce the same result each time it is

applied, (Lokesh, 1992). Reliability will be determined by administering Crobanch alpha test to evaluate the alpha value for all the variables under study. Will also administer a pilot survey in Chepterwai division using split-half reliability to test reliability of the instruments and if they are above 0.5 alpha then will employ the instruments. This is because Statistical values of alpha above 0.7 will be regarded significant in terms of internal consistency of the variables under study.

3.8 Data analysis

Descriptive statistics involving frequencies, percentages, means and modes will be used to analyze data. The descriptions of frequencies and percentages will be used to delineate the proportional amount of level of integration, ease of use, perceived relevance and accessibility proposed strategies. The resulting data analysis from questionnaires, interview schedules and check lists will be summarized and depicted in the form of frequency tables.

3.9 Ethical consideration

Before administering data collection instruments, the researcher will obtain research permit National Council of Science and Technology through the college of distance and continuing learning. It will be the duty of the researcher to remain neutral and objective, and let the respondents participate voluntarily by seeking their cooperation. The researcher will also assure the respondent of the confidentiality of information to be collected and kept to it as part of the professional ethics. Because the respondent has the right to know the identity of the researcher and the intention of research (Emil 2004), the

researcher's identity will be presented to the respondent and the intent of the research will also be openly stated.

Table 3: Operational Definition of Variables

Research Questions	Variables	Indicators	Measuring scale	Tools of data collection	Tools of analysis
What are the effects of environmental changes on access to water for domestic use in Kipkaren division?	Environmental changes	Climatic changes Global warming Deforestation Water catchment areas	. Nominal scale Ordinal scale	Questionnaire Interview	Frequencies, percentages, regression analysis
What are the effects of financial constraints on access to clean and safe water for domestic use in Kipkaren division?	Financial constraints	Scarce financial resources Price of Water Distance and Cost Resource allocation	. Nominal scale Ordinal scale	Questionnaire Interview	Frequencies, percentages, regression analysis
What are the effects of human changes on access to clean and safe water for domestic use in Kipkaren division?	Human changes	Population increase Increased irrigation and agricultural activities Pollution	Nominal scale Ordinal scale	Questionnaire Interview	Frequencies, percentages, regression analysis
What are the effects of water ownership on access to clean and safe water for domestic use in Kipkaren division?	Location of water source	Public Private	. Nominal scale Ordinal scale	Questionnaire Interview	Frequencies, percentages, regression analysis

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1Introduction

This chapter presents the results and discussions of quantitative data analysis of the study. It is divided into two major sections. The first section describes the demographic characteristics of the empirical survey, covering the ward and the number years of residence. The second section of the chapter provides results and discussions which were based on the four major research questions of the study. For the purposes of this preliminary analysis, descriptive statistics was frequently used to describe the general characteristics of the data collection.

4.2 Questionnaire response rate

Out of initial sample of 322(100%) respondents, only 300(93.16%) returned questionnaires. The rest 22(6.84%) of the questionnaires could not be retrieved some were misplaced and others could be not be traced. Thus the returned questionnaires were enough and thence could give representative information of the total population. The response rate is shown in the table 4.1

Table 4. 1: Response Return Rate

Dispatched	Returned	Percentage
322	300	93.16
Total	300	93.16

From the Table 4.1, percentage return rate was 300 (93.16%).According to Nachimias and Nachimais (1958) 80% to 90% return rate is enough for a descriptive survey study**.**

4.3 Demographic characteristics of the respondents

The study sought to determine the demographic characteristics of respondents based on location, years of residence and age of respondents.

4.3.1 Location of residence

The location of the respondents was sought since its findings would assist the study categorize respondents based on location and the findings are shown in Table 4.2.

Table 4. 2: Location of residence

Response	Frequency	Percentage
Kipkaren	158	52.6
Ndalat	142	47.4
Total	300	100.0

The findings in Table 4.2 show that majority of respondents were from Kipkaren location 158(52.6%) responses compared to 142(47.4%) respondents from Ndalat. This ratio is based on location composition of the target population which is fairly representative.

4.3.2 Years of residence

The years of residence of the respondents was sought since its findings would assist the study categorize respondents based on years of residence in the area under study thus be able to ascertain whether they are well acquainted to the factors influencing access to water and the findings are shown in Table 4.3.

Table 4. 3: Years of residence of Respondents

Response	Frequency	Percentage
Below 5	78	26.0
5-10	70	23.3
10-20	69	23.0
Above 20	83	27.7
Total	**300**	**100.0**

The findings in Table 4.3 show that those who had resided there below five years were 78 representing 26%,5-10 years comprised of 70 respondents representing 23.3%, 10-20 years only comprised of 23% while majority of respondents were residents above 20 years of stay with 83 (27.7%). This ratio is fairly representative.

4.4.1 Age distribution of the respondents.

The study did find necessary to understand the age distribution of the female household heads. This was important because it enabled the researcher to determine the level of understanding of the respondents of the information

in the questionnaire. The respondents were asked to state their age bracket and the results were presented in table 4.4

Table 4. 4: Ages distribution of the respondents

Age bracket (in yrs.)	Frequency	Percentage
18-30	110	37
31-45	98	32
46-65	63	21
65 & above	30	10
Total	**300**	**100%**

Table 4.4 shows the age of female household heads ranged from18 to 65 years, most of the respondent aged 18-30, constituting 110 (37%) with a mean of 25 years. 31-45 were 98 (32%) 46-65 were 63 while a few 6(2%) were 46-65%. this shows the age bracket of 18-30 contains majority of female household heads. From these findings it can be noted that women of age brackets 18-30 years are the majority in this area of study and are the ones shouldering the greatest responsibility of fetching water. These are the most productive women in the society and thus the government should ensure that connection of tapped water is enhanced in this area for them to get enough time to do other economic activities. Elsewhere it the situation is not different as found out by oAccess to clean, safe water is a recognized as a fundamental human right by the World Health Organization. Nobel Prize winning biochemist, Albert Szent-Gyorgyi (Hungary) advised, "There is no life without water." Contaminated water accounts for 2 million worldwide deaths annually. Declining supplies of quality water sources increase poverty through

declining employment and income opportunities for the poor. The combination of rural poverty, population pressures and dwindling water supplies is a powerful force driving rural to urban migration, as well as cross border movements. Rapid urban growth often leads to people establishing slums where there are serious problems with, for example, water supply, sanitation and industrial waste.

4.4 Influence of Environmental Changes on Accessibility to Water

The study sought to find out the influence of environmental changes on accessibility to water. This environmental change includes issues like deforestation, destruction of water catchment area and pollution.

4.4.1 Sources of water used by households.

To answer this question the respondents were asked to rank the various sources of water used by their household for other purposes, such as cooking and hand washing. Table 4.5 shows the study findings.

Table 4. 5: Source of water

Response	Frequency	Percentage
River	126	42.0
Well	72	24.0
Tap	10	3.3
Rain water	91	30.7
Total	**300**	**100.0**

The findings in Table 4.3 show that majority of respondents indicated that the river was the major source of water for the residents as shown by 42% responses ,those who depend on water from rain were 91 comprising of 30.7%, 72 respondents draws water from well constituting 24% while only 10

respondents constituting of 3.3% use tapped water .coverage of tapped water still remains very low in this area under study given that most of them draw water from rivers and springs which according to the ministry of water officials are not protected. This is also the situation elsewhere in the world as espoused by the seventh MDG is to cut in half, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. In sub-Saharan Africa, that proportion was reduced from 52 per cent to 44 per cent between 1990 and 2004. But the target, 26 per cent, still remains very distant. Some countries, such as Senegal, Gabon, Uganda and South Africa, are significantly increasing the number of new water connections and expanding delivery in urban areas, through both public and private investment. Senegal, reported the UN in a June 2007 assessment of progress towards the MDGs, "is on track to achieving the water and sanitation goals through a national investment programme financed with donor money."

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4.4.2 The influence of rain on access to water.

The study also sought to determine whether rain patterns influenced accessibility to water. The respondents were asked to state when they experienced drought. Table 4.6 shows the study findings.

Table 4. 6: Influence of rain on accessibility to water

Response	Frequency	Percentage
Non rainy months	158	52.6
Rainy months	142	47.4
Total	**300**	**100.0**

The findings in table 4.4 showed that 52.6% of respondents cited they experienced drought during non-rain months. According to the Africa Partnership Forum, "Although Africa is the continent least responsible for climate change, it is particularly vulnerable to the effects," and the long-term impacts include, "changing rainfall patterns affecting agriculture and reducing food security; worsening water security; decreasing fish resources in large lakes due to rising temperature; shifting vector-borne diseases; rising sea level affecting low-lying coastal areas with large populations; and rising water stress".

4.4.2 The influence of pollution on access to water.

The study also sought to determine the kind of air pollution experienced in the study area and its influence on accessibility to water. The respondents were asked to confirm whether air pollution experienced in the study area influenced accessibility to water. Table 4.7 shows the study findings.

Table 4. 7: Pollution experienced in the study area

Response	Frequency	Percentage
Dust	152	50.7
smoke from vehicles	75	25.0
smoke from burning plastics	73	24.3
smoke from factories	0	0
Total	**300**	**100.0**

The findings revealed that, 50.7% indicated dust was the major source of air population, 25% cited smoke from vehicles, 24.3% indicated smoke from burning plastics, while there was no response for smoke from factories. The findings in table 4.7 showed that 50.7% indicated dust was the major source of air population. This was attributed to the area being agricultural and most farmers used tractors for plough their farms, also it was noted from the interview schedule that given the fact that all roads in the area are not tarmacked most dust was generated from the roads. Climate change is a phenomenon we can no longer deny as its effects have become increasingly evident worldwide. On the list of warmest years on record, almost every year

since 1992 is included and, according to NASA and NOAA data, 2012 was the hottest.

4.4.3 Type of fuel used by the respondents.

The study sought to find out the influence of fuel used by respondents on accessibility to water. To answer this question the respondents were asked to rank the fuel used for cooking water.

Table 4. 8: The study finding.

Response	Frequency	Percentage
Wood	245	82
Petroleum gas	8	3
Biogas	30	10
Kerosene	15	5
Electricity	0	0
Total	**300**	**100.0**

The findings in the table 4.8 found out that 245(82%) of the respondents used wood as the major source of fuel,8(3%) of respondents uses petroleum gas, 30(10%) respondents use biogas while 15(5%) of the respondents use kerosene and non uses electricity as fuel in their homes. From this finding s it was found that due to majority of respondents depending on wood as their major source of fuel this encourages deforestation and to discourage this locals should be given incentives by local government and donors to install biogas since most of them own cows. This will ensure that

there is less destruction to the forest cover both in farms and the nearby forest. These will also reduce smoke emissions to the atmosphere thus minimizing air pollution as indicated by There's a lot we can do to reduce emissions, prevent climate change and protect our threatened freshwater sources (WaterMeinshausen, m, et al nov.2011). Using less energy is a great place to start. This can be done by turning off lights, better insulating our homes to conserve heat and air conditioning, driving more fuel efficient cars and driving less. Cars and light trucks (like vans and SUVs) are responsible for about 20 percent of U.S. energy-related carbon emissions. In addition, eating lower on the food chain, even going meatless just one day a week can have a significant impact on environmental resources because industrial meat production has significant greenhouse gas emissions associated with it (WaterMeinshausen, M, et al nov.2011)

4.5 Human Activities and Accessibility to Water

The study sought to find out the influence of human activities on accessibility to water. To answer this question the respondents were asked to rank the human activities on accessibility to water. Table 4.9 shows the study findings.

Table 4. 9: Human Activities and Accessibility to Water

Response	Frequency	Percentage
Deforestation	91	30.7
Destruction of water areas	76	25.3
Pollution	72	24.0
Over population	60	20.0
Total	**300**	**100.0**

The findings in table 4.9 showed that 30.7% of respondents cited deforestation as the main human activity that affect water supply, this was followed by 25.3% destruction of water catchment areas, and 24.0% cited population, while 20.0% indicated over population as the main human activity that affect water supply Clearing land for agriculture and urban growth often leads to water pollution. When soil is stripped of its protective vegetation it becomes prone to soil erosion. This leads to an increase in the murkiness of the water which can cause the following: it can block the gills of fish; bottom dwelling plants cannot photosynthesize as the sun's rays cannot reach them; and there is an increase in disease as bacteria and viruses use the soil particles as a method of transportation. *Damming of rivers* Damming of rivers can have an impact on water in the following ways: Water flowing out of dams: has reduced suspended material as a large amount settles to the bottom of dams; is depleted of nutrients; and is often more saline with detrimental effects on downstream agriculture and fisheries. Enhanced eutrophication may result due to the water spending a longer time in the dam. There is also increased evaporation in dams, especially those with a large surface area, such as the Vaal Dam.

Wetlands are nature's way of cleaning water as well as damming water (they hold back water in summer and release it in winter). Destruction of wetlands: Destroys the habitat of many birds and fish; Removes the natural filters capable of storing and degrading many pollutants, such as phosphorus and heavy metals; Destroys natural dams and causes flooding further downstream

4.6 Financial constraints and Accessibility to Water

The study sought to find out the influence of financial constraints and accessibility to water. Thus various questions were asked to gauge if indeed financial constraints played a part in determining access to water.

4.6.1 Source of income.

To answer this question the respondents were asked what they do for a living to ascertain how this influenced access to water. Table 4.10 shows the study findings.

Table 4. 10: Source of income

Response	Frequency	Percentage
Business	20	7.0
Employed	40	13.3
Farming	200	66.67
None	40	13.3
Total	**300**	**100.0**

From table 4.10 it can be deduced that majority of the respondents depend on farming for a living representing 200(66.67%), 40(13.3%) rely on employment; equally 13.3% of the respondents are neither employed or farmers and finally its only 20 respondents who represent 7% of the respondents who are doing business for a living. Thus from the ensuing statistics we can say that most locals rely on farming for a source of living thus water plays a major part in their livelihood as it was also noted by (Nasac 2007) The relationship between water, energy, agriculture and climate is a

significant one. More and more, that relationship is falling out of balance jeopardizing food, water and energy security.

4.6.2 Cost of 20 liters of water

The study sought to find out what was the cost of 20liters of water in the area under study so as to determine how cost of water influences access to water. Table 4.11 shows the findings.

Table 4. 11: Cost of 20 liters of water

Response	Frequency	Percentage
Kshs.5	100	33
Kshs.10	120	40
Kshs. 20	80	27
Kshs.50	0	0
Total	**300**	**100.0**

From table 4.8 it was noted that majority of the respondents bought 20liters of water at kshs.10 at 40%, 100 respondents bought water at Kshs. 5 and they represented 33% of the respondents, 80 respondents representing 27% got water at a cost of Kshs. 20. Therefore we can say that water is not very expensive in this area.

4.6.3 Financiers of water projects.

The study sought to find out who are the financiers of water projects in the area of study to determine how this influenced access to water**.** Table 4.12 shows the findings**.**

Table 4. 12: Financiers of water projects

Response	Frequency	Percentage
NGOs	78	26.0
Donors	40	13.3
Individuals	69	23.0
Government	113	37.7
Total	**300**	**100.0**

The findings in table 4.12 revealed that majority of respondents indicated that the government was the major financiers of water projects in the study area by 37.7% responses,78 respondents constituting of 26% were financed by NGOS, 23% financed by individuals while only 13.3% were financed by donors. The source of money to finance water projects still remains a big challenge. Donors are likely to provide only a portion of the estimated $5 bn needed annually to achieve the MDG target. The UN Development Programme (UNDP) estimates that total budgetary spending in the water and sanitation sectors in sub-Saharan Africa is currently around $800 mn a year. This amount could likely be increased to $2.5 bn through "cost recovery" measures by service providers (charging users for water) and financial mobilization by local communities. Governments should also be able to increase their own budgetary allocations somewhat. In addition, a number of countries, at the urging of the World Bank and the International Monetary Fund (IMF), have sought to enlist private investment in expanding water facilities. "There is not one single solution to ensuring everyone gains access to water," says the UK charity Water Aid

4.7 Location of water source and Accessibility to Water

The study sought to find out the influence of the source of water location and accessibility to water and the findings were tabled in table 4.13 below.

Table 4. 13: Location of water source and Accessibility to Water

Response	Frequency	Percentage
Over 2 kilometers	80	26.7
1-2 kilometers	75	25.0
1 kilometer	73	24.3
Less than a kilometer	72	24.0
Total	**300**	**100.0**

The study sought to find out the influence of location of water sources in relation to its accessibility and the findings revealed that 26.7% of respondents indicated that it over 2 kilometers far from their homes, 25.0% cited between 1-2 kilometers away, 24.3% indicated 1 kilometer away while 24.0% cited less than a kilometer away. This therefore shows that water is accessed easily unlike in other parts of the country as espoused by other scholars in areas like Samburu where Women have the main responsibility for managing their household's needs for water, sanitation, and health. In a number of regions, women and girls spend many hours a day fetching water. In the Samburu District of central Kenya, for example, some women walk more than nine kilo meters daily to find water (Aguirre 2007).

4.7.1 Who fetches water?

The study wanted to find out who usually fetches water in household to ascertain the assumption that women are charged with the sole responsibility

of fetching water and its impact on access to water. Table 4.14 shows the findings.

Table 4. 14: Who fetches water

Response	Frequency	Percentage
Mother	256	85.3
Sister	15	5
Children	29	9.7
Husband	0	0
Total	**300**	**100.0**

From table 4.11 it can be noted that majority of women fetch water for their households constituting 256 of the respondents, who make up for 85.3%, it was also notable that men do not fetch water for their households at all, children on the other hand help their mothers to fetch water in the evenings after school and on weekends this comprises of 9.7%. it can therefore be noted that women shoulders great responsibilities of getting water for domestic use and thence if tapped water could be availed it will save time and energy for other economic developments. Women have the main responsibility for managing their household's needs for water, sanitation, and health. In a number of regions, women and girls spend many hours a day fetching water. In the Samburu District of central Kenya, for example, some women walk more than nine kilo meters daily to find water (Aguirre 2007).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter provides a summary of major findings as deduced by the study, it also presents Conclusions, Recommendations and areas of further research.

5.2 Summary of findings.

In this sub section the research outlines summary of findings based on objectives of the study.

The study sought to investigate factors influencing accessibility to water for domestic use in Kipkaren division in Nandi County.

5.2.1 Influence of environmental changes on accessibility to water.

The study sought to find out the influence of environmental changes on accessibility to water, the findings indicated that, 42% cited the river as the main source of water, 24% indicated the well, 10% cited tap water while rest of the respondents indicated rain water by 30.7% responses. It was also found that 52.6% of respondents cited they experience drought during non-rain months, while 47.45% indicated that they don't experience any drought, and lastly on whether air pollution experienced in the study area influenced accessibility to water. The findings revealed that, 26.7% indicated smoke from factories was the major source of air population, 25% cited smoke from vehicles, 24.3% indicated smoke from burning plastics, while 24% indicated dust as the major air pollution agent that influence accessibility of water.

5.2.3 Influence of human activities on accessibility to water.

The study sought to find out the influence of human activities on accessibility to water, findings revealed that 30.7% of respondents cited deforestation as the main human activity that affect water supply, this was followed by 25.3% destruction of water catchment areas, and 24.0% cited population, while 20.0% indicated over population as the main human activity that affect water supply.

5.2.4 Influence of financial constraints on accessibility to water.

The study sought to find out the influence of financial constraints and accessibility to water, the findings revealed that 27.7% respondents indicated that it was the government, 26.0% indicated non-governmental organizations, and 23.0% indicated donors while 23.0% cited individuals.

5.2.5 Influence of water location on accessibility to water.

Concerning the influence of the source of water location and accessibility to water, the findings revealed that 26.7% of respondents indicated that it over 2 kilometers far from their homes, 25.0% cited between 1-2 kilometers away, 24.3% indicated 1 kilometer away while 24.0% cited 1 kilometer away.

5.3 Conclusion on the findings.

In conclusion it was found out that environmental changes had a very strong influence on access to water, respondents cited that they experienced drought and water difficulties during non-rain months., “changing rainfall patterns affecting agriculture and reducing food security; worsening water security; human activities also affects accessibility to water, respondents

cited deforestation as the main human activity that has greatly affected water supply. Financial constraints influenced accessibility to water the findings revealed that majority of respondents indicated that the government was the major financiers of water projects in the study area .The source of money to finance water projects still remains a big challenge. However it was revealed that water sources were not far away from the respondents only that access in terms of roads and access roads was the major concern as it emerged from the interview schedule where the officials cited that most water sources emanate from private land hence hindering access or even development.

5.4 Recommendations

On the basis of the findings and conclusions above, this section presents the recommendations of the study**.**

5.4.1 Influence of environmental changes on access to water.

The study recommends that the various governmental stakeholders should ensure that our environment is well taken care of to minimize pollution of our environment and protect water systems. This includes but not limited to relevant government department like forestry, water, health and NEMA, and other non- governmental organizations dealing with issues of environment should advocate for environmental protection to assure sustainability of our water resources.

5.4.2 Influence of human activities on access to water.

The study also recommends that Human activities to be controlled so as to curtail cases of destruction of water catchment with agriculture and livestock development should ensure that there is 10% farm forest cover in each household and also that people do not cultivate beyond the 30 meters

extent into the wetland. The study also recommends that the County administration and other water stakeholders should provide more information to the local community on water management to enhance safe storage and use of water.

5.4.3 Influence of financial constraints on access to water.

The study recommends that the government should put more funds to ensure that the percentage of tap water coverage is enhanced given that it a mere 10% .The study also recommends that financial aid should be put in place to enhance water management in the study area. The county administration should also ensure that they employ enough experts and water staff so as to fast track connections and management of water issues in the area of study.

5.4.4 Influence of location of water on access

The study recommends that the county government to ensure that the access roads and passages to water sources are made or renovated where necessary

.

5.5 Contributions to body of knowledge

The study had the following contribution to the body of knowledge,

Objectives	Contributions
To assess how environmental changes influence accessibility to water for domestic use in Kipkaren division in Nandi County	The study found out that environmental changes have an immense impact on access to water for residents of Kipkaren, thus with these knowledge it will help the ministry of water and the county government where this ministry fall under to plan on how to manage the impact of the environmental changes to avert the eminent crisis in the future.
To assess how financial constraints influence access to water for domestic use in Kipkaren division in Nandi County	The study also noted that the government and the individual were the main financiers of water projects in the area. Thus this will help the government through the line ministry to put more resources to ensure that coverage of tap water to the locals is increased from the current 10%. And also to get donors to fund water projects in the study area.
To determine how human activities influence access to water for domestic use in Kipkaren division in Nandi County.	This study established that human activities especially destruction of water catchment areas is on the rise, deforestation and pollution acts as some of the human activities affecting access to water in the study area. With these information the county government and ministry of water and sanitation to streamline these activities and ensure compliance to set out rules and policies pertaining protection of environment.
To determine how location of water sources influence accessibility to water for domestic use in Kipkaren division in Nandi County.	The study established that most water sources were not located very far away from the respondents and thence was not a very strong factor determining access however it was noted that the road and pssages tgo this water sources played a big role in determine accessibility. Thus the local authorities should ensure that the roads and passages to the water points are passable.

5.6 Suggested areas for further research

1. A similar study to be carried out in other counties to compare the study findings.
2. Influences of water storage on safe usage of water in learning institutions.
3. How climate changes affect access to water in Kenya.

4. Effects of global warming on water resources in Kenya.
5. Human activities influencing access to water in Kenya.

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APPENDIX A: TRANSMITTAL LETTER

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RE: Introduction

I am Linet Kerubo Orina, undertaking a Master's degree in Project Planning and Management at the University of Nairobi. In partial fulfilment of the course, I am required to carry out a research. The subject of my research is factors affecting access to safe and clean water for domestic use; a case of Kipkaren division, Nandi North District. You have been selected to participate in this study/survey. I would like to request for your assistance.

The information provided is strictly for academic purpose and will be handled with strict confidence. Your assistance and co-operation will be highly appreciated.

Yours sincerely,

Linet Kerubo Orina

APPENDIX B: QUESTIONNAIRE FOR FEMALE HOUSE HEADS

Please put a tick (√) next to the response applicable to you where appropriate.

Section I: Background Information.

1what is the name of your location?

2 How many years have you lived in this area?

(a) Less than 5 ( ) (b) 5 ( ) (c) less than 10 ( ) (d) 10 (e) more than 10 ( )

3. How old are you?

(a) 18-30yrs. ( ) (b) 31-45yrs. ( ) (c) 45-65 yrs. ( ) (d) 65yrs and above

Section 2: Influence of Environmental Changes on Accessibility to Water.

3. What is the main source of drinking water for members of your Household?

(a) River ( ) (b) well ( ) (c) spring ( ) (d) tap (e) rain water ( )

4. What were your major sources of water before this source?

(a) River ( ) (b) well ( ) (c) spring ( ) (d) tap (e) rain water ( )

5. What is the main source of water used by your household for other purposes, such as cooking and hand washing?

(a) River ( ) (b) well ( ) (c) spring ( ) (d) tap (e) rain water ( )

6. Which period of the year do you experience drought in this area. ----------

7. How often do you experience floods?

(a) Once a year ( ) (b) twice a year ( ) (c) thrice ( ) (f) rarely ( ) (e) none ( )

8. What kind of air pollution is experienced in this area?

(a) Smoke from vehicles ( ) (b) smoke from factories ( ) (c) smoke from ( ) (d) Smoke from burning plastics (e) dust

9. What kind of fuel do you use for cooking?

(a) Wood (b) petroleum gas (c) bio gas (d) kerosene (e) electricity

Section 3: Human Activities

10. Do you share your water source with other households?

_____

11. How many households use this water source?_____

(a)Below 10households ( ) (b) 10-50 households ( ) (c) 50-100households ( ) (d) 100-150 households (e) above 150 households ( )

12. How many households used this water source five years ago?

(a)Below 10households ( ) (b) 10-50 households ( ) (c) 50-100 households ( ) (d) 100-150 households (e) above 150 households ( )

13. How many households used this water source ten years ago?

(a)Below 10households ( ) (b) 10-50 households ( ) (c) 50-100households ( ) (d) 100-150 households (e) above 150 households ( )

14. What pollutes your water source?

(a) fertilizers ( ) (b) animal wastes ( ) (c) septic tanks ( ) (d) other chemicals ( ) (e) none ( )

15. What human activities affect your water source?

(a) Deforestation ( ) (b) pollution ( ) (c) destruction of water catchments ( ) (d) over population ( ) (e) none ( )

16 How has deforestation affected your water source?

(a) Dried up ( ) (b) almost drying up ( ) (c) dries up sometimes ( ) (d) ( ) not sure (e) none ( )

17. How far were you getting your water five years ago?

(a) 200 meters ( ) (b) 500metres ( ) (c) 1km ( ) (d) 1-2 km (e) over 2 km ( )

18. How far were you getting your water 5-10 years ago?

(a) 200 meter's ( ) (b) 500metres ( ) (c) 1km ( ) (d) 1-2 km (e) over 2 km ( )

19. Are there any changes in your water source?

Section 4 financial constraints.

20. What is your gross income per month? ----------

21. What do you do for a living?

(a) Business ( ) (b) employed ( ) (c) housewife ( ) (d) midwife (e) none

22. What is the cost of 20liters of water in your area?

(a) Ksh10 ( ) (b) 15 ( ) (c) 20 ( ) (d) 30 ( ) (e) 40 ( )

23. Who are the financiers of water projects in your area?

(a) Government ( ) (b) donors (( )c) government and donors (d) individuals( ) (e) not sure

Section 5: location of water source

25. How long does it take to go there, get water, and come back?

_____

(a) One hour ( ) (b) two to three hours ( ) (c) six hours ( ) (d) a day (e) less than an hour ( )

296 Who usually goes to this source to fetch the water for your household?

_____

(a) mother ( ) (b) sister ( ) (c) children ( ) (d) husband (e) none ( )

27. How far is this water source from other sources?

(a) 200 meters ( ) (b) 500metres ( ) (c) 1km ( ) (d) 1-2 km (e) over 2 km ( )

SECTION II: FACTORS DETERMINING ACCESSIBILTY TO CLEAN AND SAFE WATER

The following are factors determining access to water for domestic use in Kipkaren division, Nandi North District. Indicate what do you know affect access to clean and safe water for your household. If you are undecided about a source, tick U. **Key; SA=Strongly agree A=Agree SDA= Strongly disagree DA=Disagree U=Undecided**

Factors determining accessibility	**SA**	**A**	**SDA**	**DA**	**U**
Distance to the water source					
The number of people using the water source					
Cultural beliefs regarding a water source					
Political influence					
Safety of the water point					
Reliability of the source of water(seasonal/permanent)					
Road network					
The cost of the water					
Relationship with people sharing the water resource					
Terrain of the water point					

APPENDIX C: QUESTIONNAIRE FOR MINISTRY OF WATER WORKERS

The following are factors determining access to clean and safe water for domestic use in Kipkaren division, Nandi North District. Indicate to what extent you agree with the following statements on effects of access to clean and safe water for households. If you are undecided about a source, tick U. **Key; SA=strongly agree A=Agree SDA= strongly disagree DA=Disagree U=Undecided**

Factors determining accessibility	**SA**	**A**	**SDA**	**DA**	**U**
Distance to the water source					
The number of people using the water source					
Cultural beliefs regarding a water source					
Political influence					
Safety of the water point					
Reliability of the source of water(seasonal/permanent)					
Road network					
The cost of the water					
Relationship with people sharing the water resource					
Terrain of the water point					

SECTION II: WATER IMPURITIES

The following are water impurities; indicate the frequency of presence of impurities in water samples taken from the various household water sources in Kipkaren division. If you are undecided about a source, tick U. **Key; VR=Very regular R=Regular U= Undecided I=Irregular VI=Very Irregular**

Please put a tick (√) next to the response applicable to you where appropriate.

Water Impurities	**VR**	**R**	**U**	**I**	**VI**
Dissolved Gases					
Atmospheric Deposition					
Animal Wastes					
Septic Tank Effluent					

Fertilizers					
Human sewage					
Leaking septic systems					
Manure runoff from agricultural lands,					
Wild animal wastes					

APPENDIX E: INTERVIEW SCHEDULE FOR MINISTRY OF WATER OFFICIALS

1) Who usually goes to the water sources to fetch water for households in Kipkaren division?_____
   _____

2) What are some of the beliefs about these water sources?
   _____

3) How far were people getting water five years ago?
   _____

4) How far were people getting water 5-10 years ago?_____
5) Are there any changes in the water source?_____

6) Are there any changes in numbers of people using the water source?_____

7) How safe are the water points?_____

8) How reliable are the sources of water (seasonal/permanent)?
   _____

9) How does road network impact access to clean water?_____

10) How does cost of the water impact on access to clean and safe water?_____